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Migration, Skills and Productivity

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Contents

List of Tables and Figures

Summary

Chapter 2

Chapter 3

Chapter 4

Chapter 5

Summary Chapter

1 Introduction

The literature on international migration has repeatedly emphasised that the extent and structure of migration has an important impact on the competitiveness of regions and countries. In this respect a number of studies have stressed that highly skilled migrants are an important resource pool, which can be used to strengthen national R&D systems as well as integration into international business networks, increase entrepreneurial activity, improve integration of both sending and receiving countries into the international division of labour as well as overcome bottlenecks in regional labour supply and support regional clusters of high-tech activity. In the US for instance a recent paper by Hunt and Gauthier-Loiselle (2009), cites literature that foreign-born in the US account for about 26% of the US Nobel Price recipients (Peri 2007), 25% of founders of venture-backed US companies (Anderson and Platzer, 2006), 25% of new high tech companies with more than one million US dollars of sales and 24% of international patent applications from the US (Wadhwa et al., 2007), although they account for only 12% of the residents in the US.

In addition to these advantages it has also been argued that shifting the structure of migration to the more highly skilled – due to their better integration into the labour markets of the receiving countries – may also have a positive impact on social security systems since they are less likely to represent a burden on national social security and transfer systems (see Chiswick, 2005).

While the literature has also argued that these advantages are countered by the potential increase in wage pressures (and potentially unemployment rates) for high-skilled labour as well as potentially reduced incentives for training and education of the native population, there seems to be an almost uniform agreement in the economic literature that high-skill migration is preferable to low-skill migration.

These potential advantages of high-skill migration are also reflected in the policy arena. In the face of ageing European societies and growing needs for highly skilled labour, the developed market economies of the EU member states are facing increased competition for highly skilled migrants and a number of member states have implemented migration policies to attract increasing shares of highly skilled migrants. Furthermore also the European Commission (as evidenced for instance by the recent green paper on the European Research Area see: EC, 2007) acknowledges the fact that “It is essential to establish a single European labour market for researchers, ensuring effective “brain circulation” within Europe and with partner countries and attracting young talent and women into research careers” (EC, 2007, p11).

As, however, also pointed out by the Commission's Employment Report (EC, 2008) increased migration brings with it new demands on economic policy. This applies in particular to the need of developing appropriate integration policies and – of particular importance for the migration of highly skilled – institutional arrangements to guarantee that highly skilled migrants can transfer skills across borders and apply their knowledge in the host economies.

Furthermore, migration incentives for the highly skilled may differ from those of the less skilled. In particular, highly skilled are likely to put more emphasis on the career aspects of migration in their decision to migrate (see for instance Ackers, 2005) and the migration of highly skilled "has additional and complex aspects relating to research opportunities, work conditions and access to infrastructure" (OECD, 2007, p23). For students, issues such as the quality of training facilities and mobility grants may be more important determinants in their decision to become mobile (Trembley, 2002) than income differentials, while for those highly skilled already in the workforce additional factors such as access to intra-firm arrangements to allow for international mobility (for instance within multinational enterprises) may be much more important for migration decisions (Hunt, 2004).

In this chapter we provide an overview of the extent and the potential effects of high-skill migration to the EU27. We want to know first of all, how many high-skilled migrants live in the EU, where these migrants come from, and how the European Union is positioned in the international competition for talent. Second we want to examine how high-skilled migrants fare in European labour markets. To this end we analyse employment, unemployment and inactivity rates by skill groups as well as issues of jobs-skill mismatch for natives and foreign-born in the EU. Finally we want to address the issue of the effects of high-skill migration on multifactor productivity, gross value added and GDP per capita growth as well as patenting activities at the sectoral and regional levels.

2 Some results from the existing literature

Despite the substantial academic and policy interest in the issues raised, there is to date only very little literature which focuses exclusively on high-skilled mobility. This applies in particular to the alleged positive effects of high-skilled mobility on the receiving countries. In a recent survey of this literature, for instance, the OECD (2008) concludes that in general there is a scarcity of research on the impact of high-skilled mobility on receiving countries and that the existing literature is plagued by data and methodological problems which make it hard to identify these effects. This lack of research applies even more strongly to the EU than to the US. Furthermore much of the literature is quite controversial.

For example, in the recent literature on the potential impact of high-skilled migration on receiving countries there is a substantial debate going on which centres on the question

whether high-skilled foreigners are a substitute or a complement to high-skilled native labour (see Ottaviano and Peri, 2006 and Borjas et al., 2008 for two diametrically opposed views). This is essential for assessing the potential wage impact of high-skilled migration. Here results even for one and the same country (e.g. Germany – Brücker and Jahn, 2008, D'Amuri et al., 2008, Felbermayer et al., 2008) depend very strongly on methodological choices and the data used. Despite this, some robust findings seem to emerge. These are that first of all foreigners and natives are imperfect substitutes to each other in the aggregate, with previous immigrants being closer substitutes to recent arrivals. The findings on the high end of the skill distribution, however, remain controversial, ranging from perfect to relatively low substitutability between natives and foreigners.

These different results on substitutability or complementarity lead to relatively divergent assessments of the impacts of high-skilled migration on wages, with some authors finding positive effects and others negative effects. Here, however, even those studies that do find negative effects suggest a relatively mild impact on wages (as well as on unemployment), with even the highest estimates for European countries suggesting that increases in the stock of high-skilled migrants by 10% will lead to wage losses for high-skilled natives somewhere in the realm of 2-4%, and some evidence indicating that the primary adjustment by which highly skilled native workers escape from increased competition seems to be through occupational mobility.

In addition there is, however, some conclusive evidence on a number of positive impacts of high-skilled migrants. This applies in particular to the effects of high-skilled migration on innovation activities and on the positive trade and FDI generating effects of migration. With respect to innovation a by now quite extensive literature that, however, almost exclusively focuses on the US, finds a positive association between both high-skilled migration and ethnic diversity and measures of innovation activities (see Hunt and Gauthier-Loiselle, 2009, for a recent contribution). With respect to trade, by contrast, many contributions find a high degree of association between immigration and bilateral trade flows with estimates in general suggesting that a 10% increase in migration will increase bilateral trade by somewhere between 1% to 2% (see Combes, Lafourcade and Mayer, 2005, Parsons 2005, Girma and Yu 2002 for results for the EU or individual European countries). Similarly, the slightly smaller literature on FDI (Kugler and Rapoport, 2005, Docquier and Lodigiani, 2008, Javorick et al., 2006 and DeSimone and Manchin, 2008) suggests an equally strong association of migration and FDI activities, where in particular high-skilled migrants seem to be instrumental in generating higher FDI.

Concerning the impacts on entrepreneurship and on productivity, by contrast, evidence is much more mixed. With respect to entrepreneurship much of the literature has focused on individual case studies, in particularly successful regions or industries. The few more general (mostly US focused) studies that have become available recently (e.g. Wadwha et

al., 2006) suggest that migration contributes significantly to the founding of new enterprises and the development of entrepreneurial activity. With respect to productivity, the few existing studies (see e.g. Quispe-Agnoli and Zavodny, 2002, Paserman, 2008, Mas et al., 2008) often disagree and suggest that effects of migration are more often negative than positive, with positive effects mostly being found in cases where a successful match between migrants' skills and the requirements of their employees was achieved at the firm level.

3 How important are high-skilled foreign-born for the EU and where do they come from?

Where do highly skilled migrants in the EU reside?

Looking at the structure of highly skilled migration we find that for the EU27 as a whole the foreign-born are an important source of human capital: According to data from the European Labour Force Survey 9.1% of the total tertiary educated resident population (as opposed to 8.1% of total resident population) in the EU 27 is foreign-born. The share of highly skilled among the resident population born outside the EU is 21.1%, while for within EU migrants it is 23.0% (as opposed to 17.9% for the native-born population). The foreign-born thus contribute more than proportionately to the share of highly skilled in the EU.

There is, however, also substantial variation in migration experience in the EU 27 both with respect to receiving countries as well as with respect to sending regions. With respect to receiving regions highly skilled migration (as well as total migration) is strongly concentrated on individual receiving countries. Around 94.2% of all highly skilled foreign-born in the EU 27 live in the EU 15. Only around 5.8% reside in the EU 12 countries (table 1).

This high concentration also applies to individual EU 15 countries. The three largest receiving countries in the EU 27 (France, the UK and Spain) in sum account for 57,5% of the total stock of foreign-born in the EU 15 (Germany and Ireland are not included in the data-set; see note Table 1) and 63.1% of the highly skilled. The share of foreign-born in total resident population (aside from the obvious outlier of Luxemburg) is higher than 15% in Austria and Sweden but below 10% in Denmark, Greece, Italy and Portugal and even below 3% in Finland.

This heterogeneity is also reflected in a number of important indicators concerning the structure of migration. For instance when considering the share of highly educated foreign-born residing in a particular EU country by major sending regions of migration EU-LFS data suggest pronounced heterogeneity among EU countries with respect to the human capital structure received from migrants born in other EU countries and from migrants born outside the EU. In Austria and Greece the share of highly skilled among migrants born

outside the EU (with 11.2% and 12.4% respectively) is clearly below the average of both the EU 27 and the EU 15, but when considering the share of highly skilled migrants born in other EU countries this is higher than average for Austria (24.5%) and only modestly below average for Greece (20.4%).

Table 1

Share of foreign-born in total population and share of total foreign-born population by receiving country and skill group

	Share of foreign-born in total population				Share of total foreign-born in EU27			
	Skill level							
	Low	medium	high	total	low	medium	high	total
Total EU27	8.0	7.6	9.7	8.1	100.0	100.0	100.0	100.0
Total EU15	9.5	11.1	11.4	10.4	95.8	92.1	94.2	94.1
Austria	19.9	13.1	18.7	15.9	3.8	5.2	3.1	4.2
Belgium	14.1	9.6	11.0	11.9	4.9	2.8	4.2	4.0
Denmark	7.3	5.8	7.2	6.6	0.9	1.0	1.4	1.1
Spain	9.2	21.6	12.7	12.5	18.4	16.3	19.5	17.8
Finland	2.8	2.9	2.5	2.8	0.4	0.5	0.5	0.5
France	14.9	8.5	11.2	11.8	28.5	15.6	20.3	21.9
Greece	6.0	7.4	5.6	6.4	2.6	2.3	1.5	2.2
Italy	5.6	7.5	7.5	6.4	15.2	12.6	6.6	12.3
Luxembourg	36.9	31.9	52.9	38.1	0.5	0.5	0.7	0.5
Netherlands	11.1	12.6	10.1	11.5	5.0	6.6	5.7	5.7
Portugal	4.6	12.1	12.1	6.4	2.9	1.5	1.9	2.2
Sweden	17.7	14.2	17.1	15.8	2.5	4.8	5.1	3.9
UK	10.4	13.4	13.1	12.5	10.2	22.5	23.8	17.8
Total EU12	1.7	1.6	2.9	1.8	4.2	7.9	5.8	5.9
Bulgaria	-	0.3	0.7	0.3	0.0	-	0.1	0.1
Cyprus	12.8	17.1	20.7	16.4	0.3	0.4	0.6	0.4
Czech Republic	3.3	1.7	2.9	2.1	0.5	1.1	0.5	0.7
Estonia	11.2	17.2	20.3	16.7	0.2	0.9	1.0	0.7
Hungary	1.2	1.6	3.0	1.6	0.3	0.7	0.6	0.5
Lithuania	3.3	5.8	5.1	4.9	0.3	0.8	0.5	0.5
Latvia	10.4	14.2	17.1	13.7	0.5	1.4	1.0	0.9
Malta	3.4	6.5	7.9	4.3	0.1	0.0	0.0	0.1
Poland	2.0	0.8	1.1	1.1	1.5	1.5	0.9	1.4
Romania	-	-	-	0.1	-	-	-	0.0
Slovenia	9.3	7.5	6.3	7.8	0.4	0.7	0.3	0.5
Slovak Republic	0.7	0.6	1.3	0.7	0.1	0.2	0.1	0.1

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5; averages 2006-2007; values in brackets have a low reliability. - = data provide too few observations to be reported.

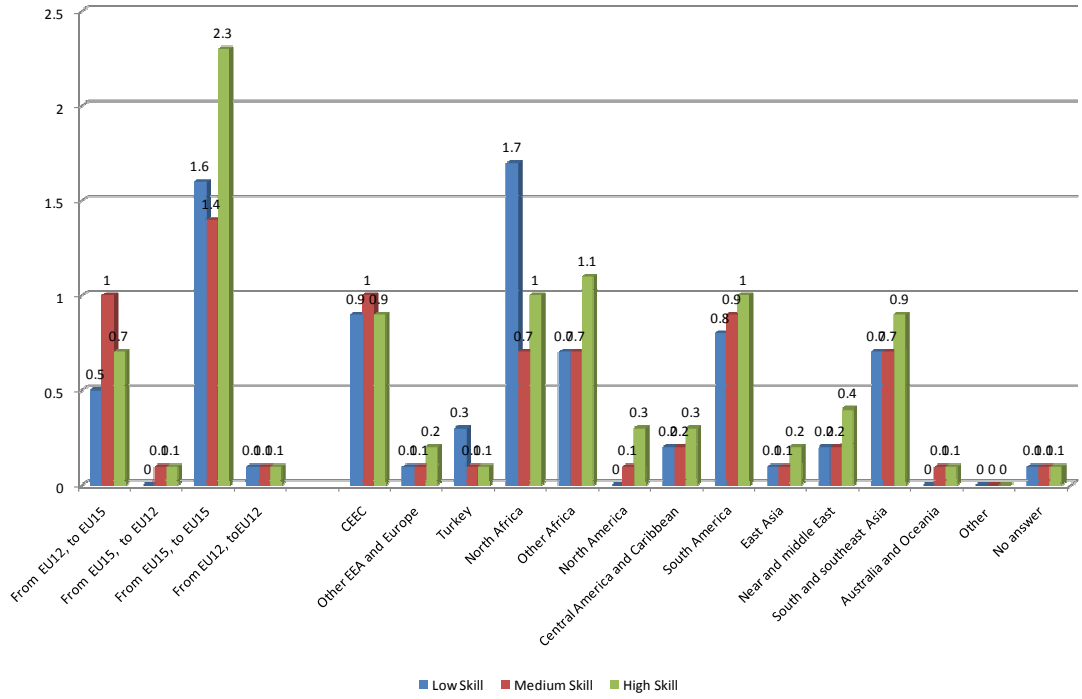
Source: EU-LFS.

By contrast in France and the EU12 the share of highly skilled among those born in other countries is clearly below the average, but a relatively high share of high-skilled migrants from among those born outside the EU live in France. The only country where substantially lower shares of highly educated workers are found for both these regions is Italy. For the UK, Sweden, Luxemburg, Spain and Denmark the share of highly skilled is above average

for persons born in both regions. Thus data on the structure of migration also suggests substantial variation in the structure of migration from different sending countries, which in turn reflect different historical ties and migration experiences among EU 27 countries.

Figure 1

Population aged 15+ by place of birth (share in total population residing in the EU 27), 2006/2007



Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries. EEA = European Economic Area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004, averages 2006-2007.

Source: EU-LFS.

Where do highly skilled migrants in the EU come from?

From a sending region perspective non-EU countries are a more important source of human capital for most EU 27 countries than migrants from within the EU. 6.6% of the total tertiary educated resident population of the EU 27 was born outside the EU. 2.5% were born in another EU country than the one in which they currently reside. Highly skilled non EU-born migrants primarily come from the other (non-EU) European countries (in particular Eastern Europe), South and Southeast Asia, South America as well as Northern and Other Africa (with each of these groups contributing more than 0.8% to the total highly skilled population residing in the EU). Highly skilled intra-EU migrants by contrast are often migrants from one EU 15 country to another EU15 country (Figure 1).

Table 2

Share of EU population aged 15+ by place of birth, duration of stay and highest completed education, 2006/2007

	Skill level					
	low	medium	high	low	medium	high
	duration of stay less than 10 years			duration of stay more than 10 years		
EU-born	25.4	48.7	25.9	42.6	36.5	20.9
of this						
From EU 12 to EU 15	27.2	56.6	16.2	27.4	48.0	24.6
From EU 15 to EU 15	19.3	35.5	45.2	37.3	44.9	17.8
From EU 27 to EU 12	20.1	51.9	28.0	34.6	49.3	16.2
Non-EU-born	41.8	37.8	20.5	43.2	35.5	21.3
of this						
Other Europe (including CEEC)	41.1	37.3	21.6	37.9	45.7	16.4
Turkey	64.1	29.5	(6.4)	66.2	27.4	6.5
North Africa	61.1	24.0	14.9	59.0	26.0	15.0
Other Africa	39.6	41.3	19.1	37.5	33.4	29.1
South & Central America Caribbean	39.7	40.7	19.6	35.3	39.8	24.8
East Asia	35.4	36.7	27.9	41.2	28.8	30.0
Near and middle East	34.3	39.6	26.1	26.1	39.7	34.2
South and southeast Asia	36.4	42.1	21.5	38.1	37.7	24.2
North America, Australia and Oceania (incl. other)	8.8	47.0	44.2	20.6	39.8	39.5
No answer	47.9	30.0	22.1	53.5	24.5	22.0
South and southeast Asia	36.4	42.1	21.5	38.1	37.7	24.2
Australia and Oceania	10.2	52.0	37.9	22.5	47.0	30.5
Other	29.5	24.7	45.9	49.7	23.3	27.1
No answer	38.4	27.4	34.2	55.3	26.0	18.7

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education, excluding unknown duration of stay (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries, EEA = European Economic area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004; averages 2006-2007; values in brackets have a low reliability.

Source: EU-LFS.

The evidence, however, also suggests that more recent migrants (that reside in the country of residence for less than 10 years) to the EU 27 are not always more highly qualified than earlier migrants. More recent migrants from the important African and Asian and South American sending regions, are less well qualified than more established migrants from these regions. Thus in aggregate the share of tertiary educated among non-EU-born residents living in the EU27 for less than 10 years is 20.5%, while it is 21.3% among the more established non-EU-born. The reason for this seems to primarily be a substantial share of lowly skilled seasonal and temporary workers coming to the EU from many of the important non-EU source countries.

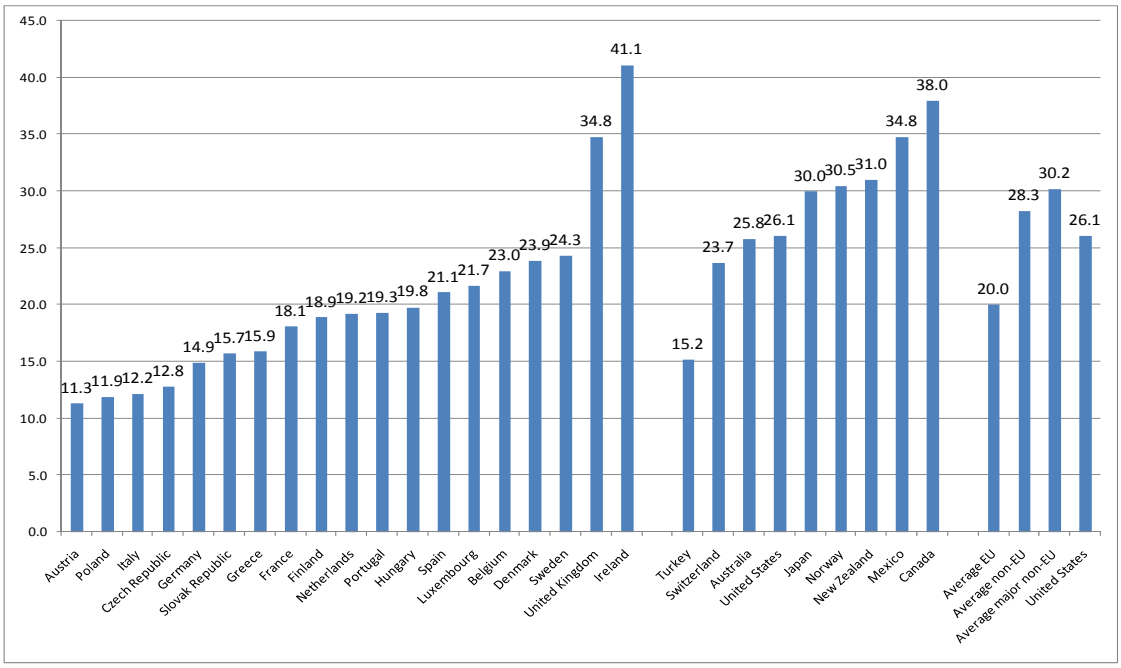
More recent migrants within the EU27 are, however, substantially more highly qualified than more established migrants from the EU27. Here the share of highly skilled among those residing abroad for less than 10 years is 25.9% (relative to 20.9% among the migrants with a duration of residence in excess of 10 years).

4 How does the EU compare to other non-OECD countries?

Comparing the skill structure of migrants in OECD countries suggests that EU countries are in general receiving a lower share of highly skilled migrants than non-EU-OECD countries but that there is also a substantial heterogeneity in the share of highly qualified migrants among EU as well as non-EU OECD countries. Countries such as Ireland and the UK received more than 30% highly skilled migration, while others such as Austria, Italy and Poland received a very low share by international standards. Furthermore, this data also suggests that - even when controlling for differences in sending country structures, migrant selectivity in the EU is substantially lower than in the important non-EU-OECD countries. Some EU countries (such as Austria, Poland and Italy) actually receive a negative selection of migrants relative to the skill structure currently existing in the sending countries.

Figure 2

Share of highly skilled foreign-born among total foreign-born population in OECD countries



Notes: Excluding individuals with unknown education level, gender or place of birth. Major non-EU = Australia, Canada, New Zealand, United States.

Source: Database on Immigrants in OECD Countries (DIOC).

When focusing on potential explanations for these differences in EU27 skill structure, results of the recent literature (see Belot and Hatton, 2008) suggest that a weakness that applies to all EU-OECD countries is the relative remoteness of the EU from the Asian countries (with a high share of highly skilled migrants) impeding on the capability of the EU to attract high-skilled migrants. Other more policy relevant factors such as differences in (post tax) wage premia for high-skilled labour, financial constraints (affecting the skill mix from poor and distant countries), language and cultural proximity all affect the qualification

mix of migrants and point to substantial heterogeneity among the EU countries, with destination country dummies further capturing other differences such as further labour market features, migration and integration policies, etc.

Furthermore, the lower share of tertiary educated migrants residing in the EU-OECD countries (relative to non-EU OECD countries) is associated with a significantly lower share of highly educated recent migrants, which most likely also reflects substantially higher shares of low-skilled temporary migration in the EU-OECD countries. On the positive side, however, the EU countries in general have experienced a slightly stronger increase in the share of tertiary educated foreign-born than non EU-OECD countries in the last decade and in terms of student mobility, EU countries seem to be more attractive and admit a higher share of foreign students.

Finally, results on the relative labour market situation of tertiary educated foreign-born residents in the EU suggest that with respect to the skill structure of migration EU countries represent an extremely heterogeneous group. Despite this, however, two general findings – both of which suggest that high-skilled migrants may face substantial difficulties in transferring skills across borders – emerge: The first is that skill gradients – i.e. the native-foreign difference amongst the higher skilled compared to the lower skilled - with respect to the foreign-native activity and employment rate differentials are somewhat larger in the EU OECD countries than in non-EU OECD countries. The second is that - relative to the native-born population - foreign-born workers in EU OECD countries tend to have higher rates of over-qualification than those in non-EU-OECD countries.

Generally, it can also be observed that comparing the EU OECD countries with the four major non-EU receiving countries in the OECD - Australia, Canada, New Zealand and the US - more often results in significant differences while comparisons of the EU with the US alone seldom lead to significant or sizable differences.[1] This result can be interpreted as indicating that those countries with modern, point-based migration systems (Australia, Canada and New Zealand) are more successful in attracting highly skilled migrants than the EU or the US.

5 The labour market situation of highly skilled foreign-born in the EU

Employment, unemployment and inactivity rates

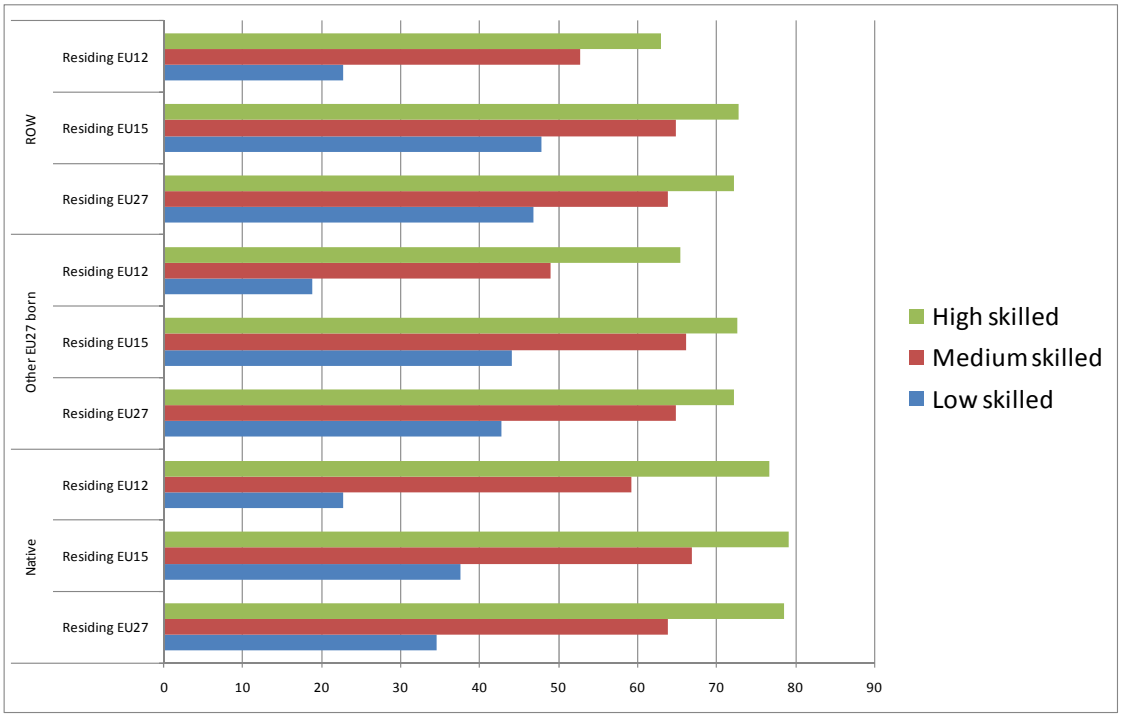
There are also substantial differences in the labour market outcomes (as measured by employment, unemployment and activity rates) of foreign- and native-born EU27 residents

[1] E.g., the major non-EU receiving countries not only show a significantly higher share of foreign-born in the population, but also a significantly better educational structure than the EU OECD countries. On the other hand no significant differences can be found when comparing the US to the EU OECD countries.

by skill groups. In general, the less skilled foreign-born in the EU27 are characterized by higher employment rates, higher labour market participation and also higher unemployment rates than the less skilled natives. The high-skilled foreign-born have lower labour market participation rates, higher unemployment rates and lower employment rates. In addition, native-foreign unemployment, employment and inactivity rate differentials are more pronounced for the foreign-born from outside the EU than for migrants from other EU countries.

Figure 3

Employment rate of foreign- and native-born by major sending and receiving regions and skill groups



Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability.

Source: EU-LFS.

Regression analyses based on (weighted) multinomial logit regression analysis on EU-LFS data (see table 3) suggests that (after controlling for country of residence, age and gender) highly skilled foreign-born in the EU have a 9.3% lower probability of being employed, a 3 percentage points higher probability of being unemployed and a 5.4 percentage points higher probability of being inactive than comparable natives. Less skilled foreign-born, by contrast, have a by 2.9 percentage points higher probability of being employed than comparable natives and face a 5.4 percentage points lower risk of inactivity but a 1.2 percentage points higher risk of unemployment. Thus (even after controlling for compositional effects) highly skilled – in contrast to less skilled – migrants in the EU27 are

substantially (by 9.3 percentage points) less likely to be employed than highly skilled natives. This points to a substantial underutilization of highly skilled foreign labour in the EU27 due to non employment.

Table 3

Regression results for the probability of unemployment, employment and inactivity

	Skill level						
	high		medium		low		Test for difference among skill groups[1)]
	Marginal effect	std. dev	Marginal effect	std. dev	Marginal effect	std. dev	
			Employment				
Female	–0.050 ***	0.006	–0.140 ***	0.006	–0.205 ***	0.009	a,b
Age 25-44	0.263 ***	0.010	0.348 ***	0.007	0.460 ***	0.008	a,b
Age 45+ years	0.043 ***	0.009	0.081 ***	0.008	0.079 ***	0.010	b
Foreign-born	–0.093 ***	0.006	–0.072 ***	0.005	0.029 ***	0.006	a,b
			Inactivity				
Female	0.045 ***	0.005	0.134 ***	0.007	0.221 ***	0.010	a,b
Age 25-44	–0.231 ***	0.010	–0.323 ***	0.008	–0.474 ***	0.009	a,b
Age 45+ years	0.001	0.009	–0.023 ***	0.009	–0.023 **	0.012	b
Foreign-born	0.054 ***	0.005	0.040 ***	0.005	–0.054 ***	0.007	a,b
			Unemployment				
Female	0.003 **	0.001	0.002	0.002	–0.004 ***	0.001	
Age 25-44	–0.023 ***	0.002	–0.018 ***	0.002	0.007 ***	0.002	a,b
Age 45+ years	–0.041 ***	0.002	–0.048 ***	0.002	–0.046 ***	0.002	b
Foreign-born	0.030 ***	0.002	0.027 ***	0.002	0.012 ***	0.001	a,b

Notes: Table reports marginal effects of a multinomial choice model. Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported. - * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate. - 1) Column presents results of a test for the significance of coefficients across skill groups: a) indicates that the coefficient of the variable for the medium-educated differs from that of the less educated, b) that the coefficient of the variable for the highly educated differs from that of the less educated. All tests are at a significance level of 5%.

