CHAPTER 4

Migration and Education

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[1] We would like to thank Jérôme Adda, Andrew Mountford, Ian Preston, and Yoram Weiss for helpful comments, and Andrew Aitken, Gianandrea Lanzara, Anna Raute, and Anna Rosso for excellent research assistance. Albrecht Glitz acknowledges the support of the Barcelona GSE Research Network, the Government of Catalonia, and the Spanish Ministry of Science (Project No. ECO2008-06395-C05-01). Christian Dustmann acknowledges the support of the NORFACE programme on migration.

ISSN 0169-7218, DOI: 10.1016/B978-0-444-53444-6.00004-3

Abstract

Sjaastad (1962) viewed migration in the same way as education: as an *investment in the human agent*. Migration and education are decisions that are indeed intertwined in many dimensions. Education and skill acquisition play an important role at many stages of an individual's migration. Differential returns to skills in origin and destination country are a main driver of migration. The economic success of the immigrant in the destination country is to a large extent determined by his or her educational background, how transferable these skills are to the host country labor market and how much he or she invests in further skills after arrival. The desire to acquire skills in the host country that have a high return in the country of origin may be another important reason for a migration. From an intertemporal point of view, the possibility of a later migration may affect educational decisions in the home country long before a migration is realized. In addition, the decisions of migrants regarding their own educational investment and their expectations about future migration plans may affect the educational attainment of their children. But migration and education are not only related for those who migrate or their descendants. Migrations of some individuals may have consequences for educational decisions of those who do not migrate, both in the home and in the host country. By easing credit constraints through remittances, migration of some may help others to go to school. By changing the skill base of the receiving country, migration may change incentives to invest in certain types of human capital. In addition, migrants and their children may create externalities that influence educational outcomes of nonmigrants in the destination country. This chapter will discuss some of the key areas that connect migration and education.

Keywords

Migration
Education
Human Capital
Return Migration
Immigrant Selection
Second-generation Immigrants

1. INTRODUCTION

Starting with *Homo erectus* about 2 million years ago, the first humans were organized in groups of hunters and gatherers. These groups were nomadic, and the economic foundation of their existence was making migrations a necessity, forcing them to move continuously according to food supplies. Constant migration was the normality. Today, populations that pursue a nomadic lifestyle are the exception. The abandonment of the hunting and gathering lifestyle by humans about 10,000 years ago, when this lifestyle was replaced by one based on agriculture, changed the technology of subsistence production. It led to social and political structures that built on nonnomadic forms of economizing. If migrations took place nevertheless, then for two main reasons: either because people were forced to move by natural disasters or man-made circumstances (such as persecution due to distinct political or religious views) or because economic prospects seemed more favorable in other regions. Immigrant-receiving countries today draw distinctions between these two different motives for movement. The Geneva Convention of 1951 defines a refugee as any person "who owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country—or return to it." Its signatories committed to not sending an individual back into a situation of possible persecution. According to United Nations figures, 7.1% of all international migrants in 2005 are refugees from their countries of origin.[2]

In this chapter, we will deal mainly with migrations due to the second motive: movements that are due to individual decisions based on some optimizing considerations. We will focus our discussion on international migrations, although much of what we discuss also holds for migrations within national borders.[3] Deliberate migrations are driven by economic motives and considerations and can therefore be subjected to economic analysis and investigation. Hicks noted in his *Theory of Wages* in 1932 (p. 76) that it is *differences in net economic advantages, chiefly differences in wages,* [that] *are the main causes of migration*.

Education, in turn, is a main determinant of wages, both in the country of origin and the potential destination country.[4] Although the decisions about how much education to obtain and whether to migrate are often sequential, individuals may in many

[2] *Source*: United Nations, Department of Economic and Social Affairs, Population Division. International Migrant Stock: The 2008 Revision, 2009.

[3] We follow the convention in most of the literature in economics and define an "immigrant" as an individual who resides and works in a country other than the country where he or she was born. This is the standard definition of immigrants in the Anglo-Saxon countries; however, some countries (like Germany) define immigrants based on nationality rather than country of birth.

[4] We will use the terms country of destination and host country and the terms country of origin and home country interchangeably throughout this chapter.

cases make these choices simultaneously, choosing education at home with a view to migrating later. Once migrated, choices about skill acquisition in the host country are crucial for the economic payoff of the migration decision. These investment decisions are, in turn, related to future migration plans and therefore the forms that migrations take over the individuals' life cycles. Furthermore, acquisition of education may be the sole reason for a migration—student migrations are an example. Some countries, such as the United States, the United Kingdom, and Australia, are established "learning centers," offering educational products to an international market. The acquisition of skills abroad that are more productive at home may also take place on the job, for instance, through the acquisition of language skills or learning of particular production technologies. Thus, individual migration decisions and decisions about educational attainment are strongly intertwined, and we will shed light on this relationship in Section 3 of this chapter.

But migrations may also affect educational attainments of those who do not choose to move, both in the destination and the origin countries. Migrations may lead to a change in the skill base of both sets of countries, affecting average levels of education and possibly generating educational externalities and new incentives for human capital investments. For instance, if immigration is selective in the sense that only better-able individuals move, then this may enhance the skill base in the destination country, while it may deplete the skill base in the country of origin, with consequences for the populations of those who have chosen not to move. However, there may be situations where migration enhances the skill base of both countries. Immigration may lead to a specialization of nonmigrant workers in the destination country in areas where they have a competitive advantage. It may also lead to an improvement of the economic situation of migrants' families, for instance, through remittances, thus enabling children to attend school instead of working. Remittances may also help to create educational infrastructures that foster educational attainment of those who do not have family members who migrate. We will discuss immigrant selection and the interrelation between migration and education of those who do not move in Section 4 of this chapter.

Finally, migration is a long-term process, with many immigrants bringing their children with them or founding families in their host countries. In this context, it is important to understand how the children of immigrants are accommodated by the host country's education system and how they perform in it relative to native children. What is the role intergenerational transmission of human capital plays for the longer run integration process and how does it affect the immigrants' long-term convergence to the native population? These are key questions in the current debate about immigration, in particular in those countries that only recently received large immigrant populations. We will discuss the educational achievement of the children of immigrants and their intergenerational mobility in Section 5 of this chapter.

There are therefore three related cornerstones to this chapter. These cover the key economic aspects of the individual migration decision, their connection to education and the skill selection of immigrants, and the nature of intergenerational spillovers. The analysis of these three cornerstones provides a comprehensive overview of the economic connections between migration and education.

Before considering these three interrelated areas in detail, we begin in Section 2 by setting the scene with the presentation of some empirical evidence about immigrant populations in OECD countries, their educational attainment, their labor market performance, and how they compare to natives and to those in their home countries who decided not to move. We will demonstrate the large diversity of immigrant populations in different countries, which is often due to historical reasons, such as colonial pasts, historical trade links, or particular recruitment policies at earlier points in time. At the same time, the descriptive evidence we present shows many common features across populations of immigrants in different destination countries. We will return to some of these features later in the individual sections that deal with the migrant, the nonmigrants, and the children of immigrants where we will embed them into a more structural framework. In order to ensure comparability, we focus on OECD countries for which detailed and standardized data are available.

2. EMPIRICAL EVIDENCE

2.1. Educational Attainment of Migrants

When thinking about the educational attainment of migrants, two points of reference naturally come to mind: the educational attainment of the migrants relative to the native population in the destination country and the educational attainment of the migrants relative to their compatriots who remained in their country of origin. To provide an overview, Table 4.1 shows the educational attainment of the foreign-born (FB) population in the 10 most important immigrant-receiving OECD countries around the year 2000.[5] These 10 countries together host 86% of the around 76 million foreign-born individuals aged 15 years and older who live in one of the 28 OECD countries for which data are available (data for Chile and Iceland are not available). Not surprisingly, given the heterogeneity in countries of origin and migration policies in place, there is substantial variation in the educational composition of the foreign-born population across

[5] We report OECD data for the year 2000, as these are the most recent ones that include comparable information on educational attainment. With the exception of Germany and France, the overall stocks of migrants have further increased across the OECD countries listed in Table 4.1 between the year 2000 and 2008, with an overall growth rate of approximately 37% (based on data from the International Migration Database). The most noticeable change over this period took place in Spain where the foreign-born population tripled to around 6.4 million in 2008. However, with the exception of Japan, whose stock of foreign workers increased particularly fast in this period, the countries listed in Table 4.1 remain the main OECD destination countries also in 2008.

Table 4.1 Educational Attainment of Immigrants in 10 Biggest Immigrant-Receiving OECD Host Countries, around 2000

Destination Country	Number of FB	Share of FB	Main Countries of Origin (Share of FB Population)	Share of FB with Low Education	Share of FB with Medium Education	Share of FB with High Education	Share of NB with Low Education	Share of NB with Medium Education	Share of NB with High Education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Australia	3,860,215	26.0	United Kingdom (26.1), New Zealand (8.2), Italy (5.6)	36.8	32.6	30.6	43.8	31.2	25.1
Canada	5,355,210	22.4	United Kingdom (11.4), China (5.9), Italy (5.9)	22.1	31.8	46.1	22.9	38.3	38.8
France	5,600,198	11.7	Algeria (21.6), Morocco (12.3), Portugal (10.1)	48.4	29.9	21.7	33.8	44.1	22.1
Germany	7,831,959	11.5	Turkey (15.2), Poland (13.1), Russia (11.9)	40.1	42.8	17.2	14.6	61.4	24.0
Italy	2,020,934	4.1	Switzerland (8.9), Germany (8.3), Morocco (6.8)	50.2	35.4	14.4	57.3	31.9	10.8
Netherlands	1,419,940	11.2	South and Central America and Caribbean (20.4), Indonesia (12.5), Turkey (11.2)	45.6	32.8	21.6	32.4	43.8	23.8
Spain	1,914,920	5.5	Morocco (14.5), Ecuador (9.9), France (7.8)	52.8	22.7	24.5	60.9	15.9	23.2
Switzerland	1,454,185	24.1	Italy (15.9), Germany (12.1), Serbia and Montenegro (9.1)	38.8	34.6	26.6	16.3	60.8	22.9
United Kingdom	4,503,466	9.4	Ireland (11.7), India (10.1), Pakistan (6.7)	39.1	21.6	39.3	51.3	25.5	23.2
United States	31,389,926	14.5	Mexico (26.3), Philippines (4.3), Puerto Rico (4.1)	35.3	33.9	30.9	12.5	53.2	34.3

Note: Data taken from Database on Immigrants in OECD Countries (DIOC) provided by the OECD. Baseline population aged 15 years and older. Ten countries with highest number of foreign-born (FB) and main countries of origin are determined using all education categories and age groups. Columns (7) to (9) refer to the native-born (NB). For each destination country, the three biggest countries of origin are reported. Low educational attainment means up to lower secondary education, medium educational attainment means completed upper secondary education, and high educational attainment means tertiary education. Education shares are calculated for the population aged 25–64 years and are reported in percentages. Observations with unknown education level and unknown place of birth were excluded from the calculation of the education shares.

destination countries. In Canada, for example, only 22% of the foreign-born population aged 25–64 years report lower secondary education ("low education") as their highest educational attainment, whereas in France, Italy, and Spain, about 50% of the foreign-born population have at most completed lower secondary education. At the other end of the educational spectrum, the share of foreign-born individuals with tertiary education ("high education") exceeds 30% in Australia, Canada, the United Kingdom, and the United States, whereas in Germany and Italy, this share is below 20%. The composition of the foreign-born population in terms of their educational attainment becomes particularly relevant when seen in relation with the educational attainment of the native-born population (NB). Based on such comparisons, one can broadly divide the OECD destination countries into two groups: one group characterized by a high-skilled foreign-born population consisting of Australia, Canada, and the United Kingdom, and one group characterized by a low-skilled foreign-born population consisting of France, Germany, the Netherlands, Switzerland, and the United States, with Spain's and Italy's foreign- and native-born populations showing relatively comparable educational structures. For example, in Australia, Canada, and the United Kingdom, the share of the foreign-born population with high education exceeds the share of the native-born population with high education by 5.5, 7.3, and 16.1 percentage points, respectively. On the other hand, in France, Germany, and the United States, the share of the foreign-born population with low education exceeds the share of the native-born population with low education by 14.6, 25.5, and 22.8 percentage points, respectively.[6]

But the relative educational attainment of the foreign-born in their destination countries is only one side of the coin. The other natural comparison group consists of the migrants' compatriots who have remained in their country of origin. Table 4.2 provides some evidence for the 11 biggest immigrant-sending countries within the group of OECD countries.[7] Though again subject to substantial variation, a prominent feature in these figures is that for the majority of origin countries, the share of movers with high education is substantially larger than the share of stayers with high education. For example, while about 23, 22, and 34% of the native-born British, French, and Americans still living in their country of birth have high education (Column (7)), the corresponding shares among the group of those who left these countries are 40, 40, and 61% (Column (4)), respectively.

[6] For a detailed analysis of worldwide international mobility by educational attainment, see Docquier and Marfouk (2006).

[7] The figures are constructed from OECD data by aggregating across all OECD countries all foreign-born by country of origin, restricting the sample of origin countries to OECD countries, and then selecting the 11 countries from which the largest number of foreign-born individuals originated. Since not all potential countries of origin are separately recorded for each OECD country, this is not entirely accurate, but, given that for each OECD country, the most important countries of origin are separately reported (and often many more), this procedure should correctly pick up the 11 biggest OECD immigrant-sending countries. Of course, there are additional important non-OECD countries of origin such as (in descending order) China, India, the Philippines, Russia, and Vietnam for which, however, we do not observe the educational attainment of the population in the home country in the OECD data.

Table 4.2 Educational Attainment of Movers and Stayers, around 2000

Country of Origin	Share of People Living in Other OECD Countries	Share of Movers with Low Education	Share of Movers with Medium Education	Share of Movers with High Education	Share of Stayers with Low Education	Share of Stayers with Medium Education	Share of Stayers with High Education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mexico	13.3	68.7	24.5	6.8	70.7	14.6	14.7
United Kingdom	6.8	22.0	37.7	40.3	51.3	25.5	23.2
Germany	4.6	20.8	44.2	34.9	14.6	61.4	24.0
Italy	4.8	51.0	32.9	16.1	57.3	31.9	10.8
Poland	6.8	19.0	53.8	27.3	19.0	67.2	13.8
Turkey	4.4	69.9	22.6	7.5	77.2	14.1	8.8
Portugal	14.5	68.4	24.8	6.8	77.7	11.9	10.4
France	2.4	27.4	32.3	40.3	33.8	44.1	22.1
Canada	4.5	11.2	38.5	50.3	22.9	38.3	38.8
South Korea	n.a.	10.3	37.7	52.0	n.a.	n.a.	n.a.
United States	0.4	10.7	28.6	60.7	12.5	53.2	34.3

Note: Data taken from Database on Immigrants in OECD Countries (DIOC) provided by the OECD. Baseline population aged 15 years and older. Eleven OECD countries with highest number of native-born residing in a foreign OECD country (listed in descending order) are determined using all education categories and age groups (for South Korea, data on native-born residing in country of birth are not available). Share of people living in other OECD countries is relative to overall population currently living in the country of origin. Low educational attainment means up to lower secondary education, medium educational attainment means completed upper secondary education, and high educational attainment means tertiary education. Education shares are calculated for the population aged 25–64 years and are reported in percentages. Observations with unknown education level and unknown place of birth were excluded from the calculation.

It appears that for these countries of origin, the better-educated individuals are the more mobile ones. However, for other countries, the picture looks different. For example, for Mexico, the main source country of US immigration, the share of movers with only low education is relatively similar to that of the stayers (around 70%), whereas the share of movers with high education (around 7%) is significantly lower than in the group of stayers (15%). Turkey, which is the main country of origin for Germany, and Portugal exhibit similar patterns. For these countries, those who decide to emigrate appear to come predominantly from the middle of the educational spectrum.

The aggregate figures in Tables 4.1 and 4.2 conceal the substantial variation in immigrants' educational attainment that exists across origin countries for any given destination country (Table 4.1) and across destination countries for any given origin country (Table 4.2). Focusing on the former, Table 4.3 shows for each of the 10 main

Table 4.3 Variation in Educational Attainment across Foreign-Born Populations from Different Origin Countries in OECD Host Countries, around 2000

	Low Education					High Education				
Destination Country	Minimum Share of Low Education across Origin Countries	Country of Origin with Minimum Share	Maximum Share of Low Education across Origin Countries	Country of Origin with Maximum Share	Standard Deviation of Low-Education Shares within Destination Country across Origin Countries	Minimum Share of High Education across Origin Countries	Country of Origin with Minimum Share	Maximum Share of High Education across Origin Countries	Country of Origin with Maximum Share	Standard Deviation of High-Education Shares within Destination Country across Origin Countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Australia	7.9	United States (1.2)	71.6	Malta (1.2)	19.4	6.5	Malta (1.2)	63.3	United States (1.2)	19.3
Canada	6.9	South Korea (1.4)	61.7	Portugal (2.9)	16.6	11.7	Portugal (2.9)	66.5	South Korea (1.4)	16.2
France	15.6	United Kingdom (1.4)	75.1	Turkey (3.0)	18.4	4.3	Portugal (10.1)	57.0	United Kingdom (1.4)	13.7
Germany	9.8	France (0.7)	73.0	Turkey (15.2)	19.1	4.2	Turkey (15.2)	49.7	France (0.7)	12.0
Italy	21.7	United States (2.2)	84.0	Senegal (1.4)	17.5	3.9	Senegal (1.4)	37.7	United States (2.2)	8.1
Netherlands	14.9	France (0.8)	75.0	Turkey (11.2)	17.9	6.0	Turkey (11.2)	76.4	United States (0.6)	16.9
Spain	28.1	Cuba (2.4)	82.4	Portugal (2.8)	15.6	8.5	Portugal (2.8)	40.3	Cuba (2.4)	10.6
Switzerland	7.4	United States (1.2)	81.1	Portugal (6.5)	25.7	2.9	Portugal (6.5)	71.9	United States (1.2)	20.3
United Kingdom	10.8	United States (2.8)	74.1	Bangladesh (3.2)	20.4	15.4	Bangladesh (3.2)	70.5	United States (2.8)	16.9
United States	4.9	Japan (1.4)	69.1	Mexico (26.3)	20.4	6.5	Mexico (26.3)	75.1	India (3.1)	19.2

Note: Data taken from Database on Immigrants in OECD Countries (DIOC) provided by the OECD. Ten countries with highest number of foreign-born and the twenty main countries of origin for each destination country are determined using all education categories and age groups. The minimum and maximum education shares are obtained from the sample of the 20 biggest origin countries for each destination country. Figures in parentheses after origin country names show the percentage share of the given origin country in the overall foreign-born population in the corresponding destination country. Low educational attainment means up to lower secondary education, medium educational attainment means completed upper secondary education and high educational attainment means tertiary education. Education shares are calculated for the population aged 25–64 years and are reported in percentages. Observations with unknown education level and unknown place of birth were excluded from the calculation. The standard deviation of educational shares within each host country is unweighted with respect to the origin countries.

immigrant-receiving OECD countries the foreign-born populations with the highest and lowest educational attainment. For instance, looking at the last row of the Table 4.3, of all the main countries of origin of immigration to the United States, the foreign-born population originating from Mexico are the least well educated with 69.1% having only low education (Column (3)). On the other hand, the most highly educated group in the United States is the group of Indians of whom 75.1% have high education (Column (8)). For Germany, the country of origin with the highest share of immigrants with only low education is Turkey with 73.0% (Column (3)), compared with French immigrants of whom only 9.8% have low education (Column (1)). The (unweighted) standard deviations reported in Columns (5) and (10) provide a summary measure of the extent of educational heterogeneity of each country's immigrant population across different countries of origin, showing that in many cases, a given destination country attracts immigrants with high educational background from some countries, but with poor educational background from other countries.

Table 4.4 shows for each of the 11 main immigrant-sending countries in the OECD the destination countries that receive the highest and the lowest educated group of its emigrating population. For instance, looking at the first row of the table, only 5.0% of all Mexicans living in Sweden have low education (Column (1)), whereas this is the case for 69.0% of all Mexicans living in the United States (Column (3)). Similarly, only 7.0% of Poles living in the Czech Republic have high education (Column (6)), whereas the corresponding share in the United Kingdom is 48.7% (Column (8)). Clearly, highly heterogeneous subgroups of individuals from a given country of origin decide to move to specific host countries, as again summarized by the standard deviations reported in Columns (5) and (10). We will discuss possible reasons for these differences below.

The educational attainment of the foreign-born population serves as a key indicator of their performance in the host country's labor market. However, even if the foreign-born population in a given host country is as well educated as the native-born population in terms of the level of formal qualification or completed years of schooling, they are unlikely to perform equally well in the labor market. The educational skills immigrants bring with them may not be easily transferable to the host country's labor market (e.g., due to language deficiencies), and a highly skilled immigrant is unlikely to command the same wage as a native-born worker with the same educational background, at least in the first few years after arrival.

We illustrate this in Column (1) of Table 4.5, which shows the median wage of the foreign-born relative to the median wage of the native-born in a selected set of OECD destination countries. Columns (2) to (4) show the corresponding wage ratios separately by education group. With the exception of Australia, the foreign-born earn overall less than the native-born, in particular in the United States where the median wage gap amounts to 21%. While in the lowest education group, immigrants tend to earn slightly more than comparable natives (with the exception of France and

Table 4.4 Variation in Educational Attainment of Emigrant Population from OECD Origin Countries across Different OECD Host Countries, around 2000

	Low Education					High Education				
Country of Origin	Minimum Share of Low Education across Destination Countries	Destination Country with Minimum Share	Maximum Share of Low Education across Destination Countries	Destination Country with Maximum Share	Standard Deviation of Low-Education Shares within Origin Country across Destination Countries	Minimum Share of High Education across Destination Countries	Destination Country with Minimum Share	Maximum Share of High Education across Destination Countries	Destination Country with Maximum Share	Standard Deviation of High-Education Shares within Origin Country across Destination Countries
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Mexico	5.0	Sweden (0.0)	69.0	United States (99.1)	20.4	6.5	United States (99.1)	77.8	United Kingdom (0.1)	20.9
United Kingdom	5.6	United States (23.4)	46.1	Spain (3.0)	13.8	26.1	Italy (1.5)	57.0	France (2.4)	11.2
Germany	8.1	United States (34.2)	49.1	Italy (5.4)	13.7	12.9	Italy (5.4)	43.3	Canada (5.8)	9.9
Italy	31.2	United States (22.0)	72.3	Belgium (5.5)	13.4	8.2	Germany (14.2)	36.5	Spain (1.0)	10.4
Poland	11.6	Sweden (1.7)	31.1	Czech Republic (1.2)	6.1	7.0	Czech Republic (1.2)	48.7	United Kingdom (2.8)	14.0
Turkey	14.2	United States (4.0)	81.8	Austria (5.4)	20.8	2.5	Austria (5.4)	52.7	United States (4.0)	15.2
Portugal	51.5	United States (16.4)	82.4	Spain (4.2)	9.8	2.2	Luxembourg (3.0)	20.5	United Kingdom (2.6)	5.8
France	6.9	United States (16.6)	51.2	Italy (11.1)	19.4	12.1	Poland (2.9)	65.9	United Kingdom (7.5)	19.5
Canada	0.7	Japan (0.6)	35.7	Italy (2.1)	11.4	16.7	Italy (2.1)	91.8	Japan (0.6)	20.2
South Korea	3.2	New Zealand (1.4)	13.7	Denmark (0.7)	3.8	27.5	New Zealand (1.4)	78.3	United Kingdom (1.0)	15.9
United States	1.8	Japan (3.9)	32.7	Mexico (12.8)	9.4	37.2	Mexico (12.8)	82.9	Japan (3.9)	16.3

Note: Data taken from Database on Immigrants in OECD Countries (DIOC) provided by the OECD. Eleven OECD countries with highest number of natives residing in a foreign OECD country (in descending order) are determined using all education categories and age groups. The minimum and maximum education shares are obtained from the sample of the 10 biggest OECD destination countries for each origin country. Figures in parentheses after destination country names show the percentage share of the corresponding origin country's emigrant population to other OECD countries, who live in the given destination country. Low educational attainment means up to lower secondary education, medium educational attainment means completed upper secondary education, and high educational attainment means tertiary education. Education shares are calculated for the population aged 25–64 years and are reported in percentages. Observations with unknown education level and unknown place of birth were excluded from the calculation. The standard deviation of educational shares within each home country is unweighted with respect to the OECD host countries.

Table 4.5 Median Wages of Foreign-Born Relative to Native-Born by Broad Educational Categories, 2005/2006

Destination Country	Overall	Low Education	Medium Education	High Education	High Education (Men)		High Education (Women)	
					Obtained in Home Country	Obtained in Host Country	Obtained in Home Country	Obtained in Host Country
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Australia	1.07	1.11	1.02	0.98	0.99	0.93	0.94	1.02
Canada	0.95	1.07	0.94	0.89	0.86	0.95	0.79	0.99
France	0.90	0.94	0.96	0.90	0.88	0.86	0.77	1.10
Germany	0.93	1.14	0.93	0.91	0.86	1.00	0.83	0.95
Netherlands	0.85	1.11	1.02	0.98	n.a.	n.a.	n.a.	n.a.
Portugal	0.94	1.00	0.76	0.80	0.49	0.88	0.52	1.00
Sweden	0.93	0.91	0.94	0.92	0.81	0.88	0.89	0.95
Switzerland	0.89	1.05	0.93	0.96	n.a.	n.a.	n.a.	n.a.
United States	0.79	1.07	0.83	0.93	0.80	1.04	0.79	1.13

Note: Data taken from International Migration Outlook 2008 (OECD (2008)), Chart I.13, Chart I.15, Table I.14. Median hourly wages of the foreign-born are expressed relative to median hourly wages of the native-born in the same group. Sample restricted to those aged 15–64 years who are in dependent employment. Low educational attainment means up to lower secondary education, medium educational attainment means completed upper secondary education, and high educational attainment means tertiary education.

Sweden), they earn substantially less than natives in the medium- and high-education group. In Canada, France, and Portugal, for example, immigrants with high education earn at least 10% less than natives with high education. Overall, wages of immigrants seem to rise more slowly with educational attainment than wages of natives, suggesting that immigrants face a lower return to schooling in the host country than natives do.

Columns (5) to (8) focus on the high-education group and show relative wages of foreign-born men and women with high education, now distinguishing between individuals who received their tertiary education in their home country and those who received it in the host country. The difference between the relative returns reported thus addresses, at least in part, the issue of transferability of human capital from the origin to the destination country.[8] The less transferable the skills acquired in the home country, the lower their return relative to the return obtained from domestically acquired tertiary education. With the exception of men in France and Australia, the figures show that wages are always higher for foreign-born graduates with host country–specific tertiary education, in some cases even exceeding the wages earned by native-born graduates with tertiary education.

2.2. Migration and Acquisition of Education

As pointed out in the previous section, it is important to distinguish between education acquired in the home country before migrating and education acquired in the host country. In particular, minors who arrive together with their parents and young adults who immigrate to attend one of the host country's universities add to their existing stock of human capital by acquiring further formal host country–specific education. With education being a tradable good, some countries have specialized in its production. For instance, Australia's third largest export article (after coal and iron ore) is international education.[9]

This specialization in the provision of educational services is apparent from Table 4.6, which shows for the 10 biggest immigrant-receiving OECD countries the share of foreign students enrolled in tertiary education. Across all destination countries, foreign

[8] Although a lack of transferability of human capital will be necessarily reflected in lower relative wage ratios, it cannot be easily distinguished from differences in the quality of education obtained because of different educational systems and institutions in the origin and destination countries. Although the OECD data reported in Tables 4.1 to 4.5 are based on the International Standard Classification of Education (ISCED 1997) that, in principle, is based on the educational content of the programs assessed rather than institutional idiosyncrasies, an accurate and consistent measurement of actual educational achievements across different countries remains difficult (see also Hanushek and Zhang (2009)).

[9] In 2007/2008, international education contributed 13.7 billion AUD to the Australian economy, measured through export earnings, which is the sum of international student expenditure on tuition fees, goods, and services related to living in Australia, and tourism associated with visits from relatives (see http://www.idp.com/research/statistics/education_export_statistics.aspx).

Table 4.6 Number and Share of Foreign Students in Tertiary Education in OECD Countries, 2008

Destination Country	Share of Foreign Students in Tertiary Education	Share of Foreign Students in Advanced Research Programmes	Number of Foreign Students in Tertiary Education	Index of Change (1998–2008)	Retention Rates (2007)
	(1)	(2)	(3)	(4)	(5)
Australia	20.6	23.3	230,635	211[a]	30.0[b]
Canada	13.1	38.6	185,781	565	14.7–18.8
France	11.2	39.8	243,436	164	27.4
Germany	10.9	n.a.	245,522	143	29.5
Italy	3.0	7.0	60,448	260	n.a.
Netherlands	6.8	n.a.	40,795	300[c]	15.0
Spain	3.6	24.0	64,906	224	n.a.
Switzerland	20.3	45.9	45,583	187	n.a.
United Kingdom	19.9	47.7	462,609	221	27.0[d]
United States	3.4	n.a.	624,474	145[a]	n.a.

Note: Data taken from OECD iLibrary. Foreign students defined as noncitizen students except for Australia and the United States where they are defined as nonresident students due to missing information on noncitizen status. Index of Change 1998–2008 in the number of foreign students is given for total tertiary education and relative to 1998 (1998 = 100). Data on retention rates taken from Table I.8 of the International Migration Outlook 2010 (OECD (2010)). Retention rates are calculated as the number of international students who change their legal migration status, for example, from "student" to "work" or "family formation," divided by the number of international students who do not renew their student permit.

[a]Base year figure in 1998 covers noncitizen students, whereas figure in 2008 covers nonresident students.

[b]Figure for Australia estimated by Australian Department of Immigration and Citizenship.

[c]Index of change calculated relative to 1999.

[d]Figure for the United Kingdom refers to 2005/2006 and is taken from ICMPD (2006).

students constitute a significant fraction of the student population, with their share often exceeding 10%. In Switzerland and the United Kingdom, about one in five students is a foreign student, a fraction that increases further to around 45% when restricting attention to advanced research programs such as doctorates. In terms of absolute numbers, the United Kingdom and the United States are the two main destination countries for foreign students, hosting around 460 and 620 thousand students in 2008, respectively. Column (4) shows by how much the number of foreign students in tertiary education has changed over the decade between 1998 and 2008. Across the board, foreign student numbers have increased substantially. This is not only true in countries that started from a relatively low base such as Italy and the Netherlands (where student numbers increased by 160 and 200%, respectively) but also in countries that were already popular destinations in 1998 such as Australia, the United Kingdom, and the United States (where numbers increased by 111, 121, and 45%, respectively). Overall, in the 10 OECD countries listed in Table 4.6, the number of foreign students increased by 80.8% between 1999 and 2008

which, given an increase in the corresponding overall stock of immigrants over the same period of around 42.5%,[10] indicates that the acquisition of formal education in foreign countries is not only a widespread phenomenon, but also one that has been rapidly gaining importance in recent years.

The last column in Table 4.6 shows estimated retention rates of graduates in their host countries following the completion of their studies. Although the calculation of these figures is not unproblematic (for details, see OECD (2010)), the estimates show that between 15 and 30% of all foreign graduates remain in their host countries after graduation, evidently to a large extent for work purposes.[11] These numbers suggest that the acquisition of education in countries that have established themselves as "learning centers" is a main reason for migration and that individuals choose to return to their countries of origin in order to apply the skills acquired (see Dustmann, Fadlon, and Weiss (2010) for modeling of such migrations and our discussion in Sections 3.2 and 4.3). Of course, these numbers may also partly be driven by regulations that do not allow individuals to remain after the completion of their studies. Indeed, in many countries, particularly in Europe, existing policies make it difficult for foreign students to stay and obtain a work permit. In recent years, the transition from study to work has been facilitated in many student destination countries, for example, by enabling students to work while studying, or by extending the period granted to search for work following the completion of study (see ICMPD (2006), for a comparative study on retention policies in a large number of industrialized countries). For instance, several countries have recently started to issue a special residence permit to foreign graduates for the purpose of seeking a job, including the United Kingdom (for 1–2 years, introduced in 2004/2005), Germany (for 1 year, introduced in 2005), and France (for 6 months, introduced in 2006).[12] Other special provisions introduced to facilitate the transition from study to work for foreign graduates include the allocation of extra points for a degree from a national institution of higher education (Canada, Australia, and New Zealand), a waiver of an obligatory work experience record (Australia and the Czech Republic), the exemption from the regular quota for "key workers" (Austria), and a specific category

[10] The calculation of this figure is based on the data from the International Migration Database and refers to the change of the sum of the foreign-born population in Australia, Canada, France, the Netherlands, Spain, and the United States and the population with foreign citizenship in Germany, Italy, Switzerland, and the United Kingdom between 1999 and 2008. The missing immigrant stocks for Canada and France were linearly extrapolated from available figures in 2001 and 2006 (Canada) and in 1999 and 2006 (France).