Source: EU-LFS.

This underutilization is larger for migrants that were born in more distant (i.e. non EU) sending countries. This applies in particular to the unemployment probability. Here only less and medium-skilled migrants born in Northern America and Oceania experience lower risks of unemployment than migrants from the EU, while the unemployment risk for highly skilled migrants born in for instance the Near and Middle East is by 7 percentage points higher than that of comparable high-skilled natives.

But also migrants born in the EU15 and even more pronouncedly migrants from the EU12 have substantially different labour market outcomes than natives. For instance focusing on the labour market situation of the highly skilled, highly skilled migrants born in the EU15 have an employment probability that is by 7.4 percentage points lower, an unemployment

risk that is 1.1 percentage points higher and a by 6.3 percentage points higher probability of being inactive than natives of the same skill group (even after controlling for receiving region, gender and age effects). These results thus suggest that even within EU15 borders the transfer of skill across country borders is far from unproblematic.

Table 4

Regression results for the probability of unemployment, employment and inactivity of foreign-born

	Skill level high		medium		Low		Test for difference among skill groups[1]
	Marginal Effect	Std. Err.	Marginal Effect	Std. Err.	Marginal Effect	Std. Err.	
			Employed				
Female	–0.120 ***	0.008	–0.210 ***	0.006	–0.271 ***	0.008	a,b
Age 25-44	0.244 ***	0.021	0.259 ***	0.009	0.381 ***	0.010	a,b
Age 45+ years	0.066 ***	0.020	0.077 ***	0.010	0.129 ***	0.013	a
Duration<10 years	–0.097 ***	0.010	–0.058 ***	0.008	–0.018 *	0.009	a,b
			Unemployed				
Female	0.010 ***	0.004	0.009 ***	0.003	–0.008 **	0.003	a,b
Age 25-44	–0.019 **	0.010	–0.021 ***	0.004	0.002	0.004	a,b
Age 45+ years	–0.033 ***	0.009	–0.048 ***	0.004	–0.045 ***	0.006	a
Duration<10 years	0.017 ***	0.005	0.014 ***	0.004	0.008 *	0.004	a,b
			Inactive				
Female	0.110 ***	0.007	0.202 ***	0.006	0.280 **	0.009	
Age 25-44	–0.225 **	0.019	–0.238 ***	0.009	–0.383 ***	0.010	
Age 45+ years	–0.033 ***	0.017	–0.029 ***	0.009	–0.084 ***	0.013	
Duration<10 years	0.081 ***	0.009	0.044 ***	0.007	0.009	0.010	

Notes: Table reports marginal effects of a multinomial logit model. Base foreign-born population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported (see below). - * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate. - 1) Column presents results of a test for the significance of coefficients across skill groups: a) indicates that the coefficient of the variable for the medium-educated differs from that of the less educated, b) that the coefficient of the variable for the highly educated differs from that of the less educated All tests are at a significance level of 5%.

Source: EU-LFS.

In addition econometric evidence indicates that highly skilled foreign-born profit more strongly from a longer duration of stay (and thus improved integration) in the receiving country than less skilled (see Table 4). The employment probability of a highly skilled foreign-born that has resided in the country of residence for more than 10 years is by 9.7 percentage points higher than that of a foreign-born that has resided in the country of residence for less than 10 years. For these migrants unemployment probability is by 1.7 percentage points and the inactivity probability by 8.1 percentage points lower. For the less skilled the respective changes are 1.8 percentage points for the employment chances and -0.8 respective -0.9 percentage points for unemployment and inactivity risks. They are thus substantially smaller. Thus highly skilled foreign-born, who stay in the country of

residence for a longer period of time have significantly higher improvements in labour market performance than less skilled[2]. The highly skilled are thus particularly likely to profit disproportionately from improved integration.

Finally, gender differences in unemployment, employment and inactivity probabilities among the foreign-born are significantly higher than for all residents (although they also decrease with increasing educational attainment of the foreign-born). This thus draws attention to the fact that also female migrants (of all skill groups) must be considered as particularly disadvantaged with respect to labour market integration.

Table 5

Share of overqualified workers in total employment by skill group and receiving country

	Highly skilled		Medium-skilled	
	Foreign-born	Native-born	Foreign-born	Native-born
Receiving country EU 27	33	19.4	19.4	7.7
Receiving country EU 15	33.3	20.9	19.8	7.4
Austria	29.3	22	20	7.3
Belgium	27.4	21.4	14.3	9.3
Denmark	25.6	13.6	14.2	8.1
Spain	57.6	32.6	31.9	7.9
Finland	30.4	17.8	13.6	9.8
France	26.2	20.1	14.6	8.3
Greece	59.5	16.8	28.6	3
Italy	42.1	11.6	21.2	4.3
Netherlands	19.8	13	7.3	2
Luxembourg			13.7	5.6
Portugal	23.7	11.6	15.2	5.2
Sweden	27.1	11.6	9.5	5.5
UK	24.2	22.4	16.9	10.2
Receiving country EU 12	27.3	13.8	14.3	8.3
Bulgaria		20.9		12.1
Cyprus	50.7	28.6	37.4	9.9
Czech Republic	14.3	5.8	8.6	4.9
Estonia	41.7	23.6	21	9.5
Hungary		10.4		5.4
Lithuania		22		12.8
Latvia	29.4	15	15.8	12.2
Malta				
Poland		15.1		8.4
Romania		9.1		9.7
Slovenia		7.3	9.7	4.8
Slovak Republic		9.3		8.8

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability.

Source: EU-LFS.

[2] Here there can be an additional important factor at play: Foreign bon with a longer period of residence might (and most likely will) have received part or all of the education in a country of residence and hence their qualifications will be more closely matched with those of natives.

Overqualification

Aside from substantial differences in foreign-native differentials in employment, activity and unemployment rates highly skilled migrants also face substantially higher risks of overqualified employment in the EU27 than medium-skilled migrants. According to results from the EU-LFS 19.4% of the native-born highly skilled, employed in the EU27 (excluding Germany and Ireland) were overqualified, but 33.0% of the highly skilled foreign-born. Both natives as well as foreign-born highly skilled women have substantially higher rates of over-qualification (of 20.7% native women and 34.9% foreign-born women) than men (18.1% natives and 31.2% foreign-born respectively).

Table 6

Regression results for the probability of overqualified employment

	High-skilled		Medium-skilled	
	Marginal effect	Standard deviation	Marginal effect	Standard deviation
Female	0.064***	0.003	0.011***	0.001
25-44 years	–0.155***	0.006	–0.041***	0.001
45+ years	–0.174***	0.004	–0.050***	0.001
		Sending country		
Native-born	Reference category		Reference category	
EU 15	–0.029***	0.007	–0.012***	0.002
EU 12	0.296***	0.017	0.192***	0.010
Other Europe	0.350***	0.015	0.148***	0.006
Turkey	0.188***	0.038	0.066***	0.012
North Africa	0.157***	0.021	0.051***	0.010
Other Africa	0.105***	0.014	0.043***	0.008
South & Central America	0.194***	0.019	0.177***	0.013
East Asia	0.103***	0.032	–0.001	0.009
Near and middle East	0.168***	0.021	0.025***	0.008
South and southeast Asia	0.123***	0.013	0.063***	0.008
US, Australia and Oceania	–0.079***	0.017	–0.040***	0.005
		Sector of Employment		
Agriculture and Mining	Reference category		Reference category	
Manufacturing	–0.155***	0.003	–0.030***	0.001
Energy and Constructiuon	–0.122***	0.004	–0.019***	0.001
Market services	–0.216***	0.005	–0.057***	0.001
Non market services	–0.363***	0.007	–0.052***	0.001

Notes: Table reports marginal effects of an ordered logit model. Base foreign-born employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 of the main report for details of data construction). Medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported (see below). - * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – Heteroscedasticity robust standard error of the estimate.

Source: EU-LFS.

For the medium-skilled, levels of overqualification, by contrast, are substantially lower both for the foreign-born as well as natives. For the average of the years 2006 and 2007 around 7.7% of the natives with an educational level equivalent to the ISCED 3 or 4 categories were over-qualified for their occupation in the EU 27. Among the foreign-born the

equivalent share was 19.4%. As with high-skilled workers, overqualification among the medium-skilled female workers is substantially higher than among males. While the overqualification rate for native-born women in the EU27 amounted to 8.4% and was thus only 1.2 percentage points higher than that of men, for foreign-born medium-skilled women gender differences amounted to 9.7 percentage points (men 15.2%, women 24.9%) (see Table 5).

In addition econometric results from regressions similar to those in the previous section (see Table 6) show that

1. The probability of over-qualification is lower for migrants born in the EU 15 than for natives. The risk of over-qualified employment is by 2.9 percentage points (for high-skilled) and 1.2 percentage points (for medium-skilled) lower than that of natives, when migrants are born in other EU 15 countries. Thus migrants born in the EU 15, provided they find work, seem to face few problems in transferring human capital across national borders.
2. High-skilled migrants from the EU 12 face a substantially (by 29.6 percentage points) higher risk of being overqualified than natives and medium-skilled migrants from the EU 12 have an over-qualification risk that is by 19.6 percentage points higher than that of natives. Migrants born in the EU 12 thus belong to the groups of migrants with the largest difficulties in transferring human capital across borders.
3. For most of the other sending country groups the over-qualification risk is by 10 to 20 percentage points higher for highly skilled migrants than for highly skilled natives and 3 to 7 percentage points higher for medium-skilled foreign-born.
4. Comparing the magnitude of over-qualification between highly and medium-skilled foreign-born, highly skilled foreign-born have substantially larger problems in transferring human capital across border than medium-skilled workers.

Furthermore as with employment, inactivity and unemployment risks also the over-qualification risk reduces more substantially with increasing duration of residence for highly skilled than for medium-skilled foreign-born and gender differences are higher among the foreign-born than among the population at large. Highly skilled foreign-born that lived in a country for more than 10 years, experience a reduction in their over-qualification risk of approximately 15.4 percentage points. For medium-skilled migrants this effect is more modest. Migrants with a duration of residence exceeding 10 years face an over-qualification risk that is by 6 percentage points lower than that of more recent migrants. Finally, also sectoral employment patterns (in particular employment in agriculture) increase the over-qualification risk more substantially among foreign-born than among natives.

6 Migration and productivity

Whether or not migrants affect productivity is likely to be dependent on the attributes that migrants have, relative to native workers. In part, this may be determined by domestic immigration policy – more selective policies enable governments to identify specific skills and professions that are required in the domestic labour market. In this section we look to estimate the impact of various aspects of migrant labour on productivity at the industry level across EU countries, incorporating skills and interactions with technology and differentiating the source of migrant. We note elsewhere the paucity of empirical evidence in this regard, particularly in the respect of differentiating labour types and their interaction with technology, discussed earlier in the report.

Table 7

Sectors available in EU LFS

	Code	Description
1	A	Agriculture
2	B	Fishing
3	C	Mining
4	15t16	Food, Drink and Tobacco
5	17t19	Textiles and textile products, leather and footwear
6	21-22	Pulp, paper, paper products, printing and publishing
7	23	Coke, refined petroleum products and nuclear fuel
8	24	Chemicals and chemical products
9	25	Rubber and plastics
10	26	Other non-metallic mineral products
11	27t28	Basic Metals and Fabricated metal products
12	29	Machinery NEC
13	30t33	Electrical and Optical Equipment
14	34t35	Transport Equipment
15	36t37	Manufacturing NEC; recycling
16	E	Energy/utilities
17	F	Construction
18	G	Wholesale and Retail
19	H	Hotels and restaurants
20	60t63	Transport and Storage
21	64	Communications
22	J	Financial intermediation
23	70	Real estate activities
24	71t74	Renting of machinery and equipment and other business activities
25	L	public administration and defence
26	N	Health
27	O	Other social, personal and community
28	P	Private households

Using data from the EUKLEMS and the EU-LFS, we explore the contribution migrant labour makes to productivity growth in the EU. As explored elsewhere in this report, the qualities that migrant workers bring are diverse, largely dependent on the home country of the migrant. Whether or not migrants affect productivity is likely to be dependent on the attributes that migrants have, relative to native workers. Here we take an industry

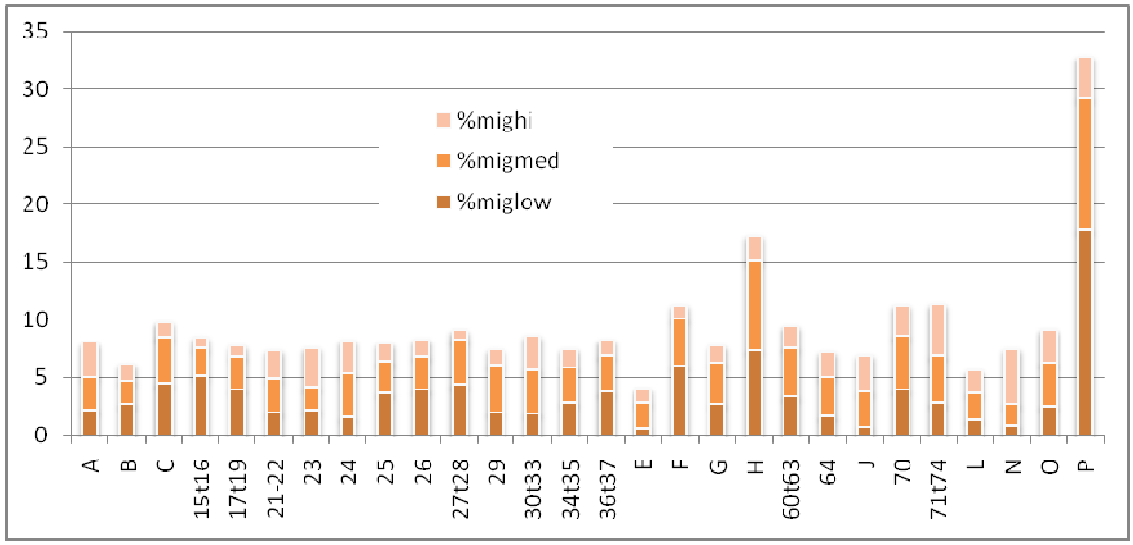
perspective. Data are available at the following NACE sectoral breakdown for the period 1995-2004:

We begin with a description of trends in sectoral levels of migration. Our analysis considers a split in migrant labour into those from the EU and those from the rest of the world (ROW). The EU here is defined as the EU15 since the data covers the period prior to the recent EU expansion. It is well documented that migrants tend to be concentrated in certain industries (Mas et al., 2009). Taking a sectoral perspective, Figure 4 shows the extent to which, at an aggregated EU level, sectors are dominated by skill types. Figure 4 reveals that as a proportion of total employment, construction, hotels and restaurants, business services (70 and 71t74) and private households are sectors where there are a significant proportion of migrants. In these sectors, the proportion of low-skilled migrants accounts for at least half of total migrants, except in business services, where higher skilled migrant workers are relatively important. Conversely, sectors where migrants play a relatively minor role are fishing, energy and public administration and defence.

The importance of low-skilled migrants in some sectors, such as construction, is not surprising, but it is perhaps more surprising to see that low skills are accounting for such a small proportion of migrant labour in some other sectors, such as agriculture. This may be taken as evidence of over-qualification in a sector such as this, where work is exceptionally seasonal and likely to be short-term.

Figure 4

Migrant share in % of total employment by sector and skill group, 2004 ('EU total')



Source: EU LFS; EU total comprises of 13 countries, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, UK.

Thus, a sectoral description of the EU LFS data shows that there is a great deal of variation in the concentration and the nature of the migrant labour force. We note also that

there is considerable heterogeneity amongst the EU countries. However, there has been significant growth in the high-skilled subsection of the migrant labour force, particularly during the 1995-2004 period (table 3 in the main report) and in the EU a decline in the growth of the low-skilled migrant workers. By comparison, the rest of the world migration growth displays a positive trend in almost all countries in all periods, in all skill groups.

As a first step, we take the measure of Multi-Factor Productivity (hereafter MFP) provided in EU KLEMS for each country and each industry over time. We use both MFP growth and MFP levels and regress them on a number of additional explanatory variables that relate to the migrant workforce, as specified below:

(1a) $\Delta LnMFP_{cti} = \alpha + \beta_1 eu\_share_{cti} + \beta_2 row\_share_{cti} + C_{it} + I_{ct} + T_{ci} + e_{cit}$

(1b) $LnMFP_{cti} = \alpha + \beta_1 eu\_share_{cti} + \beta_2 row\_share_{cti} + C_{it} + I_{ct} + T_{ci} + e_{cit}$

Where the *eu_share* is the proportion of migrant workers in the workforce from EU countries and *row_share* is the rest of the world proportion for each country (c), industry (i) and year (t). In both the difference and the levels equation, the additional migrant regressors are included as proportions in total employment and are not differenced. In this way, we aim to see how far the proportion of migrants affects both productivity levels and growth. Equations 1a and 1b are estimated using standard panel OLS, including industry, time and country dummies. A number of variants of the equation are considered, including time*country effects to take explicit account of business cycle effects, which are reported below.

As a refinement to the estimations above, we adopt a simple Cobb-Douglas production function, with value added as the dependent variable, and capital, differentiated in terms of its ICT and its non ICT component, and hours as the labour input. In addition, we include the share of migrant labour differentiated by EU and ROW:

(2a) $$\Delta LnVA_{c,t,i} = \alpha_1 + \beta_1 \Delta \ln hrs_{c,t,i} + \beta_2 \Delta \ln capit_{c,t,i} + \beta_3 \Delta \ln capnit_{c,t,i} + \beta_4 eu\_share_{c,t,i} + \beta_5 row\_share_{c,t,i} + C_{it} + I_{ct} + T_{ci} + e_{cit}$$

(2b) $$LnVA_{c,t,i} = \alpha_1 + \beta_1 \ln hrs_{c,t,i} + \beta_2 \ln capit_{c,t,i} + \beta_3 \ln capnit_{c,t,i} + \beta_4 eu\_share_{c,t,i} + \beta_5 row\_share_{c,t,i} + C_{it} + I_{ct} + T_{ci} + e_{cit}$$

In order to take better account of the impact that migrants have on productivity, we need to incorporate a measure that take explicit account of the skills that this subset of workers have. There are a number of ways in which this may be done. We include a share of the high-skilled migrants in the specification in addition to the share in terms of numbers of migrant workers. These terms should enable us to capture both the volume and the quality

effect to some extent. However, a more efficient way of incorporating these two components would be to construct a labour quality measure (Timmer et al., 2007). We separately test these two approaches as variations on the equations specified above.

Another refinement to the estimation is to incorporate a measure of the interaction between ICT and high-skilled migrant labour. This term is added to the estimated models in order to explore the extent to which migrant labour allows for the better utilisation of these new technologies, since they may bring to the labour market additional knowledge and know-how not captured in the skills measure. Table 8 below outlines the variables included in the specifications and how they have been constructed.

Table 8

Variables included in the econometric analysis

var name	description	Calculation
va	value added	From EUKLEMS
lnva	logged value added	ln(va)
dlnva	logged value added growth	d.ln(va)
mfp	multifactor productivity calculated in EUKLEMS - quality adjusted	From EUKLEMS
lnmfp	logged mfp	ln(mfp)
dlnmfp	logged mfp growth	d.ln(mfp)
ict_ratio	the ratio of ict capital to total capital (ICT+nonICT)	ict_ratio=capitlev/(capitlev+capnitlev)
ict_int	the ict ratio multiplied by the share of high-skilled migrants	ict_int=(hi_share*ict_ratio)/10
eu_share	the share of EU migrants in total employment	eu_share=(eu_hi+eu_med+eu_low)/totl_lfs
row_share	the share of ROW migrants in total employment	row_share=(row_hi+row_med+row_low)/totl_lfs
hi_share	the share of high-skilled migrants in total migrant employment	hi_share=(eu_hi+row_hi)/totl_mig
hi_share_m	the share of high-skilled migrants as a proportion of share of high-skilled natives	hi_skill_m=hi_share/(nat_hi/nat_totl)
hi_sh_nat	the share of high-skilled natives in total native employment	hi_sh_nat=nat_hi/(totl_lfs-totl_mig)

In summary, the levels estimates appear stronger than growth estimates. Thus, the ratio of migrants to total employment is negatively related to sectors where productivity levels are higher, but they are not significantly positively related to growth in productivity. When considering a simple share of migrant labour in total labour by industry, country, year, we find that the impact is negative in relation to MFP and value added levels. In growth rate specifications the impact is positive. Tables 9 and 10 outline some of the key findings in relation to the whole dataset.

Table 9

Multi-factor productivity and the impact of migrant workers, 1995-2004, EU countries, all sectors

VARIABLES	LnMFP	LnMFP	LnMFP	dlnMFP	dlnMFP	dlnMFP
mig_share	-0.7719**			0.0979***		
	[0.3185]			[0.0345]		
hi_share	0.2422***	0.2319***		0.0034	0.0035	
	[0.0738]	[0.0731]		[0.0082]	[0.0082]	
eu_share		-4.8824***	-4.2582***		0.1224*	0.1012
		[0.6428]	[0.6817]		[0.0706]	[0.0753]
row_share		0.7487**	0.1395		0.0891**	0.0890**
		[0.3775]	[0.4107]		[0.0411]	[0.0451]
ict_int			6.6211***			-0.0349
			[1.9925]			[0.2162]
Observations	2957	2957	2909	2697	2697	2654
R-squared	0.898	0.9	0.897	0.212	0.212	0.213
F	173.9	176.3	169.2	5.182	5.143	5.121
Rmse	0.381	0.378	0.374	0.0398	0.0398	0.0397

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and outliers. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

Table 10

Value added production function and the impact of migrant workers, 1995-2004, EU countries, all sectors

VARIABLES	lnVA	lnVA	lnVA	dlnVA	dlnVA	dlnVA
Lnhrs	0.5198***	0.5194***	0.4571***	0.3309***	0.3311***	0.3302***
	[0.0267]	[0.0267]	[0.0263]	[0.0277]	[0.0277]	[0.0276]
Lnkit	-0.0350***	-0.0349***	-0.1071***	0.0435***	0.0437***	0.0432***
	[0.0118]	[0.0118]	[0.0129]	[0.0097]	[0.0097]	[0.0097]
Lnknit	0.3651***	0.3646***	0.4605***	0.1333***	0.1335***	0.1309***
	[0.0198]	[0.0199]	[0.0207]	[0.0300]	[0.0300]	[0.0300]
mig_share	-0.5504**			0.1293***		
	[0.2547]			[0.0329]		
hi_share	0.3904***	0.3900***		0.0082	0.0083	
	[0.0574]	[0.0574]		[0.0076]	[0.0076]	
eu_share		-0.6853	-1.1060**		0.1470**	0.1334**
		[0.5113]	[0.4995]		[0.0661]	[0.0662]
row_share		-0.4894	-0.7684**		0.1215***	0.1154***
		[0.3240]	[0.3167]		[0.0416]	[0.0415]
ict_int			23.3410***			0.3661*
			[1.7757]			[0.2029]
Observations	2987	2987	2987	2727	2727	2727
R-squared	0.935	0.935	0.938	0.332	0.332	0.332
F	278.9	276.9	289.9	9.447	9.375	9.398
Rmse	0.3	0.3	0.294	0.0376	0.0376	0.0376

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and outliers. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

It is important to split EU and ROW migrants, since the productivity effects of these two groups of migrant workers appear to operate in opposite directions, with the EU effect being negative when significant. This is likely to be influenced by national immigration policies that are geared towards the selective inclusion of ROW workers. Restrictions towards EU nationals are much fewer. However, we acknowledge that the breakdown of migrants into ROW and EU is crude; ROW includes workers from technology leading as well as technology laggard countries. Ideally, more disaggregated data would be available and allow us to distinguish more specifically between nations.

A more disaggregated approach by sector also seems to tell us more about the nature of the relationship between migrants and productivity. We consider two sectoral disaggregations, firstly separating manufacturing from services and secondly, based on patterns of technological usage. The manufacturing and services split is particularly important since these are two distinct sectors that operate very differently. The contribution of manufacturing is generally falling in European economies, whilst the relative growth in services is has been increasing. However, services are more difficult to measure since information on inputs and outputs to these sectors is less quantifiable. It is therefore reasonable to assume that they are unlikely to operate under the same production function. When industries are grouped according to whether they use or produce ICT, there is little evidence that in ICT using or producing sectors the use of migrant labour has any significant impact on productivity in the MFP estimations and very little in the value added specifications.

Using quality adjusted measures of migrant labour does not yield significant results, which, in the case of the MFP estimates, may be the result of labour quality already being incorporated into its calculation. The use of high-skilled migrant labour and also the interaction between high-skilled migrant labour and the industry share of ICT capital are also relationships that are explored to see whether there is a productivity premium to higher skilled and technology workers. In summary the results suggest that there is some positive effect to these terms in the levels estimates but not growth estimates.

Refinements to measurement may help, and we have explored a number of possible changes to our variables and data to test how sensitive the findings are to specifications and the dimensions of the data (truncating time periods and reducing the number of countries included). Extensions to the work include adopting a more sophisticated production function; however, the interpretation of the coefficients with these more flexible functional forms is less straightforward than with the Cobb-Douglas. More sophisticated estimation techniques are also available and have been explored. The findings caution against too much emphasis being placed on the OLS results, since the effects of migrant labour on productivity largely disappear. That said, there are reasons to suppose that GMM estimation procedures are less suited to industry data than to microanalyses.

Policy conclusions:

The role of migration on productivity is an under-researched area, particularly in view of the increased mobility of labour in recent years. The findings in this section are mixed but are in line with other studies of the productivity impact of migrant labour (Mas et al., 2008; Paserman, 2008). We find some evidence of a significant effect of migrant labour at the industry level across Europe and this differs for ROW and EU migrants, with the former displaying some evidence of positive effect, whilst the EU shows if anything a negative impact on productivity and it's growth; however, this largely disappears when we take into account the potential endogeneity within the production function estimates. Thus, caution should be exercised when drawing firm policy recommendations from this exploratory research across such a diverse collection of experiences. With this in mind, however, there is some evidence to suggest that the more selective immigration policies that are implemented in relation to rest of the world workers do yield a positive effect, in contrast with the indifferent findings in relation to EU migrants. There is some limited evidence that technology and the share of high-skilled migrants have a positive impact on productivity.

7 Effects of migration on regional GDP per capita and patenting

We also studied the relationship between (skilled) migration and economic performance at the regional level. For this we combined data from the European Labour Force Survey (EU-LFS) and the Eurostat Regional data base. In particular we look at the impact of migration on GDP per capita growth and patenting at the EU-15 NUTS 2-digit level over the period 2000-2006 using (dynamic) panel regression methods.

Some regional aspects of migration are summarized in Table 11 which shows the arithmetic average over regions of the share of high-skilled workers, the share of migrants, the share of high-skilled migrants in total migrants together with the minimum and maximum for each of the respective indicators and each country. The last three columns present the arithmetic mean of the difference between the share of high-skilled migrants (in total migrants) and the share of native high-skilled employed persons (in total native employed persons).[3] The first variable (Share of high-skilled workers) indicates that there are quite large differences across countries. The shares range from a minimum of 13.5% in Portugal to a maximum of 38.4% in Belgium. This reflects of course specificities of the national educational systems (further note that these numbers are the arithmetic means over regions for each country). Even more important, however, is the range of high-skilled workers across regions. This range is lowest in Ireland and Italy with less than 10 percentage points and goes up to about 25 percentage points in France and Spain and is even higher in the United Kingdom with almost 30 percentage points.

[3] Note that in this table we report arithmetic averages (i.e. unweighted means) over regions for the respective variables. Figures thus are not comparable with those presented in the other sections.

The next variable we look at is the share of migrants in total employed persons. The corresponding figures are reported in the next three columns of Table 11. Again we report the arithmetic mean over regions for each country. These average shares range from less than 4% in Finland to about 14% in Germany (not considering the case of Luxembourg). This partly reflects the country specific patterns of migration already discussed above in more detail. Let us thus again come to the distribution of these shares measured – for simplicity – by the range, i.e. the difference between the maximum and the minimum as reported in Table 11. This range goes from little less than 10 percentage points in Finland, Greece and maybe Portugal (not considering the special case of Ireland) to more than 40% in the United Kingdom. Though these quite high numbers might be caused by data problems they nonetheless show that migrants within countries are highly concentrated in particular regions (at least in some countries). In many cases the highest migrant shares are observed in the capital cities or other larger urban areas. A closer examination shows that most regions exhibit migrant shares in the range between 0 and about 20% whereas only very few regions exhibit migrant shares larger than this. Second, between 2000 and 2005 the distribution has shifted to the right and especially so for the regions with migrant shares up to 20%. This implies that one can observe higher migration shares in most regions.

Table 11

Descriptive results in %, 2005

	Share of high-skilled workers			Share of migrants		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Austria	17.6	13.8	25.9	13.5	6.3	31.7
Belgium	38.4	30.8	50.9	12.1	3.2	37.0
Germany	25.7	18.5	38.8	14.1	3.2	24.5
Spain	32.2	21.9	47.8	11.4	4.0	21.4
Finland	31.5	22.4	37.3	3.6	1.3	9.6
France	25.3	16.3	41.6	9.0	2.7	31.5
Greece	19.9	13.2	29.4	6.2	2.6	12.3
Ireland	30.3	25.9	34.6	11.4	11.1	11.7
Italy	14.3	11.1	19.7	7.3	3.1	12.7
Netherlands	28.8	22.3	39.2	10.2	4.3	17.9
Portugal	13.5	9.1	22.8	7.9	3.9	14.5
Sweden	27.8	22.7	36.9	11.7	6.5	21.9
United Kingdom	29.2	20.6	49.6	7.8	2.7	43.2

Note: The means represent unweighted averages over regions.

In the econometric part we studied the effects of migration on regional GDP per capita growth and patents per inhabitant.

We use the following specification for regional growth:

$$\gamma_{it} = \beta_1 Gap_{i,t-1} + \beta_2 ShGFCF + \beta_3 ShSH_{it} + \beta_4 ShM_{it} + \beta_5 ShSHM_{it} + Dummies + u_{it},$$

Where γ refers to regional GDP per capita growth by NUTS-2 region, taken from Eurostat Regio database. GAP refers to the initial gap in GDP per capita defined as $Gap = (GDP\ per\ capita / \max\{GDP\ per\ capita\})$ (where $\max\{GDP\ per\ capita\}$ denotes the region with highest GDP per capita in the particular year). $ShGFCF$ is the share of gross fixed capital formation in total output, $ShSH$ is the share of high-skilled workers (workers with ISCED levels 5 and 6), ShM is the share of migrants, and $ShSHM$ is the share of high-skilled migrants. In another specification we also use the difference in the shares of native high-skilled workers to migrant high-skilled workers, i.e. $Diff = ShSH - ShSHM$. Here we report the results from various specifications of a random effects model in Table 12. Generally, we find that the share of gross fixed capital formation and the number of patents (per million inhabitants; PTcap $_t$) is not significant in any of these specifications. Further, the gap lagged by one period is significant with the proper (negative) sign, i.e. a lowering of the gap also reduces the growth rate. The share of migrants ShM does not turn out to be significant in any case. More important, the variables of interest are significant and also show the expected sign in most cases. These are the share of high-skilled workers, $ShSH$, and in particular the share of high-skilled migrants, $ShMSH$, or the difference, $Diff$, though these are only significant in specifications (1) and (2), respectively.

Table 12

Econometric results I

Dependent variable: Growth of GDP per capita

	(1)	(2)	(3)	(4)
ln Gap$_{t-1}$	-0.035 ***	-0.034 ***	-0.048 ***	-0.048 ***
	0.001	0.001	0.001	0.001
ShSH$_t$	0.028	0.061 ***	0.046 **	0.063 ***
	0.117	0.000	0.026	0.000
ShGFCF$_t$	-0.004	-0.004	-0.022	-0.021
	0.789	0.802	0.333	0.336
ShM$_t$	0.006	0.006	-0.004	-0.004
	0.658	0.642	0.783	0.804
ShSHM$_t$	0.033 ***		0.017	
	0.001		0.114	
Diff$_t$		0.028 ***		0.015
		0.002		0.146
PTcap$_t$			0.000	0.000
			0.995	0.992
Chi2	600.499	597.809	564.622	563.984
R2 within	0.252	0.251	0.275	0.275
R2 between	0.731	0.729	0.695	0.694
R2 overall	0.352	0.351	0.407	0.407
Obs.	1132	1132	846	846
No. of groups	194	194	187	187

z-values reported below coefficients; ***, **, * denote significance at the 1, 5, and 10% level, respectively. All regressions include country dummies, time dummies and a constant.

With respect to the size of the coefficients the results indicate that an increase in the share of high-skilled migrants (or the increase in difference) by one percentage point increase the growth rate by 0.03 percentage points. As the share of migrants as well as the share of high-skill migrants might be endogenous we tried to instrument for this using the lagged shares as instruments. The results of this exercise are qualitatively similar to those reported in Table 12. In particular, the share of high-skilled migrants remains significantly positive in the first two specifications.

In Table 13 we use the log of patents per million inhabitants as the dependent variable which is regressed on the lagged skill share, the share of migrants and the skill share of migrants or the difference variable. In the random effects specifications (1) and (2) we see that the lagged skill share and the share of migrants are highly significant and positive whereas the variables capturing high-skill migration are not significant. When allowing for a lagged dependent variable in specifications (3) and (4)[4] the share of migrants remain significantly positive; more important, the variables capturing high-skill migration are significant at the 10% level. One should however note that the instruments used in this specification might not be appropriate.[5]

Table 13

Econometric results II

Dependent variable: ln PTcap

	Random effects		Arellano-Bover/Blundell-Bond GMM estimator	
	(1)	(2)	(3)	(4)
ln PTcap $_{t-1}$			0.247 ***	0.251 ***
			0.000	0.000
ShSH $_{t-1}$	1.688 ***	1.661 ***	1.311	1.283
	0.006	0.006	0.130	0.140
ShM $_{t}$	2.043 ***	2.001 ***	1.766 ***	1.876 ***
	0.000	0.000	0.005	0.003
ShMSH $_{t}$	-0.085		0.380	
	0.643		0.113	
Diff $_{t}$		-0.146		0.457 *
		0.430		0.065
Chi2	633.678	634.646	179.279	179.173
R2 within	0.158	0.158		
R2 between	0.742	0.742		
R2 overall	0.712	0.712		
Obs.	850	850	832	832
Nr. of groups	187	187	184	184
Sargan			225.341	223.581

z-values reported below coefficients; ***, **, * denote significance at the 1, 5, and 10% level, respectively.
Specifications (1) and (2) include country dummies, time dummies and a constant; specifications (3) and (4) include time dummies and a constant.

[4] For this we use a GMM type estimator. Instruments in the differenced equation are the further lags of the dependent variable and first differences of the independent variables. In the level equations the instrument used is the first lagged difference of the dependent variable.

[5] The large values of the Sargan test indicating that the over identifying restrictions are not valid.

The results suggest that an increase in the share of high-skilled workers by one percentage point will increase the patents per million inhabitants by little less than 2%. Similarly, a higher share of migrants will increase it by about 2%. With respect to the size of the coefficients the results are in line with the findings by Hunt and Gauthier-Loiselle (2008), who perform similar regressions for the US; for this comparison one has to take into account that we estimated a yearly panel whereas in the paper mentioned the effects are estimated over 10-year periods. The results are however not robust to alternative specifications and when trying to take potential endogeneity, as well as heteroscedasticity of the error term, etc. into account.

8 Policy conclusions

This study provides an overview of the extent and the potential effects of high-skilled migration to the EU27. We wanted to know first of all, how many high-skilled migrants live in the EU, where these migrants come from, and how the European Union is positioned in the international competition for talent. Second we wanted to know how high-skilled migrants fare in European labour markets. To this end we analysed employment, unemployment and inactivity rates by skill groups as well as issues of job-skill mismatch for natives and foreign-born in the EU. Finally we address the issue of the effects of high-skilled migration on productivity and other measures of competitiveness at sectoral and regional levels.

We find that – despite substantial heterogeneity among individual EU countries – high-skilled foreign-born are an important source for high-skilled labour in the EU27. According to data from the European Labour Force survey 9.1% of the total tertiary educated resident population (as opposed to 8.1% of total resident population) in the EU 27 is foreign-born. The share of highly skilled among the resident population born outside the EU is 21.1%, while for within EU migrants it is 23% (as opposed to 17.9% for the native-born population). The foreign-born thus contribute more than proportionately to the share of highly skilled in the EU. Highly skilled migration is, however, also strongly concentrated on individual receiving countries. Around 94.2% of all highly skilled foreign-born in the EU 27 live in the EU 15. Only around 5.8% reside in the EU 12 countries. The three largest receiving countries in the EU 27 (France, the UK and Spain) in sum account for 57,5% of the total stock of foreign-born in the EU 15 (with Germany and Ireland excluded from this sample) and 63.1% of the highly skilled. The share of foreign-born in the total resident population (aside from the obvious outlier of Luxemburg) is higher than 15% in Austria and Sweden but below 10% in Denmark, Greece, Italy and Portugal and even below 3% in Finland.

Immigration policy vis-à-vis high-skilled third country migrants

There was some evidence that – on average – EU OECD economies (EU) had a lower share of highly qualified migrants than the (arithmetic) average of the (high migration) non-EU OECD economies; and that the distance to the average of the major migration receiving countries (such as Australia, Canada, New Zealand) is larger for short-term than long-term migrants. The distance to the US, by contrast, was much smaller and – in many instances – not significant.

Although these international comparisons could not be conducted separately for migration flows inside the EU and from outside the EU, evidence from the European labour force survey suggests that the share of high-skilled among migrants from outside the EU is lower than among migrants from within the EU, despite non-EU countries being a more important source of human capital for most EU 27 countries than migrants from within the EU.

Increasing the skill selectivity of European migration policy

Thus one possible policy initiative to improve the skill structure of migrants is to increasingly target highly skilled migrants in immigration laws. Most EU27 countries have undertaken major steps to change immigration in this direction in recent years, and this has resulted in an increasing share of high-skilled migrants settling in the EU.

However, our results also suggest that this increasing selectivity of immigration regimes is countered by a relatively low qualification structure of short-term migrants in the EU. In particular more recent migrants (having arrived in the EU less than 10 years ago) from the important African, Asian and South American sending regions, are less well qualified. In the aggregate the share of tertiary educated among non-EU-born residents living in the EU27 for less than 10 years is 20.5%, and 21.3% among the more established non-EU-born. For within EU migrants, by contrast, the share of highly skilled among those residing abroad for less than 10 years is 25.9% (relative to 20.9% among the migrants with a duration of residence in excess of 10 years).

Thus the evidence provided in this study also suggests that attempts of improving the qualification structure of migrants to the EU27 are countered by an opposing tendency of increasing labour market demand for low-skilled workers that often enter the EU-labour market as temporary or seasonal workers or illegal migrants. While international competition for migrants is focusing primarily on the high-skilled, comprehensive migration policies thus need to address future labour market needs across the full skill spectrum. Realistically migration policy will thus also need to develop strategies towards less skilled migrants. From the point of view of competitiveness, however, highly skilled migration should be preferred over low-skilled migrants.

Making the EU more attractive for high-skilled migrants

With respect to these high-skilled migrants, however, increasing the selectivity of migration regimes alone will not suffice to attract more highly skilled foreign labour. To be fully effective such measures have to be accompanied by increased efforts at making the European Union more attractive as a destination for highly skilled migrants. In this respect the still fragmented nature of EU labour markets, which make both the mutual recognition of qualifications as well as the transparent portability of entitlements to social security systems difficult even for intra-EU migrants also act as an impediment to attracting high-skilled migrants from abroad. Thus a closer coordination of migration policies with respect to highly skilled migrants among the member states could help to increase the attractiveness of the European Union as a destination for high-skilled workers. Initiatives that enable migrants to work within the entire EU and which focus on the highly skilled, such as the 'blue card', but also the creation of European networks with the aim of cross-linking national agencies and providing job exchange platforms are good examples of the kinds of initiatives that could provide substantial policy returns in this respect.

In addition, increasing the share of highly skilled migrants also has to go hand in hand with structural change in labour demand in the EU, since ultimately labour migration will only occur in sectors, occupations and regions where high-skilled labour is in high demand. Thus there is also a high need to develop migration and labour market policy with respect to the integration of high-skilled foreign-born in co-ordination industrial, thecnology and educational policies and the needs of employers dictated by structural change within the European Union.

Furthermore, results of the previous literature suggest that - aside from tax and social security related arrangements, which may act as a deterrent to high-skilled migration – different subgroups of the high-skilled migrants will be drawn to receiving countries for different reasons. Researchers for instance move abroad to keep up-to-date with the state of the art in their field, to get qualified feedback on the originality, relevance and quality of their research and as an additional source of inspiration. By contrast, political repression, social constraints, no (or only limited) access to research funding, over-regulated bureaucracies as well as precarious conditions of employment or a generally low quality level of universities and other institutions of higher education and research on the other hand deter migration by scientists and researchers. Especially for young researchers this also holds true for rigid career advancement schemes tied to seniority instead of performance. For entrepreneurially-minded individuals, by contrast, the societal and administrative climate for innovation, business-start-ups and self-employment can play important roles (either as push or pull factors) in becoming a migrant. Thus increasing the share of highly skilled migrants, moving to the EU – aside from measures designed to make immigration laws more selective – may also involve a plethora of measures that

focus on increasing the attractiveness of the EU27 for high-skilled migrants that may reach far into other policy fields, usually considered to be unrelated to migration policy.

Using the potentials of student mobility

One group of particular interest in this respect are students. With respect to this group the few results available in the literature on international student flows suggest that many EU countries have been relatively successful in attracting foreign students. This, however, seems to be mostly due to high student mobility within the EU (and thus points to the success of programs enhancing student mobility, such as the ERASMUS program). With respect to student mobility from third countries and students studying in advanced research programs, by contrast, many of the EU countries still seem to be lagging behind the major non-EU receiving countries. Thus initiatives with the aim to increase the attractiveness of European universities for students from third countries and for students intending to participate in advanced programmes (e.g. PhDs) could also be expected in the long run to increase high-skilled migration to the EU.

The success of such initiatives will, however, also hinge on the possibility of these students to work in the receiving countries after completing their degree, here success so far seems to have been rather limited, since the share of highly educated migrants working in EU countries is by and large uncorrelated to the number of students studying in a country. Recently, however, a number of EU27 countries have shifted to migration policies designed to encourage foreign-born students to remain and work in the receiving country at least for some time period after they graduate and it is currently too early to evaluate how successful these measures are in increasing the skill content of migration to the EU.

Return migrants

Another group of particular interest are highly skilled emigrants from the EU that intend to return. Here results from international comparisons suggest that a number of EU countries have a large share of highly educated migrants working abroad and the return intentions of these migrants are still an open question in international migration research. Despite this lack of research, from a policy perspective, ensuring frictionless return and encouraging models of repeat migration (i.e. brain circulation) also with non-EU partner countries are central policy concerns, which have received some attention in the recent migration debate. In particular it has to be expected that in future return and repeat migration will become increasingly common among high-skilled migrants and that migration and labour market management systems will increasingly have to accommodate for this group.

Improving labour market integration of high-skilled third country migrants

A second important policy relevant finding of this study is that high-skilled migrants in the EU face a number of challenges when entering the European labour market, that make

them distinct from other migrant groups such as less skilled migrants. In particular the high-skilled migrants – in contrast to less skilled migrants - have lower labour market participation rates, higher unemployment rates and lower employment rates than comparable natives and face substantially higher risks of being employed in jobs that do not fit their skill structure.

Econometric evidence based on the EU-LFS suggests that (after controlling for country of residence, age and gender,) highly skilled foreign-born in the EU have a lower probability of being employed (by 9.3 percentage points), a 3 percentage points higher probability of being unemployed and a by 5.4 percentage points higher probability of being inactive than comparable natives. Less skilled foreign-born, by contrast, have a by 2.9 percentage points higher probability of being employed than comparable natives and face a 5.4 percentage points lower risk of inactivity but a 1.2 percentage points higher risk of unemployment. Thus (even after controlling for compositional effects) highly skilled – in contrast to less skilled - migrants in the EU27 are substantially (by 9.3%) less likely to be employed than highly skilled natives. In addition according to results from the EU-LFS 19.4% of the native-born highly skilled, employed in the EU27 (excluding Germany and Ireland) were overqualified, but 33.0% of the highly skilled foreign-born. This thus points at a substantial underutilization of highly skilled foreign labour in the EU27 due to non employment and over-qualification.

These results thus suggest that aside from policies directed at attracting more high-skilled migrants, there is also a need for increased efforts at integrating highly skilled foreign-born into the labour market. Here aside from measures directed at improving foreign language knowledge of migrants, improving the mutual acceptance of professional qualifications, increased training and actions to fight discriminatory practices in the workplace, a number of EU27 countries have recently adopted measures that increasingly acknowledge that improved integration requires a more broad-based approach, that is backed by measures to improve the social, cultural and political integration of foreign-born. Often in such policies national approaches are also augmented by more regionally focused initiatives to improve the integration of foreign-born.

Aside from this our results, however, also point to a number of particular focus groups among the high-skilled that may require particular policy attention. This applies in particular to highly skilled foreign-born women. Virtually all our results indicate that gender differences to the disadvantage of women with respect to employment, unemployment and inactivity as well as over-qualification rates are larger among the foreign-born than among natives. This points to the double disadvantage often faced by foreign-born women when integration into the labour market of host societies.

A further target group for such measures, highlighted, by our results, are more recent migrants. Here our results suggest that differences in activity, unemployment and employment as well as over-qualification rates between more recent migrants and established migrants is larger for the high-skilled foreign-born than among the low-skilled foreign-born. High-skilled migrants thus often have to accept a sizeable 'transferability discount', which is strongly borne out by the high degree of overqualification (but also by lower employment rates) in our analysis. On the other hand low-skilled migrants find it easier to transfer their skills, which are lower in any case. Thus almost by definition high-skilled migrants are also more likely to benefit from measures aimed at better labour market integration (such as improving language proficiency and training in the host country) than the less skilled.

In addition, our results also indicate that highly skilled migrants from more distant destination countries also have larger problems in integrating in EU labour markets. Thus it has to be expected that increased efforts at attracting high-skilled migrants, which will almost by necessity also entail an increased share of migration from countries that are more remote from Europe (such as for instance Asian countries), will also have to be accompanied by increasing efforts at labour market integration of foreign-born.

Finally, a number of results in the literature (see Chiswick and Miller, 2007; Bock-Schappelwein et al., 2009) also suggest that aside from labour market integration, integration of foreign-born children into the school system of the receiving country requires close attention. Persons migrating in their late teens (i.e. above the ages where compulsory education has ended) often end up, with substantially lower educational attainment, than migrants migrating earlier or later in their lives.

Policies directed at high-skilled migrants within the EU

Finally, it should be noted that aside from highly skilled migrants from third countries also high-skilled migrants within the EU are often faced with a sizeable "transferability discount" of their human capital, which is reflected in higher rates of over-qualification and lower employment rates. This applies even to migrants migrating from one EU15 country to another, but even more strongly to the more recent group of migrants from the EU12 to the EU15, who are often faced with very high rates of over-qualification. According to our results high-skilled migrants from the EU 12 (even after controlling for differences in age and gender structure) face a by 29.6 percentage points higher risk of being overqualified than natives and medium-skilled migrants from the EU 12 have an over-qualification risk that is by 19.6 percentage points higher than that of natives.

While the policy instruments to reduce these substantial rates of over-qualification among within EU migrants clearly should follow similar lines as initiatives directed at third country migrants (i.e. giving high priority to formal and informal transferability of qualification,

language proficiency and training), it would seem that in particular with respect to these intra-EU migrants the role of the European Commission in devising such policy instruments and supervising their efficient implementation should be particularly important.

Policies directed at exploiting sectoral and regional allocation patterns of migrants

Our analysis regarding the impact of migration and of high-skilled migration in particular on sectoral productivity and gross value added (levels and growth) was still preliminary (in the sense of endogeneity issues not being fully resolved), but yielded a number of interesting results regarding the relationship between migration and productivity using sector level data. Particularly interesting was the difference of the impact of the share of migrants in levels and growth specifications, as well as the importance of a break-down by different groups of migrants (from EU and RoW). There was also a relatively robust result of a positive impact of the share of high-skill migrants and of an interactive effect of high-skill migrant share and ICT technology. Furthermore, it was shown that industry heterogeneity specifically with respect to a manufacturing vs. services sectors breakdown was important.

The overall implications of the result support the insights gained from other (country-specific) studies (see e.g. Paserman, 2008) and also from our analysis of the pervading phenomenon of 'over-qualification' that the allocation of migrants to jobs/firms/sectors is negatively related to the productivity levels in these jobs/firms/sectors – the result obtained from our level specifications – but that they contribute positively to productivity growth. It was interesting to see that migrants which undergo more skill-screening (RoW migrants) do not show the negative allocation effect in the same way – in fact the effect is often positive – and that the share of high-skill migrants mostly yields positive level and growth effects. Taking these results at face value (i.e. forgetting about the still unresolved endogeneity issue) one can conclude that there is a positive relationship between migrant shares and productivity (and output) growth and the level relationship between migration and productivity (which is an allocation effect of migrants across sectors) can be influenced through skill screening. However, one might also argue that migrants perform an important 'greasing of the wheels' function (see Borjas, 2001) in that they contribute to productivity growth also in industries which are lower productivity in levels which might be important in itself.

As regards the analysis of migrants and regional growth and regional technological development (proxied by patents per capita) we found a positive relationship between the share of high-skilled employed persons and of high-skilled migrants and the growth rate of regional GDP per capita. When looking at patenting (per capita) as the dependent variable we also found a positive significant relationship with the share of migrants. However, also these results were not robust to changes in specifications when trying to take potential endogeneity into account, so further work on this will be important. There are various avenues open to deal with this issue (exploring particular instrumental variables) but the

data-base did not allow us to make much progress so far. Nonetheless the results obtained do point to a positive relationship between the share of high-skill migrants and regional growth and of the share of migrants in a region and a region's patenting activity. The analysis of the dynamics of migrants' shares across regions revealed another interesting phenomenon: migrants' shares (and this is true also for their shares amongst skilled workers) are increasing particularly in two types of regions: in those in which they traditionally occupied a relatively low share – which amounts to a dispersion effect – and in those in which there was already a relatively high share – which is an agglomeration or network effect. The results on skilled migrants shares and regional growth (and that of migrants' shares and patenting) thus results from a possible positive relationship in both these two types of regions. On the one hand, they might contribute through an increased degree of 'dispersion' which amounts again to a 'greasing of the wheels' effect and on the other hand they might contribute through an 'agglomeration effect' which might take account of possible complementarity or externality effects on the productivity of existing stocks of migrants or of domestic workers. A possible way to disentangle these two effects would be to analyse the relationships separately for different groups of regions and test for complementarity effects explicitly. This will be explored in further research.

Keywords: migration patterns, high-skill migration, job mismatch, productivity effects

JEL classifications: J61, I21, J11

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Chapter 1
Highly skilled migration: a survey of the economic literature

1.1 Introduction

There are a number of reasons to believe that - next to other R&D and education related policies – the extent and structure of migration to the European Union will be one of the major determinants of the competitiveness of the European economy in future years. As repeatedly stressed in the literature highly skilled migrants can potentially have a substantial impact on the competitiveness of an economy. In the US for instance a recent paper by Hunt and Gauthier-Loiselle (2009), cites literature that foreign-born in the US account for about 26% of the US Nobel Price recipients (Peri 2007), 25% of founders of venture-backed US companies (Anderson and Platzer, 2006), 25% of new high tech companies with more than one million US dollars of sales and 24% of international patent applications (Wadhwa et al., 2007) although they account for only 12% of the residents.

In addition to these advantages it has also been argued that shifting the structure of migration to the more highly skilled may – due to their better integration into the labour markets of the receiving countries – also have a positive impact on social security and transfer systems (see Chiswick, 2005).

These potential advantages of high-skilled migration are also reflected in the policy arena. In the face of ageing European societies and growing needs for highly skilled labour, the developed market economies of the EU member states are facing increased competition for highly skilled migrants, to support national innovation systems, provide entrepreneurial activity and support welfare systems in ageing societies, and a number of member states have implemented migration policies to attract increasing shares of highly skilled migrants. Furthermore also the European Commission (as evidenced for instance by the recent green paper on the European Research Area; see EC, 2007) acknowledges the fact that 'It is ... essential to establish a single European labour market for researchers, ensuring effective "brain circulation" within Europe and with partner countries and attracting young talent and women into research careers' (EC, 2007, p. 11).

As, however, also pointed out by the Commission's Employment report (EC, 2008) increased migration brings with it new demands on economic policy. This applies in particular to the need of developing appropriate integration policies and – of particular importance for the migration of highly skilled – institutional arrangements to guarantee that highly skilled migrants can transfer skills across borders and apply their knowledge in the host economies.

Furthermore, highly skilled migration – aside from positive effects - may also have negative impacts on natives. In particular if high-skilled migration is a substitute to national high-skilled labour and has no additional growth inducing effects (such as generating innovation, increased international trade or entrepreneurship,) this may – due to increased labour supply – reduce wages for the native highly skilled and may also reduce incentives for training of the native population.

Furthermore, migration incentives for the highly skilled may differ from those of the less skilled. Highly skilled are likely to put more emphasis on career aspects in their decision to migrate (see for instance Ackers, 2005) and the migration of highly skilled 'has additional and complex aspects relating to research opportunities, work conditions and access to infrastructure' (OECD, 2007, p. 23). For instance, for students issues such as the quality of training facilities and mobility grants may be important determinants in their decision to become mobile (Trembay, 2002), while for those highly skilled already in the workforce additional factors such access intra-firm arrangements to allow for international mobility (for instance within multinational enterprises) may be more important for migration decisions (see Hunt, 2007 for evidence).

Despite the substantial academic and policy interest in issues associated with high-skilled migration, there is to date only very little literature which focuses exclusively on high-skilled mobility.[6] This applies in particular to the alleged positive effects of high-skilled mobility on the receiving countries. For instance in a recent survey of this literature OECD (2007) concludes that in general there is a scarcity of research on the impact of high-skilled mobility on receiving countries and that the existing literature is plagued by data and methodological problems, which make it hard to identify these effects. In this literature survey we thus focus on the topic of high-skilled migration. After shortly discussing measurement issues (in the next section), we first discuss both labour demand and supply side factors which influence the extent and the structure of international migration, focusing strongly on how highly skilled migrants may differ from low-skilled migrants in section 3.

In Section 4 we discuss the potential positive and negative effects of high-skilled migration. Here we highlight potential differences in short- and long-run effects of high-skill migration, by arguing that in the archetypical short-run labour market model, high-skilled migration will lead to lower wages and reduced employment of natives in those segments of the labour market, in which employment of immigrants occurs. We, however, also argue that this finding hinges primarily on the assumption of foreign and native labour being perfect substitutes and there being no growth inducing effects of high-skilled migration through factors such as innovation, new firm formation, increased trade and FDI and ultimately productivity.

[6] This applies in particular to research on highly skilled migration in the EU countries, with most research to date focusing on the US.

Given this theoretical prediction, we continue by surveying the literature on the potential positive as well as negative effects of high-skilled migration on the receiving country from an empirical perspective. Here we first focus on potential short-run impacts of high-skilled migration on wage and employment levels, putting particular emphasis on the recent literature discussing the elasticity of substitution between migrants an natives as well as the recent literature on the impact of migration on entrepreneurial activity, innovation, productivity as well as on other international factor flows (FDI and trade).[7]

Section 5 finally concludes by arguing that, while evidence on effects of high-skilled migration on the wages and employment of high-skilled natives is conflicting, and at worst indicates only very minor losses in wages and employment, there seems to be an emerging consensus at least in the US literature that high-skilled migration has contributed significantly to increasing patent output and (more ambiguously) to increasing new firm creation. Furthermore, there is also a robust and positive correlation between increased high-skilled migration and trade as well as FDI growth between sending and receiving countries.

1.2 Measurement of highly skilled migration

While there is some literature on motivations and effects of high-skilled international migration, there is to date no consensus, on how exactly high-skilled migration can be measured. While most of the research agrees that – especially in international comparisons – international migrants should preferably be measured according to the concept of foreign-born rather than by nationality in order to avoid distortions arising from nation specific differences in naturalization of foreign citizen (see for instance EU, 2008), no such agreement has yet been reached with respect to the measurement of the skill content of international migration. In the literature at least two different approaches to measuring high-skilled migration have been used:

First, a number of authors (e.g. Belot and Hatton, 2008,) have suggested that the skill-content of migration should best be measured through the human capital migrants have acquired in their past (to which we refer as education based measures of migrant skills). Here the highest completed education of migrants is used to measure high-skilled migration. According to this definition high-skilled migrants are usually considered to be migrants that have completed university education (i.e. ISCED levels 5 and 6)

[7] We thus largely ignore the large and important literature on the effects of emigration of highly skilled on sending countries (see. Docquier et al., 2005; Güngör and Tansel, 2007, for recent contributions and Commander et al., 2003, for a recent survey). The reason for this is that from the perspective of the European Union – and despite some recent concerns expressed on potential brain drain from EU countries (see e.g. Johansson, 2008; Becker, Ichino and Peri, 2003; Saint-Paul, 2004) – the role as a receiving country of high-skilled migrants is more important in terms of total worldwide migration flows.

Alternatively a number of other authors have argued that the skill content of migration would be better measured by the use of their human capital in the receiving country, which accordingly is best proxied by the employment status of migrants (employment based measures of migrant skills). Here some authors have defined high-skilled migration as foreign-born workers working as human resources in science and technology (see Auriol - Sexton, 2002; OECD, 2007). According to this definition (which is encoded in the Canberra manual) highly skilled migrants are considered to be workers that have completed a university degree (i.e. an educational attainment at ISCED level 5 or more) and that are also working in an occupation, which requires high-skilled workers.[8] Others (such as OECD, 2008) by contrast have defined high-skilled workers by occupational level (where highly skilled are usually defined as persons that have an occupation which is equivalent to an ISCO level of professionals) and yet another group of authors has focused on the international mobility of R&D personnel, which according to the Frascati manual (OECD, 2002a) is defined as 'professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned'.[9]

While each of these definitions is useful in some contexts it also implies a slightly different focus of research. In particular as recently pointed out by OECD (2008a) measures of high-skilled migration that focus on the employment status, highlight that labour market needs and recruitment practices for migrants are defined around the skill requirements of vacant jobs in receiving countries and that human capital acquired in one country may not automatically be transferable across national borders. By contrast measures of migrant's skills based on educational attainment more strongly reflect receiving countries concerns with the skill structure of migrants as a determinant of their medium or longer term chances of integration and acknowledge that, although some highly educated migrants occupy less skilled jobs initially, many highly educated migrants gradually progress out of low-skill jobs as they become more integrated in the host economy.