[11] Retention rates are calculated as the number of international students who change their legal migration status between 2006 and 2007, for example, from "student" to "work" or to "family formation," divided by the number of international students who do not renew their student permit. On average 61% of international students change their status for work-related reasons (OECD (2010)).

[12] While in France and Germany these jobs have to correspond to the graduate's qualification and are subject to labor market testing, permit holders in the United Kingdom are free to take up any employment they like. Contrary to the United States and Canada, the applicants in these countries do not already need to have a job offer at hand.

with a special quota for foreign graduates (Australia, Italy, United States). These policy changes are a reflection of the increasing global competition in attracting and retaining highly skilled workers. Kato and Sparber (2010) show that students are indeed responsive to such immigration policies. Studying the effect of the sharp reduction in the number of available H-1B visas—the primary means of legal employment for college-educated foreign nationals in the United States—in 2003, they find that this restrictive immigration policy has had a negative impact on the quality of prospective international applicants to US colleges. The intuition is that only the high-ability students are affected by the new policy, since low-ability foreign students are unlikely to find US employment even in the absence of visa quotas. Faced with a reduced prospect of gaining access to the US labor market after graduation, the "best and brightest" of the global talent pool appear to choose other host countries to provide them with both valuable education and the possibility of applying this education in the local labor market.

For the United States, which is host to the largest number of foreign students in the world, there are no overall retention rates of graduate students available. However, Finn (2007) shows that for the group of foreigners who have earned a doctorate in an American university, the retention rate 5 years after they received their degree is around 65–70%. In a cross-country comparison, this is likely to be at the upper end of the spectrum of retention rates.

In terms of the students' origin, there is once again substantial heterogeneity across destination countries. Looking at Table 4.7, three factors appear important for the choice of students where to obtain education: geographical distance, language, and former colonial ties. For instance, the majority of students in Australia (79.3%) originate from Asia, and in particular from China, which supplies a quarter of all foreign students. In Europe, Italy and Switzerland are countries that attract mostly foreign students from other European countries, whereas France has a large share of students from its former colonies in Africa (43.5%, of which 25.5% are from Morocco and 17.7% from Algeria), and Spain has a relatively large share of students from Spanish-speaking South America (40.7%, of which 21.4% are from Colombia and 16.7% from Peru). In the two biggest student-receiving countries, the United Kingdom and the United States, most foreign students originate from Asia (39.5 and 67.2%, respectively, of which 28.1 and 26.3% are from China).

Figure 4.1 shows the development of the overall number of foreign students studying in the 10 main OECD destination countries listed in Table 4.6 between 1999 and 2008. There is a clear upward trend, in particularly from 2001 onwards, with student numbers increasing from a little more than 1.2 million in 1999 to more than 2.2 million in 2008. Most of this increase is driven by increasing numbers of students from Asia and, to a lesser extent, from Europe and Africa. Although we cannot tell from these data whether these students came to their destination countries for the sole purpose of studying or whether they already arrived as young children with their parents and are

Table 4.7 Origin of Foreign Students in Tertiary Education in OECD Countries, 2008

Destination Country	Main Student-Sending Countries (Share of All Foreign Students in Percentage)	Share Europe	Share North America	Share South America	Share Asia	Share Africa
	(1)	(2)	(3)	(4)	(5)	(6)
Australia	China (25.0), India (11.5), Malaysia (8.1)	4.4	3.5	0.9	79.3	3.2
Canada	China (19.5), India (5.6), US (5.4)	12.0	10.1	3.1	50.2	11.7
France	Morocco (11.1), China (8.6), Algeria (7.7)	21.3	3.5	3.7	21.0	43.5
Germany	China (10.4), Turkey (9.7), Poland (5.7)	47.5	2.5	2.7	37.5	9.0
Italy	Albania (19.5), Greece (7.5), Romania (5.2)	56.5	1.9	7.6	15.0	10.8
Netherlands	Germany (40.6), China (8.4), Belgium (5.4)	69.3	2.3	3.3	19.9	5.0
Spain	Colombia (8.7), Morocco (8.4), Peru (6.8)	31.4	11.3	40.7	3.7	11.7
Switzerland	Germany (24.0), Italy (10.8), France (10.3)	75.7	2.5	2.9	9.0	5.4
United Kingdom	China (11.1), India (7.1), Ireland (5.8)	34.7	6.6	1.3	39.5	14.9
United States	China (17.7), India (15.2), Korea (11.1)	11.2	10.1	5.0	67.2	5.7

Note: Data taken from OECD iLibrary. Foreign students are defined as noncitizen students except for Australia and the United States where they are defined as nonresident students due to missing information on noncitizen status. Shares refer to students enrolled in tertiary education, both full time and part time.

expecting a more permanent stay, the important role of many destination countries in providing education to noncitizens is clearly discernible.

2.3. Return Migration

Figure 4.1 suggests that many migrations today are undertaken for the purpose of acquiring education. According to the International Passenger Survey, for example, about 40% of all migrants arriving in the United Kingdom in the year 2009 cited

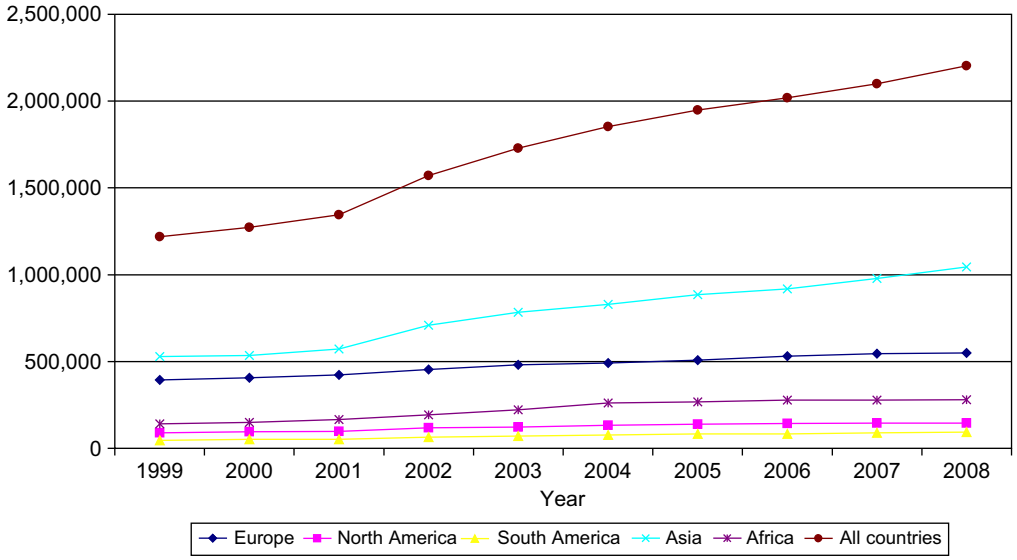

Figure 4.1 Origin of Foreign Students in Tertiary Education between 1999 and 2008.

Note: Data taken from OECD iLibrary. Graph shows total number of students in the 10 main OECD countries listed in Table 4.6 by continent of origin. Foreign students are defined as noncitizen students except for Australia and the United States where they are defined as noncitizen students from 1998 to 2003 and as nonresident students from 2004 to 2008. Numbers refer to students enrolled in tertiary education, both full time and part time. Numbers for Australia in 1999 and Canada in 2001–2003 and 2005 are missing and were linearly interpolated using the numbers in adjacent years.

as their main reason for migration the desire to pursue formal studies, up from around 23% in the year 2000. Migrations of this type are likely to be temporary. But temporary migrations are a more general phenomenon and widespread also among classical labor migrations. There are about 2.5 million temporary workers arriving in the OECD countries per year, mostly seasonal workers and young working holidaymakers with work permits for a duration of less than 1 year (OECD (2008)). The temporary character of these migrations has important implications for the type of immigrants' educational attainments and their investments in human capital as we will see in Section 3.3. Although until recently the analysis of immigrants' earnings and human capital investments has largely assumed migrations to be permanent, modern migrations seem to be characterized by different patterns. Indeed, numbers suggest that a large fraction of the foreign-born population will at some point return to their home country.

One way to study the time dimension of migration is to look at the duration of stay in the host country. Columns (1) to (3) of Table 4.8 show the share of the foreign-born population in the main OECD destination countries that have been in their host country for less than 5 years, more than 10 years, and more than 20 years. Clearly these

Table 4.8 Share of Immigrants by Duration of Stay, Outflow/Inflow Ratio, and 5-Year Re-emigration Rate (around 2000)

Destination Country	Share Duration <5 years	Share Duration >10 years	Share Duration >20 years	Ratio Outflow/ Inflow × 100 1998–2008	5-Year Re-emigration Rate
	(1)	(2)	(3)	(4)	(5)
Australia	13.6	77.5	55.0	9.8	n.a.
Canada	14.8	70.0	50.2	n.a.[a]	23.7[b]
Switzerland	23.1	62.4	31.1	51.3	n.a.
Germany	3.6	79.7	n.a.	86.0	n.a.
Spain	40.4	49.0	34.6	14.3[c]	n.a.
France	8.1	82.7	65.9	n.a.	n.a.
United Kingdom	17.0	70.2	n.a.	42.6	39.9
Italy	37.8	34.4	9.9	n.a.[a]	n.a.
Netherlands	9.7	71.6	n/a	29.3	28.1
United States	20.1	63.7	35.7	n/a[a]	19.1

Note: Data taken from Database on Immigrants in OECD Countries (DIOC) provided by the OECD. Duration shares refer to the foreign-born population. Observations with unknown length of duration were excluded from the calculation. The ratio of the aggregate outflow to the aggregate inflow of the foreign population between 1998 and 2008 is calculated using data from the OECD's International Migration Database. Ratios are based on data of foreign nationals from population registers for all countries except Australia and the United Kingdom, for which data based on residence permits or other sources were used. Data on re-emigration rates after 5 years are taken from Table III.1 (p. 171) of the International Migration Outlook 2008 (OECD (2008)). Relevant entry period for the United Kingdom was 1992–1998, for the Netherlands 1994–1998, and for the United States 1999.

[a]Data on outflows were missing for these countries.

[b]Figure taken from Aydemir and Robinson (2008).

[c]Ratio for Spain refers to period 2002–2008.

cross-sectional figures can only be indicative of the temporary nature of migrations since, for example, a high share of short durations could be either due to actual short migration durations or due to a large number of very recent arrivals (as, e.g., in the case of Italy and Spain). However, with the exception of France, the share of migrants who have already been living in their host countries for more than 20 years (and could therefore be considered as permanent) does hardly ever significantly exceed 50%. In the United States, for example, only 35.7% of the foreign-born population have already lived in the country for more than 20 years. As these figures may be driven by changing cohort sizes of the inflows of immigrants, it is useful to look at the outflows of the foreign populations from their host countries. Column (4) shows the outflow/inflow ratio of foreign nationals over the period 1998 and 2008. This ratio ranges from 9.8% in Australia, over 51.3% in Switzerland, to 86.0% in Germany. This suggests that there are indeed significant flows of foreign individuals out of their host countries. These out-migrations may be back to the countries of origin but could also be to an alternative host country. Outflow/inflow ratios are still only a crude measure of return migration, as they do not necessarily relate to the same

individuals. For a more precise measure, one requires data that follow immigrant entry cohorts over time. Column (5) in Table 4.8 provides some estimates of the share of foreign-born individuals that re-emigrate from their host country within the first 5 years of arrival. The estimates show the generally substantial extent of re-emigration, ranging from 19.1% in the United States to 39.9% in the United Kingdom.[13] Evidently, relatively short migration spells are a widespread phenomenon and, although the destination of the re-emigrating population is generally not observable, one can assume that a large fraction constitutes return migration to the country of origin.[14] As we will see later, this particular migration pattern has important implications for an immigrant's behavior both in the host and in the home country, and therefore requires particular attention. For an informative overview of the return migration issue including a detailed description of methodological approaches to measure it, see OECD (2008, Part III).

2.4. The Next Generation

The focus of the descriptive evidence presented so far has been on the educational attainment and investment, as well as the labor market performance of the working-age immigrant population. Given that a substantial fraction of immigrants will remain in the host country for a considerable amount of time, their children, whether born in the home country before arrival or thereafter, will spend a large part or even their entire childhood in the host country, passing through its educational system and making educational investment decisions along the way. These decisions have wider consequences not only for the performance of this next generation of immigrants in both the host and—in the case of a later return migration—the home country but also for the host country more generally, for example, through the immigrants' impact on the fiscal balance (see, e.g., Storesletten (2000) and Dustmann, Frattini, and Halls (2010)) or their integration prospects (see, e.g., Constant and Zimmermann (2008)). Given the often substantial differences in family backgrounds and language proficiencies, it is not surprising that in many destination countries immigrant children do significantly

[13] The OECD also provides corresponding re-emigration rates for Ireland (60.4%), Belgium (50.4%), and Norway (39.6%). Additional studies that estimate comparable 5-year re-emigration rates are Borjas and Bratsberg (1996) for the United States (17.5%), Bijwaard (2004) for the Netherlands (35%), Shortland (2006) for New Zealand (23%), Dustmann and Weiss (2007) for the United Kingdom (40% males and 55% females), Bratsberg, Raaum, and Sorlie (2007) for Norway (50%), Jensen and Pedersen (2007) for Denmark (55%), and Aydemir and Robinson (2008) for Canada (23.7% males).

[14] Nekby (2004) is one of the few who distinguishes between return migration and secondary migration to a third country, using data for Sweden for the period 1991–2000. According to her results, the share that constitutes return migration is around 90% for Nordic immigrants, 70% for Western Europeans and North Americans, 50% for Eastern Europeans, 40% for Asians, and around 30% for Africans. Bratsberg, Raaum, and Sorlie (2007) estimate the return migration share for Norway and find similar magnitudes. Over the period 1967–2003, the share of those who left Norway to return to their home country is 93% for Danes and Swedes, 86% for US Americans, 87% for UK immigrants, 78% for Turks, 81% for Iraqis, 70% for Somalis, and 33% for Vietnamese immigrants.

Table 4.9 Raw difference in PISA Test Scores between Students with Immigrant Background and Native Students

Destination Country	Reading	Mathematics	Difference of Performance between Students with an Immigrant Background Who Speak a Language at Home that Is Different from the Language of Instruction and Native Students	
			Reading	Mathematics
	(1)	(2)	(3)	(4)
Australia	8.8*	15.7**	−4.4	−4.2
Canada	−2.4	−2.7	−16.1**	−1.1
France	−25.4**	−38.9**	−31.7**	−66.7**
Germany	−57.1**	−58.1**	−81.6**	−92.8**
Italy	−60.7**	−38.6**	−79.4**	−22.2
Netherlands	−52.1**	−53.8**	−61.4**	−86.9**
Spain	−41.1**	−47.8**	−46.0**	−26.1*
Switzerland	−57.3**	−69.5**	−78.3**	−81.7**
United Kingdom	−11.5	−14.6*	−36.5**	−26.6**

Source: PISA 2006; reading scores for the US: PISA 2003. Native students are defined as those born in the country of assessment with both parents also born in the country of assessment. Immigrant students are either those born abroad with both parents also born abroad (first generation) or those born in the country of assessment but both parents born abroad (second generation). Students with a mixed background are excluded. Values are computed using the final weights provided by PISA. Stars indicate that the difference between the immigrant and the native average score is statistically significant at the 1% level (**) and at the 5% level (*).

worse at school than their native counterparts. To illustrate this, we use data from the PISA (Programme for International Student Assessment) study that provides internationally comparable measures of proficiency in reading, mathematics, and science of students aged 15 years in 18 OECD countries, as well as information on a large set of student and school characteristics.[15] Table 4.9 shows the raw differences in test scores in reading and mathematics between native children and children with an immigrant background, which include both children born abroad and children born in the host country. Both in reading and in mathematics, students with an immigrant background score significantly lower than native students. With an average native score in these tests of about 500, the test score gaps are substantial with a relative magnitude of around 10% in a number of countries (Germany, Italy, the Netherlands, and Switzerland). The only exceptions to these patterns are Australia, Canada, and to a lesser extent the United Kingdom, where students with an immigrant background do as well as, or better (in the case of Australia), than their native student counterparts. An obvious explanation for this heterogeneity across destination countries is the difference in socio-economic

[15] For detailed information on the PISA study, see OECD (2007).

characteristics between the corresponding immigrant populations, largely driven by the selectiveness of each host countries' migration policies. Australia, Canada, and the United Kingdom are all countries that have been applying a point system to select the immigrants they admit, which strongly favors individuals with characteristics conducive to their performance in the labor market, such as education and language skills. Through the intergenerational transmission of human capital, these beneficial characteristics are likely to be reflected in their children's performance at school. For illustration, we report in Columns (3) and (4) the test score gaps (relative to natives) of students with an immigrant background who do not speak the language of instruction at home. In all but three cases (Canada, Italy, and Spain in mathematics), these gaps are substantially larger than the gaps for the entire immigrant student population. For example, in the United Kingdom, those who do not speak English at home score 36.5 points below the native average in reading and 26.6 points below the native average in mathematics while overall the test score gaps only amount to 11.5 and 14.6 points, respectively. We will analyze the role language and parents' education play in explaining the achievement gaps between immigrant and native students more systematically in Section 5.3.

Do the lower test scores of immigrant children at age 15 carry over into their adulthood? One measure to assess this is to compare the average school-leaving age of first- and second-generation immigrant adults relative to the native population. Figure 4.2

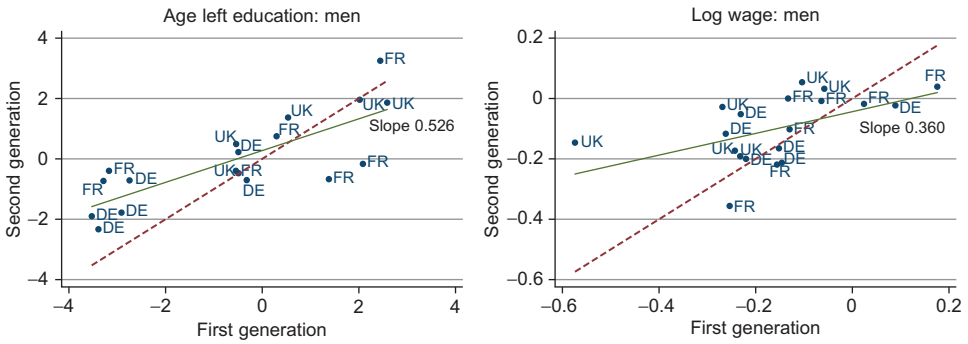

Figure 4.2 Gaps in Educational Attainment and Log Wages of First- and Second-Generation Immigrant Men Relative to Native Men.

Source: Algan, Dustmann, Glitz, and Manning (2010). Data sources are the French Labour Force Survey 2005–2007, the German Microcensus 2005–2006, and the UK Labour Force Survey 1993–2007. Data points reflect estimated gaps in age left education and log wages of different origin groups of first- and second-generation immigrant men relative to native men. Additional controls in the regressions from which these estimates were obtained are a quadratic in year of birth, region dummies, and time dummies in the age left education censored regression, and a quadratic in potential experience, region dummies, and time dummies in the linear wage regression.

reproduces estimates for men obtained by Algan, Dustmann, Glitz, and Manning (2010) for France, Germany, and the United Kingdom using the latest available data sources. The corresponding results for women show broadly similar patterns. The differences in the average age left education shown in the left-hand side scatterplot in Fig. 4.2 are estimated coefficients on dummy variables for the main immigrant groups in each country, obtained from a censored linear regression. Additional controls in these regressions are a quadratic in year of birth, region dummies, and time dummies. Each point represents the educational gap relative to natives of first-generation immigrants (x-axis) and second-generation immigrants (y-axis) for a particular country (or country group) of origin. For reference, we include a 45° line and a fitted linear regression line. The scatterplot shows that for those immigrant groups in Germany and France, who started with the biggest disadvantage relative to natives, there is some improvement in the educational attainment from one generation to the next (in the sense of a later age when individuals leave education). However, there is still a significant difference in schooling remaining for these groups in the second generation. This persistence in educational differences between natives and immigrants translates into differences in labor market outcomes, as illustrated in the right-hand side scatterplot in Fig. 4.2, which shows estimated relative earnings gaps, again taken from the Algan, Dustmann, Glitz, and Manning (2010) study in which the only included control variables in the estimated linear earnings equations are a quadratic in potential experience, region dummies, and time dummies. Most importantly, the regressions do not control for the differences in educational attainment illustrated in the left-hand side scatterplot. The figures show that for most immigrant groups there is some improvement in earnings from one generation to the next, in part due to the improved educational attainment. However, the majority of adult second-generation immigrants in these countries still experience a substantial wage disadvantage (of the order of 10% on average) relative to their native counterparts. Both scatterplots also reveal a significant correlation between first- and second-generation immigrants' education levels and earnings. Despite some convergence, those immigrant groups who started with the biggest disadvantage relative to natives in the first generation continue to be the most disadvantaged in the second generation. We will get back to this issue in our discussion of intergenerational mobility of immigrants in Section 5.

3. THE MIGRANT

3.1. The Migration Decision and Human Capital Investment

In this section, we investigate the key drivers of individuals' decisions of whether to emigrate, whether and when to return, and how these decisions interact with decisions about education and skill acquisition. In its simplest possible form, the migration

decision is based on a comparison of expected lifetime earnings in the current region of residence and in an alternative region, to which the migrant has the possibility to emigrate. In most cases, there is more than one possible destination region in the choice set of potential migrants. For simplicity, we will abstract from that and consider only one potential destination country.[16]

What are the factors that determine the emigration decision? Abstracting for the moment from amenities that arise from living in the home or potential host country, the decision problem of the potential migrant is based on the comparison of the net monetary returns of that decision. In the simplest possible model, where migrations are permanent and the acquisition of human capital is completed before the migration, these will depend on the skill prices in the origin and destination country, as well as the degree to which skills acquired in the origin country are transferable to the economy of the destination country. In a more dynamic setting, the migrant compares lifetime net discounted earnings in the two countries, allowing for the possibility that additional human capital investment is undertaken.

After migration, individuals will potentially acquire further skills in the host country. As skills obtained in the home country are not always fully transferable to the host country's labor market, new immigrants should have lower earnings than natives, even when they belong to the same skill group as measured, for instance, by the years of schooling obtained. However, the subsequent transfer of existing skills, facilitated, for example, through the acquisition of complementary skills like language, and the acquisition of new skills lead to an increase in earnings, possibly at a faster rate than that of comparable native workers. A large literature has developed around measuring this process (starting with Chiswick's, (1978) seminal paper), and we will review some of this literature in Section 3.4.

As we have shown in Section 2, many migrations are temporary, with immigrants remaining for a limited amount of time in the host country, and then returning back home. This behavior can be optimal despite consistently more favorable economic conditions in the destination country (see Dustmann (2003) and Dustmann (1994a, 1995), for an early analysis of different return motives). But if immigrants plan to return to their home countries (or to move on to a third country), then this may affect many aspects of their behavior, including their human capital investment. In particular, any investment decisions in further skills will now depend not only on the return to these skills in the host country but also on the return to these skills back in the home country. Thus, understanding the distinct forms of migration is key to understanding immigrants' human capital investment behavior.

[16] Papers by Dahl (2002), Grogger and Hanson (2008), Bishop (2008), Ortega and Peri (2009), Kennan (2010), and Kennan and Walker (2010) consider the choice problem of individuals when deciding between more than one potential destination region.

Return decisions may be driven by preferences (if, for instance, the home country provides the migrant with amenities that are valuable itself or complementary to consumption) or purchasing power considerations (if, for instance, the host country currency has a high value in the home country). However, they may also be the outcome of an optimizing strategy that consists of obtaining human capital in the destination country in order to apply it in the origin country. Examples of this type of human capital are university education or foreign language skills. In that case, return migration is the outcome of an optimal human capital investment plan over the individual's life cycle. In addition, the possibility of a migration later in the individual's life may already induce human capital investment in the home country. One reason may be that skills acquired at home have a high return in the host country. Another reason may be that skills acquired at home are a prerequisite for the possibility to acquire further valuable skills abroad, either directly because of minimum education requirements due to immigration policies or because of the sequential nature of skill accumulation.

3.2. A Simple Model of Return Migration and Investment in Human Capital

In what follows, we set up a simple model that serves to clarify some key ideas of migrants' decision processes. The model shows how individuals reach a decision of whether to emigrate and how this decision is intricately linked to the human capital they accumulate over their life cycle. It illustrates how the possibility of a temporary migration affects optimal human capital investment profiles, what these profiles imply for individuals' earnings and their growth over time, and how these patterns depend on initial observable skills and ability. The model will also help us to structure the vast empirical literature that exists on migrants' education and skill investment decisions in their home and host countries. This literature has focused particularly on the analysis of earnings profiles of immigrants as a reflection of their human capital investments, on how these profiles depend on the time horizon of the migration as well as the language proficiency of the migrant, and on the issues of skill transferability, skill downgrading, and the role of ethnic networks.

Our model has essentially three periods. Life is finite and time flows continuously. The duration of life is $T+2$. We have illustrated the timing of the model in Fig. 4.3. The first two periods are "learning periods," and they are of unit length. In the first

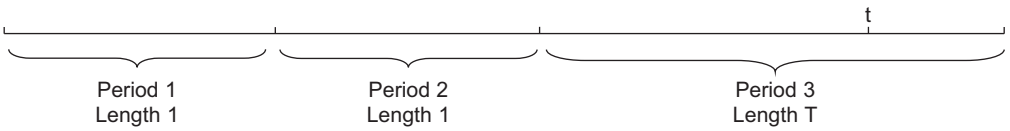

Figure 4.3 Timing of Model.

period, individuals live in the home country. In that period, individuals do not work but can acquire education and choose how much to acquire. Acquisition of education is costly, and individuals differ in their efficiency to acquire education. After the first period, individuals decide whether to emigrate.[17] In the second period, individuals live either in the home or in the host country, depending on whether they have chosen to emigrate after the first period. During this second period, individuals have another opportunity to acquire education. They divide their time between learning and working in the labor market. Thus, abstracting from direct costs of education such as fees, the cost of acquiring further education is equal to the opportunity cost of forgone earnings. We think about this period as a period where postsecondary education is obtained. This may take the form of vocational training or college education. The third period has length T. If individuals decide not to emigrate after the first period, they will spend both the second and the entire third period in the home country. If individuals decide to emigrate, then they have the possibility to return to the home country either right after the second period, or after a duration t in the host country, with $t \leq T$. Therefore, the length of the migration is given by $t + 1$, and the remaining time in the home country after remigration is $T - t$. A permanent migration corresponds to the case where $t = T$.

In case no migration takes place, individuals stay at home until death, which occurs at T. Although there is no explicit learning in the third period, we allow the return back in the home country of human capital acquired in the host country in the second period to increase with the length of stay in the host country.

In our model, individuals make a number of choices. These choices are made at the start of the first period and at the start of the second period. To solve the model, we first consider the decision problem at the start of the second period. In case no migration takes place, the individual decides about the optimal investment in learning in the home country in the second period. In case a migration does take place, the individual decides about the optimal investment in learning in the host country and the optimal time to spend in the host country. Given these decisions, we then go back to the start of the first period, where individuals decide about the optimal investment in their education while they are still in the home country. This decision depends on the returns to any such investment in the future, given the optimal decisions about human capital investment and the duration of migration at the start of the second period. Finally, the migration decision is based on a comparison of the net present value of their lifetime earnings if migration does or does not take place.

We will first consider the decisions at the start of the second period. We will then consider the educational investment decision before a potential migration has taken place and the migration decision itself.

[17] For simplicity, we assume that immigrants have only the opportunity to emigrate after the first period.

3.2.1 Skill Enhancement and Return Decisions of Migrants

In case migration takes place, the individual maximizes period 2 and period 3 earnings by choosing the optimal investment in period 2, s_D^*, and the optimal time of return, t^*:

$$\max_{s,t} F^D(s, t) = \omega_D X(1-s) + t[\omega_D(X + f(s, A, X))] + (T-t)[\omega_O(X + \gamma(t) f(s, A, X))], \quad (4.1)$$

where ω_j, $j = O, D$, is the rate of return to human capital X (acquired in the home country in period 1) in either origin country O or destination country D, s is the time investment in human capital acquisition in the second learning period (the first period in the host country in case of a migration), and t and T denote the time in the host country and the total length of the last period of life, respectively. We assume throughout this section the typical case in which $\omega_D > \omega_O$. The function $f(s, A, X)$ translates human capital investment s in the host country in the second period into skills, where A is the ability of the individual. We make the following standard assumptions: $f_s > 0, f_{ss} < 0$, $f_{sA} > 0$, $f_{sX} > 0$, $f(0, A, X) = 0$. This means that skills are produced with decreasing returns and that ability and the existing stock of human capital are complementary to the production of new human capital (see Ben-Porath (1967), and, for empirical evidence of such complementarity, Chiswick and Miller (1994) or Friedberg (2000)). The parameter $\omega_O \gamma(t)$ is the rate of return to human capital acquired in the host country back in the home country. Notice that $\gamma(t)$ may increase with the time the migrant stays abroad after the second learning period, which reflects the possibility that staying abroad increases immigrants' rate of return on human capital in the home country through on-the-job learning. Further note that if $\gamma(0) < \frac{\omega_D}{\omega_O}$, human capital acquired in the host country in the second period is less valuable back home at the beginning of the third period than in the host country. Conversely, if $\gamma(0) > \frac{\omega_D}{\omega_O}$, human capital acquired in the host country has a higher return back home.

In case migration does not take place, the individual only decides about human capital investment in the second period, s_O^*:

$$\max_s F^O(s) = \omega_O X(1-s) + T[\omega_O(X + g(s, A, X))], \quad (4.2)$$

where $g(s, A, X)$ translates human capital investment in the home country in the second period into skills and is subject to the same standard assumptions as $f(s, A, X)$.

In this model, return migration is induced by the possibility to acquire human capital in the host country that is yielding a high rate of return in the home country (see Dustmann (1994a, 1995); Borjas and Bratsberg (1996); Domingues Dos Santos and Postel-Vinay (2003); and Dustmann, Fadlon, and Weiss (2010), for a similar formulation).[18] A return

[18] We will only discuss human capital accumulation as a return motive in this chapter. There are other motives for why immigrants may want to return, such as higher purchasing power of the host country currency in the home country or consumption amenities in the home country. See Dustmann (1994a, 1995) for a detailed discussion.

to the home country may happen at the beginning of the third period if $\gamma(0) > \frac{\omega_D}{\omega_O}$. An example is "student migrations," where a migration takes place to acquire skills abroad that have a higher return in the home country.[19] Return migration can also be induced by a high return in the home country to human capital acquired in the host country "on the job".[20] In our model, this is reflected by $\gamma'(t) > 0$. Even if $\gamma(0) < \frac{\omega_D}{\omega_O}$ so that an immediate return after the second period is not optimal, returning before T may be an optimal strategy.

3.2.2 Skill Investment in the Home Country

After having chosen the optimal duration abroad t^* and the optimal investment in learning s^*, where we denote the payoff of these choices as $F^D(t^*, s_D^*)$ in case of emigrating and $F^O(s_O^*)$ in case of not emigrating, we will now consider the first-period problem. Before making the migration decision, individuals have the possibility to acquire education in the home country in the first period. To allow for this, we assume that X, the human capital stock after the first period,is a function of first-period investment i: $X = X(i)$. We further assume that the amount of skills acquired in the first period is concave with respect to investment: $X_i > 0$, $X_{ii} \leq 0$. The choice of i will depend on the possibility of a future migration. In case of migrating, the value function is then given by

$$V^D = \max_i F^D(s_D^*(i), t^*(i), i) - C(i, A), \tag{4.3}$$

where $C(i, A)$ is the cost of investing in education in the home country, which has the properties $C_i > 0$, $C_{ii} > 0$, $C_A < 0$, $C_{iA} < 0$: costs are increasing in investment, convex, and lower as well as increasing at a slower rate for high-ability individuals. In case of remaining in the home country, the value function is given by

$$V^O = \max_i F^O(s_O^*(i), i) - C(i, A). \tag{4.4}$$

[19] There is relatively little direct empirical evidence on the returns of foreign education in the home country of an immigrant after he or she returned. One obvious problem for empirical analysis is the selection of both those who decide to study abroad and those who return to their home country, which makes it difficult to identify a causal effect. Oosterbeek and Webbink (2006) exploit a discontinuity in awarding a specific grant to Dutch students for studying abroad. Their OLS estimates show a wage gain of around 4–7% for graduates who studied abroad relative to graduates who did not. However, their RD estimates, though of broadly similar magnitude, are inconclusive due to large standard errors. Wiers-Jenssen and Try (2005) find a wage premium of around 3.5% for Norwegian workers who graduated abroad, whereas Palifka (2003), using survey data covering a complete cohort of graduates from a single Mexican university, finds a premium of around 20% 6 months after graduation for graduates who spent at least some time studying abroad.