In the context of this study, which is intended to provide a broad overview of the situation and effects of highly skilled migration in the European Union, and in which we explicitly want to discuss issues of over- qualification, we primarily focus on the definition of highly skilled via educational attainment (i.e. ISCED level 5 or more), since it is the most encompassing (and also most readily available in terms of data). We however touch upon

[8] These are the following ISCO groups: 122 – Production and operating department managers, 123 other department managers, 131 - general managers, 21 – Physical mathematical and engineering science professionals, 22-Life science and health professionals, 23 – Teaching professionals, 24-other professionals, 31 Physical and engineering science associate professionals, Life science and health associate professionals, 33-teaching associate professionals, 34-other associate professionals.

[9] Finally, a further strand of the literature (see Tremblay, 2002; Parey and Waldinger, 2007; Bessey, 2007; Dreher and Poutvaara, 2005) on which we focus only in passing in this survey, but which could also be seen as a literature related to the migration of highly skilled, has focused primarily on student mobility.

alternative definitions where this is important for the assessment of the situation and effects of highly skilled migrants in the European Union.

1.3 Demand for and supply of high-skilled migrants: motives

Before looking at the effects of high-skilled migration on the host economies, we would first like to review the most important reasons for international mobility among the high-skilled by focusing, first of all, on the question of why firms recruit high-skilled migrant workers in the industrialised economies and, second of all, on the question why high-skilled workers may move across national borders.

1.3.1 Determinants of demand for high-skilled immigrants

In Europe, a firm survey covering Germany, France, the United Kingdom and the Netherlands was carried out in 2000 to shed light into the first of these questions. The survey included the total of 850 firms with at least 100 employees from the chemical industry, manufacturing, financial services, IT, and R&D (Winkelmann, 2001). On average, in this survey a proportion of 11% of foreign-born high-skilled (i.e. graduate) employees among all employees was found, with the largest share in the Netherlands, 17%. In terms of industries, the highest incidence of foreign high-skilled employees has been found in IT and R&D.

Evaluating the results of the survey, Winkelmann (2001) finds partial evidence both for the hypothesis that foreign and domestic high-skilled workers are substitutes, implying that firms hire foreign high-skilled workers mainly because of insufficient domestic supply, and the hypothesis of complementarity between foreign and domestic high-skilled employees, in the case of which the recruitment of the former is mainly motivated by their promoting technology diffusion or their cultural knowledge related to foreign markets. The survey also allowed to discern that many firms, that have not recruited high-skilled staff internationally did so because of the high costs, including legal barriers and expected difficulties of integration within the firm. Besides, the survey found that the firms recruiting internationally are more oriented towards international markets and have higher technology intensity than other companies. Interestingly, already at the time of the survey, Eastern Europe has been an important source country of high-skilled foreign workers in the countries studied (Winkelmann et al., 2001).

Epstein et al. (2002) using the same data draw different conclusions, underlining the similarity of domestic and foreign high-skilled workers in terms of their specialisation and skills and the fact that many firms refer to the lack of sufficiently good domestic candidates for their jobs. With these findings, Epstein et al. (2002) support a theoretical efficiency

wage model, arguing that a limited number of foreign high-skilled employees in a firm serves to signal the domestic employees the risk of their replacement from the “reserve army” pool abroad and makes them refrain from shirking.

The study of high-skilled migrants’ occupational choices by Chiswick and Taengnoi (2007) can also be read to reflect the demand for migrant workers across different occupations. Their analysis of US Census data shows how the presence of high-skilled migrants in various occupations depends on their English language proficiency: those with little such proficiency tend to assume occupations that require less communication. As an exception, high-skilled migrants with little English language proficiency are also found in services occupations, where they are likely to offer services for fellow migrants, so that the reliance on the English language is mitigated.

1.3.2 Supply-side motives for high-skilled migration

Apart from these factors affecting the demand for high-skill immigrants it is also important to review highly skilled workers' motives for migration. While it can be assumed that – as in the basic neoclassical model of migration – movements abroad are induced by economic incentives (like income opportunities), the literature has identified some points where distinctions between migration in general and migration of highly skilled individuals can be made. This applies especially to migration between developed countries where – in contrast to migration from developing to industrialised countries – the differences in income opportunities are not as pronounced. Broadly speaking, two strands of literature can be identified: the first has developed theories about the determinants of the aggregate skill distribution of migrants based on Roy's (1951) self-selection model. The second deals with ‘push’ and ‘pull’ factors as individual motives for migration of highly skilled workers.

The most widespread model for explaining the aggregate skill distribution of migrants is Borjas' (1987, 1999) applications of Roy's (1951) model to migration. The model presumes that migrants are not randomly selected from among the source country's population, but rather select themselves into becoming migrants based on the relative returns to skills at home and abroad. Positive selection (i.e., migrants are drawn from the upper tail of the source country's skill distribution) occurs when the host country offers a higher rate of return to skills than the home country, e.g., when the source country ‘taxes’ high-skill workers, while it ‘insures’ less skilled workers against poor labour market outcomes in return. In contrast, negative selection (i.e., migrants are drawn from the lower tail of the source country's skill distribution) occurs when the home country offers a higher payoff to skills relative to the target country (see Borjas, 1999). This result can also be interpreted in terms of income inequality: positive selection occurs if the source country has a more equal income distribution (relative to the host country), while a relatively egalitarian income

distribution in the home country (compared to the host country) induces negative selection (Liebig and Sousa-Poza, 2004).

Empirical studies for various countries (see, e.g., Cobb-Clark, 1983; Taylor, 1987; Borjas, 1987, 1991; Bratsberg, 1995; Yashiv, 2003; Hunt and Mueller, 2004; Ibarran and Lubotsky, 2005; Nakosteen, Westerlund and Zimmer, 2008) generally confirm the theoretical predictions of this model. Recent empirical findings about the effects of tax system characteristics (like the personal income tax rate or progressivity) on skilled migration are also consistent with this model. For instance Egger and Radulescu (2008) find that differences in income progressivity as well as average employer and employee born income tax rate differences have a strong and significant impact on bilateral migration flows of highly skilled among 49 industrialised countries and Cohen and Razin (2008) find that countries with more generous welfare systems also receive a lower share of high-skilled migrants.

But the results of the standard model proposed by Borjas (1987) only hold if migration costs are negligible, random or proportional to earnings. These assumptions can reasonably be questioned. The 'selection rules' of the Roy model were thus challenged, among others, by Chiswick (1999). He argues that if migration costs are fixed and sufficiently large, positive selection can be expected irrespective of the source and target countries' income distributions, because low-skill individuals will find it too costly to move and high-skill migrants will find it easier to cover migration costs through a higher income in the host country (McKenzie and Rapoport, 2007). All else equal, the same holds true if migration costs are decreasing in skills, i.e., if high-skilled migrants find it less difficult to find a job abroad (Borjas 1999, Chiswick 1999, Brücker and Defoort 2006, McKenzie and Rapoport 2007).[10] Migrant networks will thus – all else equal – lead to a more negative self-selection of migrants because they decrease the costs of migration for (less skilled) followers (McKenzie and Rapoport, 2007). The selection of migrants can thus be reversed by migration costs and networks. Depending on the countries covered by the empirical analysis, this can lead to contradicting empirical findings.

On the other hand, as Borjas and Bratsberg (1996) show both theoretically and empirically, the possibility of return migration will accentuate the self-selection of migrants. Migration often serves career or life-cycle motives: some individuals want to work abroad only for a specified amount of time and then return to their home countries after acquiring (human or physical) capital or wealth abroad. Those who stay in the host country will, however, be selected either from the upper tail (in the case of positive selection) or the lower tail (in the case of negative selection) of the skill distribution. Thus, either the 'best of the best' or the

[10] See also Brücker and Trübswetter (2007) as well as Hunt (2004) for empirical evidence on lower mobility costs of the highly skilled.

'worst of the worst' will stay abroad, depending on the type of selection that characterized migration to the host country in the first place.

But self-selection only determines the skill distribution of migrants relative to their home country's skill structure, not the size of the migration flow. Broadly speaking, the latter is determined by migration costs and the relative income levels abroad and at home. Self-selection also does not explain the choice of target countries,[11] also referred to in the literature as 'migrant sorting': 'positive sorting' is said to occur when high-skill migrants tend to settle in countries with higher absolute (post-tax) returns to skills and can be seen as a phenomenon independent of the selection question (Grogger and Hanson, 2008). Furthermore, Roy-type models can only predict the relative skills of migrants compared to the source country's population. Because selection also affects the skill differential between migrants and natives in the host country, a migrant flow's skill structure can only be interpreted against the background of the average skill differential between the source and host economies (Borjas 1999, p., 1714). A positively selected flow of migrants (with respect to the source country's skill distribution) may be comparable to the lower tail of the host country's labour force. This can be aggravated if skills are not fully transferable between countries: if high-skill migrants' educational attainments are not accredited in the host country (in which case they would end up in the lower tail of the host country's skill distribution), they might refrain from migrating abroad to 'protect' themselves from an unfavourable comparison with (in principle) equally skilled natives and a loss in 'prestige' (Fan and Stark, 2007), thus leading to a negative selection of migrants.

Aside from selection the extent and structure of international migration is, however, also stongly influenced by institutional arrangements regulating the inflow of different workers.[12] In particular a number of EU countries have stipulations regulating the access to the labour market of often low-skilled temporary and/or seasonal workers, while at the same time having moved to migration regimes that are more selective with respect to human capital attributes.[13] In this respect in particular the recent policy initiatives of some major OECD migration receiving countries (such as Australia, New Zealand and Canada) to introduce migration regimes based on point systems have been a central focus of policy discussions. For instance Richardson and Lester (2004) argue that the worse education structure of migrants to Canada relative to migrants to Australia can be accounted for by differences in immigration laws, while Birell, Hawthorne and Richardson (2006) suggest that the

[11] In this respect a recent study by Constant and D'Agosto (2008) shows that scientists' and researchers ' choice of destination regions is strongly correlated with the field of research and that access to funds is an important determinant for choosing the US.

[12] See OECD (2007) for an overview of the institutional stipulations regulating low-skilled migration in some OECD countries

[13] High-skilled migrants, by contrast, may often have access to 'low cost' migration channels provided by recruiting practices and career paths in multinational companies (see Hunt, 2004, for evidence).

Australian point system has been instrumental in guaranteeing high-skilled migration to Australia.

This finding has, however, been challenged in an econometric study by Jasso and Rosenzweig (2008), who find that the differences in skill composition in migration to the US and Australia can be fully explained by differences in returns to education and in particular vicinity to Asian countries, (which account for a large share of high-skilled migration). Thus according to this study there are few signs of migration policy having an additional impact on the selection of high-skilled migrants after controlling for income differences and geographic location of receiving countries.

Apart from these selection and policy issues, "push" and "pull" factors will affect the migration decisions of highly skilled workers on an individual level. For example, the importance of career motives as push and pull factors for high-skilled migration was highlighted by Körner (1999). Working abroad (at least for some time) increases the income opportunities of the highly skilled, both abroad and in their home countries. Furthermore, the prospect of better (on the job or vocational) training, research and education possibilities abroad constitute "pull" factors for highly-skilled migrants. Especially highly skilled individuals from developing countries will prefer to work abroad if there is a lack of career advancement opportunities in their home countries (Körner 1999, Mahmood and Schömann 2003).

In addition, some push and pull factors apply specifically to individuals in academia or entrepreneurs. Researchers move abroad to keep up to date with the state of the art in their field, to get qualified feedback on the originality, relevance and quality of their research and as an additional source of inspiration ("pull" factors, see Nerdrum and Sarpebakken 2006). Political repressions, social constraints (Dutari, 1994), no (or only limited) access to research funding (Constant and D'Agosto 2008, OECD 2008), overregulated bureaucracies (Constant and D'Agosto, 2008) as well as precarious conditions of employment or a generally low quality level of universities and other institutions of higher education (Körner, 1999) on the other hand constitute "push" factors for migration by scientists. Especially for young researchers this also holds true for rigid career advancement schemes tied to seniority instead of performance (OECD, 2002). Conversely, a high degree of political freedom and freedom of research, availability of research funding, a high quality of institutions of tertiary education, performance-oriented career schemes in academia and the opportunity to work with "star scientists" in prestigious institutions (Nerdrum and Sarpebakken 2006, OECD 2008) constitute "pull" factors for highly-skilled science and research personnel to migrate abroad.

Similar arguments apply to students. In a recent study on student migration to Germany for instance Bessey (2005) shows that, in contrast to determinants of other international

migration flows, student flows are not influenced by differences in GDP per capita between sending and receiving countries. Factors such as grants, academic excellence and existing exchange programs seem to be much more important. In a similar vein Parey and Waldinger (2007) stress the importance of the EU's ERASMUS program in fostering student mobility. They extend on this finding, however, by showing that being mobile as a student also increases the probability of migrating later in life. According to their results having been internationally mobile as a student increases the probability of later working abroad by 15 to 20 percentage points. This is a finding that is consistent with Dreher and Poutvaara (2005), who suggest that also in aggregate student mobility from a particular sending country to the US is a good predictor of total mobility to the US.

For entrepreneurially-minded individuals, finally, the societal and administrative climate for innovation, business-start-ups and self-employment can play important roles (either as a push or pull factors) in becoming a migrant. Finally, high-skilled migration also evolves with the growth and spread of multinationals which transfer highly skilled employees within the company (OECD, 2002). Generally, the relative importance of these factors will, however, vary with professions and type of work (Mahroum, 2001).

1.4 Effects of high-skilled migration on the host economies: empirical results

1.4.1 Some theoretical considerations

Given the different determinants of high-skilled migration a large literature has also focused on the impact of migration on the receiving country in particular on the labour market outcomes of natives. Although this literature has primarily focused on the effects of migration in general, without giving particular emphasis to the effects of high-skilled migration, it provides a useful theoretical background around which the discussion of the effects of high-skilled migration can be cast.

Early contributions to this literature (e.g. Freeman and Katz, 1991) start from a baseline labour market model, in which native and foreign labour are perfect substitutes and use the regional or sectoral variation in the share of foreign-born (or its change over time) to identify the effects of migration on natives. In this simple supply-demand framework an increase in labour supply unambiguously reduces wages and (if the labour supply schedule is not completely inelastic) employment of natives, with the relative size of these effects depending on the (relative) wage elasticities of labour demand and supply.[14]

[14] A further special case in this literature occurs when the labour demand schedule is infinitely elastic with respect to wages, as is often assumed in models of international trade. In this case wages and employment levels of natives do not change as a reaction to increased migration.

As pointed out by the more recent literature summarised below, however, this model's predictions hinge on a number of assumptions that are often hard to justify empirically. In particular a first important assumption is that foreign and native labour are homogeneous and thus perfect substitutes. If, by contrast, it were assumed that labour is heterogeneous and that natives and foreigners (of for instance different skill levels) were imperfect substitutes or even complements, predictions on the labour market effects of migration could change dramatically, depending on the value of the elasticity of substitution between different kinds of labour. In the context of the labour market and more general economic effects of high-skilled immigration to the host country thus, an important question is whether high-skilled migrants are substitutes or complements to natives. Depending on the extent to which foreigners substitute or complement natives, migration will have different effects on wages and employment, respectively.

Second, the identification strategy followed in much of the early work on the labour market effects of migration implicitly assumes that native workers are immobile across regions, sectors and/or occupations. In reality, however, native workers have a number of possibilities to "escape" from increased competition in a certain labour market segment through mobility. For instance if a particular region experiences a strong inflow of migrants, natives may choose to move to another, less affected region. Similarly, if a certain sector or occupation is strongly affected then moving employment across sectors and occupations may be a viable strategy. Thus a second important question concerning the impacts of migration on native labour markets is how and whether aside from wage and employment changes native workers react to increased migration through regional, sectoral and occupational mobility.

Finally, a third central assumption of the standard labour demand and supply analysis is that migrants do not bring capital with them. If one is willing to take a wide view of capital, which includes human (and potentially also social and entrepreneurial) capital, this assumption seems particularly implausible in the context of high-skilled migration. Indeed given the recent theoretical and empirical literature on endogenous growth[15], which highlights the importance of human capital externalities and networks on growth, it is easy to construct theoretical models, in which increased high-skilled migration has a positive impact on innovation, trade, FDI, entrepreneurship and potentially also productivity and GVA growth. Thus a third central empirical question related to the effects of high-skilled migrants on the receiving economy is whether these migrants, through increasing the human capital basis of the receiving economy contribute to increased innovation, trade, FDI, entrepreneurship and productivity and GVA growth.

[15] See for example Romer, (1986), Lucas (1988) and Romer (1990) for classical references in this literature

These three questions are also the central concern of most of the recent empirical literature on the effect of high-skilled migration on native economies and can serve to structure a review of this literature.

1.4.2 Are migrants and natives substitutes or complements?

While previous influential analyses on the impact of migration on natives' wages such as Borjas (2003) assumed perfect substitutability between domestic workers and foreigners, the complementarity between natives and foreigners on the labour market has received increased research interest only recently. Ottaviano and Peri (2006) were the first to investigate the wage effects of immigration to different groups of natives in a nested CES production function framework (as introduced to the study of the changes of supply and demand on the wage structure by Card and Lemieux, 2001), where the elasticity of substitution between natives and foreigners is obtained from estimating relative labour demand for native and foreign workers. In particular, it is the negative inverse of the estimated elasticity of the relative wage of natives against that of migrants with respect to their relative labour supply. Variation is obtained from grouping natives and foreigners into groups of education levels and experience categories.

The estimates of Ottaviano and Peri (2006) show that substitutability between foreigners and natives is incomplete and in particular highest for intermediate levels of education. For the extreme groups of high school dropouts and college graduates, elasticities of substitution between 3 and 5 are found. According to the authors, this is likely to be because of the occupational choices of foreigners that are rather different in the high-skilled segment, where specific talent is needed, and in the low-skilled segment, where certain jobs are avoided by natives. In the intermediate groups, they see less scope for specific skills.

The methodology of Ottaviano and Peri (2006) has been influential for the analysis of the impact of immigration on the host country wage structure (see below). However, their empirical results are heavily contested by Borjas et al. (2008). Using the same data, they show that the Ottaviano and Peri (2006) results cannot be maintained once heterogeneity in labour market attachment of workers is taken into account and more attention is paid to the measurement of the rental price of labour.[16] Borjas et al. (2008) claim that, with a careful construction of the variables, the hypothesis that natives and foreigners are perfect substitutes in all education groups cannot be rejected. Similarly, in a previous study using micro data from national censuses, Aydemir and Borjas (2006) report that perfect

[16] In particular Borjas et al. (2008) criticise that Ottaviano and Peri (2006) classify high school students as high school dropouts: including such students into the sample decreases the relative size of the labour supply shock into the respective skill group and increases migrants' wages relative to the natives' average, which results in a downward bias in the estimated elasticity of substitution.

substitutability between foreigners and natives cannot be rejected for the United States and Canada.

Following this debate several recent papers have studied the complementarity of foreign and native labour in the nested CES function approach employed by Ottaviano and Peri (2006) with European data as well. With British data from the mid-1970s to the mid-2000s, Manacorda et al. (2006) find an elasticity of substitution between immigrants of natives of between 5 and 6.3, implying imperfect substitutability in production between immigrants and natives. They cannot reject the hypothesis that the elasticity of substitution between natives and foreigners varies by education levels. Hence, high-skilled migration is not found to differ from migration in general in this respect. According to their analysis, new immigration produces negative labour market effects on earlier arrivals, suggesting that earlier and more recent immigrants are closer substitutes.

This finding is reinforced by D'Amuri et al. (2008) using German employee data for the period 1987 to 2001. They estimate an elasticity of substitution of 16 to 21 between natives and immigrants. Differences between different groups defined by education are not considered. Similar to the findings of Manacorda et al. (2006), their results also point at the fact that new and old immigrants are perfect substitutes.

Using the same German dataset as D'Amuri et al. for the period 1980-2004, Brücker and Jahn (2008) find a very similar elasticity of substitution between native and foreign workers of around 15 to 20 for all education groups except university education, which indicates imperfect but relatively high substitutability. Interestingly, they cannot reject the null hypothesis that foreigners and natives are perfect substitutes for the group of university educated, which stands in sharp contrast to the results of Ottaviano and Peri (2006) of high complementarity among foreigners and natives at the ends of the skill distribution.

Finally, with German household survey data from 1984 to 2005, Felbermayr et al. (2008) find an overall elasticity of substitution between foreigners and natives with the same education and experience of around 7.4, which is smaller than the results for Germany reported above. Interestingly, differentiating by levels of education, Felbermayr et al. (2008) find a lower elasticity of substitution, (of around 4,) for the highest level of education, which remarkably differs from the results of Brücker and Jahn (2008). Felbermayr et al. (2008) besides find insignificant elasticity coefficients for the ISCED 4+5 levels, implying perfect substitutability between foreigners and natives at this level. They explain this finding with the fact that this educational group mainly contains degrees that are specific to the German educational system, which must have been acquired by foreigners in Germany.

Felbermayr et al. (2008) also go one step further than the papers discussed above insofar as they construct general equilibrium elasticities of complementarity between natives and

workers that incorporate cross-experience and cross-educational complementarity effects as well. Such 'elasticities of q-complementarity' (Felbermayr et al., 2008: 36) are reported for four experience categories in four groupings of education levels each. According to their calculations, complementarity between foreigners and natives is lower across experience levels than within the same experience group, both for the same and different educational attainment groups respectively. Complementarity between native and foreign workers across experience groups is found lowest in the ISCED 4-5 group of education levels. In terms of total received effects of a uniform increase of the labour supply in all experience and education cells, in line with the results on the partial elasticities of substitution reported above, native workers with highest levels of education and experience are found to lose least.

Summarising the results for Europe, the robust findings are that foreigners and natives are imperfect substitutes to each other, with previous immigrants being closer substitutes to recent arrivals. The findings on the high end of the skill distribution are controversial, ranging from perfect to relatively low substitutability between natives and foreigners. These differences show up even between analyses studying the labour markets of the same country – Germany – and appear to reinforce the conclusion of Borjas et al. (2008) that very much depends on the construction of the dataset and the design of the analysis.

The wage effect of high-skilled immigration

In the past years, the wage impact of immigration on natives has seen a number of empirical contributions internationally. A useful summary is the meta-analytic review of 45 primary studies by Longhi et al. (2008). Their quantitative analysis shows that altogether, migration has very small effects on the native population. Similarly, the meta-analysis confirms the emerging stylized fact that immigration bears negative labour market effects on earlier migrants, which shows that migrants are closer substitutes to these than to natives. Besides it is found that larger impacts tend to be estimated for quantities than for wages. Altogether, the insight emerges that in Europe, immigration tends to impact more on employment than on wages, while the opposite is true for the US.

Wage impact studies of immigration only exceptionally focus on high-skilled immigration explicitly. In the past few years however, a number of studies have looked at the effect of immigration at different segments of the skill distribution of the domestic workforce. [17] In this literature Borjas (2003) investigates the impact of immigration on the wage structure at different education levels in the United States between 1960 and 2000. In this period, the United States experienced an influx of immigrants amounting to 17% of the labour force

[17] Note that in fact immigration at a particular skill level does not only affect the remuneration of native (or previous immigrant) workers with the same education, but also has cross-education and cross-experience effects that can be obtained once the respective elasticities of complementarity are estimated, as explicitly shown by Felbermayr et al. (2008) as described above.

(males only), many of whom were high school dropouts. Borjas (2003) finds that a 10% in such immigration reduces native weekly earnings by 4% but annual earnings by even 6.4% and hours worked by almost 4 percentage points. Importantly, earnings are found to be negatively affected for all education groups except college graduates. Borjas (2003) claims however that this may be due to spurious correlation that may result as changes in the experience-earnings profile of this group could not be controlled for.[18]

Ottaviano and Peri (2006) arrive at different results on this issue (and as discussed above are contested by Borjas et al., 2008). According to Ottaviano and Peri, the inflow of foreigners to the US between 1990 and 2000, resulted in an increase of real wages for all workers with at least a high school degree. College graduates are estimated to have gained 1.2% to 1.8%. Ottaviano and Peri (2006) also show, however, that the conventional assumptions of a fixed capital stock– which is plausible in the short term – and that natives and migrant workers are perfect substitutes – which is supported by the careful analysis of Borjas et al. (2008) – result in negative effects on the wages of workers in all skill groups. With these assumptions, college graduates are calculated to have lost 0.1% in terms of real wages from the observed influx of foreigners.

Several papers highlight how much the wage impact of immigration to a particular country depends on the skill structure of the immigrant inflow. Comparing the impact of immigration on the wage structure of Canada and the US based on the Borjas (2003) methodology, Aydemir and Borjas (2006) find that in Canada, where over 60% of the immigrants 1980-2000 had a college or university degree, highly educated natives incurred the highest earnings losses from immigration (of over 10% in the short term, and around 8% in the long run). Wage losses were found to be the smaller the lower the levels of education, including even positive wage effects for low-skilled workers. In contrast, in the US, where nearly one quarter of the immigrants in the same period were high school dropouts, workers in this segment of the labour market were found to suffer highest wage losses from immigration, 6% to 10.5% in the short term and almost 4% in the long run, while wage losses were predicted to be smaller (though still negative) for higher education categories.

In the European context, Manacorda et al. (2008) based on their findings on the elasticities of substitution between natives simulate that a 20% increase in the number of skilled migrants in the UK would increase the native-migrant wage differential by less than a skill neutral increase (which is still small, a 10% increase is expected to raise that differential by 2%), but that the return to education among natives would remain unaffected. Similarly Bock-Schappelwein et al. (2009) simulate the economic impact of both the migration to Austria at the beginning of the 1990's as well as the 2000's using a CGE mode which can take account of the differing skill and age structure of these two migration waves, but

[18] Note that in contrast to the studies discussed in the context of complementarity between foreigners and natives, Borjas (2003) assumes that foreigners and natives within the same experience-education category are perfect substitutes.

assumes perfect substitutionality between natives and foreigners within individual age-skill groups. They find that, due to the improved skill structure of migrants, the latter wave had a more favourable effect on the macro economic development of Austria. According to their results the migration of the early 2000's in the long run (over a simulation horizon over 15 years) will contribute to increasing GDP by 3% and employment by 3.5%, while in the short run a maximal increase of the unemployment rate of about 0,5% is predicted.

The three recent analyses of the immigration impact on the German labour market based on the Ottaviano and Peri (2006) methodology extend this approach to a general equilibrium framework allowing for unemployment as well. D'Amuri et al. (2008) find that immigration to western Germany in the 1990s has improved average natives' wages with no changes in native employment, while earlier migrants' wages have deteriorated by 4% on average. D'Amuri et al. (2008) also highlight the heterogeneous impacts of immigration on wages at different education levels: owing to the fact that immigration to western Germany in the studied period (including immigration from the eastern part of the country) was relatively high-skilled, among native workers, those with low education levels are found to see a small improvement of their wages, by 1%, while those with high education are estimated to lose by 1.5%. Similarly, among earlier migrants, those with low education are found to lose about 1.7%, while highly educated earlier migrants are reported to have faced the highest earnings losses, 4%. D'Amuri et al. (2008) show that in line with the skill composition of the respective migrant flows, in comparison with immigration from the rest of the world, east to western German immigration has particularly affected earnings of the high-skilled western Germans.

The results of Felbermayr et al. (2008) fit into this picture: they simulate the impact of expected inflows of around 300,000 to 3,500,000 immigrants from Eastern Europe to Germany, 88% of which are assumed to be low-skilled (Felbermayr et al. distinguish only two skill categories). Felbermayr et al. (2008) also allow labour markets to adjust via increased unemployment. According to their results, low-skilled foreigners would bear the highest burden of immigration, implying wage cuts of 0.4% but an increase in the unemployment rate in the short run. The changes for high-skilled earlier migrants are predicted at 0.1% (wage decline) and 1.2 percentage points (unemployment) respectively. At the same time, the simulated impacts for natives are negligible. In the long run – where capital stocks are allowed to adjust – Felbermayr et al. (2008) suggest positive wage effects (0.05%) and unemployment effects (-0.08 percentage points) for both high and low-skilled natives, but for foreigners, earnings and the risk of unemployment are not expected to fully recover in the long run either.

Finally, Brücker and Jahn (2008) simulate the wage and unemployment impacts of the labour supply shock between 1980 and 2004, which contained comparatively higher inflows in the higher skilled segment. In line with Felbermayr et al. (2008), the foreign work

force with a high school degree is supposed to suffer most from a 1% immigration, short-run wage losses of 1.5% and an increased unemployment rate by 1.3 percentage points. The short-run effects of the immigration on the foreign labour force are negative throughout, similar to the effects to all natives but those with a vocational degree. In the long run, the native population is estimated to obtain a small wage increase, by 0.06%, while the foreign labour force is still supposed to suffer wage losses of 0.55%. In the former group, those with vocational training can expect the highest wage increases, while in the latter, those with a high school degree are supposed to suffer the highest losses.

Three studies that investigate the wage impact of high-skilled immigration specifically in different frameworks – without taking a structural approach such as those studies described above – arrive at different results. Borjas (2004 and 2006) look at the considerable foreign student supply shock among those who earned doctorates in the US between 1968 and 2000. Here, from an average 20% in the 1970s, the share of the foreign-born among the doctorates awarded in all fields rose to one third in the 1990s. Borjas (2004 as well as 2006) finds that a 10% increase of the supply of foreign doctorates diminishes competing natives' wages by 3% to 4%. Islam and Fausten (2008) study the impact of migration classified as skilled on average wages in Australia between 1980 and 2006. Such migration accounted for two third of the inflows in the respective period. They fail to find a significant effect once endogeneity of such immigration is accounted for.

The above review of the studies on the wage impact of immigration at different segments of the domestic skill distribution shows the following: immigration appears to affect resident workers' earnings at various skill levels differently, depending on the specific characteristics of the labour markets of the country studied and the skill structure of the inflow. The results on the wage impacts correspond to the estimated relationships of substitution or complementarity between natives and migrants at different skill levels, including cross-education effects. For the United States, it appears that natives and foreigners are close to being perfect substitutes; but since immigration has been predominantly unskilled, it is found to harm the unskilled population in particular. In Europe, for the case of Germany, new migrants appear to be closer substitutes to previous migrants than natives. Since immigration to Germany was comparatively skilled in the researched periods, it has been found to negatively affect incomes of skilled previous migrants in particular. The consideration of employment changes induced by immigration in general equilibrium approaches developed recently seems to be particularly appropriate for European labour markets. Nevertheless, the negative effects of immigration identified on wages (as well as on unemployment) are small altogether.

1.4.3 What are the effects of high-skilled migration on regional, sectoral growth and occupational mobility of natives

These small effects of (high-skilled) foreign migrants on the wage and employment levels of (highly skilled) natives has led a number of authors to look at other potential adjustment mechanisms through which native workers adjust to increased migration from abroad. While again this literature in general does not take much consideration of the high-skilled as a particular group of interest a recent contribution by Peri and Sparber (2008) looks at the working of the labour market for high-skilled in detail.

Peri and Sparber (2008) consider three possible ways, in which highly skilled native workers can potentially escape from increased competition of foreign workers. They argue such adjustment could either occur through increased regional mobility, increased unemployment or through increased specialisation of highly skilled natives on tasks (and occupations) that cannot so easily be fulfilled by migrants (such as tasks that require high linguistic capabilities). Among these potential mechanism Peri and Sparber (2008) find this last mechanism (i.e. increase specialisation of natives on certain tasks) to be the most important.

In their regression analysis the coefficient for a variable measuring the change in high-skilled foreigner share on the probability of non-employment remains insignificant (and has an ambiguous sign in different specifications). Equally when regressing the same variable on an indicator variable for regional mobility it remains insignificant. The only variable on which the change of share of high-skilled foreigners is found to have a significant impact is on the tasks performed by high-skilled natives. Here it is found that high-skilled natives faced with increased labour market competition from highly skilled migrants significantly more often move to occupations that require more interactive or communication skills.

Similar results are also provided in a recent study on occupational choices of high-skilled migrants and natives by Chiswick and Taengnoi (2007). According to their results high-skilled migrants with a lower English language proficiency choose occupations that require less communication skills, and specialise in particular in computer and engineering skills. The only exceptions to this are (according to Chiswick and Taengnoi, 2007), high-skilled migrants with little English language proficiency working in services occupations, where they are likely to offer services for fellow migrants. In sum thus these results seem to indicate that the primary adjustment by which highly skilled native workers escape from increased competition through foreign workers seems to be through occupational mobility.

1.4.4 What are the effects of high-skilled migrants on international trade and FDI, innovation, entrepreneurship and productivity

Effects on productivity

Given there has been little wage or employment effect, one should thus look to other means of adjustment as a way of incorporating migrant labour in most European economies. In particular from the perspective of productivity and business performance, a larger pool of labour is likely to have a positive effect on productivity if the quality of migrant labour enables them to improve the quality of their workforce. This is of course often frustrated by problems of language and assimilation. On the other hand, the nature of the different skills that migrant labour may have has the potential to enhance technology adoption and adaptation, either by directly contributing to innovation (Mattoo et al., 2005), or by facilitating knowledge spillovers (Moen, 2005). Thus, one would conclude from theory that whether or not migration has a productivity enhancing effect is very much an empirical question and one that can be in part determined by immigration policy.

The relationship that immigration has with technology is a complex one. Lewis (2005) looks at the US manufacturing sector using firm level data to explore the relationship between the skills mix of migrant labour and the firms' choice of technology adoption. In modelling technology use, he argues that the Acemoglu (1998) model of innovation and technology choice is particularly pertinent.[19]

Lewis (2005) also argues that the low-skill labour supply from foreign sources may potentially have an additional negative effect, over and above the skills mix of the indigenous workforce because of the degree of path dependence in immigration waves that firms will take into account in their choice of technology use. The idea is that migrants are likely to enter into areas, industries and professions where previous waves of migrants have located. Lewis' chief finding is that automation and low-skilled labour are substitutes for each other. This, he argues, is a possible way that firms can adjust as an alternative mechanism to wages.

Quispe-Agnoli and Zavodny (2002) consider the role of immigrant labour on capital investment and labour productivity in the US manufacturing sector. They find that labour productivity is likely to be lower in both high and low-skilled industries as a result of immigration. They attribute this slowdown to problems of assimilation and argue that this may in fact be a short-run effect, that could disappear as migrants acquire the necessary language and social skills.

[19] There it is argued that technology adjusts to the skills mix. Whilst not a new idea, much of the recent literature on skill biased technical change has assumed technology to exogenous.

Studies that specify a production function are few. In a comparison of Spain and the UK Mas et al. (2008) use both growth accounting and econometric estimation techniques to explore the impact of migrants on domestic performance. Their industry level analysis distinguishes between two countries, where the experience with migration is extremely different. The UK has historically been the recipient of migrant labour, whereas until the mid 1990s, Spain had experienced very little migration. They find that the Spanish workforce demography has been significantly affected by the influx of migrants, whereas the UK has seen little change, and little effect. Taking account of the quality of labour, Mas et al. (2008) find a small but barely significant positive impact to immigrants in the UK, but a significantly negative impact in Spain. In addition, it is clear from the industry analysis undertaken in this paper that migrant labour is significantly industrially concentrated. Thus, skills and industry seem to be specific factors that need to be taken into consideration in any future analyses.

Compelling evidence is also presented in Paserman (2008) who takes a firm perspective to consider the impact of an unprecedented increase in the labour force in Israel on firm performance in manufacturing. Following the migration of a substantial number of people from the Soviet Union in the 1990s, not only were absolute numbers high, in excess of one million, but the skills content of this component of the newly expanded workforce was exceptionally high. With this in mind, she considers a number of questions not only whether productivity is enhanced by the use of migrant labour but also how migrants interact with technology and whether the technology intensity of the industry matters in determining the productivity impact from migrant labour.

Paserman (2008) employs a growth accounting generated TFP estimate and regresses migration terms on this. She finds that the migrant share of the workforce is negatively associated with productivity in low tech sectors, but some indication of a positive effect in high tech manufacturing sectors. In addition, analysis indicates that there was a negative relationship between migrant scientists and productivity in low tech sectors. Ultimately, the conclusion to be drawn from this analysis is that it is not just a question of getting high-skilled migrants into the workforce, but they have to be used effectively. Thus, the conclusion of the paper points to the importance of immigration policy. Overall, she finds little support for the idea that migrant labour increases productivity, and suggests that the findings point to an even more negative conclusion of a negative impact on productivity.

In summary, therefore, we see that little research effort has so far been devoted to the productivity impact of immigrants. What little evidence there is has tended to be concentrated in firm level manufacturing studies and their findings suggest that immigration is likely to have a negative impact, if anything. This is true even in the case of high-skilled migrants, from whom we would expect to see positive returns. Reasons put forward for

why this may be the case relate to the underutilisation of skilled workers and problems of assimilation.

Given this, and the paucity of significant findings in relation to wages and employment effects it is perhaps worth considering other avenues of business performance that migrant labour may have affected. Lach (2007) considers the impact of migrant labour on prices in Israel, Cortes (2005) considers the importance of migrant labour in affecting price levels in the US. She concludes that the largest effect is in low-skill intensive products but estimates that the effects are unlikely to be negligible; a 10% increase in immigration is estimated to affect such products by 1%.

Effects of diversity, migrant scientists and engineers on innovation

A variety of recent studies also covers the topic of migration and innovation, which is an important prerequisite for competitiveness. One strand of the theoretical literature postulates a positive connection between the ethnic diversity of the labour force and economic performance based on the hypothesis that the skills of individuals with diverse ethnic backgrounds are complementary in the production process (Fujita and Weber 2004, Alesina and La Ferrara 2005). This hypothesis was affirmed empirically by Ottaviano and Peri's (2006) study for U.S. cities. Even after controlling for endogeneity bias, these authors found a positive effect of ethnic diversity on the earnings and productivity of natives. Other studies explored the connection between ethnic diversity and innovation and R&D activities. For U.S. MSAs, Florida and Gates (2001) present some evidence of a positive correlation between the concentration of foreign-born individuals and the region's rank as a high-tech growth centre, which can, however, not be interpreted as a causal relationship. Based on data for German regions, Niebuhr (2006) found a strongly positive effect of ethnic diversity (especially among highly skilled employees with university degrees) on innovation, even when the possible endogeneity was controlled for.

Another strand of the literature analyses the influence of migrant science and engineering personnel on innovation. Migrant scientists can contribute to innovation directly (through inventions or patent development) or indirectly, e.g., through spill-overs (on the firm or regional level), the achievement of a critical mass in specialised research areas or through complementary skills (Hunt and Gauthier-Loiselle, 2008). Migration of star scientists is also an important driver of knowledge diffusion, especially if new breakthrough discoveries involve a high degree of tacit knowledge. Empirical evidence for the U.S. (see Kerr, 2008) shows a dramatically increasing contribution of migrant scientists and engineers to patenting during the last 30 years, especially among Chinese and Indian ethnicities in high-tech sectors.

Hunt and Gauthier-Loiselle (2008) use U.S. patent data and the 2003 National Survey of College Graduates (NSCG) to examine the impact of high-skill science and engineering

migrants on patent activity in the U.S. Based on the NSCG data. They show that immigrants hold about 24.2% of patents and that a one percentage point increase in the share of college immigrants in the population is connected to an increase of patents per capita by 6.1%, while a one percentage point increase in the share of natives with at least college education is associated with an increase in patents per capita of 3.5%. The contribution of immigrants with college education on patent activity is therefore twice the effect of natives. This effect can be fully contributed to immigrants' stronger orientation towards education in science and engineering (where the share of patent holders relative to the number of graduates in the field of study is largest), and not to innate ability.

In a more detailed analysis, Hunt and Gauthier-Loiselle (2008) find no evidence of immigrants "crowding out" natives. On the contrary, they find that a one percentage point increase in the share of immigrants with post-college education raises the share of all individuals with post-college education in the state by more than one percentage point. This indicates that skilled natives are attracted to states with a high degree of immigrants with post-college education. A similar, albeit less sizeable, spill-over (or "crowding-in") effect was found by Kerr and Lincoln (2008).

Furthermore, after spill-over effects are controlled for, Hunt and Gauthier-Loiselle find a positive effect of a one percentage point increase in the share of immigrants with (at least) college education on the number of patents per capita of 15%. This figure is in excess of the outcome based on the NSCG data reported above (6.1%), which indicates a positive spill-over effect of immigrants on the patent activity of other college graduates. They also find a positive, albeit smaller spill-over effect of native college graduates. Using the shares of immigrants with post-college education or the share of migrants in science and engineering occupations, the estimated spill-over effects are even larger (57% and 31%, respectively). The large results found in this study are, however, not representative of the literature. E.g., Kerr and Lincoln (2008) found direct effects of immigrant scientists and engineers (which entered the U.S. through the H-1B programme) to dominate the total effect of migration on patent activity, while the indirect effects (spill-overs) are rather negligible.

A related strand of literature focuses on the contributions of international graduate students on knowledge diffusion and innovation, again measured using data on patent applications and grants. Using time series data for the U.S., Chellaraj, Maskus and Mattoo (2008) provide evidence of a significantly positive effect of the share of foreign graduate students on patent applications or patent grants to both firms and universities. They estimate that a 10% increase in the ratio of foreign graduate students to total graduate students results in a 4.5% increase in patent applications, and a 5.1% rise in patent grants, respectively. The authors conclude that the gains from trade in education services to the U.S. go way beyond direct tuition payments.

Migrant entrepreneurs

Closely related to the literature on the innovation enhancing effects of migrants in science and engineering is the topic of migrant entrepreneurs. While there is a vast literature on the individual determinants and motives for the (generally higher) self-employment propensity of migrants (see, e.g., Yuengert 1995, Clark and Drinkwater 1998, Li 2001, Blanchflower 2001, Constant, Shachmurove and Zimmermann 2005, Fairlie and Woodruff 2008, etc.), empirical evidence on the effects of (high-skill) migrant entrepreneurs on the host countries is, however, rather scarce and rarely goes beyond anecdotal evidence or purely descriptive studies. Saxenian (2000) reviews migrants' entrepreneurial contributions in the Silicon Valley region and shows that highly-skilled Chinese and Indian migrants with education in science and engineering formed an integral part of the region's high-tech growth surge during the 1990s, creating jobs as well as additional trade and business linkages (especially) with their home countries.

Expanding Saxenian's (2000) analysis to the U.S. as a whole, Wadhwa, Saxenian, Rissing and Gereffi (2007) conclude that about one quarter (25.3%) of all engineering and technology companies founded between 1995 and 2005 in the U.S. (and 52.4% of the Silicon Valley start-ups during this period) had at least one foreign-born founder. These companies, 80% of which were founded in software or innovation/manufacturing services, accounted for $52 billion in sales and employed about 450,000 workers in 2005. The authors thus conclude that immigrants have become a "significant driving force in the creation of new businesses and intellectual property in the U.S." (Wadhwa et al., 2007, p. 5). They also found evidence for an increase in the importance of immigrants for high-tech business formation during the period analysed. These results are supported by the literature on the migration of scientists, which shows that star scientists are often the drivers of new firm entries into highly specialized, innovative niches as they can become the main resource around which a firm develop if discoveries are to be commercialized (Zucker and Darby, 2007). Star scientists thus also contribute to business formation and job creation.

Effects on Trade and FDI

Finally, a further strand of the literature highlights the effects of migrants on cross-border trade and FDI flows. The central hypothesis of this literature is that migrants provide cross-border networks, which in turn provide a number of channels through which cross border trade and FDI can be positively influenced. On the one hand migrants through their presence in the host country provide potential investors with additional information on the quality of the labour force and business opportunities in a particular country. This is termed the “information channel” effect by Combes, Lafourcade and Mayer (2005). On the other hand migrants also create a new demand for goods produced in their home country. An

effect which is referred to as the "preference channel" by Combes, Lafourcade and Mayer (2005).

Indeed from the existing empirical evidence it seems that in particular the information channel is important in creating cross border trade. As shown by Gould (1994) for the US, Head and Ries (1998) for Canada and Girma and Yu (2002) for the UK in the framework of gravity type equations, migrants have a positive impact on trade volumes, with estimates of the trade creating effect suggesting that an increase in the stock of migrants by 1% may increase trade by between 0.1% to 0.2%. Thus there seems to be a strong and very robust correlation between migration and trade expansion that applies to many countries (e.g. Bacarreza and Ehrlich (2006) for evidence on Bolivia, Bryant, Murat and David (2004) for New Zealand) and different time periods (e.g. Dunlevy and Hutchinson (2001) for the US in 1870 to 1910) as well as individual migrant flows (see Rauch and Trindade, 2002, for a case study of Chinese emigrants) and can also be established with regional trade data (see Wagner, Head and Ries, 2002, Combes, Lafourcade and Mayer, 2005).[20] For the European Union Parsons (2005) quantifies the impact of European East West immigration on East-West European trade. He finds that an increase of Eastern European migrants by 10% increases EU15 exports to these countries by 1.2% and imports by 1.4%.

While the close association of migrant flows and export growth are thus widely acknowledged in the literature, more recently there has also been increased interest in the connection between FDI and migration. In this literature Kugler and Rapoport (2005), Docquier and Lodigiani (2008), Javorick et al. (2006) and DeSimone and Manchin (2008) provide evidence of a positive effect of bilateral migration flows on FDI. This literature – in contrast to that on the association between trade and migration - also takes more explicit consideration of the skill structure of migrants and FDI. For instance Docquier and Logigiani (2006) analysing the impact of emigration on aggregate FDI flows into migrant's countries of origin find find strong network externalities associated mainly with high-skilled migration. Kugler and Rapoport (2005) explain this difference between the effects of skilled and unskilled migration by stressing that skilled and unskilled migrants may bring with them different types of information. Highly skilled migrants will often be able to provide information on business opportunities abroad, while less skilled migrants provide information on the quality of the workforce in the potential labour force. Using a similar data as Docquier and Logigiani (2006), they find evidence of a dynamic complementarity between high-skilled emigration and FDI, and some evidence of contemporaneous substitutionability between unskilled migration and FDI for intra EU15 factor flows.

DeSimone and Manchin (2008), by contrast, focus exclusively on bilateral flows for the EU15 and the new member states. They too find a strong positive correlation between FDI and migration flows. Furthermore when differentiating by skill groups these authors find a

[20] Recent surveys of this literature are provided in Parsons (2005) and Qian (2007).

positive association between FDI and migration for both highly and less skilled in panel regressions, but only of high-skilled migrants in cross sectional results. In sum thus the existing literature suggests a strong positive link between migration and bilateral trade flows as well as foreign direct investments, which is particularly pronounced for high-skilled migrants with respect to FDI.

1.5 Conclusions

In this survey we focus on the motivations and effects of high-skilled migration. We argue that with respect to the motives for migration high-skilled migrants may differ in a number of respects from the less skilled. In particular with respect to pecuniary motives for migration they are in all likelihood going to be drawn disproportionately to receiving regions with high returns to education, which suggests that regions with low income disparities will generally receive more less skilled migrants. Furthermore, for high-skilled certain non pecuniary and institutional factors such as career concerns and different quality of the workplace are likely to be more important than for less skilled migrants. From the point of view of demand for high-skilled migrants by contrast the available evidence suggests that, while high-skilled migrants are often employed to reduce bottle-necks in local labour supply, there are also important cases in which demand for high-skilled labour in firms arises from their attempts to substitute (expensive) high-skilled native labour by (cheaper) high-skilled foreign labour.

Furthermore, with respect to the potential impact of high-skilled migration on the receiving country the literature is extremely controversial. This applies in particular to the question of whether high-skilled foreigners are a substitute or a complement to high-skilled native labour, which is essential for assessing the potential wage impact of high-skilled migration. Here results even for one and the same country (e.g. Germany) depend very strongly on methodological choices and the data used. Despite this some robust findings seem to emerge: First of all foreigners and natives are imperfect substitutes to each other in aggregate, with previous immigrants being closer substitutes to recent arrivals. The findings on the high end of the skill distribution, however, remain controversial, ranging from perfect to relatively low substitutability between natives and foreigners.

These different results on substitutionability or complementarity also lead to relatively divergent assessments of the impacts of high-skilled migration on wages, with some authors finding even positive effects and other negative effects. Here, however, even those studies that do find negative effects suggest a relatively mild impact on wages (as well as on unemployment), with even the highest estimates for European countries suggesting that increases in the stock of migrants by 10% will lead to wage losses for natives somewhere between 2-4%, at most, and some evidence indicating that the primary adjustment by which highly skilled native workers escape from increased competition through foreign high-skilled workers seems to be through occupational mobility.

In addition there is some evidence on a number of positive impacts of migrants. This seems to apply, in particular, to the effects of high-skilled migration on innovation activities and on the positive trade and FDI generating effects of migration. With respect to innovation a by now quite large literature (that, however, almost exclusively focuses on the US) finds a positive association between both high-skilled migration and ethnic diversity and measures of innovation activities. With respect to trade, recent estimates in general suggest that a 10% increase in migration will increase bilateral trade by somewhere between 1% to 2%. Similarly, the slightly smaller literature on FDI suggests an equally strong association of migration and FDI activities, where in particular high-skilled migrants seem to be instrumental in explaining higher FDI.

Concerning the impacts on entrepreneurship and on productivity, by contrast, evidence is much more mixed. With respect to entrepreneurship much of the literature has focused on individual case studies in particularly successful regions or industries. This literature as well as the few more general (mostly US focused) studies that have become available recently, however, suggest that migration contributes significantly to the founding of new enterprises and development of entrepreneurial activity. With respect to productivity, finally, the few existing studies again often disagree and suggest that effects of migration are more often negative than positive, with positive effects mostly being found in cases where a successful match between migrants' skills and the requirements of their employees was achieved.

Chapter 2
Highly skilled migrant workers in the EU – a comparison between EU and non-EU OECD countries

2.1 Introduction

The literature on international migration thus suggests that the extent and structure of migration has an important impact on the competitiveness of regions and countries with in particularly highly skilled migrants representing an important resource pool which can be used to strengthen national R&D systems as well as integration into international business networks, increase entrepreneurial activity and overcome bottlenecks in regional labour supply. While this literature has also argued that these advantages may be countered by the potential increase in wage pressure (and potentially unemployment rates) for high-skilled labour, the empirical evidence for these effects is highly controversial and existing studies tend to mostly find small effects. There thus seems to be an almost uniform agreement in the literature that high-skilled migration is preferable to low-skilled migration (see also Chiswick, 2005).

Based on these results, the skill structure of migrants has also been a central concern of the international policy debate on migration in developed countries in the last decades. Faced with an ageing population and repeated bottlenecks of skilled labour in periods of high employment growth, a number of the major receiving countries have introduced policies to attract a higher share of highly skilled migrants. These developments have resulted in increased competition among receiving countries for highly skilled migrant labour and have led some analysts to voice concern over whether the European Union is capable to attract sufficient high-skilled migrants in this increasingly competitive environment.[21]

Before moving to an analysis of the labour market situation of highly skilled workers and their impact on growth, productivity and innovation in the EU, one would thus like to know, how the European Union compares to other receiving regions of migration in the "international competition for talent". Two central questions in this respect are to what degree EU countries are attracting enough highly skilled labour relative to other receiving regions and whether the highly skilled foreign-born residing in the EU, are confronted with better or worse chances of finding adequate employment than in other receiving countries. In this chapter we thus compare the extent and structure of highly skilled migrants in EU countries of the OECD to that of non-EU OECD countries, with the aim of addressing these

[21] For instance Zimmermann (2009) in a recent contribution argues that Europe is faced with an increasing lack of skilled workers and a growing tendency of unemployment amongst the low-skilled. He suggests that the key to solving these problems is to promote the integration of international workers in Europe and to open labor markets to high-skilled foreign workers.

questions. After presenting some features of the data used in the next section, we start our analysis by discussing the education structure of international migration in the OECD for different migrant groups in section three. Section 4 by contrast focuses on the scant evidence concerning other aspects of the migration of high-skilled such as student mobility and the emigration of highly skilled and in section 5 focuses on the labour market situation of highly skilled migrants from a comparative perspective. Section 6 finally concludes by summarising our main results.

Table 1

Indicators on the share and structure of the foreign-born population in OECD countries (population aged 15+)

	Proportion of foreign-born in the population (15+) (%)	Women (%)	Duration of stay 0-10 years (%)
Austria	13.8	52.1	38.3
Belgium	12.0	51.9	31.5
Czech Republic	5.2	54.5	24.9
Denmark	7.4	51.4	40.8
Finland	2.7	50.4	49.5
France	11.7	50.5	17.3
Germany	12.5	49.7	20.3
Greece	10.8	49.9	88.9
Hungary	3.2	55.9	33.8
Ireland	11.0	50.4	58.3
Italy	4.1	54.4	65.6
Luxembourg	36.6	50.6	54.6
Netherlands	11.2	51.4	28.4
Poland	2.4	59.9	
Portugal	6.7	50.9	28.4
Slovak Republic	2.9	56.3	
Spain	5.5	49.7	51.0
Sweden	14.4	51.4	32.0
United Kingdom	9.4	53.3	29.8
Australia	27.4	50.6	22.5
Canada	22.4	51.9	30.0
Japan	1.1	53.2	
Mexico	0.4	49.5	
New Zealand	22.5	51.9	36.5
Norway	8.3	51.1	44.2
Switzerland	25.1	52.2	37.6
Turkey	2.4	52.2	
United States	14.5	50.4	36.3
Average EU	9.7	52.4	40.8
Average non-EU	13.8	51.5	34.5
Average major non-EU	21.7***	51.2	31.3
United States	14.5	50.4	36.3

*Notes: M*ajor non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Database on Immigrants in OECD Countries (DIOC).

2.2 Data and country sample

The data we use in this chapter stems from various sources of which the OECD database on immigrants and expatriates (see *OECD*, 2008) is the most important. This internationally comparable dataset collects information on the age, skill, occupation and gender structure of the foreign-born population as well as some indicators concerning the labour market situation of foreign – born workers by educational attainment for most of the OECD countries. They were primarily compiled from national censuses conducted in the years 2000 and 2001 and were augmented by labour force survey data for countries where no censuses took place in these two years (see *OECD*, 2008 for details on data collection and definitions). Thus the data apply to the situation in the years 2000 and 2001. While focusing on the years 2000 and 2001 may seem problematic for a phenomenon as dynamic as the migration of highly skilled, this data to the best of our knowledge is the only comprehensive internationally comparable data source on the structure and labour market situation of highly skilled workers.

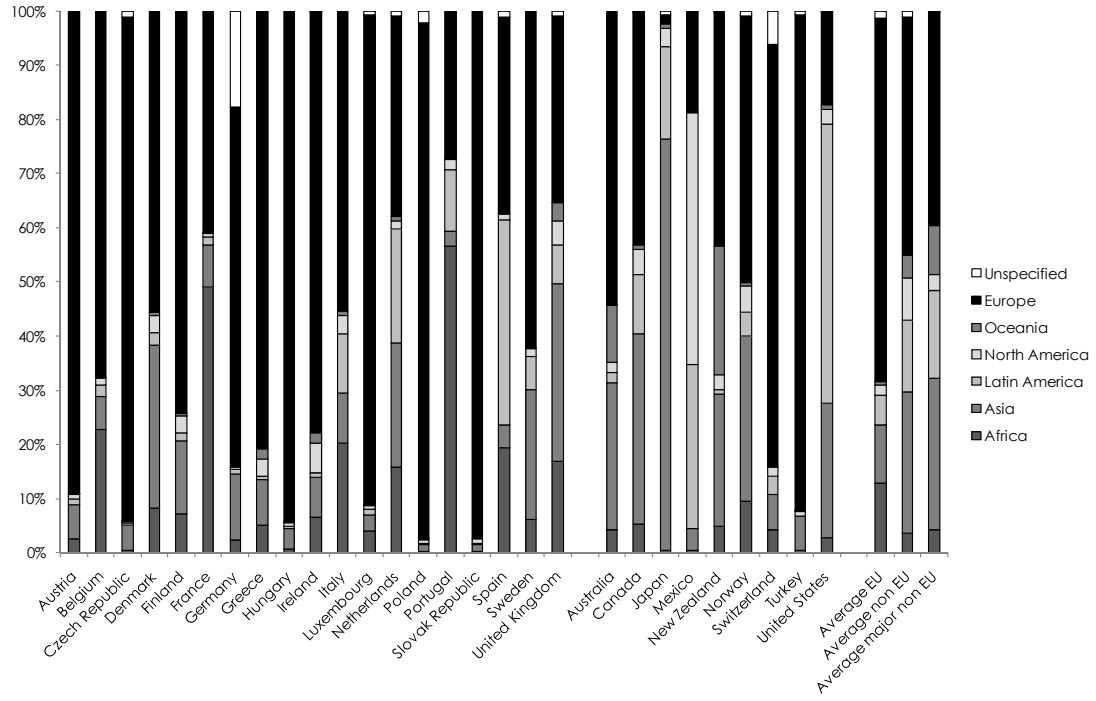
A further weakness of this data is, that it is not available on a place to place basis. Thus we cannot differentiate between within EU migration and migration from third countries. All indicators on migration for EU-countries thus include both foreign-born from third countries as well as from other EU countries. This is a substantial weakness because as will be shown in the next chapter intra-EU labour mobility is an important aspect of the international migration of highly skilled, with intra-EU migrants often being more highly qualified than migrants that were born in third countries. Thus not being able to differentiate between migration flows within the EU and from outside the EU will indicate more highly qualified migration for the EU in total, than when considering only migrants from outside the EU. Since we are unable to correct for this bias in the data, we deal with this problem by, first of all, – in this chapter - augmenting OECD data (in particular on student mobility) with the limited information available on a place to place basis, and second of all a more comprehensive analysis of place to place data from the European Labour Force Survey in the next chapter.

In addition, focusing only on OECD countries implies that we cannot analyse all EU countries and raises issues with respect to the appropriate comparison group for the EU countries. For most of the indicators considered below we cover 19 countries of the EU27 and 9 non-EU OECD countries (see table 1). The 19 EU countries considered are a rather heterogeneous group in terms of both their migration history as well as in terms of GDP per capita and labour market situation. In particular the share of foreign-born ranges from 2.4% in Poland to 36.6% in Luxemburg and a number of countries among the EU27 (such as Greece, Italy, Spain, Ireland and Luxemburg) are characterised by a large share of migrants with a duration of stay of less than 10 years, reflecting a rather short migration history and a high share of seasonal and temporary migration. Similarly, the sending region structure of the foreign-born varies substantially among individual EU countries (see

Figure 1). This thus makes it difficult to unabmbiguously define an appropriate comparison group for EU countries.

Figure 1

Share of sending regions in total foreign-born population in OECD countries (population aged 15+)



Notes: Major non-EU = Australia, Canada, New Zealand, United States.
Source: Database on Immigrants in OECD Countries (DIOC).

Heterogeneity, however, also applies to the set of non-EU OECD countries covered. Among these countries the share of foreign-born ranges from 27.4% (Australia) to 0.4% (Mexico) and the share of short-term migrants – while nowhere exceeding the 50% mark – is high in Norway but much lower in Canada. Indeed when performing ANOVA-tests for the indicators reported in table 1, we cannot reject the null hypothesis that the average share of foreign-born as well as its structure (as measured by the share of females and the share of short-term migrants) in non-EU OECD countries equals that of the EU OECD countries. The four major non-EU receiving countries of the OECD (Australia, Canada, New Zealand and the US), however, show a significantly higher share of foreign-born among their resident population than the average EU OECD country, while the US value is not significantly different from the average EU country.