[20] There is evidence that, for migrants who returned to their home country, the work experience acquired abroad enhances earnings by more than the work experience acquired in the home country. Reinhold and Thom (2009) analyzed earnings of Mexican emigrants who returned from the United States. They find that, for these immigrants, the labor market experience accumulated in the United States increases earnings by twice as much as the experience accumulated in Mexico. Papers by Barrett and O'Connell (2001) and Iara (2006) report similar findings for Ireland and migrants who returned to Eastern Europe from Western European countries. Co, Gang, and Yun (2000) report a wage premium for having been abroad for female return migrants in Hungary.

3.2.3 The Migration Decision

The choice whether to migrate will depend on the comparison of the optimal value functions:

$$V = \max[V^D - k + \eta_D,\ V^O + \eta_O]. \tag{4.5}$$

Assume that η_j, $j = O, D$, are iid extreme value distributed error terms capturing heterogeneity in the choice, and k is the cost of migration. It follows that for a given individual, the probability of a migration is given by

$$\text{Prob}_{\text{migrate}} = \frac{1}{1 + e^{V^O + k - V^D}}.$$

Thus, if we assume that abilities follow a distribution G, with support $[0, \overline{A}]$, then the proportion of individuals who migrate from country O to country D is given by

$$\text{Proportion}_{\text{migrate}} = \int_0^{\overline{A}} \text{Prob}_{\text{migrate}}(A)\,dG(A).$$

This model is simple, but instructive, as it allows for a variety of cases that have been studied in the empirical literature. For a permanent migration, the second-period problem in Eq. (4.1) corresponds to the simple human capital model that underlies the early empirical papers on immigrant assimilation (see, e.g., Chiswick (1978)). Adding the possibility of return migration with a predetermined migration period leads to more complex empirical specifications, as we will illustrate below. The problem becomes even more difficult if the migrant chooses the time of return optimally. The model also allows consideration of the relationship between migration and return migration, and human capital accumulation in the host country. It includes the special case of student migrations, in which some countries are "learning centers," as documented in Table 4.6, and provide education that has a high return in the home country.

The choices made in the first period add additional insight into learning incentives induced by migration possibilities. For instance, acquisition of education in the home country in the first period may be a prerequisite for acquiring further and higher education in the host country in the second period. Furthermore, the model allows for the possibility that human capital in the home country is acquired because it has a high return in the host country. In Section 3.3, we will explore some of the implications of this model for empirical work. We will then discuss the empirical literature, using the model as a framework of reference.

3.3. Implications of the Model

3.3.1 The Optimal Investment in Human Capital and the Optimal Migration Duration

We first consider the problem of the individual at the beginning of the second period. For those who do not migrate, the optimal investment in the second period s_O^* is

simply obtained by differentiating Eq. (4.2) with respect to s and equating the additional forgone earnings in the learning period from an extra unit of time investment, $\omega_O X$, to the benefit arising from a higher earnings potential in the subsequent period, $\omega_O g_s T$.

For those who migrate, the problem at the beginning of the second period corresponds to the decision about how much to invest in host country human capital and when and whether to return to the home country. The FOCs are given by

$$\frac{\mathrm{d}F^D(s,t)}{\mathrm{d}s}: -\omega_D X + f_s[t\omega_D + (T-t)\gamma(t)\omega_O] = 0 \tag{4.6a}$$

$$\frac{\mathrm{d}F^D(s,t)}{\mathrm{d}t}: \omega_D(X + f(.)) - \omega_O(X + \gamma(t)f(.)) + \omega_O(T-t)\gamma'(t)f(.) = 0. \tag{4.6b}$$

The equilibrium condition in Eq. (4.6a) for the optimal investment in human capital while being in the host country indicates that the cost in terms of forgone earnings in the learning period from an additional unit of time investment (first term) must be equal to the benefit arising from a higher earnings potential in the subsequent period (as in the case of no migration). This, in turn, depends on the time spent in the host country t, on the increase in productivity in the second period through investments in human capital in the first period f_s, and on the transferability of human capital acquired abroad to the home country's labor market $\gamma(t)$, which may depend on the time spent in the host country.

The optimal migration duration derived from Eq. (4.6b) depends, for the optimally chosen human capital investment, on a comparison between spending a marginal unit of time in the host country and spending the same unit of time back in the home country. The individual chooses the optimal s and t simultaneously. The optimal human capital investment s_D^* will change in response to changes in exogenous parameter (for instance, the rate of return to human capital ω_D) directly, and indirectly, because any parameter change affects the optimal migration duration, t^*, which in turn changes investment. Given our assumptions about $f(.)$ and $\gamma(t)$, it is straightforward to show that, in case of an interior solution, a unique optimum for s and t exists. To derive the comparative statics is likewise straightforward. We will now investigate some special cases, which relate to the empirical literature in the area.

3.3.2 Permanent Migration

Assume first that the migration is permanent, that is, $t = T$. One way to generate a permanent migration in our model is to assume that $\gamma = 1$, $\gamma' = 0$, and $\omega_D > \omega_O$: human capital acquired abroad has the same value at home, the value is not increasing with experience abroad, and the rental rate on human capital is higher in the host country.

In that case, the optimal investment in human capital during the second period is chosen so that $\omega_D X = \omega_D f_s T$: forgone earnings in the second period are equalized to the gain from human capital investment in the third period. Given our assumptions of the function $f(.)$, we immediately obtain a number of results: First, human capital investment s in the host country increases in T. A direct implication of this is that immigrants who arrive early in life will invest more into their skills, as their payoff period is longer (Friedberg (1992), Schaafsma and Sweetman (2001), and Wilkins (2003), explore this issue empirically). Second, investment may increase or decrease with the stock of human capital X upon arrival. Well-educated immigrants may lose considerably when spending time in learning activities. On the other hand, as human capital is productive in its own production, well-educated immigrants acquire additional skills more effectively. The larger the complementarity between skills upon arrival and the acquisition of additional skills (f_{sX}), the more likely it is that human capital investment after immigration is higher for well-educated immigrants (see Borjas (2000), for a detailed discussion). Finally, the higher the ability A of immigrants, the higher is their human capital investment.[21]

How is wage growth for permanent migrants in the host country related to these parameters? Wage growth from period 2 to period 3 is given by $\Delta w_D = \omega_D(f(.) + sX)$. Thus, for a given investment s, wages grow faster the higher the skills the individual has upon arrival. However, the effect of an increase in the initial skill level at arrival on skill investment itself is ambiguous so that the overall effect of higher education at arrival on wage growth is likewise ambiguous.[22] Wage growth is unambiguously positively related to the level of the immigrant's ability, as this raises third-period wages per unit of investment and human capital investment itself. Finally, wage growth is higher for immigrants who arrive at a younger age, as their investment in the second period is higher. We will contrast these results with the empirical literature in Section 3.4.

3.3.3 Temporary Migration with Exogenous Return Date

The next case we will consider is that of a temporary migration, in which the length of the migration period is exogenously determined. This could, for instance, be the result of a contract migration or migrations that are restricted to a limited time period for other reasons. Let $\bar{t}$ denote the exogenously set migration duration We assume that the optimally chosen migration duration would be longer than the predetermined one, so that the constraint is binding, and (for simplicity) that $\gamma(\bar{t}) = \gamma < \frac{\omega_D}{\omega_O}$ so that

[21] The results follow from totally differentiating Eq. (4.6a) after setting $t = T$, where the total differential is given by $\mathrm{d}sf_s T = \mathrm{d}x(1 - f_{sX}T) - \mathrm{d}Tf_s - \mathrm{d}Af_{sA}T$.

[22] $\mathrm{d}\Delta w_D = \omega_D\left[(f_X + s) + (f_s + X)\frac{\mathrm{d}s}{\mathrm{d}X}\right]\mathrm{d}X$.

human capital acquired in the host country is less valuable back home than in the host country.[23] In that case, the optimal investment in skills s is chosen so that $-\omega_D X + f_s[\bar{t}\omega_D + (T-\bar{t})\gamma\omega_O] = 0$.

As before, investment in human capital increases with ability A, and the effect of a higher level of skills upon arrival is ambiguous. Furthermore, an increase in the migration duration $\bar{t}$ increases human capital investments: the longer the immigrants are allowed to stay in the host country, the higher is their human capital investment in host country–specific skills. Finally, notice that investments in human capital depend on the degree to which these skills are transferable to the home country's labor market, that is, the magnitude of γ. If γ is small, then, for any given migration duration $\bar{t}$, investments will be low. It is immediately obvious that temporary migrations pose a serious problem for empirical analysis: as we will discuss below, both $\bar{t}$ and γ are usually not observed. Both introduce heterogeneity in earnings profiles that is likely to be correlated with many of the typical regressors in an earnings equation.

We can now again investigate wage growth from period 2 to period 3 in the host country. As before, individuals with higher ability A will have faster wage growth, and the effect of an increase in the skill level X upon arrival is ambiguous. However, wage growth will now be the larger the higher the transferability of human capital from the host country labor market to the home country labor market, γ. Furthermore, the longer the contract migration period $\bar{t}$, the faster the wage growth. Thus, if migrations are nonpermanent, there will be heterogeneity in the slope of immigrant's wage profiles that is determined by the transferability of human capital, as well as the length of the migration period.

3.3.4 Temporary Migration with Endogenous Return Date

So far we have assumed that the migration is permanent, or that t is exogenously given. We will now relax that assumption. The optimal migration period is determined by condition (4.6b) in conjunction with the choice of the optimal second-period investment s:

$$\omega_D(X + f(.)) - \omega_O(X + \gamma(t)f(.)) + \omega_O(T-t)\gamma'(t)f(.) = 0. \qquad (4.6b)'$$

The first term in Eq. (4.6b)′ is the return to each unit of time spent in the country of destination. It is constant for the optimally chosen s. The second term is the opportunity cost of staying abroad: it is the forgone earnings in the home country by staying abroad. If $\gamma'(t) > 0$, then this term increases with t. Finally, the third term is the additional gain from staying one more unit of time abroad through accumulation of additional skills that increase the value of human capital in the home country. If $\gamma''(t) \leq 0$, this additional gain will unambiguously decrease with time t spent in the host country. The reason is

[23] We do not consider here the case $\gamma > \frac{\omega_D}{\omega_O}$, as this may lead to a return before $\bar{t}$.

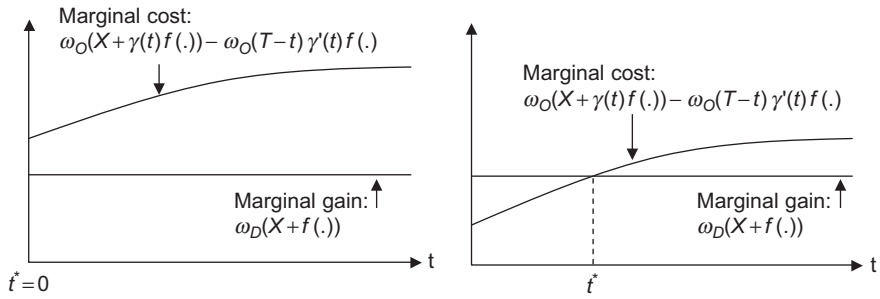

Figure 4.4 Immediate and Postponed Return Migration.

that although on-the-job experience in the host country is valued back home, there is less and less time remaining to reap the returns from applying human capital acquired in the host country back in the home country.

In our simple model, and assuming that $\omega_O < \omega_D$ (i.e., the rental rate on home country–specific human capital is higher in the host country), a return migration will occur for two reasons. First, the return on human capital acquired in the second period in the host country is higher at home, $\gamma(0) > \frac{\omega_D}{\omega_O}$, and the accumulation of home country relevant skills by staying in the host country is sufficiently slow so that directly after the second period $\omega_D(X+f(.)) < \omega_O(X+\gamma(0)f(.)) - \omega_O T\gamma'(0)f(.)$. In this case, the (constant) marginal gain from delaying return by one period is lower than the marginal cost of staying. Although emigration itself is optimal after the first period, the individual decides to return immediately after the second period. This situation is depicted in the left panel of Fig. 4.4. Migrations that are characterized by this pattern are student migrations, or migrations that take place predominantly for the purpose of acquiring particular skills or experience in the country of destination. In Column (5) of Table 4.6 in Section 2, we demonstrate that these student migrations are frequent, and that many—typically around 70%—are terminated after education has been acquired.

Second, a return migration may occur even if $\omega_D(X+f(.)) > \omega_O(X+\gamma(0)f(.)) - \omega_O T\gamma'(0)f(.)$—which means that it is optimal for the migrant to initially remain in the host country after the second period—as long as human capital acquired while working abroad increases the earnings potential of the immigrant in her home country ($\gamma'(t) > 0$). In this case, the marginal costs of staying in the host country increase with time spent there due to the increasing forgone earnings in the home country, and the immigrant may choose an optimal t^* so that $0 < t^* < T$.[24] The right panel of Fig. 4.4 illustrates this situation.

[24] A sufficient condition for the marginal costs of staying to be increasing in t is that $\gamma''(t) \leq 0$: the gain from remaining an additional unit of time abroad (in terms of enhancing the home country skill stock) decreases with time in the host country.

It is apparent that, if the return time is optimally chosen, the analysis of immigrants' earnings paths becomes more complex than before, as the optimal migration duration may affect human capital investment and is in turn affected by the optimal skill accumulation. The earnings paths of immigrants who choose their migration duration optimally will therefore depend on parameters that determine their return choice as well. This further complicates the analysis of immigrants' earnings profiles, as we will discuss below.[25]

3.3.5 The Optimal Investment in Learning in the First Period

So far we have not considered the decisions in the first period. Having solved the second-period problem by choosing the optimal migration period t^* and the optimal investment s^*, the individual will now choose the optimal investment in learning in the first period. Assuming that individuals are endowed with a base level of productivity (which could include compulsory schooling: $X(0) = X^0$), the optimal investment in the case of migrating is given by (invoking the envelope theorem)

$$\omega_D(1-s_D^*(i))X_i+t^*(i)\omega_D X_i(1+f_X)+(T-t^*(i))\omega_O X_i(1+\gamma(t^*(i))f_X)=B^D(i)=C_i(i,A), \tag{4.7a}$$

and in case of nonmigrating by

$$\omega_O(1-s_O^*(i))X_i+T\omega_O X_i(1+g_X)=B^O(i)=C_i(i,A), \tag{4.7b}$$

where $X_i=\frac{\partial X}{\partial i}$.

Thus, in the migration case, the individual will compare the marginal cost of investing in the first period (which are costs invoked by effort, and possibly monetary cost) with the marginal benefit, which is the impact of an extra unit of investment in the first period on future lifetime earnings.[26] Given our assumptions about the cost function and the learning technology in the first period, the individual will invest in learning in period 1 if the expressions on the left-hand side of Eqs (4.7a) and (4.7b) are larger than the marginal cost for the first unit of investment. Note that—as the marginal cost schedule decreases in ability—higher-able individuals will always invest more in learning. Once the optimal investment in the first period i^* has been obtained for both the migration case (together with s_D^* and t^*) and the nonmigration case (together with s_O^*), the migration decision of the individual is based on a comparison of V^D-k and V^O.

[25] Derivation of the partial effects is straightforward, although tedious. For the assumptions made and for $\omega_D-\omega_O>0$, an increase in ω_D decreases investments in human capital s, whereas an increase in ω_O leads to an increase in investments. Those with higher ability A will invest more, whereas the effect of an increase in human capital upon arrival X on s is ambiguous.

[26] To simplify the analysis, we assume here that the preference shocks η_D and η_O are drawn *after* the investment decision is made.

This framework allows us to explore a number of interesting cases. Let us first consider the simple case in which migration is permanent and no investment in human capital after period 1 is allowed ($s = 0$). In this case, conditions (4.7a) and (4.7b) simplify to $\omega_D X_i(1+T) = C_i(i, A)$ and $\omega_O X_i(1+T) = C_i(i, A)$. If (as we assume throughout) $\omega_D > \omega_O$, the return to the period 1 investment is clearly larger in the case of a migration and investment in learning in the first period will be higher for the case of a permanent migration than for the case of nonmigration. This is the core of the argument by Mountford (1997). In his model, individuals have an (exogenous) probability of migrating π so that the optimal investment is given by

$$(\pi\omega_D + (1-\pi)\omega_O)X_i(1+T) = C_i(i, A).$$

There are two insights from this relationship. First, there is (for a given π) a particular ability level A, only above which it will be worthwhile to invest in learning. Second, even if the probability of emigration is small, individuals will invest more in learning, as long as the return in the country of destination is sufficiently high. Thus, an increase in π may lead to more accumulation of human capital than in the nonmigration case. Furthermore, although emigrants take with them the human capital they acquire in the home country (which is usually associated with a brain drain), some of those who acquired more skills remain in the home country and may therefore increase the overall per capita level of skills in that country, compared with the case where no migration is possible. This may then lead to a brain gain rather than a brain drain. Thus, the country of origin could overall benefit from a migration of skilled workers—see Mountford (1997) for an insightful discussion. In Section 4.4, we discuss papers that investigate the empirical relevance of this hypothesis.

Another situation that is encompassed by this model is the acquisition of human capital in the home country as a *prerequisite* to enter the destination country. Suppose the potential host country has particular entry requirements such as a specific educational degree. The recently introduced point-based immigration system in the United Kingdom and similar existing systems in Australia and Canada reflect this scenario. Thus, if (for optimally chosen s^* and t^*) the value of migrating is sufficiently higher than the value of nonmigrating, then individuals will invest in education in the home country to obtain the critical level of $X^{\min}$ that then allows an emigration in the next period, given that

$$V^D - k\,|_{X(i) \geq X^{\min}} > V^O.$$

Again, such a policy will lead to a selection of high-ability immigrants to invest in the minimum necessary level of education, as for them the cost of acquiring education is lower.

Another (but similar) situation occurs if learning in the second period in the country of destination requires a certain level of education to be obtained at home. For instance, PhD studies in the United States may require a Bachelor's degree in the country of origin. In that case, optimal investment in the home country will take this requirement into account.

3.4. Empirical Studies

3.4.1 Assimilation and Adaptation

The first generation of papers that studies the performance of immigrants in their countries of destination, starting with Chiswick (1978), concentrates on the earnings profiles of immigrants after arrival in their destination country, viewing these as a reflection of the human capital investments undertaken by the migrants and the skill transferability between origin and destination country. These studies do not distinguish between permanent and temporary migrations, and there is no consideration of immigrants having undertaken investments in the home country with a view of obtaining returns in the host country as illustrated in the previous section. The key question these studies address is whether immigrants perform similarly, worse, or better than natives with the same set of characteristics. This depends on two factors: (1) their quality and (2) their effort to invest in further knowledge.

Why is this important and why have so many papers been published that address this issue? Mainly because the relative position of immigrants in the distribution of earnings determines the contribution they make to the host country economy. Higher earners contribute more to tax and benefit systems and may increase per capita GDP. For many years, the study of immigrant assimilation was perhaps the largest empirical literature on immigration in the economic discipline (see Table 4.L1 at the end of this chapter for a comprehensive overview of studies).

Chiswick's (1978) work suggests that immigrants—although starting with a lower level of earnings than comparative natives—experience a higher earnings growth and eventually outperform natives after about 10–15 years.[27] He obtains these results by "augmenting" a simple Mincer wage equation and allowing immigrants to have—conditional on education and potential experience at entry—different entry wages than natives, as well as different earnings growth. Earnings of immigrants grow because of two types of work experience: (1) experience accumulated in the home country and (2) experience accumulated in the host country. Experience accumulated in the host country has two components: (1) new, host country–specific human capital and (2) human capital that allows already existing knowledge to be used in the destination country. An example for the latter is language proficiency. Chiswick concludes that the

[27] Holding other characteristics constant, Chiswick's results show that the earnings of the foreign-born are 9.5% lower than those of the native-born after 5 years, equal after 13 years, and 6.4% higher after 20 years in the country.

foreign-born seem to be able to compensate any potential earnings disadvantage arising from initially lower host country–specific human capital by greater investments in training, higher work motivation, and greater ability, due to being positively selected. Some subsequent papers supported these findings (Carliner (1980) and De Freitas (1980)); thus, at least for the United States, the early literature on immigrant assimilation draws a picture of immigrants as being high achievers, who—after initial disadvantages—outperform natives through ability, hard work, and investment in their human capital and productivity.

However, this positive picture of immigration to the United States was soon challenged by a series of papers starting with Borjas (1985). Borjas argues that estimation of earnings equations based on simple cross-sectional data—as in Chiswick (1978)—does not allow a distinction between cohort and years since migration effects. An immigrant who has been in the United States for 10 years in 1970 arrived in 1960, while an immigrant who has been in the United States for 20 years in 1970 arrived in 1950. Thus, if the composition of immigrants changed over time (as it had since the abolition of country quotas - originally established by the US Immigration Act of 1924 - through the Immigration and Nationality Act of 1965 significantly increased the share of immigrants from South and Central America), estimated earnings profiles based on cross-sectional data may over- or understate the earnings growth of immigrants. In the case of the United States, Borjas argues that entry wages of subsequent cohorts have gone down so that a cross-sectional analysis *overestimates* the earnings paths of immigrants. He shows that distinction between cohort and years since migration effects is possible by simply adding an additional census year to the data. More specifically, Borjas (1985) proposes the so-called synthetic panel methodology in which earnings of migrants and natives are given by the following two equations:[28]

$$\gamma_{it}^{I} = \alpha^{I} + \beta^{I} ED_i + \gamma^{I} EX_{it} + \delta^{I} YSM_{it} + \sum_{m} \lambda_{m}^{I} C_{im} + \sum_{k} \pi_{k}^{I} \mathrm{T}_{ik} + \varepsilon_{it}^{I} \tag{4.8a}$$

$$\gamma_{it}^{N} = \alpha^{N} + \beta^{N} ED_i + \gamma^{N} EX_{it} + \sum_{k} \pi_{k}^{N} \mathrm{T}_{ik} + \varepsilon_{it}^{N}, \tag{4.8b}$$

where γ_{it}^{I} and γ_{it}^{N} are log earnings of individual i in year t, T_{ik} is an indicator variable for the year in which individual i is observed that is set equal to unity if $k = t$, and π_{k}^{I} and π_{k}^{N} are time effects on log earnings for immigrants and natives, respectively. The variable C_{im} is an indicator variable for the year m in which individual i arrived in the host country, and *ED*, *EX*, and *YSM* measure educational attainment, potential (overall) labor market experience, and potential labor market experience in the

[28] Originally, many studies did not allow the effect of education and experience to vary between immigrants and natives, assuming $\beta^{I} = \beta^{N}$ and $\gamma^{I} = \gamma^{N}$.

United States (years since migration), respectively.[29] The parameter of interest is given by $\theta = \delta^I + \gamma^I - \gamma^N$, with immigrants' earnings converging to those of natives when $\theta > 0$.[30] The coefficient β^I shows the return to education obtained in the home country on the host country labor market (assuming the migrant worker arrived in the host country as an adult). It thus reveals, in conjunction with β^N, the transferability of human capital between home and host country. This setup is called the synthetic panel methodology since it typically uses repeated cross-sectional data, for instance from US Censuses, to construct a pseudo-panel of cohorts that can be followed over time without actually observing any worker more than once.

A fundamental problem with estimating Eq. (4.8a) is that years since migration equal the difference between calendar year of observation and the cohort entry year so that these variables are perfectly collinear. This means that the coefficients δ^I, λ^I_m, and π^I_k cannot be separately identified without imposing additional identification restrictions.

To identify the model, Borjas (1985, 1995a) assumes equal time effects for immigrants and natives, that is, $\pi^N_t = \pi^I_t$, while allowing cohort quality to vary freely over time. In this case, time effects are effectively estimated from the native earnings equation which in turn ensures identification of the cohort effects in the immigrant equation. In contrast, Chiswick (1978) who only had one cross section of data at his disposal assumed in addition to constant time effects that cohort effects did not change over time so that, after normalization, $\lambda^I_m = 0$, for all m.[31]

Using data from the 1970 and 1980 US Census, Borjas (1985) shows that the quality of immigrants admitted to the United States declined over time. As a consequence, the positive impact of the years since migration variable in cross-sectional earnings equations is picking up not only the intended effect of US-specific human capital accumulation but also the effect of the higher quality of earlier immigrant cohorts. Separating these effects by looking at within-cohort earnings growth reveals that the assimilation profiles of immigrants' earnings are significantly flatter than previously estimated, with the true growth rate being up to 20 percentage points lower in some immigrant cohorts so that the point of overtaking happens much later in the life cycle, if at all. Borjas (1995a) confirmed these results in a follow-up study that included the 1990 US Census: the decline in cohort quality continued till the 1980s, albeit at a slower rate than in the 1970s, and for the bulk of first-generation immigrants, earnings parity with the typical native-born worker will never be reached over the life cycle.

[29] To simplify the notation, we ignore higher-order terms of years since migration and experience.

[30] In a similar setting, LaLonde and Topel (1992) define assimilation differently as occurring if $\delta^I > 0$, hence comparing the economic value of spending an additional year in the host country relative to a year spent in the home country.

[31] Assume for simplicity that cohort effects are linear, so that $\sum_m \lambda^I_m C_{im} = \lambda^I C_{im}$. As $C_{im} = T_{ik} - YSM_{it}$, the parameter Chiswick estimates on YSM is $\delta^I - \lambda^I$ clearly if $\lambda^I < 0$ (cohort quality deteriorates), the estimate is upward biased.

Motivated by these first studies, a large literature has developed that examines the earnings paths of immigrants for different countries and different time periods. In Table 4.L1, we provide an extensive overview, focusing on the estimated returns to education and experience, both in the home and the host country, and the transferability of home country human capital to the host country labor market.

3.4.2 Extensions of the Basic Approach

Although more flexible than Chiswick's (1978) cross-sectional approach, there are a number of restrictive assumptions underlying the synthetic panel methodology in its standard formulation in Eqs (4.8a) and (4.8b). First, it assumes that—although the entry wage of different immigrant cohorts may differ—their wage growth is the same. Our model in Section 3.2 shows that this assumption may be quite restrictive. We show that immigrants who are more able do not necessarily start off with higher earnings, as they may initially invest more in their human capital, but that their wage growth is likely to be steeper than that of less able immigrants.[32] If we distinguish cohort quality by the amount of *measured* human capital, X, then wage growth is—as described in our model—likewise affected. Thus, the assumption that wage growth is the same for different entry cohorts if these differ in terms of their average ability or their measured human capital appears quite strong. As in the benchmark study by Borjas (1995a), it should be justified in each individual case, in particular since the common interpretation of the estimated entry wages of different immigrant cohorts as a measure of their "quality" hinges crucially upon the validity of this assumption. Duleep and Regets (1999, 2002) and Green and Worswick (2004) provide a detailed discussion of the issues involved in the estimation of immigrant earnings profiles in the context of a human capital investment model. They make a strong case for not relying on entry earnings as a measure of relative cohort quality, with Green and Worswick (2004) suggesting instead a more comprehensive measure based on the estimated present value of all future earnings in the host country.

Another strong assumption in the standard synthetic panel methodology is that business cycle and time effects for natives and immigrants are the same. This assumption implies that macroeconomic trends and transitory shocks, as well as aggregate labor market conditions, affect immigrants' and natives' earnings in the same way. This is unlikely, as immigrants and natives have—as we illustrate in Section 2—usually different skills and are allocated to different occupations and industries. Dustmann, Glitz, and Vogel (2010) illustrate for Germany and the United Kingdom that the economic cycle has—even conditional on education, potential experience, and industry allocation—a

[32] This seems to suggest that it is important to use wages rather than earnings for assimilation studies. However, even wages may reflect an increased human capital investment, if contracts are of the Lazear (1979) type in which employees accept lower wages in return for training.

stronger impact on the employment of immigrants than on the employment of nonimmigrants and that these differences are more pronounced for non-OECD immigrants than for OECD immigrants. Two studies by Barth, Bratsberg, and Raaum (2004, 2006) for Norway and the United States, respectively, argue that failure to consider these differences may severely bias the assessment of the earnings assimilation process of immigrant workers. As a solution, the authors suggest to augment the earnings equations by including measures of local unemployment and allowing their impact on earnings to vary between immigrants and natives. Conditional on unemployment, time effects can then be assumed to be equal for both groups. Using data from the Current Population Survey (CPS) from 1979 to 2003, Barth, Bratsberg, and Raaum (2006) show that wages of immigrants in the United States are indeed more sensitive to changes in local unemployment than wages of natives. As a result, since the native-immigrant wage gap reduces during economic expansions, the standard estimation strategy with equal time effects yields upwardly biased estimates of both the cohort quality of recent immigrant arrivals in the United States and of the immigrant wage growth, as the wage effects of the improving labor market conditions in the 1990s are erroneously attributed to immigrant quality and wage assimilation.

In light of our model in Section 3.2, another shortcoming of the standard model stated in Eqs (4.8a) and (4.8b) is that there is no distinction between returns to education obtained in the home country and returns to education obtained in the host country. The proposed strategy yields meaningful estimates under the assumption that all immigrants arrive in the host country after they finished education. In this case, β^I measures the returns to education obtained in the home country. However, if some immigrants arrive at an age when they are still in the process of obtaining formal education, the estimated parameter β^I compounds the potentially different returns to education obtained in the home and host country. In a study for Israel, Friedberg (2000) explicitly distinguishes education obtained in the host country from education obtained in the home country. She shows that the return to an additional year of schooling obtained in Israel is 10.0% for natives and 8.0% for immigrants, whereas the return to schooling obtained in the immigrants' home countries is only 7.1%. She also finds very low returns to work experience accumulated before arrival. An additional year of experience in the country of origin yields a return of only 0.1% compared with 1.1% for an additional year of experience in Israel's labor market and a 1.7% return to experience for natives. The finding of low returns to home country education and experience in comparison with host country education and experience has been confirmed in a number of additional studies for a variety of destination countries, for example, Kossoudji (1989), Schoeni (1997), and Bratsberg and Ragan (2002) for the United States; Beggs and Chapman (1988a, 1988b) for Australia; Kee (1995) for the Netherlands; Schaafsma and Sweetman (2001) for Canada; Cohen-Goldner and Eckstein (2008) for Israel; Sanromá, Ramos, and Simón (2009) for Spain;

and Basilio and Bauer (2010) for Germany (for details of these studies, see Table 4.L1). Thus, transferability of human capital from home to host country tends to be quite low in many migration contexts. The only exception appears to be human capital that was acquired in developed countries of origin, which typically yields relatively high returns in developed host countries (see, e.g., Schoeni (1997), Friedberg (2000), or Bratsberg and Ragan (2002)). This could be either because home and host country are more similar in terms of cultural, institutional, and technological aspects of their economies so that skills are easily transferable or because more-developed countries of origin simply have higher quality education systems. Interestingly, immigrants from developed countries also receive higher returns to human capital acquired in the host countries after their arrival compared with migrants from less-developed countries, pointing toward complementarities between education obtained at home and education obtained in the host country (see, e.g., Sanromá, Ramos, and Simón (2009) and Basilio and Bauer (2010)). Such complementarities are also supported by the observation that obtaining education in the host country tends to have a positive effect on the return to home country–specific education (see Friedberg (2001)). One reason is that host country education enables the migrant to transfer their premigration skills more effectively to the host country's labor market.