In addition, there are some significant differences with respect to the sending country structure between EU-OECD and non-EU OECD countries. Non-EU OECD countries have higher shares of Latin American migrants in their population, while they have a significantly lower share of European born migrants. This applies also when considering European

migration structure relative to that of the US. For the major non-EU receiving countries (Australia, Canada, New Zealand and the US), however,—aside from the share of European born population being significantly lower in these countries—shares of migrants from Asia and Oceania are significantly larger.

Given this evidence we thus compare the 19 EU OECD countries covered to the sample of non-OECD EU countries, since heterogeneity within these two groups seems to be of a comparable magnitude. In addition we, however, also perform a comparison of EU-averages to the major receiving countries among the non-EU OECD countries (i.e. to Australia, Canada, New Zealand and the US) as well as the US alone, since these countries are often considered to be the most important competitors of the EU in the "international competition for talent".

2.3 The skill structure of the foreign-born population

Our analysis is thus closely related to a number of recent comparative studies on the skill structure of international migration and on patterns of skill-job mismatch in EU and OECD countries (see for instance Biffl, 2006; Tremblay, 2001; Gera and Songsakul, 2007; Chiswick and Miller, 2007). The studies closest to ours are, however, those provided by the OECD (2007 and 2008) and the recent Employment Report of the European Commission (see EC, 2008). Based on data from the European Labour Force Survey, which, however, does not allow for a direct comparison with other (non-EU) major migration receiving countries, the European Commission finds that '…the overall share of high-skilled migrants in total employment in the EU remains low and does not compare favourably with the shares in other similarly developed economies …' (EC, 2008, p. 49).

This finding is also confirmed by our data. As can be seen from table 2 most of the EU countries (aside from Ireland and the UK) are characterised by an (in part substantially) lower share of university graduates among their foreign-born than most of the large non-EU receiving countries (such as Australia, the US, Canada or New Zeeland). This also holds true for the other European non-EU countries covered, i.e., Switzerland and Norway) and is supported by ANOVA-test for equality of means between the EU and non-EU OECD countries, which reject the null hypothesis of equal means (see table 2). Furthermore, this lower share of university educated foreign-born in the EU is countered by a significantly higher share of foreign-born with primary education relative to the non-EU countries, as well as relative to the major non-EU OECD receiving countries. No significant differences can, however, be found when comparing the average EU-country in the data to the US.

Table 2

Qualification structure of migrants in OECD countries by gender (2001)

	Primary education			Secondary education			Tertiary education		
	Total	Women	Men	Total	Women	Men	Total	Women	Men
Austria	49.4	53.4	45.0	39.3	36.9	41.9	11.3	9.7	13.2
Poland	47.9	54.1	38.5	40.3	36.6	45.8	11.9	9.3	15.7
Italy	54.3	52.3	56.6	33.5	34.8	32.0	12.2	12.9	11.4
Czech Republic	38.6	47.9	27.4	48.7	42.1	56.5	12.8	9.9	16.1
Germany	45.8	50.5	41.2	39.3	36.4	42.1	14.9	13.1	16.7
Slovak Republic	29.3	36.4	20.2	55.0	51.9	59.1	15.7	11.7	20.7
Greece	42.7	38.8	46.6	41.4	43.3	39.6	15.9	17.9	13.8
France	54.8	57.5	52.0	27.2	25.5	28.9	18.1	17.0	19.1
Finland	52.6	52.1	53.1	28.5	27.0	30.0	18.9	20.9	16.9
Netherlands	49.2	50.4	47.9	31.6	32.4	30.8	19.2	17.2	21.3
Portugal	54.7	52.3	57.3	25.9	26.3	25.5	19.3	21.4	17.2
Hungary	41.1	45.4	35.6	39.1	37.8	40.7	19.8	16.7	23.6
Spain	56.3	54.6	58.1	22.6	23.7	21.4	21.1	21.7	20.5
Luxembourg	36.7	38.9	34.5	41.6	41.0	42.2	21.7	20.1	23.3
Belgium	53.3	55.8	50.5	23.8	23.1	24.4	23.0	21.0	25.1
Denmark	36.9	38.6	35.2	39.2	38.5	39.9	23.9	22.9	25.0
Sweden	29.5	30.2	28.8	46.2	44.4	48.1	24.3	25.4	23.0
United Kingdom	40.6	41.3	39.8	24.5	25.1	23.9	34.8	33.6	36.3
Ireland	29.6	29.4	29.9	29.3	29.4	29.2	41.1	41.2	40.9
Turkey	53.6	57.1	49.9	31.2	28.8	33.7	15.2	14.1	16.4
Switzerland	41.6	44.9	38.0	34.7	35.2	34.1	23.7	19.9	27.9
Australia	41.3	48.0	34.7	32.8	26.1	39.6	25.8	26.0	25.6
United States	39.2	38.1	40.3	34.7	36.2	33.1	26.1	25.6	26.6
Japan	25.9	27.7	23.7	44.2	45.4	42.7	30.0	26.8	33.6
Norway	18.3	19.3	17.3	51.2	48.7	53.8	30.5	32.0	28.9
New Zealand	18.7	18.9	18.4	50.4	51.9	48.7	31.0	29.2	32.8
Mexico	39.0	40.6	37.4	26.2	28.5	24.0	34.8	30.9	38.6
Canada	30.1	32.4	27.6	31.9	30.6	33.4	38.0	37.0	39.0
Average EU	44.4	46.3	42.0	35.6	34.5	37.0	20.0	19.1	21.0
Average non-EU	34.2**	36.3**	31.9**	37.5	36.8	38.1	28.3**	26.8**	29.9***
Average major non-EU	32.3**	34.4**	30.3*	37.4	36.2	38.7	30.2**	29.4**	31.0**
United States	39.2	38.1	40.3	34.7	36.2	33.1	26.1	25.6	26.6

Notes: Primary level refers to ISCED 0/1/2, secondary level refers to ISCED 3/4 and tertiary level refers to ISCED 5/6. Excluding individuals with unknown education level, gender or place of birth. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

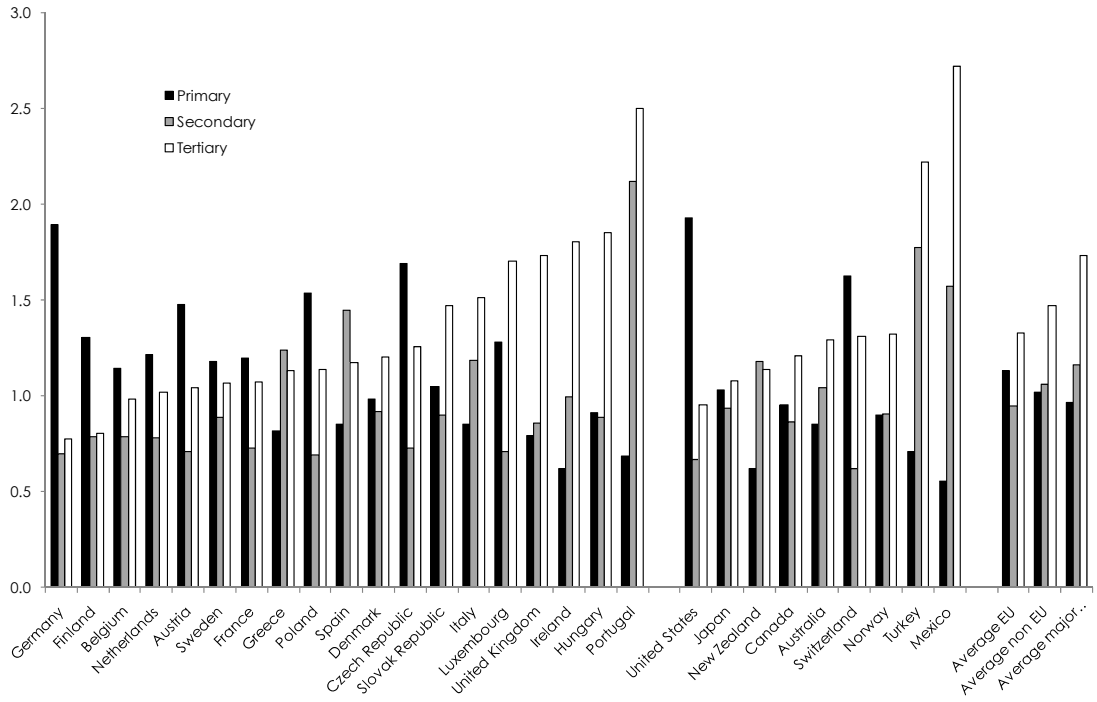
Source: Database on Immigrants in OECD Countries (DIOC).

There is, however, also a substantial degree of heterogeneity among the EU OECD countries with respect to the share of tertiary educated migrants as well as the general education structure of migrants. The share of tertiary educated migrants ranges from 11.3% in Austria to 41.1% in Ireland with the unweighted average across all EU countries lying at around 20%. Furthermore in countries like France, Portugal, Spain and Belgium the share of migrants with primary education exceeds 50% - a value only reached by Turkey for non-EU OECD countries. On the other hand, this share is lower than 30% for Ireland, Sweden and the Slovak Republic and thus also substantially lower than for many

of the non-EU OECD countries. Finally, the share of migrants with completed secondary education is lower than 25% in the UK, Spain and Belgium (and thus smaller than in any of the non-EU countries considered in Table 2) but exceeds 50% in the Slovak Republic.

Figure 2

Relative shares of foreign-born by education groups



Notes: Figure displays the share of foreign-born in an educational level in total foreign-born relative to the same share for natives. A value of 1 thus indicates equal shares for both natives and foreigners, a value larger than 1 implies that foreigners are overrepresented. Primary level refers to ISCED 0/1/2, secondary level to ISCED 3/4 and tertiary level to ISCED 5/6. Excluding individuals with unknown education level, gender or place of birth. Major non-EU = Australia, Canada, New Zealand, United States.

Source: Database on Immigrants in OECD Countries (DIOC).

Despite this heterogeneity and the in average significantly lower share of highly skilled migrants in the EU-OECD receiving countries, highly skilled migrants are an important source of human capital in most EU countries. This is shown in Figure 2 where we report the share of an education group among the foreign-born relative to the share of the same education group among the native-born.[22] As can be seen in all EU27 countries (except for Germany, Finland and Belgium) as well as in all non-EU OECD countries (with the notable exception of the United States) the share of tertiary educated among the foreign-born is

[22] Thus in this figure a value larger than one indicates that the foreign-born contribute more than proportionately to the total population in that education group, while a value smaller than one indicates that the foreign-born contribute less than proportionately.

higher than the share of tertiary educated among the natives, with relative shares in many of the EU countries exceeding those in the large non-EU receiving countries. [23]

Thus, with respect to the education structure of their migrants, the EU countries may be described as a set of relatively heterogeneous group countries which, in general, have received relatively low shares of highly educated (and relatively high shares of less educated) migrants in the past. Despite this, the share of highly educated (as well as the share of less educated) among the foreign-born is higher than among the native-born.

2.3.1 Explaining the low share of highly qualified migrants

There exist a number of potential explanations for the lower share of highly educated migrants (and the higher share of less skilled) and the large differences between EU countries: One argument, for instance, holds that differences in the sending country structure of migrants to the EU from that of other large immigration regions in the world may contribute to the lower skill structure of migration. If certain countries receive migrants from countries with a less qualified population this could impact on the skill structure of migration. Another argument is that language and cultural affinities (such as previous colonial ties) among sending and receiving countries are driving the cross country variation in the skill structure of migrants. Finally, economists (see Borjas, 1999 and chapter 1 for a survey) have long argued that relative returns to education are an important determinant of the skill structure of migration, with highly skilled migrants being more likely to migrate to countries with high returns to education.

In a recent study, Belot and Hatton (2008) address the issue of which factors drive the skill structure of migration by calculating two adjusted ratios of highly skilled migrants in the EU.[24] In the first version of this ratio, the total share of highly educated migrants in the OECD from a particular sending country is applied to the weight of migrants from this sending country in a particular receiving country. This indicator creates a "predicted" share of highly skilled migrants if every OECD country received the same share of highly skilled migrants from each sending country. If the predicted share of highly skilled migrants is higher than the actual share, this suggests that the respective receiving country is on average also receiving the less skilled migrant groups from a particular sending country. If the predicted share of highly skilled migrants is lower than the actual high-skill migration share, the opposite applies.

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[23] When performing t-tests for differences in means between EU and non-EU countries for these relative means we cannot reject the null hypothesis of equal means for any of the subgroups considered.

[24] In this section we draw heavily on the results of Belot and Hatton (2008). In contrast to these authors, which primarily seek to explain differences between individual countries, our focus, however, is on comparing the EU to non EU-countries.

Table 3

Decomposition results for the skill structure of migrants in the EU

	(1) % of foreign-born high-educated	(2) Adjusted foreign-born % high-educated	(3) Weighted source country high-educated	(4) Difference (2)-(1)	(5) Difference (3)-(1)
Austria	11.3	20.0	11.6	8.7	0.3
Poland	11.7	27.9	15.8	16.2	4.1
Italy	12.2	25.9	13.0	13.7	0.8
Czech Republic	12.5	18.6	11.5	6.1	–1.0
Slovak Republic	14.7	25.6	11.6	10.9	–3.1
Germany	14.9	17.4	11.4	2.5	–3.5
Greece	15.3	22.1	13.9	6.8	–1.4
Belgium	17.4	24.2	12.7	6.8	–4.7
Netherlands	17.6	20.6	9.9	3.0	–7.7
France	18.1	18.7	9.2	0.6	–8.9
Luxembourg	18.3	20.4	15.3	2.1	–3.0
Finland	18.9	31.4	15.9	12.5	–3.0
Portugal	19.3	24.6	7.8	5.3	–11.5
Denmark	19.4	27.6	13.2	8.2	–6.2
Hungary	19.8	23.0	10.1	3.2	–9.7
Spain	21.8	24.8	12.8	3.0	–9.0
Sweden	22.3	26.8	13.9	4.5	–8.4
United Kingdom	30.5	33.0	12.3	2.5	–18.2
Ireland	38.7	37.7	18.8	–1.0	–19.9
Turkey	14.3	20.4	15.9	6.1	1.6
Switzerland	18.6	21.0	13.7	2.4	–4.9
Norway	22.3	30.5	14.2	8.2	–8.1
Japan	24.2	34.6	17.6	10.4	–6.6
United States	25.9	22.8	12.6	–3.1	–13.3
New Zealand	27.3	34.9	15.4	7.6	–11.9
South Korea	32.2	38.1	11.7	5.9	–20.5
Mexico	37.1	33.9	29.3	–3.2	–7.8
Australia	37.9	33.1	16.4	–4.8	–21.5
Canada	38.0	32.2	13.5	–5.8	–24.5
Average EU	18.7	24.8	12.7	6.1	–6.0
Average non-EU	27.8***	30.2***	16.0**	2.4*	–11.8*
Average major non-EU	23.3***	28.1*	18.1	4.8**	–5.2**
United States	25.9	22.8	12.6	–3.1*	–13.3

Notes: (2)-predicted high education share under assumption equal sending country specific education shares to all OECD countries based on skill structure of total migrants. (3) predicted high education share under assumption of equal sending country specific education shares to all OECD countries based on skill structure in the home country. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Belot and Hatton (2008).

As can be seen from table 3 (column 5), for most of the EU countries in *Belot - Hatton's* (2008) sample the difference between the predicted and actual shares of highly skilled migrants are positive (with the exception of a small negative value for Ireland), while negative values are found for Australia, Canada and the US[25]. Most EU countries thus receive a lower share of tertiary educated migrants given their sending country structure,

[25] Negative values are also found for Mexico.

while the US, Canada and Australia receive better qualified migrants. An ANOVA-test also shows that the ratio for the average EU country is significantly larger than for the major non-EU migration countries in the sample, as well as for the major receiving countries and on the verge of significance when comparing EU countries to the US.

As a second measure Belot and Hatton (2008) apply the share of the highly skilled in the sending country to the weight of this sending country in total migration flows to predict the share of highly skilled migrants in a particular sending country. Differences between this predicted share and the actual share of highly skilled migrants can be considered an indicator of migrant selectivity. If the predicted share is higher than the actual share, the receiving country under consideration on average receives less highly qualified migrants than projected and migrants are thus negatively selected. If, by contrast, the predicted share is lower than the actual share, the opposite applies.

Results (column 6 of table 3) indicate that for the majority of receiving countries migrants are positively selected from among the sending country population. This, however, does not seem to apply to those EU receiving countries with the lowest share of highly skilled migrants (Austria, Poland and Italy). In general, migrant selectivity in the EU countries seems to be weaker than in the US, Canada and Australia, with only the UK and Ireland outperforming the US in this respect. Furthermore, the average differences for both these indicators are significantly higher for EU OECD countries than for non-EU OECD countries, thus suggesting that EU countries on average are not as selective with respect to migration as non-EU OECD countries. Interestingly this does not apply to the US, however. In sum even after controlling for sending country structure the EU countries in average receive less skilled migrants, in particular when comparing the EU to the major non EU receiving countries. This is indication of a lower selectivity of migration flows to the EU is an important factor contributing to the low skill structure of EU migrants.

In a next step, *Belot - Hatton* (2008) apply a regression-based decomposition, where they include wage differentials (measured as the wage differentials between the sending and receiving country for low wage workers as well as the wage premium for high-skill workers), various measures of cultural and geographic vicinity (such as colonial ties, common language, linguistic vicinity and distance) as well as country dummy variables to explain the share of highly skilled migrants. These regressions are then used to calculate the differences between the actual proportion of highly skilled migrants and the predicted value (see Table 4)[26].

[26] A positive value in table 4 indicates that the respective variable makes a positive contribution to the proportion of high-skill migration, while a negative value implies a negative contribution.

Table 4

Decomposition results for the skill structure of migrants in the EU

	Low wage differential	Premium differential	Colonial-ties	Common language	Linguistic proximity	Distance	Destination Country Dummy
Austria	0.04	0.49	0.02	1.58	–0.18	–2.75	–6.18
Belgium	0.01	–0.03	0.15	3.15	–3.40	–2.97	–1.76
Denmark	0.05	–2.44	0.10	–1.82	–0.14	–2.97	5.29
France	0.03	–0.09	–0.62	1.85	–1.75	–3.51	2.20
Hungary	0.00	0.68	0.00	–0.58	3.26	–4.80	6.71
Ireland	0.01	–1.85	–0.04	8.90	–12.04	–6.04	16.04
Italy	–0.01	0.05	0.10	–1.14	–0.23	–1.60	–7.30
Luxembourg	0.12	0.43	0.00	4.49	–4.79	–3.35	–6.53
Portugal	0.00	2.83	0.79	1.64	–3.90	–3.62	10.60
Spain	0.01	0.40	0.08	0.84	–2.22	–2.81	3.22
Sweden	0.00	–3.18	0.03	–1.09	–2.56	–3.16	5.92
United Kingdom	0.00	1.42	–2.31	4.33	–4.50	–3.83	10.94
Australia	0.01	–2.38	0.07	8.62	–5.21	18.85	0.62
Canada	0.04	–1.95	0.09	7.58	–6.88	7.78	9.30
Japan	0.05	–2.85	0.10	–2.59	2.94	6.22	6.04
Mexico	–0.05	7.06	0.02	1.96	6.20	–2.08	–12.62
New Zealand	0.02	2.67	0.05	8.18	–7.57	16.11	–22.18
Norway	0.04	–2.24	0.12	–2.38	–0.19	–2.99	8.81
Switzerland	0.06	0.16	0.04	3.15	–8.28	–3.76	0.45
Turkey	–0.02	–0.48	0.15	–1.41	–1.96	–3.08	–3.00
United States	0.23	1.08	1.05	4.12	4.37	–2.75	–9.06
Average EU	0.02	–0.11	–0.14	1.85	–2.70	–3.45	3.26
Average non-EU	0.04	0.12	0.19	3.03	–1.84	3.81*	–2.40*
Average major non-EU	0.09	0.46	0.39	6.97*	-2.80	10.74**	-10.21**
United States	0.23	1.08	1.05	4.12	4.37*	–2.75	–9.06

Notes: Figure is based on regression results of the variables named. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Belot and Hatton (2008).

The results suggest substantial country specific heterogeneity. Among the EU countries covered low wage premia ceteris paribus reduce the share of high-skilled workers for Denmark (by 2.44 percentage points), Sweden and Ireland[27], while for the other EU countries wage premia increase the share of highly skilled. Thus, low wage differentials between highly and lowly skilled workers do not seem to be a general explanation for the low share of highly skilled migrants residing in the EU.

For the English-speaking EU countries (U.K. and Ireland) as well as for Austria, Belgium, France, Luxemburg, Portugal and Spain common language with the sending countries tends to increase the share of highly skilled migrants. Thus, having a less commonly spoken language is a disadvantage in attracting highly skilled labour only for Denmark, Hungary, Italy and Sweden, while for former colonial powers the colonial legacy shifts the

[27] Negative, albeit much smaller values, were also found among the EU countries for Belgium and France.

skill composition of migrants towards a lower share of highly skilled migrants[28]. Furthermore, remoteness from source countries with a large share of highly skilled migrants, which mainly includes Asian countries, reduces the share of highly skilled migrants in all EU countries. Only New Zealand, Australia, Canada and Japan profit from their vicinity to these sending regions.[29] Finally, receiving country fixed effects, which are included in the regression analysis to account for any unobserved receiving country influences on the skill structure of migration, ceteris paribus reduce the share of high-skilled migration in Austria, Italy, Luxemburg and Belgium, while in all other EU countries they contribute to increasing this share. In average, however, these country fixed effects are significantly higher for the EU countries than for the major non-EU receiving countries.

ANOVA tests, however, also suggest that the contribution of distance to the proportion of highly skilled migrants is significantly larger among the major non-EU migration countries than for the average EU country. This is mainly due to the large effects found for Australia and New Zealand. Compared to the United States, there are no significant differences to the average EU country, with the only exception being the contribution of linguistic proximity which is on average larger than in the US for the EU countries. Thus the relative remoteness of the EU from the Asian countries seems to emerge as the only common factor, which impedes on the capability of all European countries to attract highly skilled migrants. All other factors such as linguistic and colonial ties, differences in wage premia for high-skilled labour, by contrast, point to substantial heterogeneity among the EU countries and lead to few conclusions that can be generalised across EU countries.

2.3.2 Differences in the skill structure of recent and more established migrants

Further evidence for the potential causes of the low share of high-skilled foreign-born residing in the EU can, however, also be derived the skill structure of foreign-born by duration of residence. The share of tertiary educated foreign-born among more recent groups is higher in all EU countries with the exception of the Southern European countries (Greece, Italy, Spain and Portugal) and in some EU countries more recent migrants are substantially better qualified than more established migrants (see table 5).[30] In Belgium, the Czech Republic, France, Ireland, Luxemburg and Sweden the share of tertiary educated foreign-born is more than 15 percentage points higher among the most recent

[28] This occurs because former colonial ties lead to a decrease in migrant selectivity according to the results of *Belot - Hatton* (2008)

[29] The positive effect for Canada can be attributed to the relatively high share of US citizen migrating to Canada.

[30] At the same time, however, the share of lowly qualified migrants among recent migrants has not been falling as unanimously in the EU. Among the EU countries covered in table 5 the share of low-skilled migrants is unambiguously decreasing in duration of stay for the southern European countries (Greece, Italy Spain and Portugal) and the UK, and has not been unambiguously decreasing for the Czech Republic, Finland, Hungary, the Netherlands and Sweden.

migrants (those that resided in the country for less than five years) than among the more established migrants.[31]

Table 5

Share of education groups among foreign-born by duration of stay

	Primary			Secondary			Tertiary		
	0 to 5 years	5 to 10 years	10+ years	0 to 5 years	5 to 10 years	10+ years	0 to 5 years	5 to 10 years	10+ years
Austria	32.8	39.4	45.0	46.5	47.8	43.4	20.7	12.7	11.5
Belgium	36.2	44.7	58.7	26.2	27.4	22.6	37.5	27.9	18.8
Czech Rep.	20.0	18.9	40.0	47.7	49.8	51.6	32.2	31.4	8.4
Denmark	33.5	37.0	37.8	42.2	40.0	38.1	24.3	23.0	24.1
Finland	39.7	35.5	31.5	36.3	40.6	46.9	24.0	23.9	21.6
France	37.4	49.8	55.8	28.6	25.9	27.5	34.1	24.3	16.8
Germany	43.2	45.8	45.9	35.0	35.3	40.2	21.7	18.9	13.9
Greece	48.2	47.9	26.8	39.8	40.8	45.5	12.0	11.4	27.8
Hungary	25.9	20.8	32.2	50.9	58.9	44.9	23.2	20.3	22.8
Ireland	19.4	26.8	32.8	28.3	25.7	30.0	52.3	47.5	37.3
Italy	56.2	55.4	54.6	30.2	32.5	30.6	13.6	12.1	14.7
Luxembourg	25.5	37.8	44.9	41.6	41.8	41.7	33.0	20.4	13.4
Netherlands	46.6	51.3	49.0	31.6	29.3	32.3	21.8	19.4	18.8
Portugal	53.4	70.4	59.1	31.6	21.7	25.1	15.0	8.0	15.8
Spain	59.8	54.6	53.9	22.5	23.4	22.4	17.7	22.1	23.7
Sweden	22.9	30.6	30.5	32.7	42.5	49.4	44.4	26.9	20.0
U.K.	30.1	26.8	25.3	29.7	34.7	39.4	40.2	38.5	35.3
Australia	26.9	32.2	44.7	34.0	33.9	32.6	39.1	33.9	22.8
Canada	22.5	28.6	32.5	27.1	33.9	32.5	50.3	37.5	35.0
New Zealand	10.1	10.8	22.7	52.7	53.8	48.7	37.2	35.4	28.5
Norway	21.8	18.3	17.8	49.1	54.3	50.9	29.1	27.4	31.3
Switzerland	23.0	39.6	44.7	32.5	38.0	42.0	44.5	22.4	13.4
United States	41.7	42.8	37.5	31.4	32.8	36.2	26.9	24.4	26.3
Average EU	37.1	40.8	42.6	35.4	36.4	37.2	27.5	22.9	20.3
Average non-EU	24.3**	28.7*	33.3	37.8	41.1	40.5	37.8*	30.2	26.2
Average major non-EU	25.3	28.6	34.4	36.3	38.6	37.5	38.4*	32.8*	28.2*
United States	41.7	42.8	37.5	31.4	32.8	36.2	26.9	24.4	26.3

Notes: Primary level refers to ISCED 0/1/2, secondary level refers to ISCED 3/4 and tertiary level refers to ISCED 5/6. Excluding individuals with unknown education level, gender or place of birth. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Database on Immigrants in OECD Countries (DIOC).

This improvement of the qualification structure of more recent migrants, however, also applies to almost all OECD countries (except for Norway). Indeed, the data presented in table 5 suggest that even though recent migrant cohorts in the EU are characterized by a higher share of individuals with tertiary education, they are still less qualified relative to recent migrants in non-EU OECD countries (see table 5). Even more, the difference in the

[31] This evidence is thus highly consistent with earlier studies. In particular the European Commission (2008) also finds that more recent migrants (those that migrated between 2000 and 2007) to the European Union are significantly better qualified than migrants from earlier cohorts.

average shares of tertiary educated migrants in EU and non-EU OECD countries is substantially higher for more recent cohorts: the (unweighted) average share of tertiary educated migrants that reside in the EU for at most five years is 10.3 percentage points below the (unweighted) average of non-EU countries.[32] When considering the differences in the share of tertiary educated migrants among the more established cohorts (10 years of residence or more) the difference between the average EU and average non-EU OECD country amounts to 5.9 percentage points and is statistically insignificant for all comparison groups but the large non-EU receiving countries.

Similarly, the share of migrants with primary education is lower for more recent cohorts, but when considering differences in the (unweighted) average share of the primary educated among the foreign-born with less than 5 years of residence the difference between the average EU and non-EU OECD country amounts to 12.8 percentage points (and is statistically significant) while for the more established migrants (10 years of residence or more) it amounts to only 9.3 percentage points and is no longer statistically significant. Once more there is, however, only a small difference to the US, which is not statistically significant. Thus temporary migration (which is more preponderant in the EU) and differences in migrant attitudes towards return migration for different skill levels are another important factor shaping the (worse) skill structure of migrants within the EU.

2.3.3 Changes in high-skilled foreign-born between 1990 and 2000

The data provided by the OECD (2008) as well as that analyzed in *Belot - Hatton (*2008), however, present only a static picture of the qualification structure with respect to the foreign-born in OECD countries. This may be misleading, since migrant stocks build up over time and may thus reflect migration policy that has long passed. A comparison of the 1990 and 2000 share of migrants with tertiary education in the total migrant stock based on data on OECD countries collected by Docquier and Mafouk (2006) shows that the distribution of these shares is relatively stable over time for most countries. Nevertheless, the difference in the share of tertiary educated migrants between the EU and non-EU OECD countries has decreased slightly from 15.3 percentage points to 13.0 percentage points. Above that, EU countries saw a slightly stronger (but statistically insignificant) increase in the share of tertiary educated workers between 1990 and 2000, than other non-EU OECD countries.

[32] This difference is on the verge of statistical significance at the 5% level both when comparing EU countries to all non-EU OECD countries and the major receiving countries, but not when comparing them to the US.