A related literature concerned with the transferability of human capital has studied the extent of overeducation of immigrants that is defined as the difference between the formal qualifications held by the immigrants and the typical qualifications required in the occupations they hold (see, e.g., Chiswick and Miller (2007, 2008), Green, Kler, and Leeves (2007), Lindley and Lenton (2006), Nielsen (2007), and Sanromá, Ramos, and Simón (2008)). The main findings from this literature show that immigrants are more likely to be overeducated than natives, but that with time in the host country, this difference in overeducation relative to natives decreases, a pattern reminiscent of the assimilation of immigrants' earnings to those of natives over time.

One important implication arising from the theoretical model set up in Section 3.2 is that the expected time the migrant will spend in the host country has an important effect on the decision to invest in host country–specific human capital, as it determines the time horizon over which the benefits from such investments can be reaped by the immigrant. The longer the horizon, the higher are the investment incentives. Even under the assumption that migrations are permanent, this implies that immigrants who arrive at a younger age should have more incentives to invest in host country–specific human capital and thus experience a larger initial earnings gap and steeper earnings profile. Wilkins (2003) confirms these predictions using Australian survey data for 1997, distinguishing four age-at-migration groups: 0–14, 15–24, 25–34, and 35+ years of age. His results show that, for a given stock of human capital at the time of migration, initial wages of immigrants who arrive as children are significantly lower, at least 15%, than those of any other age-at-migration group, but their wage growth with time in Australia is

significantly higher.[33] More explicitly focusing on the human capital acquisition, Gonzalez (2003) shows that for Mexicans arriving in the United States before the age of 19, each year of delayed entry results in about 0.25–0.30 less years of overall schooling and, because this reduction in schooling is due to less US-specific education, significantly lower future earnings. This negative relationship between the eventual educational attainment of immigrants who arrive in the host country in their youth and their age at arrival is a fairly consistent finding in the literature (see, e.g., Hirschman (2001); Chiswick and DebBurman (2004); Cortes (2006); and Perreira, Harris, and Lee (2006)).

3.4.3 Return Migration

Relaxing the assumption that all migrations are permanent and allowing for nonpermanent migrations, the estimation of immigrant earnings profiles becomes far more complex. Consider first the case of a temporary migration, in which the return time is exogenously given and where this constraint is binding (in the sense that the migrant would otherwise wish to stay longer). As we have shown in Section 3.3.3, in that case, the immigrant's investment in learning in the host country depends on the level of skills upon arrival and on the expected economic opportunities in the home country, which are directly affected by the return to any human capital investment when back home. Estimating equations as stated in Eqs (4.8a) and (4.8b) would therefore omit an important set of conditioning variables. The evolution of earnings of the migrant in the host country (measured by the return to experience and the return to the number of years since migration) should depend on the length of the migration. This in turn should also depend on the labor market characteristics in the home country, introducing additional heterogeneity if immigrants come from different origin countries. Neglecting these variables may lead to biased estimates of earnings profiles.[34]

The situation becomes more complex when return migrations are chosen by the immigrant. In that case, investment in human capital in the host country and the optimal migration time are chosen simultaneously and should be modeled accordingly. Table 4.8 in Section 2 shows that return migrations are very common, and in most cases, returns and total migration durations are chosen by the migrant. In principle, the

[33] Friedberg (1992) and Borjas (1995a) find that age at migration has an important overall negative effect on immigrant earnings in the United States. According to their results, a worker who arrived at age of 30 earns about 5% less than one who already arrived at age of 20, all else equal. See also Schaafsma and Sweetman (2001) and van Ours and Veenman (2006) for related work for Canada and the Netherlands, respectively.

[34] For instance, our model in Section 3.2 suggests lower initial earnings (due to larger human capital investments), but a steeper earnings profiles for immigrants who have a longer expected duration in the host country. Thus, assimilation profiles will depend on the duration of migration. Omission of variables that capture this in the estimation of earnings profiles will lead to sample-specific returns to time in the host country, which depend on the distribution of anticipated migration durations. Our model also suggests that an increase in migration durations will lead to steeper earnings paths for higher-able immigrants, which adds further identification problems.

remigration decision and the human capital investment decision have to be estimated simultaneously. This poses a number of difficulties for the empirical researcher. Although the simple model we describe earlier is deterministic, remigration decisions in the real world are unlikely to remain unrevised over the migrants' migration history. Thus, even if (as is possible now in some register data sets) completed migration histories were observable, the completed migration duration may have been different than the migration duration that was intended when human capital decisions were made. But what matters for economic decisions is the *expected* migration duration at the time a decision is taken, and not the actual migration duration.

The data thus required are information on the *expected* duration of a migration rather than on the *completed* duration of a migration. Unfortunately, these return intentions are usually unobserved. An exception is the German Socio-Economic Panel, which asks a boost sample of immigrants in each wave how long they would like to remain in Germany, and whether they would like to return home at all. In an early paper, Dustmann (1993) uses this information to estimate earnings profiles of immigrants. Only about a third of all male immigrants intend to stay in Germany for 30 more years or forever, whereas slightly more than 60% of immigrants intend to return to their home countries within the next 10 years, most of them before they reach retirement age. Allowing assimilation profiles to vary by the intended years of stay in Germany, he finds that "permanent" immigrants have indeed steeper earnings profiles than "temporary" immigrants. After 5 years of residence, an additional year in the host country improves immigrants' earnings by 0.4% if the total intended duration of stay is 10 years, 1.05% if it is 20 years, and 1.26% if it is 30 years. Dustmann (1997, 1999, and 2000) provides additional evidence of differential labor market behavior of immigrants with different return intentions.

Following this line of argument, Cortes (2004) suggests that one of the main reasons for the steeper earnings profile of refugee migrants compared with economic migrants in the United States is the implicit difference in their expected duration of stay. As refugees are typically unable or unwilling to return to their home countries for fear of persecution or violent conflict, they have a longer time horizon in the host country and therefore more incentives to invest in country-specific human capital. Her empirical findings support this hypothesis, as do those of Khan (1997) who finds a higher propensity of Cuban and Vietnamese refugees in the United States to invest in schooling compared with other foreign-born immigrants.

Thus, although—as we show in Section 2—return migrations nowadays are likely to be the rule rather than the exception, the empirical literature has so far largely ignored the implications for the estimation of immigrants' earnings profiles. Careful estimation of earnings profiles of immigrants with different migration plans, taken in conjunction with their human capital investment decisions, requires modeling of the processes of human capital investments and return plans simultaneously. This needs to be addressed within a well-defined structural setting.

An additional problem with return migration, apart from the behavioral reasons stated earlier, is that it is likely to be selective, in the sense that those who return are not randomly chosen. Returning migrants may be either those who do not perform very strongly in the host country's labor market or those who perform above average. In the latter case, for example, the average quality of a given immigrant cohort in the host country will decrease over time, leading to an underestimation of the true earnings profiles of immigrants of that cohort relative to natives. Lubotsky (2007) addresses this problem by using longitudinal earnings data from US Social Security records that allow following individual migrants over time. His results show that in the US case, out-migrants are negatively selected, implying that previous studies have systematically overestimated the wage progress of immigrants who remained in the United States, by a factor of around 2.[35] We will discuss some reasons for selective immigration and out-migration in Section 4.1.

3.4.4 Language

One dimension of human capital that deserves particular attention in the context of migration is language capital. Language is, on the one hand, a crucial human capital factor for the productivity of immigrants in the host country. Not only is language important in its own right, but it is complementary to many other skill components. For instance, a qualified physician is unlikely to be able to work as a general practitioner when she does not master the language of the host country. On the other hand, investments in language skills are likely to be of little use in the home country. For instance, a migrant from Bosnia to Sweden is unlikely to benefit much from speaking Swedish after having returned home.[36] Thus, although being very important as a complement to existing and future skills, language may at the same time be less transferable to other countries' labor markets in the future. In any case, the improvement in language skills over the time spent in the host country is an important driver of the observed earnings assimilation profiles of immigrants in their host countries.

A key question in this context concerns the return to language capital: what is the percentage increase in earnings if an immigrant speaks the host country language well as compared to speaking it poorly? This parameter has important policy implications, as it helps assessing the benefits of language schemes or of selective migration policies that discriminate according to language proficiency. However, this parameter is difficult to measure for several reasons. First, immigrants who acquire language proficiency may

[35] It is, however, not clear that the hypothetical assimilation profile of immigrants had no return migration taken place is the interesting policy parameter. If the interest in wage profiles of immigrants is driven by their potential contributions to the economy and the tax and benefit system, what matters are those immigrants who remain in the host country.

[36] English may be an exception, with the acquisition of English being an important reason for a migration in the first place. It is not surprising in this context that the most popular destination countries for tertiary education are English-speaking countries: the United Kingdom and the United States (see Table 4.6).

be positively selected, thus introducing a classical selection bias in estimations that regress economic outcomes on language proficiency measures. Second, most available language measures are self-reported. This introduces two types of measurement error: (1) a classical measurement error, due to the interviewer reporting with error and (2) a systematic measurement error, due to the fact that individuals have different "scales" on which they assess their own language skills: the same proficiency may be evaluated as "poor" by one individual and as "good" by another individual. We will discuss below attempts to address these problems after reviewing the literature and its main findings.

In much of the literature, the return to language proficiency is obtained by estimating a standard earnings equation in which a measure of language skills is added as an additional regressor (see, for instance, early work by Carliner (1981); McManus, Gould, and Welch (1983); Grenier (1984); Kossoudji (1988); Tainer (1988); Rivera-Batiz (1990, 1992); Chiswick (1991); Chiswick and Miller (1992, 1995); and Dustmann (1994b)). These studies rely on self-reported language information in survey questionnaires, typically on either a 4-point or 5-point scale, and ignore the problems pointed out earlier. In all these papers, language proficiency is found to be strongly positively associated with earnings in the host country. For instance, for a sample of illegal immigrants in the United States, Chiswick (1991) estimates that immigrants who can read the English language well or very well have earnings that are about 30% higher than those of immigrants with low English reading skills. He also finds that reading skills dominate speaking skills and that the latter does not have an additional separate effect on earnings. For a more representative sample of adult foreign-born immigrants in the United States, Chiswick and Miller (1992) report that English-language fluency is associated with around 17% higher earnings. Dustmann (1994b) estimates that immigrants in Germany who speak German well or very well earn about 7% more than immigrants who speak German on an intermediate level, badly, or not at all. Similarly, those who have good or very good German writing skills earn between 7.3% (males) and 15.3% (females) more than those with bad or no German writing skills.[37]

Language proficiency is also found to have a complementary effect on the transferability of preimmigration human capital in the form of education and experience. Chiswick and Miller (2002, 2003) show that language skills enhance the return to human capital obtained before migration so that a migrant's greater proficiency in the languages spoken in the host country enhances the effects on earnings of his or her preimmigration schooling and labor market experience. These results hence support the hypothesis that language is an important complementary skill to other forms of

[37] Additional studies show an earnings advantage associated with host country language fluency of 12% in Canada (Chiswick and Miller (1992)), 8% in Australia (Chiswick and Miller (1995)), and 12% in Israel (Chiswick (1998) and Chiswick and Repetto (2001)).

human capital: if immigrants cannot conduct a conversation in the host country language, human capital acquired prior to immigration cannot be translated into higher earnings in the host country.

The importance of language as a factor to enhance the productivity of other forms of human capital is also demonstrated in studies that investigate the capacity of different immigrant communities in acquiring further human capital. Sanromá, Ramos, and Simón (2009) show that returns to schooling obtained in Spain are significantly higher for immigrants from Latin America (4.4%), who speak Spanish, than for immigrants from other less-developed countries such as those situated in Eastern Europe (3.6%). Beggs and Chapman (1988b) show that the return to schooling in the Australian labor market in 1981 was 9.0% for the native-born, 8.4% for immigrants from English-speaking countries, and only 4.9% for immigrants from non-English-speaking countries. These findings are suggestive for language being important for the acquisition of further skills, although estimates may be compromised by selection, and do not isolate the effect of language from other country of origin-specific factors that may be driving the differential returns to human capital.

Language proficiency is also a key factor in explaining the educational outcomes of the children of immigrants. Dustmann, Machin, and Schönberg (2010) show that the single most important factor explaining achievement gaps between children of immigrants and natives in the United Kingdom is language spoken at home. In Section 5.3.1, we will discuss the importance of language for children of foreign-born parents in more detail.

As we discussed earlier, a key difficulty in determining the impact language has on economic outcomes is selection, likely leading to an upward bias in the return to language proficiency in straightforward earnings equations, and measurement error in self-reported language measures. Dustmann and van Soest (2001, 2002) were the first to argue that measurement error may lead to a substantial downward bias in simple OLS regressions, which possibly overcompensates the upward bias through selection. To illustrate the possible magnitude of the attenuation bias, they use repeated information on self-reported language proficiency from a panel of immigrants in Germany. Assuming that from year t to year $t+1$, deterioration in language proficiency is not possible, Dustmann and van Soest (2001) estimate that 85% of the within-individual variance and at least 24% of the overall variance in language measures are due to unsystematic measurement error, in the sense that it varies unsystematically over time. They discuss as a further difficulty of self-reported language information that individuals may have different scales of evaluation. In a cross section, these individual-specific scales cannot be distinguished from measurement error. However, with panel data, and if differences in scales across individuals are constant over time, such a distinction is possible. Dustmann and van Soest (2001) develop an estimator that separates time-varying from time-persistent misclassification. Further, to address the

endogeneity problem, they use parental education as an instrument for language proficiency *conditional* on individuals' education, noting that this is less problematic than instrumenting individuals' education with parental education. The findings show that overreporting language ability is more frequent than underreporting and that there is substantial time-persistent misclassification. According to their results, the return to a one standard deviation increase in true German language fluency decreases from 2.8 percentage points to 0.9 percentage points once unobserved heterogeneity is taken into account. However, controlling subsequently for both time-varying measurement error and time-persistent misclassification, the return to German language fluency increases to approximately 7.3 percentage points. Thus, measurement error may lead to a large downward bias of the estimated return to language proficiency that overcompensates any upward bias due to unobserved ability.[38]

If repeated information on language ability is available, an alternative way to address the endogeneity problem is by conditioning on individual-specific effects (or estimating difference equations). However, the downward bias through measurement error in the language variable will be greatly enhanced by such techniques. In most panel data sets that contain repeated information on language ability, immigrant populations have been resident for a large number of years, so that the noise-to-signal ratio is too large to allow estimation.[39] Berman, Lang, and Siniver (2003) use repeated information on the language proficiency of male immigrants from the former Soviet Union, who moved to Israel after 1989, focusing on the first few years after arrival in which typically the largest improvements in language skills take place. They find large wage gains of language proficiency for workers in high-skilled, but not low-skilled professions as well as evidence for an upward ability bias in cross-sectional estimates, particularly for workers in low-skilled professions.

Bleakley and Chin (2004) present a further strategy to address the endogeneity problem of language proficiency. Based on census cross sections, they devise an IV strategy that exploits the psychobiological phenomenon that young children tend to learn languages more easily than adolescents and adults. Focusing on childhood immigrants, an immigrant's age at arrival in the host country is therefore a strong predictor of his or her language proficiency later in life. It can be used as a valid instrument once its effect on earnings through other channels than language is controlled for. Bleakley and Chin (2004) use immigrants from English-speaking countries as a control group to net out the effects of age at arrival that are not associated with language. Their findings

[38] Dustmann and Fabbri (2003) find a similarly large downward bias due to measurement error for the United Kingdom, whereas Dustmann and van Soest (2004) compare parametric and semiparametric estimators to address measurement error in language variables.

[39] See Dustmann and van Soest (2002) for a discussion.

show that OLS estimates of the returns to English language fluency in the United States are severely downward biased, which is unexpected if selection is the only problem. They explain this by the IV estimator possibly revealing a local average treatment effect, and by measurement error. Using data on language test results, they estimate that attenuation bias due to measurement error may lead to a reduction of the estimated coefficient by one-half, which is similar in magnitude to the effects found by Dustmann and van Soest (2001).

One particular feature of language capital is that it is in most cases not transferable to the country of origin. Thus, in the formulation of our model in Section 3.2, language capital should be sensitive to the duration individual immigrants would like to spend in the country of destination. This hypothesis is analyzed by Dustmann (1999) who investigates the impact of immigrants' intended duration of stay on their language skills. As migration durations are endogenous in a language equation, he uses an indicator for whether parents who are residing in the home country are still alive as an instrument for the planned migration duration. The findings show that an increase in the total intended duration in Germany by 10 years is associated with a 5 percentage point higher probability of being fluent in German.

3.4.5 Downgrading and Ethnic Networks

The low wages immigrants often receive upon arrival may be partly explained by initial "downgrading," possibly due to a lack of important complementary skills that allow individuals to fully utilize their human capital in the host country's labor market. The stereotypical cab-driving physician vividly captures this phenomenon. Friedberg (2001) and Eckstein and Weiss (2004) study directly the type of jobs immigrant workers perform after arrival using data for Israel. They find substantial occupational downgrading of Russian immigrants who arrived in Israel in the 1990s. Although these immigrants worked in Russia predominantly as engineers, managers, physicians, and teachers, their most important occupations in Israel turned out to be occupations such as service workers, locksmiths/welders, and housemaids. However, over time, particularly highly educated immigrants climb up the occupational ladder. Eckstein and Weiss (2004) show that the proportion of highly educated immigrants working in high-paid professional occupations increases from about 30% at arrival to about 70% 20 years later, compared with an increase from 60 to 80% for equally educated natives over the same time interval. Overall, around 17% of immigrants' wage growth in the first 10 years after arrival in Israel can be attributed to occupational transitions. Mattoo, Neagu, and Özden (2008) provide similar evidence of "underplacement" of immigrants in the US labor market, where in particular skilled immigrants from countries with lower expenditures on tertiary education and non-English languages of instruction, such as Latin American or Eastern European countries, tend to end up in unskilled jobs.

An important consequence of this occupational downgrading is that an allocation of immigrants to particular skill groups based on observed measurable skills such as their education—for example, in order to assess with which subgroup of the native workforce they are most likely to compete in the labor market—is likely to be highly inaccurate and not reflecting the true section of the labor market in which the immigrants are active. Dustmann, Frattini, and Preston (2008) illustrate how, due to downgrading, an allocation of immigrants in the United Kingdom based on their observed education levels misrepresents their true position in the native wage distribution: although these immigrants are on average significantly better educated than natives, they earn wages at the lower end of the native wage distribution in the United Kingdom.

Not only complementary skills (such as language) may be important for immigrants to being able to fully utilize their human capital, but also the reduction in informational deficiencies with respect to the host country's labor market. Here ethnic networks may play an important role. Bartel (1989) and Jaeger (2007) demonstrate the tendency of immigrants to settle in areas where there are already established communities of their ethnic group. Chiswick and Miller (2005) show that living in a region of the United States with a high linguistic concentration of the immigrant's mother tongue has a negative effect on the immigrant's own English language skills, which in turn tends to reduce his or her earnings potential. This would speak against ethnic networks operating to the advantage of immigrants. However, straightforward correlations of ethnic segregation and economic outcomes may be affected by a sorting problem. In two papers, Edin, Fredriksson, and Åslund (2003) and (Damm (2009)) use random dispersal policies of refugee immigrants in Sweden and Denmark to investigate the effects of living in enclaves on labor market outcomes. By using the ethnic concentration in the initial assignment area (Edin et al. (2003)) and the past inflow of assigned conationals (Damm (2009)) as an instrument, these authors convincingly address the sorting problem. They find that living in an ethnic enclave has positive effects on wages and employment, in particular for workers who have low skill levels. Dustmann, Glitz, and Schönberg (2010) find similar evidence of a positive effect of obtaining a job through an ethnicity-based network on wages and job stability in the German context. This speaks in favor of networks as a mechanism to reduce informational uncertainties.

3.4.6 Observed Postmigration Schooling Investment and Learning Centers

Most of the assimilation literature discussed so far draws conclusions about the human capital investment of immigrants after arrival in the host country indirectly from the observed earnings patterns. A more direct approach, given suitable data, is to look at the actual acquisition of additional education by immigrants and the factors that determine it. Using data from the 1976 Survey of Income and Education (SIE) and the 1980 US Census and focusing on the years of schooling obtained after migration and the

enrolment status as dependent variables, Khan (1997) finds that the acquisition of human capital of foreign-born adult men decreases with age at migration, and is higher for refugee immigrants and those who are naturalized, and in states with low tuition fees and better quality of schooling. In the SIE data, she also finds that preimmigration schooling up to the postbachelor professional level is a substitute for schooling in the United States, a finding in support of an earlier study of male Hispanic immigrants by Borjas (1982). In contrast, Chiswick and Miller (1994), who study adult immigrants in Australia, find a positive effect of preimmigration schooling and occupational status on postimmigration schooling, concluding that these are complementary.

As briefly pointed out in Section 3, one reason for immigration can be the acquisition of human capital in a host country. This was a particular aspect of our model, which encompasses migration situations where the sole purpose of a migration is the acquisition of human capital that has a high value upon return to the home country (see Section 3.3.4 for details). This phenomenon is particularly pronounced in higher education and in countries such as Australia, the United States, and the United Kingdom, which receive large numbers of foreign students to study at their universities (compare Table 4.6).[40] In the United States, for example, foreign-born students (mostly from India, Taiwan, South Korea, and China) accounted for 31% of all PhD recipients in 2006, with even higher shares in specific fields such as physical science (44%), engineering (59%), and economics (59%).[41] Bound, Turner, and Walsh (2009) provide an excellent overview of the latest developments in the US context. In the United Kingdom, foreign students account for 42% of all PhD recipients and 55% of all recipients of a Master's degree in 2007/2008.[42] Many students who acquire doctoral degrees stay on after completing their studies. Finn (2007), for example, estimates that about 58 (71)% of foreign citizens who received a PhD in science or engineering from a US university in 1991 (1999) are still living in the United States in 2001.

4. THE EFFECT OF MIGRATION ON THE SKILL BASE AND EDUCATIONAL ATTAINMENT OF NONMIGRANTS

In the previous section, we discuss the relationship between education and migration from the perspective of the migrant. In this section, we address the issue from the perspective of those who have chosen not to migrate both in the origin and in the destination country. Our focus will be on the consequences of migration for the skill base and the acquisition of education in the two countries. Migration can affect the skill base of

[40] This type of immigration is institutionalized in many host countries by issuing specific visas created explicitly to permit temporary study (e.g., the F-1 visa in the United States or the Student Visas in the United Kingdom).

[41] *Source*: National Science Foundation: Science and Engineering Doctorate Awards 2006. Own calculations. Foreign students are defined as non-US citizens with temporary visa.

[42] *Source*: Higher Education Statistics Agency. Foreign students are identified as those with non-UK domicile.

the origin country directly, by changing the skill composition and the talent base. Here the question of selection—who migrates—becomes important. Migration can also affect the skill base of the origin country indirectly by generating incentives to invest in learning and skill acquisition. In the destination country, besides the direct effect because of the inflow of immigrants, migration may change the skill base through responses of the native population, by creating incentives for additional skill accumulation, or for specializing in particular skills where natives have a comparative advantage. Migration can also create spillover effects, for example, through complementarity of the migrant population with the existing populations. In this section, we will discuss some of these aspects.

We start with reinvestigating one of the key questions in the literature on migration, which has important consequences for the issues we raise here: Who migrates? In an early paper, Borjas (1987) uses the Roy (1951) model to relate the skills and abilities of immigrants to the distribution of wages and earnings in the host and home country. His analysis provides deep insights and has been empirically tested in a number of subsequent papers. However, many of these papers have focused on a particular case of Roy's model, where skills are one-dimensional. Here we will reexamine the original Roy model and explore more closely the implications of multidimensionality in skills. We believe that in the context of migration, this will provide much additional insight.

4.1. The Selection of Migrants

We will start with addressing the question of who migrates. In Section 3, we discuss the incentives to emigrate from the perspective of the potential migrant and show that these depend—among others—on the capacity of the individual to produce knowledge, which we termed "ability." The optimal migration plan—in the simplest setting where the return to human capital is higher in the host country—usually provides higher migration incentives to those who have a lower cost of human capital production: those with higher ability. In those considerations, we only looked at the migration decision of a single individual, the "average" individual. We did not compare this individual to other individuals in the origin or destination country by characterizing a distribution of skills. Further, we thought about "skills" as a one-dimensional concept—an individual who has more skills is more productive in both countries.

In this section, we give up this assumption by introducing multiple skills, which—added up and weighted by skill prices that may differ across the two countries—determine the productive capacity, or human capital, of an individual in a particular country. We argue that viewing skills as a multidimensional concept, with different prices in different countries, is particularly sensible in the context of migration. We investigate the selection of individuals along the distribution of these skills and state the conditions for positive and negative selection.

Our considerations are based on the Roy (1951) model that we will formalize as a multiple-skill model (concentrating on the special case of two skills), and in which we

allow for the possibility that one skill has a higher price in one country, whereas the other skill has a higher price in the other country.[43] This generates the possibility of "nonhierarchical sorting" (to use the terminology of Willis (1987)), in which those who are most productive in the host country migrate and those who are most productive in the home country do not migrate.[44] We will develop this aspect of the Roy model which, as we believe, has not received sufficient attention in the migration context. In our view, thinking about migration as a decision that considers the prices for *multiple* skills is appropriate in a world where diversely structured national economies trade their comparative and absolute advantages on globalized markets. We show that some of the observed migration patterns that seem not compatible with the one-dimensional skill version of the Roy model can be accommodated by a multidimensional skill model. Drawing on Dustmann, Fadlon, and Weiss (2010), we then show how the basic static Roy model can be extended to a dynamic Roy model by allowing for learning of skills in the two countries so that each country is characterized not only by prices for skills but also by learning opportunities.

4.1.1 A Multiple-Skill Model of Migrant Selection

Consider two countries, an origin country (O) and a destination country (D). Further, suppose individuals have two latent skills, S_1 and S_2 (this can be easily generalized to more skills). We will here refer to these skills as "analytical skills" (S_1) and "manual" or "trade" skills (S_2). Suppose the two countries have different technologies and industry structures. Thus, we can think about the two countries rewarding the two skills differently according to the two equations:

$$Y_{Di} = \ln y_{Di} = \mu_D + b_{D1} S_{1i} + b_{D2} S_{2i} = \mu_D + u_{Di} \tag{4.9a}$$

$$Y_{Oi} = \ln y_{Oi} = \mu_O + b_{O1} S_{1i} + b_{O2} S_{2i} = \mu_O + u_{Oi}. \tag{4.9b}$$

In Eqs (4.9a) and (4.9b), b_{j1} and b_{j2} represent the prices for the two skills in country j, $j = O, D$. Notice that this setup allows for many interesting combinations. For instance,

[43] The Roy model goes back to a paper by Andrew D. Roy published in the Oxford Economic Papers in 1951. In this paper, Roy develops the implications of *multidimensional* abilities for occupational choice, the structure of wages, and the earnings distributions. The model has in later years been formalized and developed further (see, e.g., Heckman and Honoré (1990); Willis and Rosen (1979); and Willis (1987)).

[44] Borjas does, in principle, consider this case, which he terms "refugee sorting," but he does not develop its implications in much detail. Most of the literature (e.g., Chiquiar and Hanson (2005); Orrenius and Zavodny (2005); McKenzie and Rapoport (2007); Ibarrarán and Lubotsky (2007); Belot and Hatton (2008); Fernández-Huertas Moraga (2010); and Kaestner and Malamud (2010)) considers a special case of the Roy model, where skills are one-dimensional, which leads to hierarchical sorting. A very interesting and insightful extension is provided by Gould and Moav (2010) who distinguish between observable skills (such as education) and unobservable skills. Bertoli (2010) considers the case in which there is uncertainty about the earnings potential in the destination country, showing that such uncertainty leads to negative selection becoming more likely.

if countries specialize in particular industries and exchange goods in global markets, then in one country the price for skill 1 may be high and the price for skill 2 low, whereas in the other country the price for skill 2 may be high and that of skill 1 low. If both countries are equipped with the same distribution of skills, migration in both directions may create a more efficient skill allocation.

To compare this with the notation used in much of the literature (e.g., Borjas (1987)), we combine the weighted skills to two measures $u_D = \ln K_D = b_{D1}S_1 + b_{D2}S_2$ and $u_O = \ln K_O = b_{O1}S_1 + b_{O2}S_2$, where K_j is the productive capacity of a person if he or she works in country j. Therefore, we can characterize every worker by either a pair of latent skills (S_1 and S_2) or a pair of productive capacities in the two countries (K_D and K_O).

We can think of μ_j as the log of the rental rate to human capital in country j so that $\gamma_j = e^{Y_j} = R_j K_j$, with $\mu_j = \ln R_j$. The rental rate of human capital in the country of destination, D, for example, could be persistently higher if it had a superior technology and if it regulated the inflow of immigrants so that only some of those who wish to enter are allowed in.

We assume that both countries have identical distributions of the two skills S_1 and S_2 before migration and that these distributions are normal and independent with mean zero and variance 1: $S_k \sim N(0,1)$.[45] It then follows that the random variables Y_D and Y_O are likewise normally distributed, with means μ_D and μ_O and variances and covariance.[46]

$$Var(Y_D) = Var(u_D) = \sigma_D^2 = b_{D1}^2 + b_{D2}^2; \quad Var(Y_O) = Var(u_O) = \sigma_O^2 = b_{O1}^2 + b_{O2}^2 \tag{4.10a}$$

$$Cov(Y_D, Y_O) = Cov(u_D, u_O) = \sigma_{DO} = b_{D1}b_{O1} + b_{D2}b_{O2}. \tag{4.10b}$$

We define $\sigma^2 = Var(u_D - u_O) = \sigma_D^2 + \sigma_O^2 - 2\sigma_{DO} = b_{D1}^2 + b_{D2}^2 + b_{O1}^2 + b_{O2}^2 - 2b_{D1}b_{O1} - 2b_{D2}b_{O2}$, which is the variance of the difference in the log of productive capacity between country D and country O. Further, let $u = (u_D - u_O)/\sigma$ and $z = (\mu_O + k - \mu_D)/\sigma$, where k are migration costs (in time-equivalent units). Also, let

$$\sigma_{DU} = Cov(u_D, u) = (\sigma_D^2 - \sigma_{DO})/\sigma = [b_{D1}(b_{D1} - b_{O1}) + b_{D2}(b_{D2} - b_{O2})]/\sigma \tag{4.11a}$$

and

$$\sigma_{OU} = Cov(u_O, u) = (\sigma_{DO} - \sigma_O^2)/\sigma = [b_{O1}(b_{D1} - b_{O1}) + b_{O2}(b_{D2} - b_{O2})]/\sigma. \tag{4.11b}$$

These covariances are the weighted sums of the differences in skill prices between host and home country, where the weights are the skill prices for the host and home country, normalized by σ. Notice that $\sigma_{DU} = \sigma_{OU} + \sigma$ so that $\sigma_{DU} - \sigma_{OU} > 0$.

[45] The latter assumption simplifies notation but can easily be relaxed.

[46] Notice that productive capacities are correlated, although we assume that the skills S_1 and S_2 are independent.

Finally, define the correlation between the log of productive capacities in the home and host country as

$$\rho = Corr(u_D, u_O) = \sigma_{DO} / (\sigma_D \sigma_O) = (b_{D1} b_{O1} + b_{D2} b_{O2}) / [(b_{D1}^2 + b_{D2}^2)(b_{O1}^2 + b_{O2}^2)]^{1/2}. \quad (4.12)$$

We are now ready to establish the different migration scenarios and to compare the wages of those who decide to migrate and those who decide not to migrate. It follows from Eqs (4.9a) and (4.9b) that an individual will migrate from country O to country D if $Y_{Di} - k > Y_{Oi}$, or

$$\begin{aligned} & \mu_D - \mu_O + (b_{D1} - b_{O1}) S_{1i} + (b_{D2} - b_{O2}) S_{2i} > k \\ \Leftrightarrow\ & (u_D - u_O) / \sigma > (\mu_O + k - \mu_D) / \sigma \\ \Leftrightarrow\ & u > z \end{aligned} \quad (4.13)$$

Denoting the density function and the cumulative distribution function of the standard normal distribution by $\phi(\cdot)$ and $\Phi(\cdot)$, the expected earnings of individuals who decide to emigrate are given by[47]

$$\text{(I)} \qquad E(Y_D | Y_D - k > Y_O) = \mu_D + \sigma_{DU} [\phi(z) / (1 - \Phi(z))].$$

Likewise, the expected earnings of those in the home country who decide not to migrate are given by

$$\text{(II)} \qquad E(Y_O | Y_O \geq Y_D - k) = \mu_O - \sigma_{OU} [\phi(z) / \Phi(z)].$$

How much would those who decide to migrate earn in the home country, and how much would those who decide not to migrate earn in the host country? These two counterfactuals are given by

$$\text{(III)} \qquad E(Y_O | Y_D - k > Y_O) = \mu_O + \sigma_{OU} [\phi(z) / (1 - \Phi(z))]$$

$$\text{(IV)} \qquad E(Y_D | Y_O \geq Y_D - k) = \mu_D - \sigma_{DU} [\phi(z) / \Phi(z)].$$

It follows from (I)–(IV) that the selection of migrants depends on the size and the relative magnitude of the covariances σ_{DU} and σ_{OU}. We can distinguish three regimes.

Regime 1: $\sigma_{DU} > 0$ and $\sigma_{OU} > 0$. It follows that the mean earnings of those who decide to emigrate are higher than the mean earnings in the host country (I) and higher than the mean earnings in the home country (III). On the other hand, the mean earnings of those who decide not to migrate are lower than the mean earnings in the host country (IV) and lower than the mean earnings in the home country (II). This case is one of positive selection of immigrants: those who migrate have higher than average earnings in both countries, and those who do not migrate have lower than average earnings in both countries.[48] A necessary condition for regime 1 is a higher variance

[47] See Johnson and Kotz (1972), Heckman (1979), and Heckman and Honoré (1990) for details.
[48] Note that mean earnings always refer to the premigration period.

of the earnings distribution in the destination country compared with the origin country and a sufficiently high correlation between the productive capacities in both countries, $\frac{\sigma_D}{\sigma_O} > 1$ and $\rho > \frac{\sigma_O}{\sigma_D}$ (see Borjas (1987, 1999)).

In terms of the underlying skill distribution, regime 1 states that the return to both skills must be sufficiently large in the host country. It follows from Eqs (4.11a) and (4.11b) that the sum of the price differentials for the two skills between host and home countries, weighted by the host country prices, is larger than the sum of the price differentials weighted by home country prices. This is certainly the case if the returns to both skills are higher in the host country.

One special case, which is frequently assumed in the literature on the selection of immigrants (see e.g., Chiquiar and Hanson (2005) and Belot and Hatton (2008)), is that $u_D = cu_O$, where c is some constant. This occurs if either the return to one skill equals zero in both countries (for instance, $b_{D2} = b_{O2} = 0$), or the ratios of skill prices are equal in the two countries ($b_{D2}/b_{D1} = b_{O2}/b_{O1} = c$). In both cases, the correlation between u_D and u_O, ρ, is equal to one. Notice that the two cases have different interpretations. In the first case, the skill distribution reduces to one dimension. In the second case, the skill distribution is still two-dimensional (both "analytical" and "manual/trade" skills are needed in the two countries), and individuals may still have different endowments of the two skills; however, the production technologies in the two countries are such that the skill price proportions are exactly equal. A particular case is the one where $c = 1$, which implies identical skill prices in both economies.

Regime 2: $\sigma_{DU} < 0$ and $\sigma_{OU} < 0$. This case leads to opposite conclusions to regime 1.

Regime 1 and 2 are the two cases that are usually considered in the migration literature. They correspond to the "positive selection" and "negative selection" scenarios in Borjas (1987).

Regime 3: $\sigma_{DU} > 0$ and $\sigma_{OU} < 0$. In this case, the mean earnings of those who decide to migrate are higher than the mean earnings in the host country (I), but they are lower than the mean earnings in the home country (III). On the other hand, the mean earnings of those who do not migrate are lower than the mean earnings in the host country (IV), but they are higher than the mean earnings in the home country (II). Thus, those who migrate have a below-average productive capacity in their origin country, but an above-average productive capacity in the destination country. Their departure increases the average productivity level in the home country (as individuals with below-average productive capacity leave the country) and in the host country. Thus, if the initial skill distribution is the same in the two countries, this situation may lead to a "brain gain" in both countries.[49]

Borjas (1987) refers to regime 3 as "refugee sorting," the underlying idea being that highly skilled individuals are discriminated against in dictatorial systems, receiving a

[49] It is important to define brain drain or brain gain. We think about *brain gain* as an event that increases *per capita* productivity in either country, and a *brain drain* as an event that decreases *per capita* productivity in either country.

return for their skills that is below average, while being rewarded according to market prices in countries that accommodate refugees. However, this case has many more interesting implications for the study of modern migrations. As we discuss earlier, global trade has led national economies to focus on particular industries, such as manufacturing or financial services. These industries may have different skill requirements across more than one dimension, and many migrations we observe today may be a response to these processes. The idea that migration is a response to skill demands along more than one skill dimension is compatible with the literature on task usage and polarization, which argues that jobs can be characterized by multiple tasks, such as cognitive, routine, and manual tasks (see, for instance, Autor, Levy, and Murnane (2003); Goos and Manning (2007); and Acemoglu and Autor (2010)).

Regime 3 is "nonhierarchical," in the sense that both those who migrate and those who do not migrate have above-average earnings in the country of their choice: individuals are sorted based on their *comparative* advantage. Note that the case $\sigma_{DU} < 0$ and $\sigma_{OU} > 0$ is not possible if we allow for regime 3, as it would contradict $\sigma_{DU} - \sigma_{OU} > 0$. Notice further that the assumption $u_D = cu_O$, which is made in many papers that study the selection of immigrants, rules out regime 3.

A special case of regime 3 occurs when each skill is only priced in one of the two countries; for example, $b_{D1} = b_{O2} = 0$. Now the correlation between productive capacities in the two countries is zero: the productive capacity of an individual in one country does not give any insight about his or her productive capacity in another country. An individual who possesses skill S_1 will only be able to obtain a return in the home country, whereas an individual with skill S_2 will only obtain a return in the host country.

4.1.2 Skill Prices, Productive Capacity, and Selection

It follows from Eqs (4.11a) and (4.11b) that whether migration is selective in terms of productive capacity depends on the underlying skill prices. Changes in these prices will change the type of migration that occurs and the nature of selection. Which regime characterizes a particular migration situation depends on the two expressions

$$\sigma_{DU} = (\sigma_D^2 - \sigma_{DO})/\sigma = [b_{D1}(b_{D1} - b_{O1}) + b_{D2}(b_{D2} - b_{O2})]/\sigma$$

and

$$\sigma_{OU} = (\sigma_{DO} - \sigma_O^2)/\sigma = [b_{O1}(b_{D1} - b_{O1}) + b_{O2}(b_{D2} - b_{O2})]/\sigma,$$

where $\sigma_{DU} = \sigma_{OU} + \sigma$. To illustrate how the different regimes depend on skill prices, consider Fig. 4.5a, where we have fixed $b_{D1} = 1$, $b_{D2} = 2$, $b_{O2} = 1$, and we allow b_{O1} to vary between 0 and 5. The dashed and dotted lines in the figure are σ_{DU} and σ_{OU}, respectively. For b_{O1} in the range between 0 and 1.62, $\sigma_{DU} > 0$ and $\sigma_{OU} > 0$; thus,

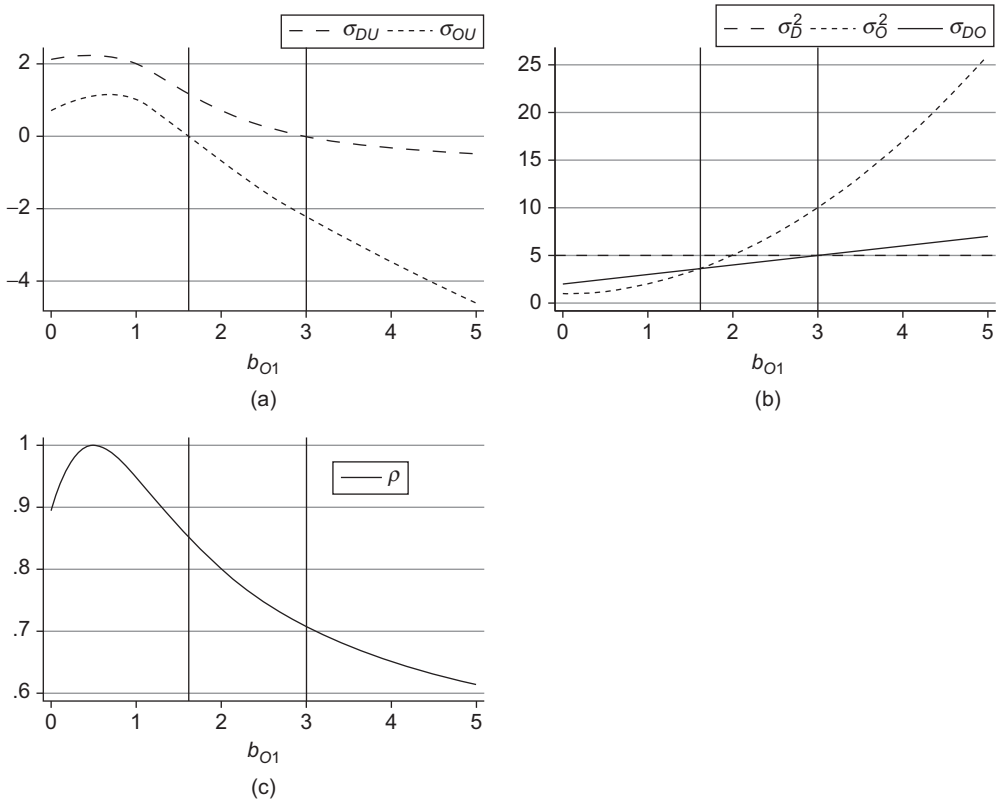

Figure 4.5 Selection Scenarios.

we are in regime 1, with migration being positively selective. In the range where b_{O1} is between 1.62 and 3, $\sigma_{DU} > 0$ and $\sigma_{OU} < 0$, and we are in the nonhierarchical regime 3, where those who would do best in the host country migrate and those who would do best in the home country do not migrate. Finally, above $b_{O1} = 3$, both σ_{DU} and σ_{OU} are negative; we are in regime 2 where migration is negatively selective. This demonstrates that the selection of immigrants in terms of their productive capacity depends on relative skill prices, which may change over time.

In Fig. 4.5, we plot the corresponding variances and the covariance (Fig. 4.5b), as well as the correlation coefficient (Fig. 4.5c). In the range where positive selection occurs, the variance of productive capacity is higher in the destination country, and the correlation between skills is high. In the range where negative selection occurs, the variance of productive capacity is higher in the country of origin, and the correlation between skills is lower. Notice that there is a range where the variance of productive capacity is higher in the destination country; yet, we are in regime 3, where we cannot hierarchically sort immigrants in terms of their average productive capacity.

The migration decision of an individual migrant is based on a comparison of individual earnings in the home and host country. Using Eqs (4.9a), (4.9b), and (4.13), an individual will emigrate if $Y_D - k > Y_O$, or

$$S_2 > \frac{\mu_O - \mu_D + k}{b_{D2} - b_{O2}} - \frac{b_{D1} - b_{O1}}{b_{D2} - b_{O2}} S_1.$$

4.1.3 Explaining Different Selection Patterns

There is by now a large empirical literature that attempts to assess the direction of migrant selection. Most of the papers in this literature draw on Borjas (1987) as an underlying theoretical framework, but consider the special case where $u_D = cu_O$. The evidence these papers establish is mixed. Some papers (including Borjas' (1987) original analysis) find evidence that is compatible with the predictions of the simple one-dimensional skill model, namely that selection is positive from country O to country D if skill prices are higher in country D, and that selection is negative if skill prices are lower in country D. Examples are Cobb-Clark (1993) or Ramos (1992), who find that, consistent with negative selection, nonmigrants in Puerto Rico are more educated than individuals migrating from Puerto Rico to the United States and that those individuals migrating back from the United States to Puerto Rico are more educated than those who remain in the United States. Others (e.g., Feliciano (2005), Orrenius and Zavodny (2005), McKenzie and Rapoport (2007), and Belot and Hatton (2008)) find limited or no evidence that is compatible with this simple model.

In an influential paper, Chiquiar and Hanson (2005) analyze migration from Mexico to the United States. They argue that as the return to schooling is higher in Mexico, individuals with high levels of schooling are less likely to migrate. They compare actual wage densities for residents of Mexico with counterfactual wage densities that would be obtained were Mexican immigrants paid according to skill prices in Mexico, thus comparing the conditional distributions whose means are given by (I) and (III). The findings suggest that, were Mexican immigrants in the United States paid according to Mexican skill prices, they would fall disproportionately in the middle and upper middle of Mexico's wage distribution. As Chiquiar and Hanson (2005) point out, this does not support negative selection, but rather suggests intermediate or moderate positive selection of Mexican immigrants. This empirical finding is not compatible with the original model they started off with, which is our model discussed earlier, but restricted to the special case where $u_D = cu_O$. To reconcile the empirical evidence with the model, they introduce nonlinear migration costs. They assume that costs are large, but decrease in schooling at a decreasing rate, so that the net advantage of migration is highest for those in the middle of the distribution of skills. We reproduce their explanatory graph in Fig. 4.6, which illustrates the case of constant migration costs (Y_D)

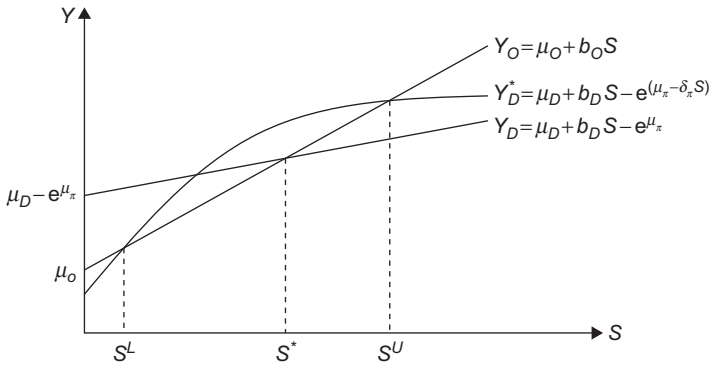

Figure 4.6 Nonlinear Migration Costs.

and varying migration costs that are nonlinear in schooling (Y_D^*).[50] Note that skills are one-dimensional and migration costs k in the latter case are equal to $k=\exp(\mu_\pi-\delta_\pi S)$. The way we have drawn the figure for the constant migration cost case $(\delta_\pi=0)$ implies that the rent on human capital is higher in the destination country (United States), $\mu_D>\mu_O$, but the return to skill S is higher in the origin country (Mexico). Thus, in this case, those with levels of skill S below S^* will emigrate, but those with levels of skill S above S^* will remain in Mexico—which is what Chiquiar and Hanson expected to find in the data. However, if $\delta_\pi>0$ and if the fixed costs of migration are sufficiently high, those at the low end of the skill distribution, below level S^L, may find it too costly to emigrate, whereas for those in the middle of the skill distribution, between level S^L and level S^U, migration is advantageous. Chiquiar and Hanson conclude that such nonlinear cost schedules may provide a possible explanation for the observed migration pattern from Mexico to the United States.[51]

Nonlinear migration costs are one reason why the one-dimensional model may not fit the data. Another reason may be that the one-dimensional model is overly restrictive and omits an important aspect of migration decisions. Our discussion in the previous section has illustrated that migration decisions may be taken by considering the prices of multiple skills in the home and potential host country. Clearly, education is a one-dimensional measure of skills, which may for instance reflect well the academic skills of individuals but may measure less well manual and trade skills. If the latter are highly valued in the destination country and are more prevalent for individuals in the middle

[50] The case of migration costs that are linear in schooling is straightforward in that it either leaves the overall selection pattern unchanged or reverses it entirely, depending on the pace at which migration costs decrease with educational attainment.

[51] For a further discussion of how different assumptions regarding the migration costs affect predicted selection patterns—for example, whether migration costs are assumed to be fixed in time-equivalent units or in monetary units—see Rosenzweig (2007) and Hanson (2010).

Table 4.10 Example Intermediate Selection

	S_1	S_2	b_{D1}	b_{D2}	b_{O1}	b_{O2}	$Y_D(=b_{D1}S_1 + b_{D2}S_2)$	$Y_O(=b_{O1}S_1 + b_{O2}S_2)$	Y_D-Y_O
Low	1	0.5	1	2	2	1	2	2.5	−0.5
Medium	2	2.5	1	2	2	1	7	6.5	0.5
High	3	2	1	2	2	1	7	8	−1

of the education distribution, then migration patterns like those illustrated by Chiquiar and Hanson (2005) can be explained without making specific assumptions about migration costs, as the following example illustrates.

Consider the case where the skill distribution is two-dimensional. Suppose further that the first skill (which we termed "analytical" skill) is strongly correlated with education, but the second skill (which we termed "manual" or "trade" skill) is more strongly present in individuals with intermediate years of education. A multidimensional education system like the German apprenticeship system could produce such patterns, with individuals with intermediate levels of education having often gone through vocational training in crafts and trades. In countries without well-developed vocational training schemes, those with intermediate years of education may still have specialized in manual- or trade-related skills, as development of many of these skills requires some basic level of schooling. Measured education may reflect mainly skill S_1, but not necessarily skill S_2.

For the case of Mexican–US migration, the manual- or trade-related skill dimension, although probably not highly valued in Mexico (as these skills are in plentiful supply), may command a relatively high price in the United States. This seems to be compatible with the occupational distribution of Mexican immigrant workers in the United States, with the three main occupations falling exactly into this category of skills: cooks (6.1% of workers), construction laborers (5.8%), and grounds maintenance workers (4.9%).[52]

In Table 4.10, we give a numerical example. We distinguish among three education groups, "low," "medium," and "high." We have chosen the skill prices such that skill 1 has a higher return in the origin country, and skill 2 has a higher return in the destination country. Skill 1 increases with education but skill 2 is particularly high for those in the middle of the education distribution, and less developed for those who are either low educated or highly educated. For simplicity, suppose migration costs are zero and the rental rate of human capital is identical in both countries and normalized to zero. The differentials between wages that can be obtained in the destination and the origin country are reported in the last column of Table 4.10. Those who are low educated will not

[52] Figures calculated from the 2009 IPUMS CPS sample using all Mexican-born individuals in the United States who are currently at work and aged above 16 years.

migrate and are better off in their country of origin, whereas those with intermediate levels of education will gain from migration, and those with high levels of education will again lose. Thus, this scenario creates a migration situation where only those in the middle of the education distribution will want to emigrate.

The scenario corresponds to the empirical evidence of intermediate selection provided by Chiquiar and Hanson (2005) without introducing nonlinear migration cost. This illustrates the capacity of the multidimensional Roy model to accommodate different migration patterns that remain unexplained in a simple one-dimensional skill model.

To conclude, we believe that the full potential of the Roy model has not been explored in the migration context. The situation where individuals are characterized by multiple skills, and where these skills are priced differently in different countries, is, in our view, important in an ever more globalized world economy where individual countries specialize in particular industries.

4.2. Selection and Return Migration

The framework above explains selection of immigrants but does not address return migration. Borjas and Bratsberg (1996) use the one-dimensional Roy model to explore the selection of emigrants and those who return. We will briefly introduce the main features of their model and extend it below to a multidimensional skill model.

Using our notation, log earnings in the origin and destination country in their model are given by $Y_O = \mu_O + u_O$ and $Y_D = \mu_D + u_D$, respectively. They further assume that $u_O = cu_D$. Thus, $Var(u_D) = 1$, $Var(u_O) = c^2$, and $Corr(u_D, u_O) = 1$ so that the variance of earnings is higher in the host country when $c < 1$. They allow workers to have three options: (1) to stay at home, (2) to migrate temporarily, or (3) to migrate permanently. A return migration may be optimal for the same reason we discuss in Section 3.3.4: staying abroad for a period t increases human capital that is valuable at home by an amount κ. Thus, earnings when emigrating and returning are given by $Y_{DO} = t(\mu_D + u_D) + (1-t)(\mu_O + u_O + \kappa)$. No migration will take place if $Y_O > Y_D$ and $Y_O > Y_{DO}$; a permanent migration will take place when $Y_D > Y_O$ and $Y_D > Y_{DO}$; and migration and return migration will take place when $Y_{DO} > Y_D$ and $Y_{DO} > Y_O$. We illustrate the ensuing regimes in Fig. 4.7 for the case where $c < 1$ (which is the case where the variance of earnings—and the price of skills—is higher in the destination country).

The figure shows the distribution of skills, where those with the lowest skills (below the threshold $\mu_O - \mu_D - \kappa(1-\tau)/\tau$) will decide not to emigrate, those with the highest skills (above the threshold $\mu_O - \mu_D + \kappa$) will decide to emigrate and remain permanently, and those between the two thresholds will decide to emigrate but return home after spending time t abroad. Thus, those who return have higher skills than those who have not emigrated, but lower skills than those who decide to remain permanently.

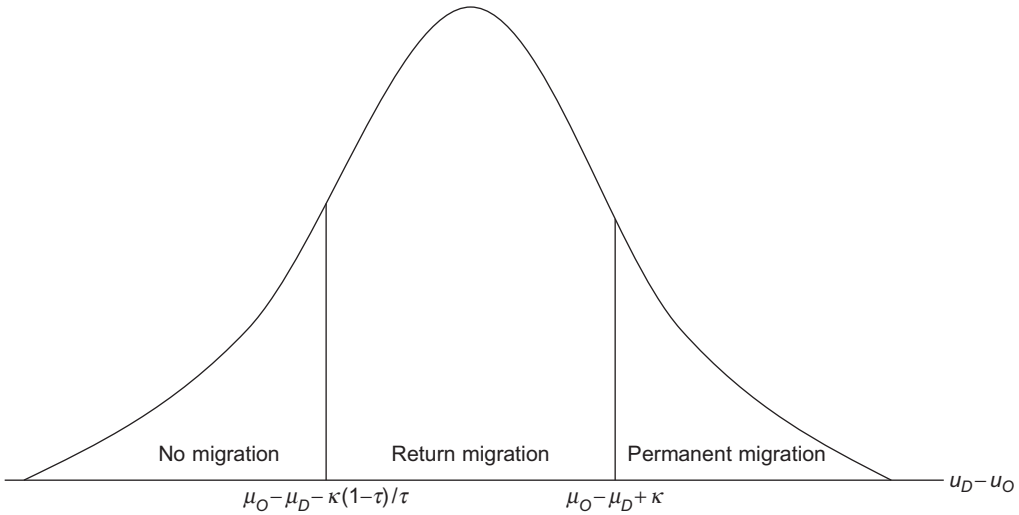

Figure 4.7 Selection with Return Migration.

Further, an increase in the rent on human capital in the country of destination μ_D will lead to a shift in the thresholds to the left, whereas an increase in the value of human capital acquired abroad back in the home country, κ, leads to a widening of the distance between the two thresholds and thus to increased return migration. It is easy to show that selection of emigrants and return migrants will be exactly the opposite when the price of skills is higher in the country of origin. We will now extend this model to a multidimensional setting.

4.3. Learning, Multidimensional Skills, and Return Migration

The multidimensional model described in Section 4.1 is a static model, in the sense that it assumes that the skills individuals have cannot be augmented. In Section 3, we illustrate—within a one-dimensional skill framework—that many migrations take place for the purpose of skill accumulation. Student migrations, for example, have increased by more than 80% between 1999 and 2008, constituting an increasingly important component of international migration as illustrated in Fig. 4.1.

In a recent paper, Dustmann, Fadlon, and Weiss (2010) extend the two-dimensional framework and develop a dynamic Roy model with learning, where migration and return migration decisions do depend (for given skill prices) not only on the skills individuals possess, but also on the learning opportunities in the origin and destination countries, that is, where skills can be acquired more efficiently. As in Section 4.1, they allow skills to command different prices in different countries but, in addition, add the possibility that individuals can accumulate skills in different countries at different rates.

We will briefly sketch their model using the same notation as earlier. Human capital is again an aggregate that summarizes individual skills:

$$Y_j = \ln y_j = \mu_j + \ln K_j(t) = \mu_j + b_{j1} S_1(t) + b_{j2} S_2(t),$$

where $j = O, D$, and where the skills S now carry a time index as they can be augmented in a "learning by doing" way. Dustmann, Fadlon, and Weiss (2010) concentrate on the case where $b_{D1} > b_{O1}, b_{O2} > b_{D2}$, which allows for nonhierarchical sorting.

Individuals accumulate skills S_1 and S_2 while working. However, the extent of human capital accumulation differs between the two countries, due to different learning rates and different prices for the two skills. Denoting the rate of accumulation of skill S in country j by γ_{jS} and assuming that skill S_1 can be accumulated at a faster rate in country D, whereas skill S_2 can be accumulated at a faster rate in country O, one obtains $\gamma_{D1} > \gamma_{D2}, \gamma_{O2} > \gamma_{O1}$. Assuming continuous time, a person who works in country D accumulates local productive capacity ($K_{D,D}$) and productive capacity applicable in the country of origin ($K_{O,D}$) at rates

$$\frac{\dot{K}_{D,D}}{K_{D,D}} = b_{D1}\gamma_{D1} + b_{D2}\gamma_{D2} \equiv g_{DD}; \quad \frac{\dot{K}_{O,D}}{K_{O,D}} = b_{O1}\gamma_{D1} + b_{O2}\gamma_{D2} \equiv g_{OD}.$$

Further, human capital is accumulated in country O at rates

$$\frac{\dot{K}_{O,O}}{K_{O,O}} = b_{O1}\gamma_{O1} + b_{O2}\gamma_{O2} \equiv g_{OO}; \quad \frac{\dot{K}_{D,O}}{K_{D,O}} = b_{D1}\gamma_{O1} + b_{D2}\gamma_{O2} \equiv g_{DO}.$$

The parameter g measures the rates at which productive capacity for either country can be augmented in each country. For example, the parameter g_{OD} measures the rate at which productive capacity for the origin country can be acquired in the destination country D. This depends on the rate at which the two skills S_1 and S_2 are acquired in country D (γ_{D1} and γ_{D2}), and the prices these skills command in country O (b_{O1} and b_{O2}).

The model is analyzed under certainty, with infinitely long-lived agents, and a fixed interest rate. There is a fixed learning period: learning can take place only until age T, and remains constant thereafter, so that substitution between learning abroad and at home occurs. The time line is given in Fig. 4.8. Individuals are born at 0, emigrate at τ, and have the possibility to return at ε. The length of the learning period is given by T, and the return time ε may be before or after T.

Three cases are distinguished that relate to the intensity at which staying in the host country affects human capital in the two countries, referred to as *partial transferability,*

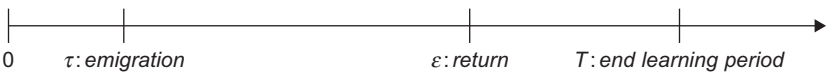

Figure 4.8 Timeline Return Migration.

strong transferability, and *super transferability*. We will here briefly consider the first two cases.

Partial transferability characterizes a situation where $g_{DD} > g_{OO} > g_{OD}$, whereas strong transferability characterizes a situation where $g_{OD} > g_{DD} > g_{OO}$. Thus, with partial transferability, experience in the host country leads to less accumulation of human capital that is applicable to the home country than experience in the home country. Furthermore, experience in the home country leads to less accumulation of human capital that is applicable to the home country than experience in the host country leads to accumulation of human capital applicable in the host country. Thus, those who have a high endowment of K_D will emigrate (and they will do so at the first possible opportunity, $\tau = 0$, as this maximizes the amount of human capital that can be accumulated). Furthermore, as experience in the host country enhances human capital in the host country by more than human capital in the home country, those who have decided to emigrate will never return.

With strong transferability, time in the host country will enhance human capital applicable in the home country by more than human capital in the host country and by more than time in the home country. Country D is a "learning center." Again, those who decide to emigrate will do so at $\tau = 0$, but now some of them will return prior to T.

In Fig. 4.9, we display the marginal gain and marginal cost schedules from delaying the return back home for the case of strong transferability.[53] The intersection of these two curves presents the optimal return time. The cost of a delayed return rises with the time in the host country, as the migrant's home country human capital K_O increases at a faster rate than his or her host country human capital K_D ($g_{OD} > g_{DD}$). A return will occur if the two schedules cross at $\varepsilon < T$. If the schedules cross at $\varepsilon > T$, Dustmann, Fadlon, and Weiss (2010) show that return will occur either at T, or the migration will be permanent.

Consider now the question who leaves and who will return. In the case of partial transferability, migrations will either not occur, or they will be permanent, as the gap between home and host country human capital will increase with the migration duration. This situation is not dissimilar to the two-dimensional Roy model we have discussed in Section 4.1. The migration decision is based on $S_2(0) > \frac{\Omega}{b_{D2} - b_{O2}} - \frac{b_{D1} - b_{O1}}{b_{D2} - b_{O2}} S_1(0)$, where now the skills S_1 and S_2 are evaluated at $\tau = 0$, and Ω depends on the present value of lifetime earnings and is endogenously determined. As before, who migrates (and the type of selection) depends on the skill prices.

[53] Notice that this situation is similar to the one-dimensional model we discuss in Section 3.3.4, where a return is triggered by an increase in human capital that is valuable in the home country. The reason for the increasing marginal gain schedule is that Dustmann, Fadlon, and Weiss (2010) allow for imperfect transferability of productive capacity. They assume that the rent on human capital in the destination country is initially the same as in the origin country (R_O) but converges to the rent on human capital in the destination country (R_D). The discontinuity in the marginal cost schedule at T results from the assumption that learning can only take place until T.

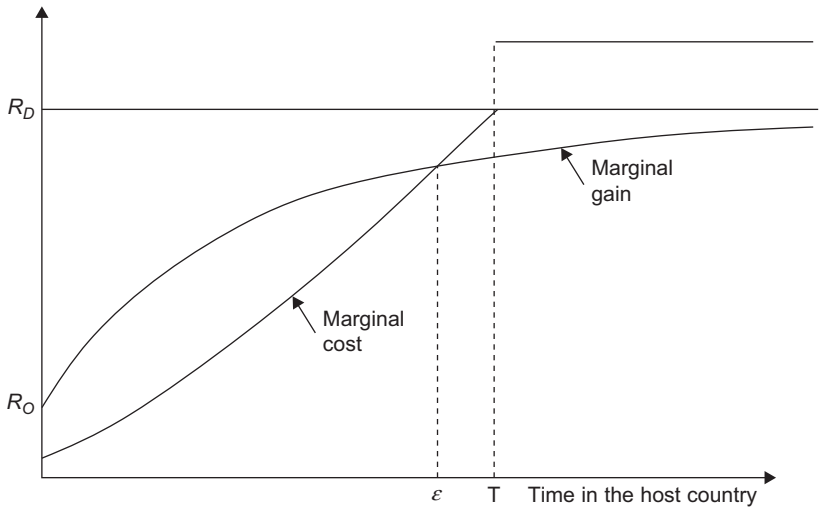

Figure 4.9 Return Migration in Two-Dimensional Skill Framework with Learning.

More interesting is the case of strong transferability. In this case, return migration occurs, given the assumptions on skill prices and their accumulation rates in the host and home country ($b_{D1} > b_{O1}$, $b_{O2} > b_{D2}$, and $\gamma_{D1} > \gamma_{D2}$, $\gamma_{O2} > \gamma_{O1}$). Figure 4.10 illustrates the migration and remigration choices in the $S_1(0)$ and $S_2(0)$ space. Those with relatively more $S_1(0)$ (which commands a higher price in the country of destination) will emigrate and, among them, those with relatively more $S_2(0)$ will return home.

In Borjas and Bratsberg (1996), the motive for a return is the same as the one we discuss here: the time in the host country may increase immigrants' home country human capital by more than their host country human capital. However, they do not consider learning (which in our case affects both emigration and remigration decisions), and they consider the return decision in the one-dimensional case. The model collapses to the one-dimensional case by assuming that $S_1 = S_2$ (or, alternatively, by assuming $b_{D1} = b_{O1} = 0$). In that case, the two-dimensional distribution of S_1 and S_2 collapses to a one-dimensional distribution along the 45° line (or along the $S_2(0)$ axis if $b_{D1} = b_{O1} = 0$). It is obvious that in that case, selection will be either positively or negatively selective, according to the relative skill prices—similar to Fig. 4.7 in Section 4.2. For the way Fig. 4.10 is drawn, emigration and remigration will be negatively selective.