Table 6

Proportion of highly skilled migrants in the OECD countries and difference, 1990 to 2000

	1990	2000	Difference 2000-1990 (percentage points)
Austria	8.4	12.7	4.3
Belgium	12.6	21.5	8.9
Denmark	12.1	18.8	6.7
Finland	11.7	23.8	12.1
France	8.6	16.4	7.8
Germany	17.0	21.0	4.0
Greece	25.3	22.5	–2.8
Hungary	15.3	21.7	6.4
Ireland	26.5	41.1	14.6
Italy	15.3	15.4	0.1
Luxembourg	12.8	25.6	12.8
Netherlands	15.3	19.2	3.9
Poland	15.3	14.0	–1.3
Portugal	8.6	14.4	5.8
Spain	17.5	16.8	–0.7
Sweden	22.4	27.4	5.0
United Kingdom	20.5	34.5	14.0
Australia	33.8	37.8	4.0
Canada	50.7	58.8	8.1
Japan	30.7	34.6	3.9
Mexico	33.9	34.0	0.1
New Zealand	42.7	38.5	–4.2
Norway	24.6	31.5	6.9
Switzerland	13.5	16.8	3.3
Turkey	8.2	17.1	8.9
United States	40.1	42.5	2.4
EU Average	15.6	21.6	6.0
Non-EU Average	30.9***	34.6***	3.7
Average major non-EU	41.8***	44.4***	2.6
United States	40.1***	42.5**	2.4

Notes: Base population aged 15+, highly skilled= ISCED 5,6. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Docquier and Mafouk (2006).

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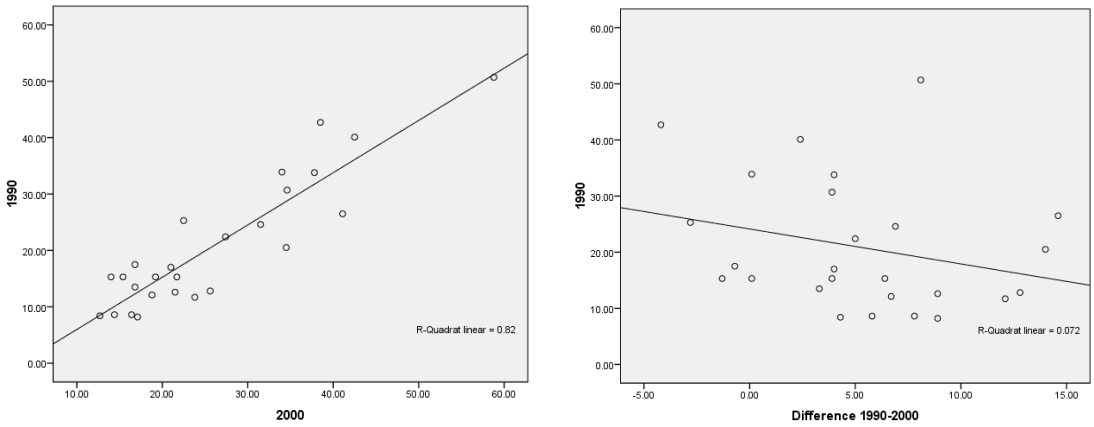
Albeit insignificant, this slightly stronger increase in the share of tertiary educated workers in EU OECD countries is consistent with mild tendencies for convergence in shares of tertiary educated migrants among countries: correlation analysis on the Docquier and

Mafouk (2006) data (see figure 3) shows that countries which started with a high share of university graduates among their foreign-born in 1990 have in general experienced a smaller increase in the share of university educated foreigners between 1990 to 2000. The correlation coefficient between the 1990 share of university educated migrants and its change between 1990 to 2000 amounts to -0,27. A regression of the 1990 share of university educated migrants on its change between 1990 and 2000 suggests a relatively low speed of convergence: countries that started with a one percentage point higher share of tertiary educated migrant experienced 0.11 percentage points slower growth in the share of tertiary educated during the last 10 years. Thus although there is some indication of a (modest) catching up of the EU countries with respect to the major non-EU receiving countries in terms of the skill structure of foreign-born in the last decade, this catching up has been rather slow and the international distribution of high-skilled migration shares seems to be highly persistent.[33]

Figure 3

Correlation between share of migrants with tertiary education 1990 and 2000 and its change



Source: Docquier and Mafouk (2006).

Summarising the results with respect to the education structure of foreign-born in the EU suggests that the EU-OECD countries can be considered a set of countries which – relative to non-EU OECD countries and the major migration receiving countries (i.e. Australia, Canada, New Zealand and the US) - is characterised by a number of weaknesses in the skill structure of migrants. In particular the share of highly educated foreign-born residing in the EU OECD countries in average is lower than that in the comparison group with the difference being most pronounced for recent migrants. Furthermore there is also some indication that this worse qualification structure of the EU migrants is not only due to differences in the countries from which migrants come, but also

[33] This is also evidenced by the correlation coefficient between the share of university educated foreign-born in 1990 and 2000 across the countries observed in the Docquier and Mafouk (2006) data set, which is at 0.91 and thus suggests only very little mobility in the distribution

due to a lower selectivity of migration patterns. There is, however, also some indication of a slow catching up of the EU-OECD countries in terms of the skill structure of migrants, as well as some indication, that the differences in skill structure apply most strongly when comparing the EU to the major non-EU-OECD receiving countries (such as Australia, Canada and New Zealand), and much less so to the US.

2.4 Other indicators of high-skilled migration

2.4.1 Migration of professionals and student mobility

As pointed out in the chapter 1 of this study the share of tertiary educated is, however, only one of many ways in which high-skilled migration can be measured. Aside from data on the skill structure of migrants the OECD (2008) also provides data on the share of foreign students in total students residing in an OECD country as well as the share of foreign-born professionals[34] among all migrants. While data on the share of the foreign-born employed as professionals reflect the low share of university graduates among migrants to EU countries (see table 7), data on foreign students points in a different direction. It suggests that EU countries are relatively successful in attracting students from abroad. Among the 23 OECD countries for which data on this indicator is available, 9 EU countries are among the top 10 with respect to the share of foreign students among the total number of students. Among the large immigration countries, only Australia attains figures comparable to those of the EU countries.[35]

Thus, at least from the point of view of student enrolment rates most EU countries are able to attract a fair amount of young college students to their countries. This, however, should not distract from a number of caveats concerning this data. In particular, data on the share of foreign-born students may be seriously biased because of differences in national education systems and may also be distorted by students in different phases of their curriculum. In this respect related literature on the share of foreign-born students in advanced research programs (see OECD 2007, 2007b) shows that — when considering this more selected group — all EU countries (except for France and the UK) have a share of foreign students involved in such programs that is below 20% and thus substantially lower than that of the US (with around 25%).[36]

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[34] Note that — in contrast to the share of foreign-born university graduates in total foreign-born — the share of foreign-born professionals in total foreign-born can only be calculated for the employed. Thus, international comparisons may be distorted by differences in employment rates of high-skilled migrants between countries.

[35] Note that as shown in the previous chapter motivations for international mobility of students differ substantially from those of other migrants (see also Bessey et al 2008)

[36] In addition there is a wide variation in the field of study chosen by foreign students among the OECD countries, which we do not analyze further here (see OECD, 2007b for data).

Table 7

Indicators concerning skilled emigration and immigration in OECD countries

	Share of foreign-born students in total students	Share of professionals in total foreign-born	Share of university graduates living abroad
Austria	11.5	13.3	9.8
Belgium	4.0	31.6	5.8
Czech Rep.	1.9	18.6	
Denmark	6.0	16.9	6.3
Finland	1.7	21.6	6.1
France	7.3	22.1	4.2
Germany	8.1	10.2	7.1
Greece		11.2	7.9
Hungary	2.6	31.8	8.4
Ireland	4.8	38.1	22.1
Italy	1.2	17.5	3.8
Luxemburg	30.5	23.3	
Netherlands		25.3	6.2
Poland	0.5	32.7	12.3
Portugal		21.3	6.3
Slovakia		23.8	
Spain	1.7	15.5	2.4
Sweden	4.5	19.0	4.6
UK	10.8	34.2	10.3
Australia	12.6	31.2	2.5
Canada	2.8	28.8	3.0
Japan	1.4		1.1
Mexico		36.1	6.5
New Zealand	3.7	33.4	8.2
Norway	3.2	20.9	4.5
Switzerland	16.0	23.1	9.8
Turkey	1.3		3.2
USA	3.2		0.4
Average EU	6.5	22.5	7.7
Average non-EU	5.5	28.9*	4.4*
Average major non-EU	5.6	31.1*	3.5*
USA	3.2	-	0.4**

Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: OECD (2008).

Furthermore, simple correlation analysis suggests that the share of university educated foreign-born living in a country as well as its change are only weakly correlated to the share of foreign students studying in a country. The correlation coefficients (which are -0.05 and 0.08 respectively) cast doubt on the viability of student migration to increase the share of highly qualified migrants in the labour force.[37]

[37] This accords well with the data presented in Tremblay (2001) which also shows relatively high shares of foreign-born students to the EU. This author, however, also shows that most of the EU countries have higher shares of students studying outside their home country than the US or Australia. Furthermore Parey and Waldinger (2007) find that two-thirds of the German students studying abroad end up working in an EU country other than that of their education, which suggests also substantial post education mobility among foreign students.

Finally, with this data we cannot differentiate between student flows from different EU countries and from outside the EU. In the light of the importance of intra EU-mobility grants (such as those from the Erasmus programme) this is likely to be a severe limitation. Indeed recent data on the structure of international student flows in 9 EU-OECD countries[38] (see OECD, 2008a) suggests that only the UK and potentially Germany receive substantial shares of students from outside Europe. In all other countries more than 50% of the international students are from other European countries (or have an unspecified origin). Thus while OECD data suggests that the EU attracts substantial numbers of foreign-born students the evidence provided in the recent literature suggests that this is primarily due to a high students mobility within the EU and a large share of students that are not enrolled in advanced research programs.

Emigration of highly skilled

Finally, OECD data also provides some limited information on the emigration of highly skilled persons for OECD countries by calculating the share of all university graduates born in a particular country residing outside their country of birth. While this indicator is subject to criticism as it does not take into account the duration of stay of these high-skilled emigrants (and thus ignores the potential for brain exchange) as well as the fact that brain drain generally constitutes a larger problem for small countries (see Beine et al., 2008), there is some indication that the EU – aside from attracting few university graduates from abroad – may also be faced with high emigration rates among its native academics. A number of EU-countries (most notably Hungary, Austria, Great Britain, Poland and Ireland, see Table 7) are characterized by a high share of nationals with academic degrees living outside their home country (i.e. a high emigration rate among the high-skilled). Only in Spain is the share of emigrants among university graduates lower than in Australia or Canada.[39] Compared to the (major receiving) non-EU OECD countries, the share of university graduates living abroad is significantly higher in Europe, at least at the 10% level and when comparing the (unweighted) EU average to the US figures, which are significantly lower by 7.3 percentage points.[40]

These figures in conjunction with the literature thus suggest that brain drain could be an issue for individual EU countries, and that with respect to student mobility, while being highly attractive for foreign students in general, many EU countries attract relatively few students in advanced study programs. In addition a large part of the registered flows seem to be accounted for by intra-EU student mobility, so that the number of foreign students

[38] These are Belgium, Denmark, Germany, Ireland, the Netherlands, Slovak Republic, Spain, Sweden, and the UK.

[39] See Johanson (2007) for a study on the potential for brain drain from Finland.

[40] Again, however, before drawing firm policy conclusions on the basis of this data one would want to know how much of this high-skilled emigration is intra-EU mobility and whether it is associated with actual brain drain or rather brain exchange. Furthermore the data is also likely to be distorted by the substantially smaller size of most EU countries relative to for example the US or Australia.

from outside the EU, may actually be lower than in the major non EU OECD countries. This said it has to, however, als be acknowledged that much more research is necessary before firm policy relevant conclusions with respect to these aspects of high-skilled migration can be reached.[41]

2.5 The labour market situation for highly skilled migrants

2.5.1 Native–foreign unemployment, employment and activity rate differentials

Aside from the extent of highly skilled migration to the EU countries the utilization of foreign-born highly skilled labour in the EU relative to non-EU OECD countries is also of central concern to our analysis. The reason for this is that making the best use of highly skilled migrants implies that a) the labour market integration of highly skilled migrants and b) the transferability of skills across national borders are important aspects of labour market policy. In this respect recent comparative studies (e.g. EC 2008, OECD 2007) show that in most countries:

1. The native – foreign-born unemployment rate differential is increasing in skill levels for most countries.
2. Foreign-born individuals do not necessarily have lower economic activity and employment rates than natives, but their activity and employment rates vary considerably more across subgroups (e.g. defined by gender and age) than that of natives.
3. There are substantial differences in skill – job matches between natives and foreign-born workers, with migrant workers often working in jobs that require lower skill levels than they actually possess (i.e. over-qualification).

While these stylised facts are confirmed for many countries, when comparing native–to–foreign-born unemployment, activity and employment rate differentials (based on the OECD data base on immigrants and expatriates) in EU and non-EU OECD countries in table 8, only one significant difference emerges: the activity rate of foreign-born workers with primary education in the average EU country is lower than in the average non-EU OECD country, while the activity, unemployment as well as employment rate differentials between natives and foreign-born are not significant for the medium- and highly skilled. This lack of significance points to the substantial heterogeneity in native–foreign activity, employment and unemployment rate differentials among tertiary educated workers within EU countries:

[41] Indeed this research could lead to results that contradict the conclusions drawn here, as is evidenced by a recent study on high-skilled emigration from Poland (see Fihel et al 2009). This study argues that the high share of skilled emigration is a result of an oversupply of skilled labour in Poland (brain overflow) and is unlikely to present a major problem for the Polish economy on account of the high level of education in this country.

Table 8

Activity, employment and unemployment rate differentials between native and foreign-born residents in OECD countries by educational attainment

	Activity Rate			Unemployment rate			Employment rate		
	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary	Primary	Secondary	Tertiary
Austria	18.4	–2.7	–7.9	4.2	4.3	4.5	13.7	–5.8	–11.5
Belgium	–0.3	–3.2	–4.1	12.4	10.9	7.6	–6.8	–10.6	–10.2
Czech Republic	15.3	–7.1	–1.4	6.6	1.7	1.7	8.1	–7.8	–2.9
Denmark	–16.4	–21.4	–19.9	5.5	4.5	3.8	–18.4	–23.7	–22.3
Finland	–3.8	–7.1	–11.7	8.8	14.5	18.2	–7.7	–16.5	–25.0
France	9.5	–2.4	–4.9	7.1	7.3	5.3	3.5	–7.6	–8.8
Germany	5.1	3.6	–1.5	9.8	6.8	8.9	–1.5	–2.2	–9.2
Greece	15.9	6.6	–8.0	0.1	–2.3	2.1	14.2	7.3	–9.0
Hungary	–0.2	–6.7	–5.1	–8.2	–1.3	0.7	2.8	–5.3	–5.5
Ireland	2.7	0.6	–3.7	3.4	5.1	4.0	0.2	–3.0	–6.8
Italy	10.5	–2.0	–10.1	0.9	2.1	3.0	8.6	–3.2	–11.8
Luxembourg	24.0	5.5	–2.1	–1.5	2.2	2.0	23.7	3.8	–3.7
Netherlands	–12.1	–9.0	–8.1	5.4	2.9	2.8	–14.4	–10.9	–10.3
Poland	–10.4	–31.6	–13.0	–14.5	–4.8	–0.3	–3.4	–22.5	–11.8
Portugal	6.7	4.8	–1.2	1.5	1.2	1.2	5.1	3.5	–2.3
Slovak Republic	9.9	–6.5	–5.8	–5.3	–2.0	0.1	7.4	–3.8	–5.5
Spain	10.2	8.9	–0.8	1.6	4.6	3.8	7.4	4.6	–3.4
Sweden	–9.0	–15.6	–18.5	6.2	4.7	4.7	–11.4	–18.1	–21.4
United Kingdom	–12.9	–11.2	–8.6	4.1	3.7	2.7	–14.2	–13.2	–10.5
Australia	–7.4	–10.4	–6.4	0.5	2.3	3.0	–6.9	–11.4	–8.7
Canada	–1.0	–6.2	–4.8	–3.2	0.0	2.3	1.1	–5.7	–6.5
Japan	–13.9	–8.4	–7.8	1.2	1.5	0.5	–14.0	–9.1	–7.9
Mexico	–2.3	–8.1	–0.1	0.0	–0.2	–0.4	–2.3	–7.9	0.1
New Zealand	–8.6	–12.7	–6.5	1.0	2.4	2.8	–8.2	–13.4	–8.7
Norway	–9.0	–8.9	–8.1	6.0	6.1	3.0	–11.6	–12.7	–10.3
Switzerland	7.5	–2.8	–7.6	4.9	3.4	3.6	3.4	–5.5	–10.7
Turkey	–11.0	–1.2	–14.1	3.8	0.6	7.3	–12.2	–1.4	–17.9
Average EU	3.3	–5.1	–7.2	2.5	3.5	4.0	0.9	–7.1	–10.1
Average non-EU	–4.7*	–7.4	–7.1	1.2	1.9	2.6	–5.1	–8.4	–8.8
Average major non-EU	-3.5	-9.4	-6.5	-1.2	1.4	2.3	-2.3	-9.7	-8.3
United States	3.2	–8.1	–8.3	–3.2	0.8	1.2	4.7	–8.2	–9.1

Notes: Primary level refers to ISCED 0/1/2, secondary level refers to ISCED 3/4 and tertiary level refers to ISCED 5/6. Excluding individuals with unknown education level, gender or place of birth. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: Database on Immigrants in OECD Countries (DIOC).

1. Differentials in activity rates between tertiary educated foreigners and natives for instance range between 19.9 percentage points in Denmark and 0.8 percentage points in Spain. Double digit differentials are registered in Finland, Poland and Sweden, very low differentials in the Czech Republic, Germany and Luxemburg.

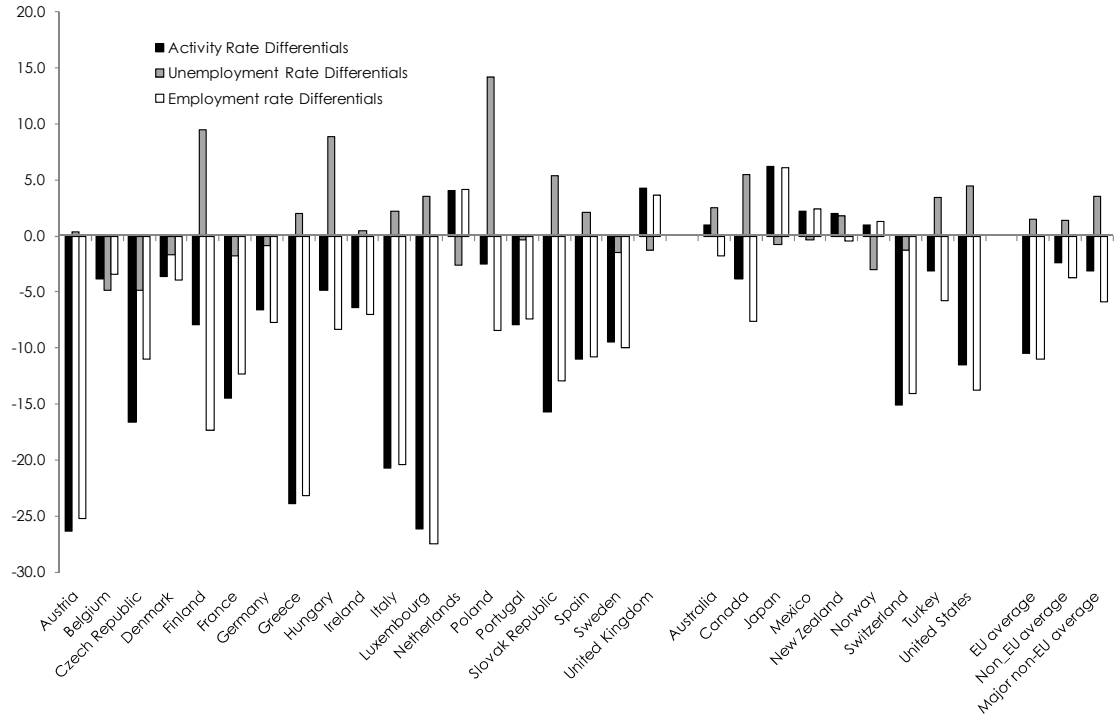
2. Similarly, according to OECD data, the native—foreign-born employment rate differential among highly-skilled individuals in the EU was highest in Finland with a spectacular difference of 25 percentage points and lowest in Portugal (2.3 percentage points), the Czech Republic (2.9 percentage points) and Luxemburg (3.7 percentage

points). Furthermore the list of countries with double digit foreign-native employment rate differentials (Austria, Belgium, Denmark, Italy, the Netherlands, Poland, Sweden and the UK) is rather long.

3. Finally, native-foreign unemployment rate differentials for the tertiary educated were 18.2 percentage points in Finland but actually negative in Poland. Countries such as Belgium, France and Germany had native—foreign unemployment rate differentials exceeding 5 percentage points, and in Hungary and the Slovak Republic these differentials were below 1 percentage point.

Figure 4

Skill gradient of activity, employment and unemployment rate differentials between native and foreign-born residents in OECD countries



Notes: Skill gradient = native- foreign employment rate differential for highly skilled minus native-foreign employment rate differential for less skilled. Major non-EU = Australia, Canada, New Zealand, United States.

Source: Database on Immigrants in OECD Countries (DIOC).

Even larger differences can be found for individuals with primary education only: activity rate differentials between low-skilled natives and migrants are positive in 11 (with the highest difference of 24 percentage points found in Luxemburg) and negative in 8 out of 19 EU countries (with Denmark having the highest differential with –16.4 percentage points). Similar heterogeneity can be observed for the native—foreign employment rate differential among those with primary education which ranges from 23.7% in Luxemburg to -18.4% in Denmark, and is negative in 8 but positive in 10 EU countries. Finally, for low-skill workers

the native–foreign-born unemployment rate differential was 2001 negative in Hungary, Poland, Luxemburg and the Slovak Republic, while being positive in all other EU countries.

To visualize the differences between migrants and natives across skill levels, figure 4 displays the "skill gradient" in native-foreign activity, employment and unemployment rate differentials.[42] These are calculated, e.g. for unemployment, by subtracting the respective native–foreign unemployment rate differential for workers with primary education from the native–foreign unemployment rate differential for workers with tertiary education. Thus, a negative number implies that unemployment rate differentials are decreasing in educational attainment (to the disadvantage of foreigners), while a positive figure suggests that unemployment rate differentials are increasing in educational attainment (to the advantage of migrants). Similarly, we construct equivalent indicators for activity and employment rate differentials, where, however, due to higher employment rates indicating better labour market integration, negative numbers imply that employment (or activity) rate differentials are increasing in educational attainment (to the disadvantage of foreigners), while a positive figure suggests that employment rate differentials are decreasing in educational attainment.

As can be seen, foreign-native activity rate differentials are increasing with skill levels in all EU countries with the exception of the Netherlands and the U.K. This indicates that highly skilled are (possibly on account of greater difficulties in transferring human capital) less likely to participate in the labour market in the EU countries. In some countries these disadvantages of the highly skilled are very large indeed and exceed the 20 percentage points mark in Austria, Greece, Italy and Luxembourg. Thus, more highly skilled foreign-born workers are disadvantaged with respect to activity rates in the EU. This observation does not apply as unambiguously to the non-EU OECD countries, where it applies only to Canada, Turkey, Switzerland and the United States.[43]

Similar results arise for the skill gradient of employment rate differentials: foreign-native employment rate differentials are increasing with skill levels in all EU countries (again with exception of the Netherlands and the United Kingdom) and again exceed the 20 percentage points mark in Austria, Greece, Italy and Luxemburg. For non-EU OECD countries the picture is again less homogeneous: in contrast to most EU countries, skill gradients are positive in Japan, Mexico and Norway and substantially (and significantly) smaller in the average non-EU OECD country[44]. Thus, the high-skill gradient in foreign-

[42] Note that ideally for this type of analysis we would like to exclude the 15-25 year olds, as their high – but differentiated – rates of schooling may distort the analysis. This route is, however, not open to us with this data set (see, however, the next chapter for a more detailed analysis by age groups).

[43] When testing for differences in mean "skill gradients" in foreign-native activity rate differentials we can reject the null of equal means between EU and non-EU OECD countries at a 5% significance level. The activity rate skill gradient is thus significantly smaller in the EU than in the other OECD countries.

[44] Again, when testing for differences in means we can reject the null of equal mean employment rate skill gradients between EU and non-EU OECD countries at a 5% significance level.

native activity and employment rate differentials working to the disadvantage of more highly educated workers seem to be a common feature shared by the labour markets of many EU (and some non-EU OECD) countries. This suggests that more highly skilled migrants have particular problems in transferring their skills to EU countries.

This observation of high-skill gradient in foreign-native labour market disparities does, however, not apply to unemployment rates. Here, skill gradients are positive and thus to the disadvantage of the highly skilled in only 9 out of the 19 EU countries considered in Figure 4 while they are positive in the other 10. On average, the skill gradient of the unemployment rate is slightly positive for the EU countries. Furthermore, statistical tests for equality of means show that there are no differences between the average EU and non-EU OECD country.

2.5.2 Overqualification

Further evidence for the possible problems of migrants to the EU in transferring skills across national borders can be derived from indicators on job-skill mismatch, which have recently been calculated by the OECD (see OECD, 2007). These indicators are derived by assessing whether highly skilled workers are working in jobs that are adequate for their skills, in which case they will be called adequately qualified, or have higher skills than required by their occupation, which makes them overqualified (see next chapter for methodological details). With respect to over-qualification the EC (2008) finds that two thirds of the recent high-skill migrants employed (relative to 19% of all workers with tertiary education) are overqualified. The OECD (2007) calculated indices of over-qualification for its member countries (see table 9) and found that foreign-born women generally suffer from higher over-qualification rates than men in almost all countries and that over-qualification rates – on account of better labour market integration of more established migrants, but also probably because of return migration – decrease with duration of stay. In the subsequent analysis we thus use the data provided by the OECD (2007) to consider some rudimentary stylized facts on over-qualification in the EU (relative to non-EU OECD countries).[45]

According to the OECD data, rates of over-qualification vary substantially over individual EU countries. For natives the rates of over-qualification range from 5% (Czech Republic) to 24% (Spain), or even 27% (Slovakia). For foreign-born they lie between 7 and 9% (Hungary and Luxemburg) to as high as 43% (Spain). Non-EU OECD countries are characterized by a substantially smaller range of over-qualification rates that lie well within the minimum and maximum covered by EU countries. Due to the substantial heterogeneity

[45] In this analysis it should be taken into account that a certain share of established migrants got their –tertiary or even earlier – training in the host country and hence do not face a problem of transferability of skills. For an in-depth analysis of over-qualification based on European Labour Force Survey data see the next chapter.

of the EU countries, no significant differences between EU and non-EU OECD countries can be found.

Table 9

Overqualification rates among natives and foreign-born workers in OECD countries according to different sources

	Survey Data: population 15-64, 2003-2004			Censuses and Population Registers: population 15+, ca. 2000		
	Total	Native-born	Foreign-born	Total	Native-born	Foreign-born
Austria	11.5	10.3	21.1	10.9	9.9	20.0
Belgium	16.2	15.6	21.6			
Czech Republic	5.2	5.2	10.0	5.8	5.6	9.6
Denmark	10.9	10.4	18.6	11.9	11.2	24.5
Finland	14.4	14.3	19.2	16.2	16.1	21.6
France	11.6	11.2	15.5	11.0	10.8	13.7
Germany	12.3	11.4	20.3			
Greece	11.3	9.0	39.3	13.1	10.1	32.4
Hungary	6.4	6.3	9.7	5.1	5.0	7.4
Ireland	16.6	15.7	23.8	17.5	16.9	21.0
Italy	7.0	6.4	23.5	7.3	6.9	15.4
Luxembourg	5.5	3.4	9.1	7.6	5.4	11.7
Netherlands	10.1	9.3	16.8			
Poland				7.8	7.8	9.0
Portugal	9.0	7.9	16.8	9.0	8.3	13.6
Slovak Republic				26.9	26.9	24.5
Spain	25.5	24.2	42.9	8.1	7.3	19.8
Sweden	7.6	6.5	16.1	8.7	7.6	18.6
United Kingdom	15.5	15.3	17.8	14.4	14.0	18.4
Australia	20.4	19.0	24.6	14.5	12.9	18.9
Canada				22.1	21.3	25.2
Mexico				23.7	23.7	15.9
New Zealand				18.6	18.9	17.2
Norway	9.2	8.4	20.3			
Switzerland	10.5	10.0	12.5	7.8	7.2	10.6
Turkey				5.3	5.3	6.7
United States (2002)	14.0	13.4	18.1	14.4	14.0	17.3
Average EU	11.6	10.7	20.1	11.3	10.6	17.6
Average non-EU	13.5	10.6	17.0	15.3	15.1	15.5
Average major non-EU	9.9	9.2	16.4	12.3*	12.1*	11.1
United States (2002)	14.0	13.4	18.1	14.4	14.0	17.3

Notes: Base employed. Major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level.

Source: OECD (2007).

To evaluate the relative disadvantages of foreign-born with respect to over-qualification the OECD suggests using the ratio of the share of overqualified foreign-born and natives as an indicator. As can be seen from table 10, this indicator too varies substantially over the individual EU countries, with values between 0.9 (i.e. indicating a 10% lower rate of over-qualification for foreign-born than for native-born) for the Slovak Republic to over 4 for

Greece. When considering the census based data – which we consider superior to survey based measures on account of the higher data reliability and larger number of observations provided – the relative over-qualification of the foreign-born is significantly higher in the average EU country compared to the average non-EU OECD country. When compared to the US, however, there is no statistically significant difference in terms of relative over-qualification.