4.4. Empirical Studies

The selection of immigrants and return migrants and the effect of migration on the skill base of the origin and destination country are important to understand the consequences of migration for those who do not migrate. The last sections have developed

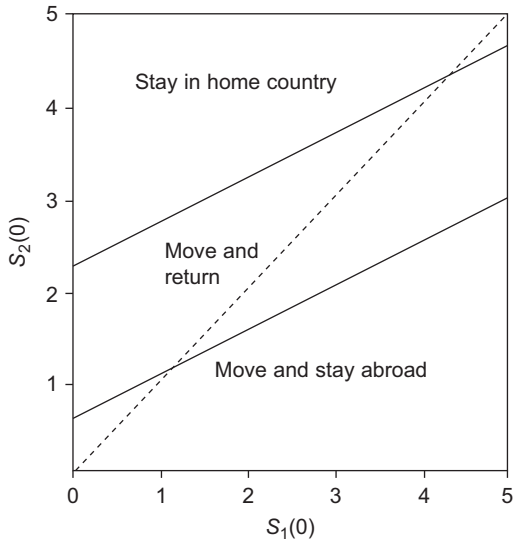

Figure 4.10 Selection in Two-Dimensional Skill Space with Learning.

a framework within which these processes can be understood and analyzed. We have also discussed some empirical papers that try to assess the direction of selection, and we have suggested some possibilities of how to think about selection in a multidimensional skill world.

In this section, we will discuss some of the empirical papers that study additional ways in which migrations affect nonmigrants and their skills and skill accumulation. Much of this work can be directly related to the theoretical models we discussed in the previous sections.

4.4.1 Emigration and Human Capital Investment in the Sending Country

Emigration, or the possibility of emigration, may have important consequences for the skill accumulation in the origin country through several channels. First, emigrants may redistribute some of the surplus they capture to family members back home by means of remittances, which may then be used for educational investments that would otherwise not have been possible due to a lack of available funds and credit constraints (for a formal model describing this mechanism, see Rapoport and Docquier (2006)). A number of studies suggest that this is happening. Yang (2008), for instance, studies how sudden shocks in exchange rates due to the Asian financial crisis in 1997 affected child schooling and educational expenditures in the Philippines through their effect on remittances, taking advantage of the diverse set of host countries Filipino emigrants are located in. He finds positive effects on human capital accumulation in the origin households. Similarly, Cox Edwards and Ureta (2003) and Acosta (2006) provide evidence

that remittances increase educational attainment of children in El Salvador, and López-Córdova (2005) shows that municipalities in Mexico that receive more remittances have higher literacy and school attendance rates among their 6- to 14-year-old children.

Second, the possibility of a future migration may increase the incentives to invest in further education. This point has first been made by Mountford (1997), and we have illustrated the basic idea in Section 3.3.5: if the return to education is higher in a potential destination country and if there is a positive probability of a future migration, then this will lead to a higher incentive to invest in human capital. Although higher returns to education in the host country have a negative direct effect on the home country's skill base by inducing skilled emigration, it encourages human capital formation in the longer run. Mountford shows that this can potentially be beneficial for the country of origin ("beneficial brain drain"), as long as the probability of an actual future emigration is smaller than 1 (see also Stark, Helmenstein, and Prskawetz (1997); Vidal (1998); and Beine, Docquier, and Rapoport (2001)). Such uncertainty of migration could result, for example, from the unpredictability and restrictiveness of migration policies in potential destination countries.

In a series of empirical studies, Beine, Docquier, and Rapoport (2001, 2008) and Beine, Defoort, and Docquier (2010) assess the possibility of a beneficial brain drain using both cross-sectional and panel data for a large set of developing countries. Their findings provide some evidence that higher emigration rates may indeed have a positive effect on average human capital levels. For example, their work shows that in those countries that are characterized by low levels of human capital, low income and relatively low emigration rates of skilled workers (not exceeding 20–30%), the net effect on the average human capital level of the remaining population is positive, implying a beneficial brain drain effect. Such a positive incentive effect of emigration on human capital accumulation may be further reinforced in the presence of positive externalities of human capital in production (Stark and Wang (2002)) and perpetuated through the intergenerational transmission of human capital from one generation to the next. Schiff (2005) takes a more sceptical view regarding the likelihood and magnitude of a beneficial brain drain through the incentive effect of skilled emigration, a view supported by empirical evidence provided by Lucas (2005) and Checchi, De Simone, and Faini (2007). These studies suggest that in many countries that experience emigration of their skilled workers, the net effect on the average educational attainment of those remaining in the country is likely to be negative.[54]

[54] This is more likely for those countries where skilled emigration rates are excessively high, such as many sub-Saharan African and Central American countries where they often exceed 40%. See also Marchiori, Shen, and Docquier (2009) who come to this conclusion based on an overlapping-generations general equilibrium model.

Third, selective emigration, as discussed in the previous section, may affect skill acquisition in the origin country by changing the existing skill base, which in turn affects the return to education. For example, if emigrants are predominantly high skilled, then the reduction in the relative supply of high-skilled workers in the home country should lead to an increase in skilled workers' wage rates. Mishra (2007) analyzes this relationship for the Mexican case. Following an empirical strategy first suggested by Borjas (2003), she finds that Mexican emigration to the United States has had a significant positive effect on Mexican wages, a conclusion supported by evidence provided by Hanson (2007) and Aydemir and Borjas (2007). According to Mishra's results, a 10% decrease of Mexican workers in a skill group (measured by education and experience) due to emigration increases average wages in that group by 4%. Since emigrants are disproportionately drawn from the middle of the Mexican skill distribution (high school graduates and those with some college education), wages of medium-educated workers in Mexico have increased the most as a result of emigration. The resulting increase in the return to education may induce more individuals to invest in additional schooling.

Lastly, as discussed by Dustmann, Fadlon, and Weiss (2010), emigration and return migration may lead to an increase in the productive human capital stock in the sending country if a sufficiently large fraction of the migrations are temporary and the returning migrants accumulate valuable human capital while being abroad. One channel through which human capital of return migrants may lead to economic growth in their home countries is through facilitating knowledge and technology spillovers from the typically more advanced host countries. Domingues Dos Santos and Postel-Vinay (2004) derive the theoretical conditions required for such an overall positive effect to occur.

Although each of the four channels presented may individually lead to a positive effect of migration on educational attainment in the origin country, there are also counteracting factors, likely to depend on the particularities of the considered migration situation that tend to reduce educational attainment. For example, although the positive income effect through remittances may well alleviate credit constraints and lead to higher investments in education, the absence of a parent, and in particular of a mother, is likely to negatively affect overall parental inputs into the children's development. It may also force children to undertake additional household chores or other work to help maintaining the household. Cortés (2010), for instance, provides evidence that children of migrant mothers in the Philippines are approximately 10 percentage points more likely to be lagging behind in school compared with children of migrant fathers.

Also, the possibility of a future migration may create opposite incentive effects if the return to education in occupations potential emigrants consider as attainable is lower in the destination country than in the origin country (this could be due to a high return to

trade (manual) skills and low returns to academic skills), or if migration is seen as an alternative to the acquisition of education. Due to these counteracting factors, the overall effect of migration on human capital acquisition in the home country is a priori ambiguous. McKenzie and Rapoport (2010) empirically assess this net effect of migration for the Mexican case based on data from the National Survey of Demographic Dynamics using historical migration rates to instrument for current migration. Their findings show a significant negative effect of migration on school attendance and educational attainment of 12- to 18-year-old boys and 16- to 18-year-old girls: living in a migrant household is estimated to lower the probability of completing high school by 13% for males and 14% for females. These effects are somewhat mitigated for children from a poorer background, which is consistent with a more prominent role of credit constraints in these households. Overall, most of the negative effect of migration on educational attainment is due to young males migrating themselves rather than attending school and young females dropping out of school to work at home.[55] For a detailed discussion of this literature, including earlier work, see Commander, Kangasniemi, and Winters (2004) and Docquier and Rapoport (2009).

4.4.2 Immigration and Human Capital Investment in the Receiving Country

In the last section, we considered the possible channels by which emigration can affect skill accumulation and education of those in the country of origin who do not emigrate. We now turn to the destination country. Again, there are various channels by which immigration may affect the accumulation of skills and education. First—and similar to what we discussed in the previous section—immigration may affect the price of skills by changing the relative factor supplies in the host country's economy. For example, a large inflow of low-skilled immigrants could lead to a decrease in the relative wages of low-skilled workers and an increase in the relative wages of high-skilled workers. Most of the existing papers do not find large wage effects of immigration, although there is still a lot of controversy in the literature investigating this issue, which includes studies by Card (1990); Altonji and Card (1991); Butcher and Card (1991); Borjas, Freeman, and Katz (1997); Card (2001); Friedberg (2001); Borjas (2003); Dustmann, Fabbri, and Preston (2005); Manacorda, Manning, and Wadsworth (2011); Ottaviano and Peri (2011); Dustmann, Frattini, and Preston (2008); and Glitz (2011).[56]

In the simplest model of an economy with one sector and unskilled and skilled labor, the effect of immigration depends on assumptions about the elasticity of capital supply and the share of skilled immigrants relative to the share of skilled workers in

[55] See also De Brauw and Giles (2006) and Antman (2009) who similarly find a negative overall effect of migration on investments in education in China and Mexico, respectively, and Hanson and Woodruff (2003) who find a positive effect on the schooling of less-educated mothers' teenage daughters in Mexico.

[56] For a comprehensive overview of this literature, see Okkerse (2008).

the native population. We have seen in Table 4.1 in Section 2 that this share differs substantially across countries so that we cannot expect immigration to have the same effects in different countries. If immigration is unskilled and affects skill prices by, for example, generating higher returns to education, then this may create incentives to invest in education. Findings for the United States by Jackson (2010) show that a 1% increase in relatively unskilled immigrant labor increases the rate of native college enrolment by 0.33%. This crowd-in effect is driven primarily by natives aged 18–24 because of their higher sensitivity to the returns to college education relative to older natives. In a more specific case, if immigrants are complementing labor supply of highly skilled women by providing domestic services that are otherwise not available or considerably more costly, then this is likely to increase the return to higher education for women. Such immigration should then lead to not only higher female labor supply (as shown by Cortés and Tessada (2009); Cortés and Pan (2009); and Farré, González, and Ortega (2009)) but also more human capital investment.

Second, immigration may create incentives for native-born workers to specialize in areas where they have a comparative advantage, for instance through their knowledge of the host country language or of existing networks. Such specialization may well imply the accumulation of additional skills. More generally, if immigrants and natives have different comparative advantages in the labor market, then immigration will lead to shifts in the skill distribution of the native workforce. For example, Peri and Sparber (2009) show that natives reallocate their task supply toward occupations that are more communication and language intensive when faced with an inflow of immigrants that increases the supply of manual and physical labor intensive occupations. Task specialization also extends to the highly educated segment of the labor market, where immigrants with a graduate degree tend to specialize in occupations demanding quantitative and analytical skills, whereas native-born graduates specialize in occupations requiring interactive and communicative skills (Peri and Sparber (2008)).

Third, immigrants may affect the human capital acquisition of natives through their presence in the educational system, both on the tertiary and prior levels. Borjas (2006a) finds that admitting foreign students to doctoral programs has a negative effect on the earnings of native doctoral recipients in the corresponding field. According to his results, a 10% increase in the supply of doctorates in a specific field reduces earnings of competing workers by 3–4%, half of which is due to a shift toward lower-paid postdoctoral appointments. He also finds some evidence of foreign students crowding out white native men (Borjas (2007)) which, although in line with earlier evidence provided by Hoxby (1998), stands somewhat in contrast to other findings showing no significant crowd-out effect of native students (Jackson (2010)). Crowding-out of native students has also been found at the secondary school level. Betts and Fairlie (2003) found evidence that for every four immigrants who arrive in public high schools, one native student switches to a private school and that this "native flight" is particularly

pronounced among white native students and in response to the arrival of non-English-speaking immigrant children. Gould, Lavy, and Paserman, (2009) show that the presence of immigrants during elementary school has a negative long-term effect on the probability of passing the high school matriculation exam in Israel, which enables students to attend college. Neymotin (2009), on the other hand, provides evidence that immigration did not negatively affect the SAT scores of native high school students in California and Texas.

Finally, in a wider context, immigration may affect the stock of human capital in the host country by its contribution to new innovations. For instance, Hunt and Gauthier-Loiselle (2010), using the 2003 National Survey of College Graduates, show that the large number of immigrants with science and engineering degrees in the United States add significantly to the number of patents granted: a single percentage point increase in the immigrant college graduates' population accordingly leads to an increase in patents per capita by 9–18%. Hunt (2010) and Kerr and Lincoln (2010) find complementary evidence regarding immigrants' contribution to general productivity-increasing activities such as patenting, publishing, and company start-ups.

5. THE CHILDREN OF IMMIGRANTS

In the previous sections, we have considered the relationship among education, skill accumulation, and migration. We focused on the way education interacts with migration decisions and how migration affects skill accumulation and the skill base of those populations who do not migrate. In this context, we have touched on the educational achievements of the children of emigrants in the home countries and on the incentives to invest in education for young people in the host countries as a result of immigration. In this section, we will focus explicitly on the children of immigrants in the countries of destination. We will study their educational achievements and ensuing labor market outcomes and relate these to their parent generation and their peers born to native parents.

The educational achievement of the children of immigrants is one of the key issues in the immigration debate in many countries. Underachievement of immigrant children is often seen as a major factor for the long-term segregation of immigrant communities, and educational achievements of immigrant children in comparison to their native-born peers are considered an important indicator of successful immigration policy (see, e.g., OECD (2006)). As Table 4.9 in Section 2 shows, the test score results for children with a migration background, based on the PISA data, are indeed on average below those of children of native-born parents, although there is quite some variation across countries. This is in line with the limited set of findings for individual countries that are based on alternative standardized performance measures. For instance, Rampney, Dion, and Donahue (2009) show that the reading (mathematics) score gap in the National

Assessment of Educational Progress (NAEP) between White and Hispanic students in the United States in 2008 was 9.2 (6.4)% for the 9-year-olds, 9.7 (7.9)% for the 13-year-olds, and 8.8 (6.7)% for the 17-year-olds.

As Fig. 4.2 shows, educational achievement of immigrant children is related to the educational achievement of their parents. This suggests that the relatively low achievement of immigrant children in some countries is at least partly due to the lower educational background of their parent generation and does not necessarily reflect the failure of the host society to educate second-generation immigrants. However, in the public debate, the comparison between children born to immigrants and native parents is often *unconditional* on parental characteristics—a comparison that seems not very meaningful. If the first generation of immigrants is less educated than the native population (which is the case for a number of countries, see Section 2), then even a strong educational progress of immigrant children may still result in educational outcomes that are lower than those of natives. We will discuss this issue below.

How should we then think about the *dynastic* assimilation of immigrant communities? What is it exactly that determines the educational outcomes of immigrant children? There are at least three factors that matter: First, as just argued, the educational achievements of immigrant children are linked to their parental background. There is a large literature on the intergenerational transmission of human capital, for example Behrman and Taubman (1985); Solon (1992); Zimmermann (1992); Björklund and Jäntti (1997); Corak and Heisz (1999); or Blanden, Goodman, Gregg, and Machin (2004), which shows that there is considerable intergenerational immobility across generations in a large number of outcomes.

Second, immigrant children may be differently affected by the institutional setting and support structures of the host countries' education systems. Another large literature in economics studies the different features of educational production and how it relates to resources, institutions, and parental input (see, e.g., Todd and Wolpin (2003); Cunha, Heckman, Lochner, and Masterov (2006); or Hanushek and Woessmann (2008, 2010)). Even without differential access to these educational institutions across populations in the same country, the same resources may affect immigrant children's educational outcomes in a different way than those of children born to native-born parents—for example, due to complementary forms of knowledge that are not sufficiently available in immigrant communities[57]—and prevent immigrants' children from making full use of existing educational support structures.

Third, the social context in which immigrant children grow up is an important determinant of their educational outcomes. Borjas (1992, 1995a) was among the first to emphasize what he calls the effect of "ethnic capital" on the educational achievements

[57] One of those is, for instance, language. Dustmann, Machin, and Schönberg (2010) illustrate that language is the key factor that holds children of ethnic minority background back in the first years of full-time education.

of immigrant children. The ethnic context of immigrants shapes their own, and their parents' values and incentives. For instance, immigrant children who grow up in an ethnic environment that is characterized by particular educational and occupational choices are likely to make similar choices. Ethnic capital summarizes things, such as peer effects, role models, and community ambitions, which may all be strongly related to immigrants' educational outcomes. This may reduce the overall educational attainment of second-generation immigrants, but it may also enhance it. A good example is the success of south and south east Asian immigrant children that may be partly due to the high value attached to education within their communities (which in turn may be related to the Confucian tradition, which emphasizes the importance of study). In the United Kingdom, for example, Chinese students, who at the beginning of their compulsory schooling at age 6/7 start off with a 7.6% of a standard deviation lower English test score than White British students, outperform their native counterparts by more than 50% of a standard deviation by the time they reach age 15/16 (Dustmann, Machin, and Schönberg (2010)).

There are other important factors that relate to the educational achievement of immigrant children. Parental considerations that affect their own investment in learning may also influence decisions about their children. For instance, we have seen that in the case of temporary migrations, and if skills acquired in the host country are only partially transferable to the home country labor market, immigrants will invest less in their human capital than they would in case of a permanent migration. In the same way, it is not unlikely that parental decisions about the educational investments of their children are affected by where parents see their children's future. For instance, if a migrant household intends to return to the home country, and if this planned return migration is including the children, then this may induce parents to invest less in their children's education than they would do in the case of a permanent migration. Dustmann (2008) has made this point and provides empirical evidence that supports this hypothesis.

As earlier, we will commence with a formal discussion, laying out some of the key issues. We will then review and interpret the empirical evidence that exists to date.

5.1. Immigrants and Intergenerational Mobility

The empirical approach to study the relationship between outcomes of parents and outcomes of children is to regress a permanent outcome measure of the child on a permanent outcome measure of the parent by applying a Least Squares estimator to the regression equation

$$\log y_{it}^{j} = \alpha^{j} + \rho^{j} \log y_{it-1}^{j} + \varepsilon_{it}^{j}, \tag{4.14}$$

where $\log y_{it}^{j}$ and $\log y_{it-1}^{j}$ are some permanent measures for outcomes (such as education, wealth, or earnings) of a child and parent, respectively, belonging to group j (which could be immigrants and their children, or natives and their children). For

simplification, in what follows, we will refer to the outcome as "earnings." According to Eq. (4.14), the earnings of family i's child is determined by family i's parental earnings and other influences ε (which we will discuss further below). The parameter α^j can be thought of as the average effect of these other influences on earnings, which can differ between groups. Assuming that the variances of $\log y^j_{it}$ and $\log y^j_{it-1}$ are the same, ρ^j is the population correlation coefficient between $\log y^j_{it}$ and $\log y^j_{it-1}$. Assume that the ε^j_{it} are iid distributed with mean zero and $Var(\log y^j_{it}) = Var(\log y^j_{it-1}) = \sigma^{2,j}_y$, so that estimation of Eq. (4.14) gives a consistent estimate of ρ^j, $\hat{\rho}^j$.[58] The coefficient ρ^j represents the fraction of economic advantage (in terms of earnings, education, or wealth) that is on average transmitted across the generations. It is called the intergenerational correlation coefficient or transmission parameter. A coefficient close to zero suggests high intergenerational mobility, whereas a coefficient close to one indicates low mobility. The coefficient $(1-\rho^j)$ is often referred to as the degree of regression to the mean.

For immigrants, the study of intergenerational mobility has a particular significance. If first-generation immigrants are disadvantaged, in the sense that they are less well educated or have lower earnings than the native population, then immigrant and native populations may differ for many generations, depending on the magnitude of ρ.

To illustrate this point, consider Eq. (4.14) and index outcomes of immigrants and natives by I and N, respectively. Further, allow the intergenerational transmission parameter to differ between the two groups so that $\rho^N = \rho^I + \zeta$. Then, the wage differential between the two populations in generation t is given by

$$E(\log y^N_t) - E(\log y^I_t) = \alpha^N - \alpha^I + \rho^N(E(\log y^N_{t-1}) - E(\log y^I_{t-1})) + \zeta E(\log y^I_{t-1}). \quad (4.15)$$

Consider the case where $\zeta = 0$ (intergenerational transmission ρ is the same in the two populations) and assume for simplicity that $\alpha^N = \alpha^I$. In this case, the native-immigrant gap in outcomes disappears from one generation to the next only if $\rho = \rho^N = \rho^I = 0$. If $\rho = 1$, the initial outcome differential will be fully transmitted to the next generation. If ρ is smaller than 1, inequality between the two groups will fall and assimilation across groups will take place, but not within one generation. The magnitude of ρ determines the speed of convergence. For example, for $\rho = 0.4$, a 20% average earnings disadvantage for immigrants in the parent generation translates into an 8% earnings disadvantage in their children's generation. Now, suppose "other influences" determining outcomes as captured by the parameter α differ across the two groups. If $\alpha^N - \alpha^I > 0$, the difference in outcomes in the next generation may even be larger than in the parent generation, despite regression to the mean, as indicated by $\rho < 1$.

[58] If the variance of log wages differs across the two generations, the OLS estimator $\hat{\rho}$ measures $\rho\sigma_{yt}/\sigma_{yt-1}$.

Now, consider the case where $\zeta \neq 0$: the intergenerational transmission parameter differs between the two groups. It follows from Eq. (4.15) that if $\zeta > 0$. (i.e., intergenerational mobility in the advantaged groups, natives, is smaller than in the disadvantaged group), outcome differentials in the next generation may even be larger than those in the previous generation despite regression to the mean in both groups. The degree of assimilation between the two groups across generations depends on the parameters ζ, ρ^N, and $\alpha^N - \alpha^I$.

In general, earnings of immigrants in the next generation will converge to the earnings of natives (in the sense of $E(\log y_t^N) - E(\log y_t^I) < E(\log y_{t-1}^N) - E(\log y_{t-1}^I)$) if

$$\frac{\alpha^N - \alpha^I}{(1-\rho^N)E(\log y_{t-1}^I)} + \frac{1-\rho^N+\zeta}{(1-\rho^N)} < \frac{E(\log y_{t-1}^N)}{E(\log y_{t-1}^I)}.$$

Thus, if mean log earnings of natives are larger than those of immigrants in generation $t-1$, there will always be convergence as long as $\alpha^N - \alpha^I = 0$, $\zeta = 0$ and $\rho^N = \rho^I = \rho < 1$. On the other hand, both a higher ζ (less intergenerational mobility of natives) and a higher $\alpha^N - \alpha^I$ (stronger effect of other influences on native earnings than on immigrant earnings) lead to slower convergence. For sufficiently high values of either of these parameters, the difference in expected earnings between immigrants and natives in the next generation could be larger than in the previous generation.

What is the interpretation of the parameters ρ and α, and how do they relate to an underlying structural model and its parameters? This is what we will explore next. We will show why these parameters are likely to differ between immigrants and natives and generate different intergenerational correlation coefficients and intercepts and hence different intergenerational persistence of outcomes for these groups. We will also demonstrate why the assumption that ε_{it} is iid is unlikely to hold in reality, which may affect the actual estimation of the parameter ρ.

5.2. A Model of Intergenerational Mobility of Immigrants

Becker and Tomes (1979) develop a theoretical model for the intergenerational transmission of wealth and human capital, and Solon (2004) provides a parameterization that derives an intergenerational transmission function of the type illustrated above. In the following, we will draw on Solon's formulation, simplify, and adjust it to emphasize what we believe are some key insights for the study of educational attainments of the children of immigrants in comparison with natives. The model is a permanent income model of intergenerational mobility with parental investments in the child's earnings potential. Consider a one-person household with one child, situated in the host country. There are two periods. In the first period (period $t-1$), the parent has earnings equal to y_{t-1} and the child is in full-time education. In the second period (period t), the parent retires while the child participates in the labor market and has

earnings y_t, which depend in magnitude on investments in education in the first period. The parent is altruistic and maximizes an intertemporal utility function by choosing first-period savings S_{t-1}, and investment in the child's human capital in the first period, I_{t-1}:

$$V = u(c_{t-1}) + \delta[u(c_t) + \gamma \log y_t], \tag{4.16}$$

where $u(.)$ is the parent's utility from consuming c_t and c_{t-1} in periods t and $t-1$, respectively, and δ is a discount factor. The parameter γ is an altruistic weight. If $\gamma = 0$, the parent does not consider the child's earnings in period t. Assume that parental investments I_{t-1} translate into human capital of the child (H_t) according to the following production technology:

$$\log H_t = h = \theta \log I_{t-1} + e_t. \tag{4.17}$$

The parameter θ is a technology parameter measuring the productivity of investments. This parameter can be viewed as the "talent" or the "ability" of the child but may also be related to institutional settings and school quality. The term e_t is the human capital the child receives without any direct parental investments. This term represents the attributes endowed upon the child, depending on characteristics of the parents, the child's upbringing, genetic factors, environment, and luck. It may also depend on existing networks, as well as the lack of opportunity to move out of social and economic structures from one generation to the next. Becker and Tomes (1979) refer to this term as endowments of capital that "are determined by the reputation and 'connections' of their families, the contribution to the ability, race, and other characteristics of children from the genetic constitutions of their families, and the learning, skills, goals, and other 'family commodities' acquired through belonging to a particular family culture. Obviously, endowments depend on many characteristics of parents, grandparents, and other family members and may also be culturally influenced by other families." The influence of cultural factors and family background may be particularly important for immigrants, and we will discuss the implications in Section 5.2.3. These factors include what Borjas (1992) calls "ethnic capital," the quality of the environment in which parental investments are made.

Human capital translates into earnings of parents and children according to the following relationship:

$$\log y_{t-1} = \mu_{t-1} + r_{t-1} h_{t-1}, \tag{4.18a}$$

$$\log y_t = \mu_t + r_t h_t. \tag{4.18b}$$

Our formulation allows for different "rental rates" on human capital in the different periods, μ, as well as different returns to human capital, r. It follows from

Eqs (4.17) and (4.18.b) that the child's earnings in the second period are related to parental investments by

$$\log y_t = \mu_t + r_t \theta \log I_{t-1} + r_t e_t. \tag{4.19}$$

The parent's consumption in period $t-1$ equals $c_{t-1} = y_{t-1} - I_{t-1} - S_{t-1}$, where y_{t-1} are earnings in period $t-1$. For simplicity, we assume that the parent cannot borrow against the child's future earnings and does not bequeath financial assets to the child. As the parent retires in period t, period t consumption is equal to period $t-1$ savings, $c_t = S_{t-1}$.

Choosing a simple logarithmic utility function for consumption and substituting Eq. (4.19) for the child's earnings in Eq. (4.16), the optimization problem of the parent can be expressed as

$$\max_{S,\, I} V = \log(y_{t-1} - I_{t-1} - S_{t-1}) + \delta[\log S_{t-1} + \gamma(\mu_t + r_t \theta \log I_{t-1} + r_t e_t)]. \tag{4.20}$$

Maximizing Eq. (4.20) with respect to savings and investment, and solving the first-order conditions for the optimal investment I_{t-1} yields

$$I_{t-1} = \frac{\delta\gamma\theta\, r_t}{(1+\delta) + \delta\gamma\theta\, r_t}\, y_{t-1}. \tag{4.21}$$

The term in the numerator (which is the same as the second term in the denominator) is the expected discounted utility gain to one log unit of parental investment in the child's human capital. The first term in the denominator is the expected lifetime utility gain from one log unit of additional lifetime consumption. Thus, investments in the child as a fraction of income equal the expected fraction of utility resulting from this investment. Simple comparative statics show that investment in the child's human capital increases with altruism γ, the productivity of investment θ, the return to human capital r_t, and the discount rate δ.

Human capital and earnings of the child are related to human capital and earnings of the parent as follows:

$$h_t = \theta \log\left[\frac{\delta\gamma\theta\, r_t}{(1+\delta) + \delta\gamma\theta\, r_t}\right] + \theta\mu_{t-1} + \theta\, r_{t-1} h_{t-1} + e_t \tag{4.22a}$$

$$\log y_t = \mu_t + r_t \theta \log\left[\frac{\delta\gamma\theta\, r_t}{(1+\delta) + \delta\gamma\theta\, r_t}\right] + \theta\, r_t \log y_{t-1} + r_t e_t. \tag{4.22b}$$

Equations like (4.22a) and (4.22b) are usually estimated in the literature when regressing education (or earnings) of children on those of their parents. Consider first Eq. (4.22a). The level of education obtained by the child depends on all the parameters that affect investment. These may differ between immigrants and natives. If, for

instance, the rate of return to skills r_t, is perceived to be lower for immigrants, the level of human capital acquired by immigrant children will also be lower as will be their earnings. Neal (2006), for example, discusses statistical discrimination as one reason that has frequently been brought forward to explain the low attainment levels of black youth in the United States, in the sense that employers are not likely to view them as skilled no matter what their level of education is. Also, a lower price for human capital, μ_{t-1}, in the parent generation of immigrants relative to natives due to, for instance, a lack of important complementary skills such as language, leads to a lower level of education of their children. Finally, education of children depends on "inherited" traits and institutional features such as access to schooling and school quality, which are all captured in the term e_t. If these differ between the immigrant and native population, both their education and earnings may differ due to this channel, too (see, e.g., Parent (2009)).

Suppose now that we regress log earnings (or education) of immigrant children on log earnings (or education) of their parents, following much of the literature that we will discuss below. What does the OLS coefficient we estimate measure? Following Becker and Tomes (1979) and Solon (2004), assume that e_t follows an AR(1) process, reflecting a serial correlation in the parent's and the child's human capital endowments, so that $e_t = \lambda_0 + \lambda_1 e_{t-1} + \nu_t$, where ν_t is a white noise error term and $\lambda_1 \in (0, 1)$. As discussed earlier, these endowments may include ability but may also be related to networks, ethnic reference groups, or other "ethnic capital." Then, in steady state, the probability limit of the OLS estimate of the coefficients on h_{t-1} and y_{t-1} are given by $\frac{\theta r_{t-1} + \lambda_1}{1 + \theta r_{t-1} \lambda_1}$ and $\frac{\theta r_t + \lambda_1}{1 + \theta r_t \lambda_1}$, respectively. Thus, the coefficient estimate of ρ in the simple model we discussed at the beginning of Section 5.1 is larger the larger the return to human capital and the productivity of human capital production, r_t and θ, and it also increases in the correlation in heritable traits, λ_1. All these parameters can differ between populations. For instance, if the heritability parameter is larger in the immigrant population because family structures are tighter, the intergenerational correlation coefficient will also be larger for this population, implying less mobility from one generation to the next.

5.3. Empirical Evidence

5.3.1 Schooling Outcomes of Immigrant Children

We start in this section with the first important period in an immigrant's life, his or her childhood. To this end, we return to the data from the PISA study that we already introduced in Section 2. As we have seen in Table 4.9, with the exception of Australia and Canada, the student population with immigrant background tends to score significantly lower than the native population in both mathematics and reading. One of the main explanations for these differences could be the lack of fluency

in the host country language. The last two columns of Table 4.9 indeed show that students who speak a different language at home than the language of instruction at school fare particularly badly. In addition to language, the general skill level of the parents is likely to play a major role in the ability of their children to acquire human capital and, given that in most host countries the immigrant population is less educated than the native population, may contribute significantly to any observed differences in the raw test scores.

Table 4.11 shows a number of descriptive statistics for our 10 most important immigrant-receiving OECD countries. For the sake of brevity, the immigrant student populations we consider include all children whose parents are both foreign-born, no matter whether the children themselves were born in the host country.[59] As Column (4) shows, in many countries the majority of immigrant students speak a language at home that is different from the language of instruction at school.[60] This pattern is particularly pronounced in Italy and the United States, where the share of those speaking a foreign language at home exceeds 60%. Given the complementarity between language and human capital accumulation, this is bound to affect the performance of these children in the different proficiency tests. Columns (5) and (6) show that relative to the native student population, immigrant students have parents with, on average, significantly lower educational attainment. With the exception of Italy and Spain, the share of native students whose both parents have low educational attainment (measured as not exceeding lower secondary education), is fairly low, ranging between about 2 and 15%, whereas it ranges between 10 and 40% for immigrant students (not considering Australia and Canada). The differences in parental educational attainment are particularly large in France, Switzerland, and the United States. These results also hold when looking at alternative measures of economic status, such as the Highest International Socio-Economic Index of Occupational Status (HISEI) of the parents (not reported), which is designed to capture those features of occupations that convert education into income (Ganzeboom, De Graaf, de Leeuw, and Treiman (1992)).

So how do these differences in language and family background contribute to the measured raw test score gaps between natives and immigrants? Column (7) shows again the raw proficiency gaps in mathematics between immigrant students and native students. As we already discussed in Section 2, immigrant students do substantially worse in all destination countries except Australia and Canada, with the largest gaps arising in Germany, the Netherlands, and Switzerland. However, controlling for language

[59] The results we present in this section draw on work by Dustmann, Frattini, and Lanzara (2010).

[60] Whether a student speaks a foreign language at home is obviously only an imperfect measure of language skills as it may very well be that a student is proficient in the language of instruction but still speaks another language at home with his or her parents.

Table 4.11 PISA Outcomes—Summary Statistics and Regression Results

	% of Student Population		% Foreign Language at Home		% Low Education Families		PISA Test Score Gap (Mathematics)		
Destination Country	Natives	Immigrants	Natives	Immigrants	Natives	Immigrants	Unconditional	Conditional on Language	Conditional on Language & Parents' Education
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Australia	60.7	21.2	0.3	33.9	11.0	9.3	15.7**	15.3**	11.1**
Canada	67.9	20.7	0.3	48.3	2.4	6.3	-2.7	-1.8	-3.2
France	76.8	19.7	0.3	34.8	10.9	38.9	-38.9**	-32.5**	-21.0*
Germany	83.8	11.2	0.4	55.0	11.7	24.8	-58.1**	-31.7**	-29.3**
Italy	91.0	6.4	0.1	66.9	27.3	22.1	-38.6**	-28.0*	-33.2
Netherlands	82.5	10.6	0.1	46.1	8.3	29.7	-53.8**	-52.4**	-46.3**
Spain	89.1	6.9	0.3	33.0	37.5	25.3	-47.8**	-49.3**	-55.4**
Switzerland	62.5	3.4	0.1	56.9	14.9	35.8	-69.5**	-47.1**	-44.0**
United Kingdom	84.3	9.1	0.1	38.0	4.2	10.5	-14.6*	-6.7	-7.2
United States	80.1	13.7	0.4	62.3	2.4	25.0	-22.9**	-2.2	4.8

Source: PISA 2006. Columns (1) and (2) report the share of native and immigrant students in the PISA student population. Native students are defined as those born in the country of assessment with both parents as well born in the country of assessment. Immigrant students are those born either in the country of assessment or in another country with both parents foreign-born. The missing category is students with mixed background. Columns (5) and (6) show the percent of families where both parents have low education. Values of summary statistics are computed using the final weights provided by PISA. Columns (7) to (9) report the proficiency gaps in mathematics of immigrant relative to native students. The values are the estimated coefficients of a regression of PISA scores on a dummy for immigrant status (the omitted category is natives). Column (7) reports unconditional regressions; Column (8) adds a dummy for determining whether the language of assessment is spoken at home; and column (9) adds dummies for the higher educational level of either parent ("low": no schooling, primary education, lower secondary education; "medium": secondary education, postsecondary nontertiary education; "high": tertiary education, postgraduate education). The regressions are run separately for each country. All coefficients and standard errors are estimated according to the Unbiased Shortcut procedure (OECD (2009)), using the replicate weights provided by PISA. Stars indicate that the difference between the immigrant and the native average score is statistically significant at the 1% level (**) and at the 5% level (*).

reduces these gaps significantly as shown in Column (8). The reduction is particularly large in Germany, Italy, Switzerland, the United Kingdom, and the United States. In the latter two countries, including an indicator for language spoken at home actually closes the test score gap entirely, with none of the remaining small differences being statistically significant. Adding control variables for the educational attainment of the parents in Column (9) has a further mitigating effect on the test score gaps between natives and immigrants, in particular in France, the Netherlands, and the United States. The only major exception is Spain where the test score gap actually widens once controls for parental education are included, owing to the, on average, better educational background of immigrant children's parents (compare Columns (5) and (6)). Very similar patterns hold for immigrant and native students' reading proficiency (not reported) where, naturally, the impact of language spoken at home is an even stronger determinant of performance. Both language and the educational attainment of the parents thus go a long way in explaining the large gap in mathematics and reading skills between native and immigrant students (for additional evidence, see e.g., Entorf and Minoiu (2005) and Schnepf (2007)).

The significance of language spoken at home for the, at least initial, achievements of immigrant children at school is also documented in other work. In a recent paper based on the British school census, Dustmann, Machin, and Schönberg (2010) investigate the school curriculum of children from ethnic minority backgrounds and compare it to children from nonminority families, from the age of 5 until the age of 16. Their findings show that just before they start school, ethnic minority children significantly underperform in early cognitive tests compared with white British-born children. However, by the end of compulsory schooling at age 15/16, most ethnic minority groups catch up with (Bangladeshi, Pakistani, and black non-Caribbean pupils) or even overtake (Indian and Chinese pupils) their white British counterparts (in key stage 4 tests). The analysis shows that improvements in their proficiency of the English language is the single most important contributor to the catch-up of ethnic minority pupils relative to white British pupils, accounting for up to two-thirds of their relative progress. The importance of language proficiency, in particular, for school performance and integration more generally has been recognized by many host countries by implementing a variety of policies and practices to support immigrant students' acquisition of the language of instruction. For a detailed overview of these policies across OECD countries, see OECD (2006).

5.3.2 Intergenerational Transmission of Human Capital

The results presented in Table 4.11 demonstrate that parental background and language spoken at home matter importantly for the educational success of the children of immigrants. We now briefly review the empirical evidence regarding the intergenerational

transmission of human capital and the long-term assimilation of second-generation immigrants.[61]

Chiswick (1977) and Carliner (1980) were the first to look at the intergenerational aspect of immigrant earnings in the United States. These studies do not relate one generation's earnings to the earnings of its parent generation in the spirit of Eq. (4.14) but compare directly the earnings of different generations of immigrants using cross-sectional data from the 1970 US Census. They distinguish male first- and second-generation immigrant workers and native workers, with the latter defined as individuals who have two native-born parents. Both studies' key finding is that the earnings of second-generation immigrant workers are higher than those of natives.[62] In addition, Carliner (1980) finds that second-generation immigrant men also earn more than first-generation immigrant men from the same ethnic group. Pointing again to the substantial changes in cohort quality over the course of the twentieth century and the bias this can induce in cross-sectional analyses, Borjas (1993) employs grouped data from the 1940–1970 Censuses to isolate cohort effects from intergenerational earnings mobility. He compares the relative earnings of foreign-born men in 1940 with the relative earnings of their potential offspring 30 years later, in 1970. His findings show that the earnings of second-generation immigrants are strongly correlated with the earnings of the corresponding first generation, with an estimate of the intergenerational correlation coefficient of around 0.45. Hence, about half of the differences in relative economic status across different ethnic groups in one generation persist into the next generation. Using more recent data reaching up to the year 2000, but based on a similar methodology of grouping immigrants and their potential offspring, Card, DiNardo, and Estes (2000) and Borjas (2006b) show that the intergenerational correlation of earnings has remained relatively unchanged over the last decades: native-born children of immigrants can expect to close 50–60% of the gap in relative earnings experienced by their father's generation. Card, DiNardo, and Estes (2000) also estimate the intergenerational correlation in the years of education obtained and find a very stable estimate over time for both sons and daughters in the range of 0.41–0.47. These estimates are comparable with those we report in Fig. 4.2 for the pooled sample of immigrant groups in France, Germany, and the United Kingdom, where the slopes of the regression lines with respect to education and log wages are 0.53 and 0.36, respectively.[63] Overall, the

[61] For an overview of the literature on intergenerational mobility, see Solon (1999, 2002), Corak (2004, 2006), and D'Addio (2007).

[62] Note that Chiswick only looks at white second-generation immigrant men who, at the time of the study, had predominantly a European background.

[63] Dustmann and Theodoropoulos (2010) analyze the educational attainment and economic behavior of ethnic minority immigrants and their children in Britain and compare it with that of their white British-born peers, showing that Britain's ethnic minority immigrants and their children are on average better educated than their white native-born peers, and that groups with better educated parents have higher levels of education.

empirical evidence suggests that most of the strong intergenerational linkages between immigrant fathers and their native-born children work through education.

With increasing data availability and the passing of time, it has become possible in some cases to analyze the correlation between first- and third-generation immigrants. Using data from the 1910 US Census and the General Social Surveys to link a sample of American-born workers to their grandparents who arrived in the United States during the first Great Migration at the beginning of the twentieth century, Borjas (1994, 2006b) estimates an intergenerational correlation in relative wages between the first and the third generation of about 0.22, which implies that 22% of the wage gap between any two groups in the immigrant generation persisted into the third generation. Note that this is compatible with a correlation coefficient across subsequent generations of about 0.5, similar to the one estimated in the studies discussed above. Current differences in economic status among first-generation immigrants are thus likely to shape the labor market experience of their offspring for generations to come.[64] Table 4.L2 at the end of this chapter summarizes the existing literature on the intergenerational mobility in earnings and educational attainment of immigrants across a variety of different countries. Column (7) reports estimated intergenerational correlation coefficients based on specifications such as the one in Eq. (4.14). Overall, the evidence suggests that intergenerational mobility is lower for immigrants than for natives, higher for immigrant women than for immigrant men, relatively high in Scandinavian countries (with an estimated correlation coefficient for men of around 0.1–0.2), relatively low in the United States (with estimates of around 0.5–0.6), and somewhere in the middle in Canada and Germany (with estimates of around 0.2–0.4).

As we discussed earlier, the investment decisions of immigrants in their own education, and that of their children, may be shaped by their return intentions. Dustmann (2008) extends the standard permanent income model of intergenerational mobility as sketched in Section 5.2 by allowing for the possibility of return migration. As we have already alluded to on various occasions throughout this chapter, the prospect of returning home has important consequences for an immigrant's human capital investment in the host country. In an intergenerational context with altruistic parents, such considerations also affect the parents' investment in the human capital of their children (under the assumption that the child's perceived return probability increases with the return probability of the parent) and thus the measured intergenerational earnings mobility. More specifically, Dustmann (2008) shows that as long as the return to human capital is higher and the preference for consumption lower in the host than in the home country, investments in the children's human capital will increase with the probability of a permanent migration. This is because the latter increases the expected monetary gain from an additional unit of human capital for the child, and because it decreases the expected

[64] Deutsch, Epstein, and Lecker (2006) and Hammarstedt (2009) provide evidence on the relative outcomes of first-, second-, and third-generation immigrants in Israel and Sweden, respectively.

utility gain from consuming in the home country, leading to a reduction in parents' savings for future consumption and an increase of their investments in their children. Using German panel data on father–son pairs that include information on parental return intentions, Dustmann (2008) shows, first, that parental investment in children's education increases with the permanent migration probability of the parent and, second, that the son's permanent earnings increase with the father's permanent migration probability, conditional on father's permanent earnings and education. Accounting for measurement error in parental earnings by using repeated wage observations reveals substantial downward bias in a standard estimation of the intergenerational earnings correlation, increasing the parameter estimate from about 0.140 to 0.344. The corresponding estimates for native father–son pairs are 0.177 and 0.251, which, although not statistically different, suggest less intergenerational mobility for immigrants than for natives.

5.3.3 Intergenerational Transmission and Language

In Section 3.4.4, we discussed language as one of the key human capital characteristics determining the economic outcomes of immigrants in their host country. Since the language skills of parents are likely to at least partly determine the language skills of their children, they could be an important factor underlying the observed persistence in economic status between first- and second-generation immigrants. A number of studies have investigated the link between the language proficiency of children and their parents. For Australia, Chiswick, Lee, and Miller (2005) find strong links between parents' measured and unmeasured determinants of language proficiency and the language skills of their children, in particular between mothers and their children. Bleakley and Chin (2008) show that parental language skills have a significant positive causal effect on US-born children's ability to speak English. Interestingly, this positive effect is only present while the children are young but fades out by the time they reach middle school. However, the poorer language skills when young turn out to have detrimental long-term consequences for the children's educational outcomes in terms of drop-out rates, attendance of age-appropriate grades and attendance of preschool.[65] Unlike Bleakley and Chin (2008), who use data from the 2000 US Census, and Chiswick, Lee, and Miller (2005), who use data from the 1996 Australian Census, Casey and Dustmann (2008) use repeated information on both parents and their children from the German Socio-Economic Panel. This allows them, first, to address the problem of measurement error that is widespread in self-reported data on language proficiency (see Dustmann and van Soest (2001)), second, to avoid sample selection due to children leaving the parental household, and third, to analyze the association between parental language proficiency and children's later

[65] As in Bleakley and Chin (2004), the authors use the parents' age at arrival interacted with a dummy for non-English-speaking country of origin as an instrument for their English language skills, making this the probably most convincing strategy to deal with the endogeneity of parental language skills.

economic outcomes. The results from this study show a significant and sizeable effect of parental language fluency on that of their children. Although for males, language proficiency does not significantly affect any of the labor market outcomes considered (wages, labor market participation, employment, and unemployment), it has a beneficial effect for the labor market outcomes of women, in particular those who were born abroad but arrived in Germany before the age of 10. This differential pattern could be due to women's higher propensity to work in occupations where language fluency is important, such as white-collar jobs in the service sector. Overall, the empirical evidence so far suggests a strong intergenerational transmission of language skills, in particular at younger ages of the second-generation immigrants, which may contribute to the relatively low intergenerational mobility in educational attainment and earnings that characterizes many immigrant groups in the host countries studied.

5.3.4 Intergenerational Transmission and Ethnic Networks

In an important contribution, Borjas (1992) extends the standard framework for analyzing the intergenerational transmission of human capital by assuming that ethnicity acts as an externality in the human capital accumulation process. In the model outlined in Section 5.2, such an externality would be captured in the term e_t. This implies that a correctly specified economic model of intergenerational mobility should not only include parental inputs as a determinant of the children's skills but also the average quality of the ethnic environment in which the child is raised, the so-called "ethnic capital". As long as ethnic capital plays an important role in the intergenerational transmission of skills, ignoring it in a regression based on individual level data may lead to a severe underestimation of the true persistence in earnings across generations. Using data from the General Social Surveys and the National Longitudinal Surveys of Youth that include information on both the respondents' and their parents' educational attainment and occupation, as well as the respondents' wages (NLSY only), Borjas (1992) finds overall intergenerational correlations of educational attainment, occupations, and log wages of around 0.35–0.40, 0.57, and 0.60, respectively, where all of these estimates reflect the sum of the effects due to parental variables on the one hand, and ethnic capital on the other hand. The latter, measured by the mean of the characteristic in the corresponding ethnic group, has a positive and significant effect of roughly similar (for education and wages) or greater (occupations) magnitude as the corresponding parental variable, suggesting an important role in the intergenerational transmission process. Neglecting ethnic capital will thus lead to an underestimation of the intergenerational correlation coefficient and hence to an overestimation of the speed of economic convergence of ethnic groups across generations.[66] Aydemir, Chen, and Corak

[66] In later work, Borjas (1995b) shows that segregation into particular neighbourhoods could be one reason for the external effects of ethnicity, a point that has been reemphasized by Nielsen, Rosholm, Smith, and Husted (2003) and Rooth and Ekberg (2003). See also Cutler, Glaeser, and Vigdor (2005).

(2009) work with a somewhat broader interpretation of what the average group characteristics may capture, including social factors such as discrimination or lack of access to good schools and credit markets. Using grouped data from the 2001 Canadian Census, they employ quantile regression methods to separate the influence of social capital from the influence of broader social institutions. Their findings suggest that social institutions limit intergenerational earnings mobility and that parental education is the key ingredient necessary to circumvent the restrictions imposed by such social institutions.

6. CONCLUSION

This chapter addresses the relationship between migration and education. What seems at first view a small and rather specific area in the research on the Economics of Migration turns out to be at its front and center. The chapter attempts to provide a first overview of the issues we consider important when studying migration in relation to education.

Overall, this is a rapidly growing field, illustrated by the rising number of papers over the last decades,[67] and there are exciting new research avenues at its frontier. It is also an area that reflects the challenge to single economies to develop competitive structures that prevail on increasingly globalized markets, and that are based on a flexible and highly responsive skill base. Both education and migration are key ingredients to achieve this.

Our first reference is to Sjaastad (1962), who viewed migration—as education—as an *investment in the human agent*. As the various sections of this chapter show, migration decisions and decisions about learning and human capital investments are indeed closely related. Migration is not only intertwined with human capital investment decisions of those who move but also has important consequences for education and knowledge acquisition of those who do not move, both in the home and in the host countries. Migrations are dynamic and dynastic processes, forming countries for generations to come, and one of the key determinants of the success of the children of immigrants is their educational attainment. We decided to focus in this chapter on three aspects that we believe are the cornerstones of the connection between migration and education: the economic aspects of the individual migration decisions and how they relate to the acquisition of education, the connection between the acquisition of education and the skill selection of immigrants, and the nature of intergenerational spillovers. Although we attempted to be exhaustive in our coverage, we have almost certainly missed important additional contributions that investigate these subjects.

The chapter commences with a section (Section 2) that provides an overview of the stylized facts that connect immigration and education. The following three sections

[67] Searching on Google for papers written in Economics, Business, or Finance with migration, immigration, or emigration and education, human capital, or skill in the title gives 36 papers between 1991 and 1999, 40 papers between 2000 and 2004, and 65 papers between 2005 and 2009.

(Sections 3–5) each start off with a discussion of a simple theoretical framework, which helps to structure the large empirical literature that exists in each of the areas considered. In Section 3, where we focus on the migrant, we show that educational choices and the accumulation of skills are inherently connected to migration and remigration decisions. We emphasize that decisions about nonpermanent forms of migration are key to understand educational choices and decisions about skill acquisition, and we demonstrate the challenges for obtaining estimates of immigrant career paths that are generated if migrations are nonpermanent and if migration decisions are taken in conjunction with decisions on human capital investment. In our view, this is an area where many research questions are still unexplored. For instance, as we show in Section 2, in many cases the acquisition of education rather than the pursuit of higher wages may be the main motive of migration: a hypothesis that is supported by the growing fraction of student migrations in the overall migration flows. Also, the forms of migration and implied career paths of immigrants have been changing, with temporary migrations today being the rule rather than the exception. Yet, most papers that study career paths of immigrants are still assuming permanent forms of migration.

In Section 4, we discuss the way in which migration affects educational choices and skill accumulation of individuals who do not migrate, both in the home and in the potential host countries. This area overlaps with many issues in development economics. We argue that while, as in the quote of Sjaastad, the *return* to education has been the main motive for migration, it is the acquisition of education itself that is becoming an important trigger for migration movements, and we explore the consequences for the destination and the origin countries. Another important aspect, from the perspective of both sets of countries, is *who migrates*. The answer to this question has important implications for the effect of immigration on the economies of both countries, through mechanisms such as the brain gain and the brain drain. We argue that additional insights can be gained when considering an application of the Roy (1951) model to the migration context that takes account of the multidimensionality of skills, in order to be able to explain recent migration patterns. Modern economies have specialized in different industries to gain competitiveness in international markets. As a consequence, the return to different skills may differ across countries, changing the incentives underlying individual migration decisions. Yet, most of the literature that studies the selection of immigrants focuses on a special case of the Roy model where skills are one-dimensional.

In the final section, we take a more dynastic view of immigration. Here, we focus on the children of immigrants, their educational achievements, and their human capital accumulation and ensuing career paths. This long-term aspect of immigrant integration and assimilation is likely to be a particular focus of research over the next decade due to the increasing number of countries that have recently experienced significant increases in their foreign-born populations. The existing evidence we discuss suggests that education is the key factor determining both the degree and the pace of the economic integration of immigrants and their descendants.

Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Baker and Benjamin (1994)	Canada	DA: Public Use Microdata Files of the Canadian Census for 1971, 1981, and 1986. SA: Men aged 16–64 years who report 40 or more weeks of work in the previous year.	DV: Log annual earnings (the sum of wage and self-employment earnings). IA: Equal time effects.	1950s and 1960s: Britain, United States, and Europe; 1970s and 1980s strong increase in inflow from Asia, Africa, and Latin America.	Entry earnings are falling across successive immigrant cohorts, whereas their rates of assimilation are uniformly small. The results confirm US evidence of "permanent" differences across arrival cohorts. The authors find small or negative rates of assimilation for most cohorts over the sample period. The results are robust to the choice of different base group. The authors find a relative decline for returns to experience for immigrants educated outside Canada. Using data from three censuses, the authors fail to reject the usual cohort fixed-effect specification.	RRI: 4.8% (1971), 4.4% (1981), 4.9% (1986). RRN: 7.3% (1971), 6.6% (1981), 7.6% (1986).	Cross-sectional estimates: RREI: 3.3% (sq: −0.0006) (1971), 3.7% (sq: −0.0006) (1981), 4.3% (sq: −0.0007) (1986). RREN: 4.6% (sq: −0.0007) (1971), 5.2% (sq. −0.0009) (1981), 5.9% (sq. −0.0009) (1986). RRYSM: n.a.
Barth, Bratsberg, and Raaum (2004)	Norway	DA: Register data for 1980, 1990, 1992–1996. SA: Individuals aged 25–64 years.	DV: Log annual earnings. IA: Equal time effects after allowing for differential effect of local unemployment.	Nordic Countries, (non-Nordic) OECD countries, Eastern Europe, Asia, Africa, and Latin America.	Nordic and OECD immigrant men catch up to the earnings of natives after 15–18 years, for all other groups of men earnings do not converge. Non-OECD men earn 30% less than natives after 25 years. Similar patterns for women. Non-OECD women earn around 18% less than natives after 25 years, whereas OECD women earn 10% less. Standard methodology would understate assimilation effects by 10–20%. Early cohorts have higher earnings than recent cohorts. (All conditional on education, for an immigrant arriving at age 25).	n.a.	n.a.
Barth, Bratsberg, and Raaum (2006)	United States	DA: Current Population Survey (CPS) from 1979 to 2003. SA: Individuals aged 21–64 years (and not enrolled in school).	DV: Log hourly wage rate (constructed). IA: Equal time effects after allowing for differential effect of local unemployment.	Mexico, other Central and South American countries, Asia, Africa, United Kingdom, and Commonwealth, Europe.	Wages of immigrants are found to be more sensitive to unemployment than wages of natives. A 10% increase in the unemployment rate reduces wages of immigrant men aged 31–39 years by 1.7% and those of natives by 0.3%. The traditional synthetic panel methodology assuming equal time effects estimates significant assimilation effects in terms of wages. For males, the standard method predicts immigrant wage growth over 20 YSM to exceed the one of natives by 15–17 pp. The proposed methodology reveals much smaller assimilation effects. The positive bias in the standard method arises from a negative trend in unemployment in the data, attributing to wage effects of improving labor market conditions during the 1990s to wage assimilation.	n.a.	RREI: Low education: males 1.5% (sq: −0.0004), females 1.7% (sq: −0.0012). High school: males 3.8% (sq: −0.0020), females 2.6% (sq: −0.0014). College: males 5.2% (sq: −0.0028), females 5.7% (sq: −0.0036). RREN: Low education: males 3.8% (sq: −0.0021), females 2.1% (sq: −0.0012). High school: males 5.0% (sq: −0.0024), females 3.7% (sq: −0.0020). College: males 6.5% (sq: −0.0026), females 6.5% (sq: −0.0034). RRYSM: Low education: males 2.0% (sq: −0.0005), females 0.7% (sq: −0.0002). High school: males 2.3% (sq: −0.0007), females 1.4% (sq: −0.0004). College: males 2.5% (sq: −0.0006), females 2.5% (sq: −0.0006).

Continued

Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Basilio and Bauer (2010)	Germany	DA: German Socio-Economic Panel (GSOEP) 1984–2007 for West Germany. SA: Individuals aged 16–64 years.	DV: Log hourly real wage (constructed). IA: Equal time effects.	Turkey, Eastern Europe and Former Soviet Union, Ex-Yugoslavia, high-income OECD.	The native–immigrant earnings gap at the time of arrival can be largely explained by different regional sources of human capital. For immigrants as a whole, foreign schooling and labor market experience is valued lower in the German labor market than domestic schooling and experience. The authors find evidence for heterogeneity in the returns to human capital across origin countries. Immigrants from high-income countries earn similar returns as natives and earn the highest return to their foreign human capital among all immigrant groups.	RRI education abroad: for men 4.5%, for women 6.2%. RRI education in Germany: for men 5.5%, for women 6.2%. RRN: for men 7.2%, for women 6.8%.	RREI experience abroad: for men 0.3%, for women 0.1%. RREI experience in Germany: for men 1.3%, for women 0.9%. RREN: for men 0.9%, for women 0.6%. RRYSM from restricted model: for men 0.8%, for women 0.5%. Only foreign labor market experience for immigrants from high-income OECD countries has positive returns, 0.7% for men and 0.9% for women.
Beggs and Chapman (1988b)	Australia	DA: 1973 ANU Social Sciences Mobility Survey and 1981 Australian Census. SA: Wage or salary-earning men aged 30–64 years.	DV: Log hourly income. IA: Equal time effects.	English-speaking immigrants (mostly from the United Kingdom and Ireland), non-English-speaking immigrants (mostly from Italy and Greece).	Authors analyze assimilation profiles of immigrants both using single cross-sectional data and using the time dimension of the data. Migrants from non-English-speaking countries entering Australia in 1965 perform significantly better between 1973 and 1981 than predicted from the 1973 cross section. This finding is consistent with the view that the quality of non-English-speaking immigrants arriving in Australia has increased over the 1960s. Migrants from English-speaking countries perform similarly no matter whether estimates are based on cross-sectional data or based on time-series data.	RRI for schooling abroad: non-English-speaking immigrants 2.5% (1973), 4.9% (1981), English-speaking immigrants: 8.9% (1973), 8.4% (1981). RRI for schooling in Australia: non-English-speaking immigrants 2.4% (1973), 0.8% (1981), English-speaking immigrants 0.9% (1973), −0.9% (1981). RRN: 10.5% (1973), 9.0% (1981).	Cross-sectional estimates: RREI for experience abroad: non-English-speaking immigrants 0.6% (sq: −0.0002) (1973), 1.1% (sq: −0.0002) (1981), English-speaking immigrants 3.4% (sq: −0.0005) (1973), 0.9% (−0.0002) (1981). RREN: 2.6% (sq: −0.0004) (1973), 2.1% (−0.0003) (1981). RRYSM: non-English-speaking immigrants 0.5% (sq: 0.0001) (1973), −0.3% (sq: 0.0001) (1981), English-speaking immigrants 0.1% (sq: −0.0000) (1973), 0.9% (sq: −0.0001) (1981).
Bell (1997)	United Kingdom	DA: General Household Surveys (GHS) 1973–1992. SA: Immigrant men aged 18–64 years who are working more than 30 hours per week.	DV: Log gross weekly wages. IA: Equal time effects.	Caribbean, India, Europe, and Old Commonwealth.	Large changes in the national–origin mix of immigrants in the United Kingdom in the postwar period. Immigrants have on average more years of schooling than natives, and this gap has risen over successive cohorts. Most disadvantaged group are immigrants from the Caribbean. However, that disadvantage diminishes relatively fast with time spent in the United Kingdom. Immigrants who arrive without any labor market experience typically experience only a small wage penalty. White immigrants earn a wage premium upon arrival but quickly assimilate to the earnings of natives.	RRI: Caribbeans 4.4%, Indians 3.7%, Whites 6.5%. RRN: 7.7%.	RREI: Caribbeans 2.2% (sq: −0.0001), Indians 2.9% (sq: −0.0005), Whites 3.5% (−0.0005). RREN: 5.8% (sq: −0.0010). RRYSM: Caribbeans −0.6% (sq: 0.0002), Indians −1.0% (sq: 0.0002), Whites −1.6% (sq: 0.0003).

Continued

Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Borjas (1985)	United States	DA: 1970, 1980 US Census. SA: Men aged 18–54 years in 1970 and 28–64 years in 1980.	DV: Log hourly wage rate (constructed). IA: Equal time effects.	Mexico, Cuba, Other Hispanic, Asian, Whites, Blacks.	Only white immigrants overtake the earnings of statistically comparable white native workers after 10–15 years. All other groups have slower or even negative rates of convergence to their specific native comparison groups. Quality of immigrant cohorts declined over time.	RRI: between 2.8% (Mexicans) and 7.1% (Asians) (1970), between 2.9% (Mexicans) and 5.9% (Asians) (1980). RRN: between 4.9% (Cubans) and 6.9% (Whites) (1970), between 4.6% (Cubans) and 6.0% (Other Hispanics) (1980). Return to schooling significantly lower for Mexicans, Cubans and other Hispanics relative to native counterparts. For other groups about the same.	Cross-sectional estimates. RREI: between 0.5% (Asians, sq: 0.0000) and 4.0% (Whites, sq: −0.0007) (1970), between −0.2% (Cubans, sq: −0.0000) and 3.9% (Whites, sq: −0.0006) (1980). RREN: between 2.6% (Blacks, sq: −0.0004) and 11.2% (Cubans, sq: −0.0026) (1970), between 0.6% (Blacks, sq: −0.0000) and 3.5% (Asians, sq: −0.0005) (1980). RRYSM: n.a.
Borjas (1995a)	United States	DA: 1970, 1980, 1990 US Census. SA: Men aged 25–64 years.	DV: Log hourly wage rate (constructed). IA: Equal time effects.	Mexican, Other Hispanic, Asian, Whites.	Relative wages of immigrants grow by about 10 pp during the first two decades after arrival, very little thereafter. For 1970 and 1980 cohorts, eventual wage gap is about 5–10 pp. Immigrants who arrived in the late 1980s (1970, 1960) earned about 19.3% (13.4%, 8%) less than natives at the time of entry (all conditional on education, for an immigrant arriving at age 20).	RRI: 4.7%, RRN: 6%	RREI: 8.8% (sq: −0.0016). RREN: 9.4% (sq: −0.0015). RRYSM: 1.9% (sq. −0.0004)
Bratsberg and Ragan (2002)	United States	DA: 1970, 1980 and 1990 US Census and National Longitudinal Survey of Youth. SA: Foreign-born men aged 25–64 years (worked positive hours and earned at least US $1000 wage or salary income in 1989 and not enrolled at school at time of census)	DV: Log of weekly earnings. IA: Equal cohort effects.	Mexico and other Central American Countries, South America, United Kingdom and Europe, Commonwealth, Asia, and North Africa.	Immigrants with US schooling earn higher wages than immigrants with non-US schooling. This wage advantage results from both greater educational attainment and higher returns to education and cannot be attributed to greater English proficiency. Returns to years of non-US schooling are higher for immigrants who complete their schooling in the United States and can be interpreted as US schooling upgrading education received in the source country. For immigrants without US schooling, returns are higher for immigrants from highly developed countries and countries in which English is an official language.	RRI (linear spline function): for non-US schooling: less or equal 11 years of schooling 0.8%, more than 11 years of schooling 8.9%. For US schooling: less or equal 11 years of schooling 4.1%, more than 11 years of schooling 10.2%. RRN: n.a.	RREI: for those with non-US schooling 1.8% (sq. −0.0003), for those with US schooling 4.2% (sq. −0.0007). RREN n. a. RRYSM: for those with non-US schooling 2.5% (sq. −0.0003), for those with US schooling 1.0% (−0.0001).

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Chiswick (1978)	United States	DA: 1970 US Census. SA: White men (natives and immigrants) aged 25–64 years.	DV: Log annual earnings. IA: Equal cohort effects.	Mexican, Cuban, Asian/African Immigrants.	Earnings of foreign-born 14.9% lower after 1 year in the country, 9.5% lower after 5 years, equal after 13 years, and 6.4% higher after 20 years.	RRI: overall 5.7%, to foreign schooling 5.8%, to domestic schooling 5.0%. RRN: 7.2%.	RREI: 2.0% (Experience squared: −0.0003). RREN: 3.2% (sq: −0.0005). RRYSM: 1.5% (sq: −0.0009)
Clark and Lindley (2009)	United Kingdom	DA: UK Labour Force Survey 1993–2004. SA: Men aged 16–64 years.	DV: Employment rate (excl. inactive) and log real gross weekly earnings. IA: Equal time effects.	White immigrants from old Commonwealth (Australia, New Zealand, Canada) and European Union and the rest of the world. Nonwhites from Britain's former colonies in Asia, the Caribbean, and Africa and immigrants from the rest of the world.	Differentiate results by ethnicities (whites/nonwhites) and by whether the immigrant has completed his or her education (labor market entrant) or whether he or she still has to complete his or her education in the United Kingdom system (education entrants). Among whites, education entrants perform better in comparison to white natives than labor market entrants. Among labor market entrants, whites do better than nonwhites, while among education entrants, highly qualified prime-aged nonwhites perform, as well as both white immigrants and natives. Patterns of labor market assimilation are found to be diverse depending on ethnicity and immigrant type. Labor market outcomes for all immigrant groups have a tendency to decline with age relative to white natives.	Labor market entrants: RRI: 6.3% for white immigrants, 5.6% for nonwhite immigrants. RRN: 7.9%. Education entrants: RRI for white immigrants: 67.1% for university degree, 30.7% for A-levels, 19.4% for O-levels. RRI for nonwhite immigrants: 77.6% for university degree, 31.4% for A-levels, 23.6. for O-levels. RRN for white natives: 69.8% for university degree, 27.8% for A-levels, 19.9% for O-levels.	n.a.
Dustmann (1993)	Germany	DA: German Socio-Economic Panel (GSOEP). SA: Men aged 16+ years in 1984, who were full-time employed at time of interview (exclude self-employed, civil servants, individuals in education or apprenticeships).	DV: Log monthly gross earnings. IA: Equal cohort effects.	Turkey and Southern Europe.	The author shows within a human capital framework that in the case of temporary migration, the optimal investment into country-specific human capital is lower than in the case of permanent migration. The empirical results indicate that foreign workers in the German labor market receive lower wages than their native counterparts throughout their working history, and that there is no earnings crossover between these two groups. Using data on expected length of stay in the country, the empirical results support the hypothesis that total length of stay positively influences host country–specific human capital investment and thus earnings of immigrants. Earning profiles are less concave (i.e., the longer the total intended duration of stay in the host country).	RRI: for schooling: 1.2%, for job-specific training: 1.0%. RRN: for schooling: 5.5%, for job-specific training: 3.4%.	RREI: 1.9% (sq: −0.0005). RREN: 3.7% (sq: −0.0007). RRYSM: 1.4% (sq: −0.0002).

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Edin, LaLonde, and Åslund (2000)	Sweden	DA: LINDA database, registry data for immigrants entering between 1970 and 1990. SA: Individuals aged 18–55 years at the time of immigration.	DV: Log annual earnings. IA: Equal time effects.	Nordic countries, other OECD countries, political migrants from Yugoslavia, Iran, Iraq, Poland, and Chile.	Economic migrants are much more likely to emigrate than political ones, with the least economically successful economic migrants most likely to leave. Immigrant earnings grew on average by around 20,000SEK relative to natives during their first 10 years in Sweden. Controlling for emigration, the relative earnings growth during the first ten years reduces to 13,500SEK on average. For OECD migrants, the authors estimate negative assimilation. For non-OECD migrants, there is still substantial evidence for unconditional convergence, even after accounting for emigration. A failure to adjust for emigration leads to an overestimation of the rate of economic assimilation, especially for Nordic and OECD immigrants.		RRYSM from cross-sectional estimates: apart from Nordic women no positive returns to YSM for economic migrants, but positve RRYSM for immigrants from non-OECD countries. From the longitudinal analysis: growth for non-OECD migrants slows down after a few years and cross-sectional results likely to be driven by changes in cohort quality.
Friedberg (2000)	Israel	DA: Israeli Census of Population and Housing 1972 and 1984. SA: Men aged 25–65 years. Arabs excluded and only full-time, salaried, nonagricultural workers retained.	DV: Log monthly earnings. IA: Equal cohort effects, test in Appendix using two cross sections that one cross section is sufficient to identify assimilation rates.	Asia and Africa (largest emigration country Morocco), Eastern Europe, USSR, and Western Hemisphere, and Western Europe.	The gap in the residual earnings of immigrant and native workers is eliminated once the national origin of individual's human capital is accounted for. Human capital acquired abroad receives a lower return in the host labor market than human capital acquired domestically. Return to schooling obtained abroad is highest for immigrants from the West (7.1%) and lowest for immigrants from Asia and Africa (5.7%). The returns to experience acquired abroad are generally insignificant. The portability of home country education varies significantly with its level (elementary school education equally valued in home and host country).	RRI : 8.0% for domestic schooling and 7.1% for foreign schooling. RRN: 10.0% to domestic schooling.	RREI: 1.1% for each year of domestic experience, 0.1% for each year of foreign experience. RREN: 1.7%, from estmation of restricted model RRYSM: 0.8%.
Funkhouser and Trejo (1995)	United States	DA: Special supplements to Current Population Survey (CPS) 1979, 1983, 1986, 1988 and 1989. SA: Men aged between 18 and 61 years.	DV: Log average hourly earnings. IA: Equal time effects.	Mexico and other Latin America, Europe, Canada, and Oceania, Asia (mainly Japan, Korea, China, and the Philippines).	Tracking the immigrants' skill levels through the 1980s, the authors find that male immigrants who entered during the late 1980s are more skilled than those who arrived earlier in the decade. This represents a break from the steady decline in immigrant skill levels that took place between 1940 and 1980, but the average skill level of recent immigrants remains low by historical standards.	RRI: 5.1%. RRN: 8.2%.	RREI: 3.4% (sq: −0.0005). RREN: 5.1% (sq: −0.0008). RRYSM: 2.1% (sq: −0.0002).

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Green and Worswick (2004)	Canada	DA: Immigrant Database (IMDB) for immigrants, Survey of Consumer Finances (SCF) for natives, for the years 1981, 1982, 1984–1997. SA: Men aged 25–64 years.	DV: Log real annual earnings. IA: Equal time effects, with comparison group being native new entrants into the labor market.	English-speaking countries (United States, United Kingdom, Australia, New Zealand), North-Western Europe, Others.	Based on a life cycle human capital framework, the authors argue for defining cohort quality based on the present value of all future earnings rather than the entry earnings of an immigrant cohort. Compare newly arriving immigrants to the subgroup of natives who enter the Canadian labor market at the same time as the immigrants, arguing that these should be more likely to be affected by the same macroshocks and subject to the same human capital investment conditions. Findings show that changes affecting all new entrants play an important role in understanding the large cross-cohort earnings decline in Canada between the 1980s and 1990s. Present value comparisons show that the cohorts of the 1990s were not dramatically worse than the cohorts of the 1980s. Shifts in the source country composition and the general new entrant effects account for over 90% of the 1980s decline. Foreign experience of immigrants from non-English-speaking, non-European countries yields zero return.	n.a.	Paper reports full set of estimates for immigrants' earnings profiles over YSM relative to matched native entrants by education group (high school and university education), age at entry (distinguishing four groups), and entry cohort (distinguishing five groups).
Hayfron (1998)	Norway	DA: Population Census of Norway Data Bank for 1980 and 1990 (8.3% sample of the central register). SA: Men aged 17–55 years in 1980 and 27–65 years in 1990 who work full time, and earn positive income (self-employed and students excluded). Immigrants defined by citizenship.	DV: Log earnings (taxable income from work, sickness pay, unemployment benefits, and income when in labor market programs). IA: Equal time effects.	n.a.	The results show that the 1970–1979 cohort experiences a relative earnings growth of about 11% between 1980 and 1990, which is substantially lower than the cross-sectional estimate of 19%. There is rapid earnings divergence across immigrant cohorts and between the 1960–1969 immigrant cohort and natives.	Cross-sectional estimates: RRI: 2.4% (1980), 1.9% (1990). RRN: 3.8% (1980), 6.9% (1990).	Cross-sectional estimates: RREI: 8.8% (sq: −0.0010) (1980), 9.0% (sq: −0.0010) (1990). RREN: 10.7% (sq: −0.0012) (1980), 4.1% (sq: −0.0004) (1990). RRYSM: n.a.

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Husted, Nielsen, Rosholm, and Smith (2001)	Denmark	DA: Registry data 1984–1995. SA: Men aged 20–59 years (self-employed not observed and individuals in education excluded).	DV: Log hourly wage (constructed), employment. IA: Equal time effects.	Other Nordic countries, EU, Turkey, other European countries, Sri Lanka, Irak, Iran, Vietnam, and Pakistan.	Initial employment probability for refugees is much lower, but after 5–10 YSM approaches the level of non-refugees and natives. Refugees from Africa and Palestine have lower initial employment chances than refugess from e.g. Europe and Vietnam. Refugees start at a much lower wage rate than Danish workers, and after 4 years their wage growth is just above the wage growth for Danes. The slow assimilation is partly due to the immigrants' weak attachment to the Danish labor market.	For hourly wages the paper reports estimates for education indicators. For Danish-born workers, hourly wage is 10.2% higher if they completed secondary education (relative to primary education), 9.4% higher if they completed vocational training, and 29.9% higher if they completed the highest education level.	Classical model: RREI: refugees 0.5% (sq: −0.0000), non-refugees 1.6% (sq: 0.0001). RREN: 2.7% (sq: −0.0003). RRYSM (linear spline function): first 5 years −5.5%, 5–10 years 0%, 10 years and more, 2%.
Kee (1995)	The Netherlands	DA: Quality of Life Surveys (QLS) 1984–1985 for immigrants, Labour Supply Panel 1985 for natives. SA: Men aged 18–65 years.	DV: Log hourly wage rate. IA: Equal cohort effects.	Turks, Moroccans, Surinamese, Antilleans.	Focus of the paper is more on potential discrimination of immigrants in the Dutch labor market. Taking account of sample selection, the authors estimate that for Antilleans and Turks about 35% and 15% of their wage gaps relative to natives are due to "discrimination." There is no indication of discrimination against Surinamese and Moroccan immigrants.	RRI for schooling abroad: Antilleans 5.1%, Surinamese 3.6%, Turks −0.2%, Moroccans 0.2%. RRI for schooling in the Netherlands: Antilleans 4.4%, Surinamese 3.2%, Turks 1.3%, Moroccans 3.0%. RRN: 4.0%.	Cross-sectional estimates: RREI for experience abroad: Antilleans 1.3% (sq: −0.0003), Surinamese 2.7% (sq: −0.0004), Turks 0.4% (sq: −0.0002), Moroccans 0.4% (sq: −0.0001). RREI for experience in the Netherlands: Antilleans 4.8% (−0.0015), Surinamese 5.5% (sq: −0.0012), Turks 2.5% (sq: −0.0007), Moroccans 2.2% (sq: −0.0006). RREN: 3.3% (sq: −0.0005). RRYSM: n.a.
Kossoudji (1989)	United States	DA: 1976 Survey of Income and Education (SIE). SA: Native and foreign-born men aged 20–64 years who are in full-time employment.	DV: Occupation-specific earnings. IA: Equal cohort effects; separate sample by ethnic group to account for the fact that ethnic groups were differently affected by immigration law.	Hispanics and East Asians.	The author estimates a simultaneous equations mixed model of occupational choice and earnings, distinguishing between immigrants who migrated as adults and those who migrated as children.	For immigrants, except for higher levels of occupations (professionals), the returns to education are not significantly different from zero. For natives, the returns to education are statistically significant and positive for all occupation groups. No significant difference in the returns to education by the location of where education was obtained. Education always significant in occupational choice equations.	Results typically exhibit quadratic shape of experience profiles for workers in all occupations. RREI: experience in the United States has a significant positive effect on earnings for all groups except Hispanic managers and craft workers and Asian sales/clerical and service workers. No significant gain from experience accumulated in the home country. RREN: positive returns for all occupations, returns higher than for Hispanics, but lower than for Asians. RRYSM: n.a.

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LaLonde and Topel (1991)	United States	DA: 1970 and 1980 US Census. SA: Men aged 16–64 years who worked 40 or more weeks during the preceding calendar year.	DV: Log weekly wages (constructed). IA: Equal time effects.	Europeans, Asians, Mexicans, Middle Easteners, and Other Latin American and Caribbean.	Initial relative earnings between immigrants and natives declined between 1970 and 1980 with an initial earnings disadvantage of 20% in 1970 and 35% in 1980. Decline can be attributed to changes in the composition of source countries towards Asian and Latin American countries. Assimilation rates after 10 years since arrival in the United States are positive and large. Assimilation is found to be more rapid for groups who start with lower wages, such as Asians and Middle Easterners.	n.a.	Cumulative effect of 10 YSM (relative to old immigrants of same ethnicity): Europeans 8%, Asians 24%, Middle Easterners 42%, Mexicans 21%, Other Latin Americans and Caribbeans 19%.
Longva and Raaum (2003)	Norway	DA: 1980 and 1990 Norwegian Population Census (supplemented by administrative data for 1990). SA: Men aged 17–55 years in 1980 and 27–65 years in 1990 who work full time, and earn positive income (self-employed and students excluded in 1980). Uses universe of immigrant population defined by country of origin conditional on their presence in Norway in 1992.	DV: Log earnings (taxable income from work, sickness pay, unemployment benefits, and income when in labor market programs). IA: Equal time effects.	OECD and non-OECD countries.	The authors find that the earnings assimilation of immigrants in Norway from 1980 to 1990 differs considerably between cohorts and by country of origin. They estimate the relative earnings growth for the 1970–1979 immigrant cohort to be 6% over the decade (lower than the 11% estimated by Hayfron (1998)). They find earnings of OECD immigrants to be comparable to natives as opposed to non-OECD immigrants, who earn considerably less than natives at the time of entry, but improve gradually over time.	All immigrants: RRI: 3.9% (1980), 4.3% (1990). Separate estimates for OECD and non-OECD immigrants: RRI OECD: 4.4% (1980), 4.7% (1990). RRI non-OECD: 2.4% (1980), 3.3% (1990). RRN: 3.7% (1980), 5.2% (1990).	Cross-sectional estimates. All immigrants: RREI: 6.0% (sq: −0.0007) (1980), 5.3% (sq: −0.0006) (1990). Separate estimates for OECD and non-OECD immigrants: RREI OECD: 8.0% (sq: −0.0009) (1980), 6.1% (sq: −0.0007) (1990). RREI non-OECD: 4.6% (sq: −0.0006) (1980), 4.6% (sq: −0.0005) (1990). RREN: 11.9% (sq: −0.0014) (1980), 4.5% (sq: −0.0005) (1990). RRYSM: n.a.

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lubotsky (2007)	United States	DA: Longitudinal data: Social Security Earnings records 1951–1997 linked to 1990 and 1991 Survey of Income and Program Participation (SIPP) and 1994 Current Population Survey (CPS). SA: Men born between 1930 and 1969.	DV: Log annual earnings (social security earnings). IA: Equal time and experience effects; but author only interested in differences in wage growth between cross-sectional data set and longitudinal dataset, which are adjusted in the same way.	n.a.	Actual earnings growth among immigrants who remained in the United States until the 1990s was considerably slower than implied by estimates based on repeated cross-sectional data. Over their first 20 years immigrant earnings in the longitudinal data grew by 10–15% relative to natives, while repeated cross sections suggest a growth about twice as fast, of about 26%. Selective emigration by low-wage immigrants leads to overestimation of economic assimilation when using census data. Back-and-forth migration, which leads to misclassification of many low-wage immigrants as more recent arrivals, has caused typical estimates to overstate the measured decline in the entry level of earnings of immigrants between the 1960s and 1980s by one-third.	n.a.	RRYSM: repeated cross-sectional data suggest immigrants relative earnings gap to narrow by 13% in the first ten years and an earnings growth of 10–20 pp in each successive decade; longitudinal data: relative earnings grow by 12–15% in the first 15 years in the United States and relatively little thereafter.
Sanromá, Ramos, and Simón (2009)	Spain	DA: Spanish National Immigrant Survey 2007. SA: Immigrants aged 15–65 years (working at least 10 hours per week and earning net monthly earnings above 200 Euros), immigrants with Spanish nationality excluded.	DV: Log net monthly wages. IA: Equal cohort effects.	Latin America and Eastern Europe.	With the exception of immigrants from developed countries and immigrants who have studied in Spain, the returns to host country human capital are higher than returns to home country human capital. Having legal status is associated with a wage premium.	RRI: for foreign schooling 1.8%, for schooling in Spain 3.3%. RRN: 4 % (from Wage Structure Survey 2006). Immigrants from developed countries have higher return to home country education (6.0%) than Latin Americans (1.8%) and Eastern Europeans (1.1%).	RREI 0.7% (sq: −0.0002). RREN: n.a. RRYSM: 1.4% (sq: −0.0000).

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Schaafsma and Sweetman (2001)	Canada	DA: 1986, 1991, and 1996 Canadian Census. SA: Men aged 16–64 years on the survey date who worked more than 40 weeks in the previous year.	DV: Log earnings (including self-employment). IA: Effect of age on earnings the same for immigrants and natives in the specifications that include age at immigration.	n.a.	The authors observe a correlation between age at immigration and earnings, which is driven by three main effects: absence of a return to source country work experience, the return to education varying with age at immigration, and an acculturation effect for immigrants who are visible minorities or whose mother tongue is not English. Educational attainment and earnings vary systematically across age at immigration. Immigrants who arrive around age 15–18 complete fewer years of schooling than those who arrive either earlier or later.	RRI for schooling abroad: 5.7% (1986), 5.9% (1991), 6.3% (1996). RRI for schooling in Canada: 5.5% (1986), 6.3% (1991), 7.0% (1996). RRN: 7.3% (1986), 7.6% (1991), 7.7% (1996).	Cross-sectional estimates: RREI for experience abroad: 0.9% (sq: −0.0002) (1986), 0.8% (sq: −0.0001) (1991), 0.9% (sq: 0.0001) (1996). RREI for experience in Canada: 5.1% (sq: −0.0011) (1986), 4.6% (sq: −0.0009) (1991), 4.4% (sq: −0.0008) (1996). RREN: 6.2% (sq: −0.0010) (1986), 6.0% (sq: −0.0009) (1991), 6.1% (sq. −0.0009) (1996). RRYSM: n.a.
Schoeni (1997)	United States	DA: 1970, 1980 and 1990 US Census. SA: Men aged 25–60 years.	DV: Log weekly wages (constructed), including self-employment, and wage and salary income. IA: Equal time effects.	Europeans, Mexico, Japan, Korea and China, United Kingdom and Canada, Central America, Philippines, Caribbean, Africa, other Hispanics and Middle East/other Asia.	Europeans have entered the US labor market with relatively high wages and have earned wages comparable to natives over their life course. Japanese, Koreans and Chinese had a lower initial wage, but have quickly caught up with US-born workers. Mexicans and Central Americans entered with low wages and the wage gap between them and comparable US workers has not shrunk. Wages are closely linked to education and returns to education are higher if some schooling was obtained in the United States.	RRI: for immigrants without US schooling: 4.5% (1970), 5.1% (1980), 5.3% (1990). For immigrants with some US schooling: 6% (1970), 5.6% (1980), and 5.7% (1990). RRN: 7.9% (1970), 7.1% (1980), and 10.3% (1990). Returns vary substantially by country of origin: in 1990 the RRI was 5.3% for Mexicans, around 8% for most other groups, and 13.1% for Japanese, Koreans, and Chinese.	The author accounts for six 5-year categories for YSM. Detailed results for each country of origin group reported with full interactions of all variables with census year dummies.
Shields and Wheatley Price (1998)	England	DA: UK Quarterly Labour Force Survey 1992–1994, pooled cross section. SA: Men aged 16–64 years, resident in England.	DV: Log gross hourly earnings (constructed). IA: Equal cohort effects.	Irish and other Whites, Indian, Pakistani, Bangladeshi, African, Caribbean.	Native-born nonwhites and whites (other) receive higher returns from schooling obtained in the United Kingdom than native-born whites. All other immigrant groups have lower returns to schooling than native-born whites. For nonwhite natives, UK labor market experience is more beneficial and for all immigrant groups less beneficial than for white natives. For Irish and nonwhite immigrants in England there is not statistically significant return to experience abroad.	RRI for foreign education: white British 3.7%, Irish 4.2%, other whites 7.4%, nonwhites 3.3%. RRI for UK education: white British 3.8%, Irish 4.4%, other whites 10%, nonwhites 4.1%. RRN: whites 4.9%, nonwhites 6.6%.	Cross-sectional estimates: RREI UK experience: white British 3.3% (sq: −0.0007), Irish 2.5% (sq: −0.0006), other whites 2.4% (sq: −0.0003), nonwhites 3.0% (sq: −0.0006). RREI foreign experience: white British 2.4% (sq: −0.0008), Irish 2.0% (sq: −0.0007), other whites 4.5% (sq: −0.0008), nonwhites 0.2% (−0.0001). RREN: whites 3.8% (sq: −0.0006), nonwhites 4.5% (sq: −0.0008). RRYSM: n.a.

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Table 4.L1 Summary of the Literature on Immigrants' Earnings Assimilation—continued

Authors	Country	Data (DA) and Sample (SA)	Dependent Variable (DV) and Identification Assumption (IA)	Main Immigrant Groups	Main Results	Rates of Return to Schooling: Immigrants (RRI), Natives (RRN)	Rates of Return to Experience: Immigrants (RREI), Natives (RREN); Rate of Return to Years Since Migration (RRYSM)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Stewart and Hyclak (1984)	United States	DA: 1970 US Census. SA: Immigrant males aged 14–65 years.	DV: Log annual earnings. IA: Equal cohort effects.	Mexican, Cuban, Asian/African Immigrants, United Kingdom, and European.	Earnings differ greatly by race and country of origin. Immigrants from Scandinavia and Western Europe earned higher incomes than migrants from the United Kingdom, whereas immigrants from the Orient, South America and the West Indies earned significantly less. Black and Hispanic immigrants were found to have depressed earnings profiles with the differential relative to nonblack immigrants increasing over time.	RRI: overall 3.5%, to home country schooling 3.2%, to host country schooling 3.4%. Returns to having attended vocational training: 3.1%. RRN: n.a.	RREI: overall 2.8% (sq: −0.0006), to experience in home country 1.5% (sq: −0.0003), to experience in host country 3.4% (sq: −0.0007). RRYSM: overall 1.9% (sq: −0.0003).
Venturini and Villosio (2008)	Italy	DA: Work Histories Italian Panel (linked employer employee database), 1990–2003. SA: Full-time male workers aged 18–45 years (public employment, self-employment, agricultural sector, and housekeeping excluded).	DV: Log weekly wage and number of days worked per year (constructed). IA: Panel data estimated separately for immigrants and natives. For selection correction: GNP in sending country being valid instrument for the probability of staying in the host country.	Eastern Europe (Albania, Romania and Ukraine), North Africa, Asia (mainly Philippines), Latin America.	The results with and without the return intention controls that are observed in the data are very similar. The return to experience on the job is almost the same for natives and immigrants. The return to age is higher among natives than among immigrants. Migrants initially start at similar earnings levels, but their wage growth over time is smaller than for natives. Initial differences in days worked per year between native and immigrant workers persist over time. The relative wage differential over time is increasing faster for Africans than for the other immigrant groups, whereas for Asians and Eastern Europeans the widening of the employment differential stops after 5 years.	n.a.	RREI: 3.1% (sq: −0.0001). RREN: 5.5% (sq: −0.0003).
Wilkins (2003)	Australia	DA: Australian Bureau of Statistics Education and Training Survey 1997. SA: Men aged 15–64 years, employed full time at the time of the survey.	DV: Log hourly wages (constructed). IA: Equal cohort effects.	English-speaking immigrants, non-English-speaking immigrants.	The author accounts for age at migration and potentially different effects of years since migration for different arrival ages. For a given stock of human capital, initial earnings are lower for younger arrivals, but their earnings growth is faster with time in the destination country. The return to eduation for immigrants with language difficulties is significantly lower.	Without control for age at migration: RRI for English speakers 4.6%, non-English speakers 5.1%. With control for age at migration: RRI for English speakers 4.5%, non-English speakers 4.4%. RRN: n.a.	Without control for age at migration: RREI for English speakers 1.7% (sq. −0.0003), for non-English speakers 1.9% (sq. −0.0003). With control for age at migration: RREI for English speakers 0.3% (sq: −0.0001), for non-English speakers 1.0% (sq: −0.0003), both main effects not statistically signifcant. RREN: n.a. RRYSM: greater for child arrivals than later arrivals.

Note: Main immigrant groups in Column (7) refer to main groups focused on in the analysis, not necessarily the main groups present in the country.

Table 4.L2 Summary of the Literature on Immigrants' Intergenerational Mobility

Authors	Country	Data	Definition First Generation	Definiton Second Generation	Dependent Variable	Generational Income Elasticity for Immigrants (And Natives If Available)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Aydemir, Chen, and Corak (2009)	Canada	1981, 2001 Canadian Census.	Foreign-born men with a foreign-born spouse who have children aged 5–17 years in 1981.	Canadian-born, both parents foreign-born, aged 25–37 years in 2001.	Log weekly earnings, schooling.	Sons: 0.27*. Daughters: -0.048 (insignificant). For annual earnings, Sons: 0.18*. Daughters: -0.093. For natives, 0.19 for annual earnings for the overall population (reported from other study in Table 1).
Borjas (1992)	United States	General Social Surveys (GSS) and the National Longitudinal Surveys of Youth (NLSY) 1977–1989.	Foreign-born men.	US-born, at least one foreign-born parent, aged 18–64 years in the GSS and 22–29 years in the NLSY.	Educational attainment and occupation (using Hodge–Siegel–Rossi prestige score) in GSS. Educational attainment and log wage in NLSY.	GSS education: 0.27*; total effect of parental and ethnic capital: 0.48. GSS occupations: 0.20*; total effect of parental and ethnic capital: 0.64. NLSY education: 0.27*; total effect of parental and ethnic capital: 0.37. NLSY wage: 0.35*; total effect of parental and ethnic capital: 0.61.
Borjas (1993)	United States	1940, 1950, 1960, 1970 US Census.	Foreign-born men aged 25–64 years.	US-born men, at least one parent foreign-born.	Earnings relative to third-generation Americans.	0.27* (relating 1970 second-generation workers to their presumed 1940 immigrant fathers). Reduces to 0.25* with ethnic capital (the group average in 1970) included.
Borjas (2006b)	United States	1940, 1950, 1960, 1970 US Census.	Foreign-born, aged 18–64 years.	US-born, at least one foreign-born parent, aged 18–64 years.	Log weekly earnings relative to third-generation Americans.	Men: 0.511 for 1940–1970 and 0.560 for 1970–2000. Women: 0.242 for 1940–1970 and 0.280 for 1970–2000.
Card, DiNardo, and Estes (2000)	United States	1940 and 1970 US Census, Pooled 1994–1996 Current Population Survey.	Foreign-born men aged 16–66 years.	US-born men and women, both parents foreign-born, aged 16–66 years.	Mean log weekly wages and mean years of schooling.	Men: 0.44* for 1940–1970 and 0.62* for 1970–1995. Women: 0.21* for 1940–1970 and 0.50* for 1970–1995.
Carliner (1980)	United States	1970 US Census.	Foreign-born ("earlier immigrants"), aged 18–64 years, distinguish those who arrived in the United States between 1965 and 1970 ("recent immigrants").	US-born men, at least one foreign-born parent, aged 18–64 years. Third generation: US-born, both parents also US-born.	Log hourly wages and log annual earnings.	n.a.

Continued

Table 4.L2 Summary of the Literature on Immigrants' Intergenerational Mobility—continued

Authors	Country	Data	Definition First Generation	Definiton Second Generation	Dependent Variable	Generational Income Elasticity for Immigrants (And Natives If Available)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Deutsch, Epstein, and Lecker (2006)	Israel	1995 Census of Israel.	Male Jews, older than 10 years of age when they immigrated to Israel between 1948 and 1952, from Asian–African countries.	Foreign-born men, aged 10 years or younger who came between 1948 and 1952, and Israelis, aged between 33 and 53 years in 1995, with foreign-born fathers. Third generation: Israelis younger than 33 years of age in 1995 with immigrant fathers whose age at immigration was 10 years or younger.	Log monthly gross wages.	n.a.
Dustmann (2008)	Germany	GSOEP 1984–2002.	Foreign-born men.	German-born men, father foreign-born, aged 20–34 years.	Log hourly wages (constructed).	Baseline estimate: 0.15*. If at least five wage observations used for average wage: 0.37*. If at least eight wage observations used: 0.41*. Last estimate drops to 0.39* if control for father's permanent migration propensity is included. Baseline estimate for natives: 0.18*. If at least five wage observations used: 0.25*. If at least eight wage observations used: 0.29*.
Gang and Zimmermann (2000)	Germany	GSOEP 1984–2002.	Foreign-born men.	German-born to foreign parents or who arrived before the age of 16, aged 17–38 years in 1984.	Total years of education, categorical schooling levels, and receipt or absence of vocational training.	Migrants' education has no effect on the educational attainment of their children. Natives' education has an effect on the educational attainment of the next generation; father's education has a larger impact than mother's education.
Hammarstedt and Palme (2006)	Sweden	1975, 1980, Swedish Census, foreign-born individuals who immigrated to Sweden between 1916 and 1969 and were gainfully employed in 1970. Data on all biological children for the years 1997, 1998, and 1999.	Foreign-born men aged 20–64 years in 1975 and 1980.	Swedish-born, father foreign-born, aged 20–64 years in 1997, 1998, and 1999.	Annual earnings.	OLS, average of 1975 and 1980 earnings: 0.207*. IV, using parent's educational attainment: 0.39*. OLS natives: 0.14*. IV natives: 0.22*. Regressions include quadratic polynomial in age for first and second generation on RHS.

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Table 4.L2 Summary of the Literature on Immigrants' Intergenerational Mobility—continued

Authors	Country	Data	Definition First Generation	Definiton Second Generation	Dependent Variable	Generational Income Elasticity for Immigrants (And Natives If Available)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Nielsen, Rosholm, Smith, and Husted (2003).	Denmark	Entire population of immigrants and 10% of Danish population for 1985–1997.	Foreign-born men and women from less-developed countries.	Danish-born, both parents foreign-born, aged 18–35 years, left education.	Log hourly wages in the first job after leaving education.	Sons: 0.001. Daughters: -0.003. Native sons: -0.009*. Native Daughters: 0.001*.
Osterberg (2000)	Sweden	Swedish Income Panel (SWIP) data from 1978 to 1997. From 1978, a 1% sample of native-born and a 10% sample of foreign-born were taken. Supplementary 10% samples of people immigrating each year from 1979 until 1997.	Foreign-born individuals aged less than 65 years in 1982. Observed between 1978 and 1982.	Swedish-born, at least one foreign-born parent ("second generation"). Foreign-born who immigrated to Sweden when not older than 16 years of age ("young immigrants"). Foreign-born with both parents Swedish-born ("adopted immigrants"). All individuals aged 25 years and more and observed between 1993 and 1997.	Log of average of son's and daughter's reported annual earnings over the period 1993–1997.	Sons (log of father's earnings): second generation: 0.079*, young immigrant: 0.107*, adopted: 0.007*. Sons (log of mother's earnings): second generation: 0.079*, young: 0.076*, adopted: 0.076*. Daughters (log of father's earnings): second generation: 0.037*, young: 0.068*, adopted: -0.004*. Daughters (log of mother's earnings): second generation: 0.041*, young: 0.045*, adopted: -0.025*. Native sons (log of father's earnings): 0.068*. Native sons (log of mother's earnings): 0.022. Native daughters (log of father's earnings): 0.042*, Native daughters (log of mother's earnings): 0.080*.
Riphahn (2003)	Germany	German Microcensuses for 1989, 1991, 1993, 1995, and 1996.	Foreign citizen with a valid year of entry into Germany.	German-born with foreign citizenship, aged 16–19 years.	Currently attending advanced school (Gymnasium), binary variable.	−0.285* (coefficient for father's lowest schooling degree) and 0.267* (coefficient for father's advanced vocational training). −0.442* (coefficient for mother's lowest schooling degree) and 0.367* (coefficient for mother's advanced vocational training).

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Table 4.L2 Summary of the Literature on Immigrants' Intergenerational Mobility—continued

Authors	Country	Data	Definition First Generation	Definiton Second Generation	Dependent Variable	Generational Income Elasticity for Immigrants (And Natives If Available)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Smith (2003)	United States	Census (1940–1970) and Current Population Survey (CPS); special supplements from 1979, 1983, 1986, and 1988 and CPS from 1994–1998.	Foreign-born men.	US-born men, at least one foreign-born parent. Third generation or more: both parents US-born.	Years of schooling and log wages.	Years of schooling: 0.50* (second generation regressed on first) and 0.22* (third generation regressed on second). Log wages: 0.46* (second generation regressed on first) and 0.27* (third generation regressed on second).
Trejo (2003)	United States	Current Population Survey, 1979 and 1989.	Foreign-born, parents also foreign-born, aged over 16 years.	US-born men, at least one foreign-born parent, aged 18–61 years. Third generation: US-born whose parents are also US-born.	Log hourly earnings (constructed).	n.a.

Note: A (*) indicates statistical significance at the 5 percent level.

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