Table 10

Relative overqualification of foreign-born workers in OECD countries

	Survey Measure	Census Measure	Men[1)]	Women[1)]
Austria	2.0	2.0	1.6	1.4
Belgium	1.4		2.7	1.6
Czech Republic	1.9	1.7	1.4	1.4
Denmark	1.8	2.2	1.3	1.1
Finland	1.3	1.3	1.9	2.0
France	1.4	1.3	1.9	1.7
Germany	1.8	-	1.4	1.3
Greece	4.4	3.2	1.3	1.5
Hungary	1.5	1.5	2.4	1.4
Ireland	1.5	1.2	6.0	3.1
Italy	3.7	2.2	1.4	1.6
Luxembourg	2.7	2.2	1.4	1.6
Netherlands	1.8	-	1.5	1.5
Poland	-	1.2	3.9	3.4
Portugal	2.1	1.6	4.4	1.6
Slovak Republic	-	0.9	0.8	0.6
Spain	1.8	2.7	1.7	1.9
Sweden	2.5	2.4	0.7	1.3
United Kingdom	1.2	1.3	0.7	1.3
Australia	1.3	1.5	1.8	2.7
Canada	-	1.2	1.0	0.9
Mexico	-	0.7	2.0	1.6
New Zealand	-	0.9	2.1	3.0
Norway	2.4	-	1.8	1.0
Switzerland	1.3	1.5	1.6	1.1
Turkey	-	1.3	1.8	1.0
United States (2002)	1.4	1.2	1.6	1.1
Average EU	2.0	1.8	2.0	1.6
Average non-EU	1.7	1.1**	1.7	1.5*
Average major non-EU	1.3	1.2*	1.3	1.3
United States (2002)	1.4	1.2	1.6	1.1
P-value* *t*-test for equality of means	0.31	0.02	0.19	0.09

Notes: major non-EU = Australia, Canada, New Zealand, United States. *** significantly different from EU average at 0.01, ** 0.05, * 0.10 level. 1) based on census and survey data.

Source: OECD (2007).

2.6 Conclusions

The results of this chapter suggest that EU countries in general receive a lower share of highly skilled migrants than non-EU OECD countries but that there is also a substantial heterogeneity in the share of highly qualified migrants among EU countries. For example shares of highly skilled migrants in Ireland and the UK are as high as 30%, while other countries such as Austria, Italy and Poland receive a very low share by international standards. Furthermore, subsequent analyses of this data suggest that—even after controlling for differences in sending country structures—migrant selectivity in the EU is substantially lower than in the major non-EU receiving countries in the OECD and that some EU countries (such as Austria, Poland and Italy) actually receive a negative selection of migrants relative to the skill structure of the sending countries.

When focusing on potential explanations for these differences the results of a recent study by Bellot and Hatton, 2008 suggest that the relative remoteness of the EU from the Asian countries (with a high share of highly skilled migrants) emerges as the only common factor which impedes on the capability of European nations to attract highly skilled migrants, with all other factors such as linguistic and colonial ties, differences in wage premia for high-skilled labour and country fixed effects pointing to substantial heterogeneity among the EU countries.

In addition comparing the migration structure across migrant cohorts, more recent migrants are generally higher qualified than those living in the recieving countries for more than 10 years. This, however, applies even more strongly to almost all non-EU OECD countries. Thus, even though the EU countries are characterised by a better qualification structure of more recent migrants, they are still lagging behind the non-EU OECD countries because the share of migrants with tertiary education among recent cohorts is even higher for the latter.

Comparing the general stock of highly skilled migrants between 1990 and 2000, however, shows that the difference in the share of tertiary educated foreign-born between EU and non-EU OECD countries has decreased slightly over time and that there is a weak tendency for catching up.

Considering data on other aspects of high-skilled migration in addition suggests that brain drain could be an issue for individual EU countries, and that with respect to student mobility, while being highly attractive for foreign students in general, many EU countries attract relatively few students in advanced study programs. In addition a large part of the registered flows are accounted for by intra-EU student mobility, so that the number of foreign students from outside the EU, may actually be lower than in the major non EU OECD countries. With respect to these aspects of high-skilled labour mobility data quality is, however, too low (and research to underdeveloped) to draw firm policy conclusions.

Finally, results on the relative labour market situation of tertiary educated foreign-born citizens in the EU show that EU countries are an extremely heterogeneous group. Despite this, two general findings – both of which suggest that highly skilled migrants may face substantial difficulties in transferring skills across borders – emerge: firstly, skill gradients with respect to the foreign-native activity and employment rate differentials are somewhat larger in EU than in non-EU OECD countries. Secondly – relative to the native-born population - foreign-born workers in EU OECD countries tend to have higher rates of over qualification than those in non-EU OECD countries.

Generally, it can be observed that comparing the EU OECD countries with the four major non-EU receiving countries in the OECD – Australia, Canada, New Zealand and the US – more often results in significant differences, while comparisons of the EU with the US alone seldom lead to significant or sizable differences. For example the major non-EU receiving countries not only show a significantly higher share of foreign-born in the population, but also a significantly better educational structure than the EU OECD countries. On the other hand no significant differences can be found when comparing the US to the EU OECD countries. This result can be interpreted as indicating that those countries with modern, point-based migration systems (Australia, Canada and New Zealand) are more successful in attracting highly skilled migrants than the EU or the US.

Chapter 3
The labour market situation of highly skilled migrant workers in the EU

3.1 Introduction

Increased high-skilled migration is a major policy challenge for receiving countries. Making the best use of highly skilled migrants implies increased efforts at improving the transferability of skills across national borders as well as improving the integration of (high-skilled) foreign workers into the national labour market. In this respect recent comparative studies (e.g. EC 2008, OECD 2007) show that in most countries high-skilled migrant workers are faced with higher unemployment risks and also a higher risk of being employed below their actual qualification level than their native fellow residents. In addition the last chapter indicates that in general the EU countries are marked by steeper increases in the foreign-native activity and employment rate differentials and a slightly higher rate of over-qualification of foreign-born relative to native-born. This suggests greater problems for highly skilled foreign-born workers in transferring their skills across national borders in EU countries than in other non-EU OECD countries.

In this chapter we are thus interested in the question how highly skilled migrant workers in the EU and its member states fare in terms of labour market integration and over-qualification. We thus extend our analysis to the EU 27 and - in contrast to existing comparative studies on the labour market situation of foreign workers in the EU - take stock of the labour market integration of foreign-born workers with a tertiary education in the European Union. After discussing data issues in Section 2 we start our analysis with a description of the structure of highly skilled migrants to the European Union in Section 3. The central research question of this section is thus to assess how important high-skilled migrants are as a human capital base for the EU27.

In Section 4 by contrast we look at the labour market situation of high-skilled migrants in terms of employment, unemployment and activity rates. We compare these to the equivalent indicators of their native peers and perform a regression analysis to determine a) how large native-foreign-born differentials for different skill groups are with respect to labor market integration and b) for which groups of foreigners these differentials are largest. Our central question of interest in this section is thus what difference formal education makes for the labour market outcomes of migrants in terms of employment, unemployment and inactivity rates.

Labour market access of highly skilled workers should, however, not only be measured against the yardstick of employment and unemployment but also in terms of the match between their qualifications and their jobs (see OECD 2007). Here highly skilled migrants

may face a number of difficulties which differentiate them from low-skilled migrants. These may arise from differences in the "value" of education in different sending countries, lacking (formal, informal or non formal) recognition of skills abroad, lacking receiving country specific human capital (such as language skills and/or knowledge of labour market institutions), the labour market situation in receiving countries, institutional factors and various forms of discrimination.

In Section 5 we thus consider the match between migrants' skills and their jobs by calculating measures of over- and under-qualification. While with the data at our hands, we are unable to identify the exact causes of skill-job mismatch, our primary aim here is to determine the size of the native-foreign differentials in skill-job mismatch for migrants from different sending regions and to highlight some of the common factors determining job-skill mismatch. Finally, in section 6 we summarise our main findings.

3.2 Data, definitions and measurement

The data we use are taken from the European Labour Force Survey (EU-LFS) for the years 2006 and 2007. This is a regular questionnaire presented to a representative sample of households in all countries of the EU 27.[46] In this questionnaire, respondents are interviewed on a number of demographic and workplace characteristics (such as occupation and branch of employment, age, gender, highest completed education and others) as well as place of birth. From these questions it is possible to estimate both the total number and structure of foreign-born residing in the European Union. Thus in this chapter as in most of this study – and in accordance with much of the migration literature – we focus primarily of the concept of "foreign-born" as a definition of a migrant. The reason for this is that the "foreign-born" concept relative to the nationality concept of migrants provides a more complete picture of migration by also including naturalized citizens and (of particular importance for international comparisons) avoids distortion arising from differences in naturalization policies and autochtonus minorities across countries.

Since our aim is to focus on the educational attainment of the foreign-born population and since children under the age of 15 have mostly not completed education, we consider only the population aged 15 and older.[47] Furthermore, this data can be analysed from the perspective of the sending regions (by analysing the structure of migrants by place of birth), the receiving region (by analysing foreign-born by country of residence) or from a place to place perspective (by analysing separate sending-receiving country pairs). In this chapter due to space limitations we focus primarily on the sending and receiving country perspective without putting particular emphasis on a place to place analysis.

[46] see: http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/index.htm for the questionnaire and its methodology

[47] We decided on this age limit since it is also the age limit at which active age population is calculated, which makes comparison to official sources easier.

While our data are thus well suited for our purposes, its analysis is also subject to a number of caveats. The first of these arises with respect to the number of countries analysed and the structure of the sample. In particular our data, due to differences in the national Labour Force Surveys, offers no information on the country of birth of residents in Germany and Ireland, making it impossible to identify non-EU-born nationals in these countries. We thus follow previous literature using the same data set as ours (see for example EU, 2008, Huber and Nowotny, 2008) and exclude these two countries from our analysis. Furthermore, due to its sampling structure the EU-LFS (which focuses strongly on permanent residents) is likely to underrepresent short-term and seasonal migration if such migration.

Another caveat applies to missing data and non response. In our data 0.09% of the residents in the European Union did not respond to the question on place of birth, 1.87% of the foreign-born did not answer to the question on duration of stay and 4.04% of the residents did not answer to the question on their highest education level. While these figures seem sufficiently small to allow representative analysis, non response rates are substantially higher in individual countries. In particular in the UK the non-response rate for highest completed education is at 22% and in Denmark almost 27% of the foreign-born do not answer to the question of the years of residence.[48] Thus data for analyzing the educational structure on a receiving country basis for the UK must be considered questionable and data with respect to the duration of stay for Denmark is also likely to be distorted.

We deal with these non response problems as follows: First, we exclude from our analysis all persons, who did not answer the question on the highest completed education. Thus our estimates of the EU population and workforce will disaccord with official statistics on account of these persons. In addition, we include non responders with respect to the question on place of birth as a separate category when analyzing our data from the sending country perspective. We exclude them, however, when analysing from a receiving country perspective. Thus there may be some differences with respect to the aggregate data for EU residents depending on whether the receiving country or the sending country perspective is analysed. Finally, we exclude foreign-born persons with missing data on the duration of stay in the country of residence only when considering data on the duration of stay.

A third drawback to our data is that it is taken from a survey, which is subject to sampling error. We minimize the problem of high variability of the data for individual years by using averages across two years (2006 and 2007), but in a number of cases the number of foreign-born is well below the confidence bounds provided by EUROSTAT. Thus to avoid misinterpretation, we follow the rules of reporting suggested by Eurostat[49] by listing all

[48] Non response with respect to country of birth, by contrast, is not concentrated on any individual country. The highest non-response rate to this question is found in Denmark, where it amounted to 0.5% of all residents.

[49] see http://circa.europa.eu/irc/dsis/employment/info/data/eu_lfs/index.htm

figures where high standard errors of the estimates may be expected in brackets and suppressing all numbers where levels are below the lower confidence bounds suggested by EUROSTAT.

3.3 The qualification structure of foreign-born in the EU 27

3.3.1 The sending country perspective

In this chapter, we also follow previous literature (see EC, 2008) by dividing the total population resident in the EU into three groups

1. Native-born – these are persons that reside in the same country as they are born
2. Other EU-born – these are persons born in another EU member state than they reside
3. Non-EU-born – these are persons that are born outside the EU, but reside in an EU country.

Table 1

LFS-based data on population aged 15+ by place of birth

	Skill level							
	low	medium	high	total	low	medium	high	total
	Absolute in thousand				Share of total In %			
Native-born	122,116.4	120,518.0	52,758.5	295,392.9	92.0	92.4	90.3	91.9
EU-born	2,917.3	3,259.0	1,843.8	8,020.2	2.2	2.5	3.2	2.5
of this								
From EU 12 to EU 15	628.2	1,238.8	433.9	2,300.8	0.5	1.0	0.7	0.7
From EU 15 to EU 15	2,135.9	1,781.0	1,321.3	5,238.2	1.6	1.4	2.3	1.6
From EU 27 to EU 12	153.2	239.2	88.6	481.1	0.1	0.2	0.2	0.1
Non-EU-born	7,718.7	6,604.1	3,833.0	18,155.8	5.8	5.1	6.6	5.6
of this								
Other Europe	1,339.5	1,474.9	632.0	3,446.4	1.0	1.1	1.1	1.1
Turkey	456.0	193.0	44.9	693.9	0.3	0.1	0.1	0.2
North Africa	2,245.6	958.8	569.4	3,773.8	1.7	0.7	1.0	1.2
Other Africa	960.6	920.3	635.3	2,516.2	0.7	0.7	1.1	0.8
South & Central America Caribbean	1,298.9	1,385.3	757.6	3,441.7	1.0	1.1	1.3	1.1
East Asia	167.9	146.5	126.5	440.8	0.1	0.1	0.2	0.1
Near and middle East	233.8	311.7	243.7	789.2	0.2	0.2	0.4	0.2
South and southeast Asia	907.0	938.8	555.1	2,400.9	0.7	0.7	0.9	0.7
North America, Australia and Oceania (incl. other)	109.3	275.0	268.5	652.8	0.1	0.2	0.5	0.2
No answer	144.6	78.0	63.0	285.6	0.1	0.1	0.1	0.1
Total	132,752.3	130,381.1	58,435.4	321,568.9	100.0	100.0	100.0	100.0

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non EU central and Eastern European countries. EEA = European Economic Area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004, averages 2006-2007.

Source: EU-LFS.

We further divide the set of EU-born into persons, who are born in the 12 countries that joined the European Union in 2004 resp. 2007 (EU 12) but live in the other (EU 15) countries (to which we refer as migrants from the EU 12 to the EU 15), persons who were born in one country of the EU 27 but live in another EU 12 country than their country of birth (migrants from EU 27 to EU 12)[50] and migrants, who were born in one country of the EU 15 but reside in another country of the EU 15 (migrants from the EU 15 to the EU 15). The non-EU-born migrants by contrast are subdivided into various groups according to major sending regions (see table 1).

Table 2

Share of EU population aged 15+ by place of birth, gender and highest completed education

	Skill level								
	low	medium	high	low	medium	high	Low	medium	high
	Male			Female			Total		
Native-born	38.9	43.4	17.7	43.7	38.3	18.0	41.3	40.8	17.9
EU-born	35.4	42.0	22.6	37.2	39.5	23.3	36.4	40.6	23.0
of this									
From EU 12 to EU 15	26.0	57.2	16.8	28.4	51.2	20.5	27.3	53.8	18.9
From EU 15 to EU 15	25.4	46.8	27.8	41.9	39.3	18.7	33.7	43.1	23.3
From EU 27 to EU 12	25.4	54.9	19.7	37.2	45.4	17.3	31.9	49.7	18.4
Non-EU-born	41.6	36.8	21.5	43.3	35.9	20.7	42.5	36.4	21.1
of this									
Other Europe (including CEEC)	39.1	44.2	16.7	38.7	41.6	19.7	38.9	42.8	18.3
Turkey	61.0	32.0	7.0	70.9	23.2	5.9	65.7	27.8	6.5
North Africa	56.5	26.6	16.9	62.9	24.0	13.0	59.5	25.4	15.1
Other Africa	35.1	36.5	28.4	41.3	36.7	22.0	38.2	36.6	25.2
South & Central America Caribbean	39.7	40.1	20.2	36.2	40.4	23.4	37.7	40.2	22.0
East Asia	38.2	34.6	27.2	38.0	32.1	29.9	38.1	33.2	28.7
Near and middle East	29.3	38.9	31.7	30.0	40.2	29.8	29.6	39.5	30.9
South and southeast Asia	34.9	39.8	25.3	40.6	38.4	21.0	37.8	39.1	23.1
North America, Australia (Oceania)	16.3	44.6	39.1	17.2	39.9	42.9	16.7	42.1	41.1
No answer	47.9	30.0	22.1	53.5	24.5	22.0	50.6	27.3	22.1

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries, EEA = European Economic Area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004; averages 2006-2007.

Source: EU-LFS

Tables 1 to 4 display some of the features of the qualification structure of the European population (over the age of 15 and excluding Germany and Ireland) from this sending

[50] We cannot separate migrants from the EU 15 to the EU 12 and the within the EU 12, because this would cause severe problems with the representativity of our data.

country perspective. According to this data around 92% of the European population in the years 2006 and 2007 aged 15 or more is native-born, 2.5% of the population are born in the EU 27 but live in another country than their country of birth and 5.6% of the total population were born outside the EU 27. Also the share of non-EU-born is slightly higher than in the total for the low as well as the high-skilled, while for the EU-born migrants it is increasing in qualification level (see Table 1). Thus migrants from outside the EU are a more important group in the EU 27 than migrants within the EU and overall the share of foreign-born aged 15+ is highest among the highly skilled in the European Union (excluding Germany and Ireland).

The most important individual migrant groups among the non EU-born are persons born in North Africa (1.2% of the residents), other European countries, which include primarily migrants from Eastern European and Balkan countries (1.1%), South and Central America (including the Caribbean, 1.1%), and other African Countries (0.8%). While with respect to intra EU migration migrants from the EU 15 to the EU 15, which account for 1.6% of the EU wide population, followed by migrants from the EU 12 to the EU 15 are most important and EU 27 to EU 12 migrants are only a very small share of the total population.[51]

Looking at the education structure of non EU-born residents there is substantial variance in the share of highly educated migrants by sending region (see table 2). The highest share of foreign-born with high qualification levels (with 41.1%) is found among migrants born in North America, Australia and Oceania, the lowest share (with 6.5%) among migrants from Turkey.[52] Among the most important sending regions for non EU migrants (i.e. North Africans, other Europeans, South and Central Americans and other Africans) the largest share of highly qualified migrants (of 20.6%) is registered among south and southeast Asians. The only immigrant groups (aside from persons born in Turkey) for whom the share of highly educated is smaller than for natives, are Northern Africans. Thus in general the share of highly skilled is higher among the resident population born outside the EU than among natives, which underlines the importance of migrants as a source for human capital in the EU 27.

The high share of highly skilled migrants relative to the native-born applies even more strongly to within EU migrants. In particular migrants from the EU 15 to the EU 15 have the highest high education share among the EU-born migrants. Migrants from the EU 12 to the EU 15 and migrants from the EU 27 to the EU 12 by contrast are slightly less highly skilled, although their share of highly skilled still exceeds that of natives.

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[51] While these shares for individual sending regions may seem small, as pointed out inter alia by Huber and Nowotny (2009) migrants tend to cluster regionally so that shares of individual sending regions (such as South Americans in Spain) may be substantially higher; furthermore the share of Turkish born in the EU population is severely distorted downwards in our data on account of missing information on Germany

[52] Figures for Turkish born migrants are, however, severely distorted by missing information for Germany

Furthermore, there is no clear indication whether women or men are more likely to be highly qualified (see Table 2). While EU-born women living in another country than their country of birth in aggregate have a higher share of highly qualified, this does not apply to women that moved from the EU 27 to the EU 12 or from the EU 15 to the EU 15. Similarly the high education share among non-EU-born women is slightly lower than that of men. When, however, moving to individual sending regions we find that in four out of ten sending regions women take a higher share of highly educated among migrants, while for six the opposite applies.

Table 3

Share of EU population aged 15+ by place of birth, Age groups and highest completed education

	Skill level								
	low	medium	high	low	medium	high	low	medium	high
	15-24 years			25-44 years			45+ years		
Native-born	47.2	45.0	7.8	24.3	48.3	27.4	51.8	34.0	14.2
EU-born	42.1	49.0	8.8	24.4	45.3	30.4	46.5	34.5	19.0
of this									
From EU 12 to EU 15	43.0	50.6	6.4	21.4	57.8	20.8	30.2	47.1	22.7
From EU 15 to EU 15	38.6	51.1	10.3	9.5	38.0	52.5	41.2	44.0	14.8
From EU 27 to EU 12	(40.0)	53.5	-	12.5	57.0	30.5	39.4	46.1	14.4
Non-EU-born	55.7	37.3	7.0	36.5	38.9	24.6	46.1	32.6	21.3
of this									
Other Europe (including CEEC)	60.7	34.4	4.9	32.8	45.8	21.4	38.8	42.1	19.2
Turkey	65.3	32.7	-	60.8	31.6	7.7	75.0	18.9	(6.1)
North Africa	68.8	25.9	5.3	52.5	28.5	18.9	63.5	22.9	13.6
Other Africa	48.8	42.3	9.0	35.2	37.3	27.5	38.8	32.6	28.6
South & Central America									
Caribbean	58.1	36.8	5.1	31.7	43.0	25.3	38.2	36.4	25.4
East Asia	36.4	47.5	16.1	35.7	30.0	34.3	45.0	27.4	27.6
Near and middle East	53.7	37.9	(8.4)	24.8	42.3	32.8	23.6	36.2	40.3
South and southeast Asia	48.5	41.8	9.7	34.3	40.1	25.6	39.6	36.9	23.5
North America, Australia									
(Oceania)	32.0	54.3	(13.7)	12.2	42.8	45.1	19.3	36.3	44.3
No answer	47.9	(30.0)	-	53.5	24.5	22.0	50.6	27.3	22.1

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non EU central and Eastern European countries, EEA = European Economic Area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004, averages 2006-2007, values in brackets have a low reliability. - = indicates that data include too few observations to be reported.

Source: EU-LFS

With respect to the skill structure by age the middle age groups of the foreign-born are the most highly qualified from almost all sending regions[53] (see table 3). While in the age group between 15 and 24 years the share of highly qualified migrants is very low, since these migrants are often still in education, the share of highly skilled non-EU-born migrants in the

[53] The only exceptions to this are persons born in North Africa, East and Southeast Asia.

age of between 25 to 44 years is 24.6%, and for the age groups of those older than 45 it amounts to 21.3%. For Other-EU-born migrants the respective figures are 30.4% and 19.0%. The most spectacular differences in the high-skilled share of foreign-born workers in the age of 25 to 44 years and in the age of 45 years or older can be found among migrants from the EU 15 to the EU 15. Here the high-skilled share among 25 to 44 year olds is 52.5% but that of 45 or more year olds is only 14.8%.

More interestingly, however, this data also indicates that non-EU-born migrants of the age of 25 to 45 years in general do not have a higher share of high-skilled than natives of the same age group. Only 24.6% of the non-EU-born (relative to 27.4% of the native-born) in the age group between 25 and 45 had completed a tertiary migration in the years 2006 to 2007. The higher share of highly educated among the non-EU-born migrants is thus solely due to the age group of those 45 or older. This result hinges primarily on the low qualification profile of younger migrants born in other European countries (CEEC and other European countries), Turkey, North Africa and to a lesser extent South America and South and Southeast Asia. In particular with respect to the first three groups this suggests that the high share of seasonal workers and irregular migrants – which are often in the age group between 25 and 44 years are reducing the qualification level of younger foreign-born workers in the EU. For migration within the EU 27 this does not apply, however. Here migrants in the age of 25 to 44 years also have higher shares of highly educated than natives.

Finally, the data on qualification structure by duration of stay (see table 4) suggests that within EU migrants with a shorter duration of stay (less than 10 years) have higher shares of highly educated migrants. This, however, does not apply to non-EU-born migrants. Here migrants with a shorter duration of stay have a lower share of highly educated than migrants with a longer period of stay for all regions of birth except for other European countries, America, Australia and Oceania and the “others” category.[54] Thus the improved qualification structure of migrants with a shorter period of stay in Europe is solely due to the better qualification structure of recent migrants within the EU27. Recent migrants from outside the EU (aside from those from other European and highly developed countries such as America and Australia), by contrast, are actually less often highly educated than more established migrants. To the degree that this is not solely due to better access of more established migrants in the receiving country this again is indication of the substantial amount of low-skilled short-term migration from non EU-countries into the EU 27.

Thus a look at the migration figures from a sending country perspective suggests that first of all migration of highly educated workers is an important element in improving the skill structure of migrants in the EU. According to the EU Labour Force Survey nearly 10% of

[54] This result is consistent with the results of EC 2008 (p83) where however a cutoff point of a seven year duration of stay is used to distinguish between recent and established migrants

the highly educated population in the EU is foreign-born and almost 7% is born outside the EU. This said there is, however, also a vast heterogeneity in the skill structure of foreign-born in the EU by sending country groups, with highly skilled foreign non EU-born migrants coming primarily from the other European countries, South and Southeast Asia and South America (with each of these regions contributing more than 0.8% to the total high-skilled population living in the EU27) and intra-EU migration (as well as some quantitatively less important groups such as migrants from the Near and Middle East as well as Northern America, Australia and Oceania) most strongly tilted towards more highly skilled migrants .

Table 4

Share of EU population aged 15+ by place of birth, duration of stay and highest completed education

	Skill level					
	low	medium	high	low	medium	high
	duration of stay less than 10 years			duration of stay more than 10 years		
EU-born	25.4	48.7	25.9	32.6	46.5	20.9
of this						
From EU 12 to EU 15	27.2	56.6	16.2	27.4	48.0	24.6
From EU 15 to EU 15	19.3	35.5	45.2	37.3	44.9	17.8
From EU 27 to EU 12	20.1	51.9	28.0	34.6	49.3	16.2
Non-EU-born	41.8	37.8	20.5	43.2	35.5	21.3
of this						
Other Europe (including CEEC)	41.1	37.3	21.6	37.9	45.7	16.4
Turkey	64.1	29.5	(6.4)	66.2	27.4	6.5
North Africa	61.1	24.0	14.9	59.0	26.0	15.0
Other Africa	39.6	41.3	19.1	37.5	33.4	29.1
South & Central America Caribbean	39.7	40.7	19.6	35.3	39.8	24.8
East Asia	35.4	36.7	27.9	41.2	28.8	30.0
Near and middle East	34.3	39.6	26.1	26.1	39.7	34.2
South and southeast Asia	36.4	42.1	21.5	38.1	37.7	24.2
North America, Australia and Oceania (incl other)	8.8	47.0	44.2	20.6	39.8	39.5
No answer	47.9	30.0	22.1	53.5	24.5	22.0
South and southeast Asia	36.4	42.1	21.5	38.1	37.7	24.2
Australia and Oceania	10.2	52.0	37.9	22.5	47.0	30.5
Other	29.5	24.7	45.9	49.7	23.3	27.1
No answer	38.4	27.4	34.2	55.3	26.0	18.7

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education, excluding unknown duration of stay (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries. EEA = European Economic area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004; averages 2006-2007, values in brackets have a low reliability.

Source: EU-LFS.

The evidence from the sending country perspective, however, also corroborates earlier results of this study, that more recent migrants to the EU are not more highly qualified than earlier migrants and suggests that the increase in qualification of more recent migrants in most EU countries is primarily a result of the higher qualification of recent migrants within

the EU as well as other European countries. More recent migrants from the important African and Asian and South American sending regions, by contrast, are less well qualified than more established migrants from these regions. In addition the data suggests that the deficits of the skill structure of in particular more recent migrants found in the last chapter, where we were unable to distinguish between intra-EU and extra-EU migration, would be even more pronounced if only migrants from outside the EU were considered, since migrants from non-EU countries have a lower qualification profile than within EU-migrants and since this difference applies even more strongly to recent migrants from non-EU countries.

Table 5

Share of foreign-born in total population and share of total foreign-born population by receiving country and skill group

	Share of foreign-born in total population				Share of total foreign-born in EU 27			
	Skill level							
	Low	medium	high	total	low	medium	high	total
Receiving country EU 27	8.0	7.6	9.7	8.1	100.0	100.0	100.0	100.0
Receiving country EU 15	9.5	11.1	11.4	10.4	95.8	92.1	94.2	94.1
Austria	19.9	13.1	18.7	15.9	3.8	5.2	3.1	4.2
Belgium	14.1	9.6	11.0	11.9	4.9	2.8	4.2	4.0
Denmark	7.3	5.8	7.2	6.6	0.9	1.0	1.4	1.1
Spain	9.2	21.6	12.7	12.5	18.4	16.3	19.5	17.8
Finland	2.8	2.9	2.5	2.8	0.4	0.5	0.5	0.5
France	14.9	8.5	11.2	11.8	28.5	15.6	20.3	21.9
Greece	6.0	7.4	5.6	6.4	2.6	2.3	1.5	2.2
Italy	5.6	7.5	7.5	6.4	15.2	12.6	6.6	12.3
Luxembourg	36.9	31.9	52.9	38.1	0.5	0.5	0.7	0.5
Netherlands	11.1	12.6	10.1	11.5	5.0	6.6	5.7	5.7
Portugal	4.6	12.1	12.1	6.4	2.9	1.5	1.9	2.2
Sweden	17.7	14.2	17.1	15.8	2.5	4.8	5.1	3.9
UK	10.4	13.4	13.1	12.5	10.2	22.5	23.8	17.8
Receiving country EU 12	1.7	1.6	2.9	1.8	4.2	7.9	5.8	5.9
Bulgaria	-	0.3	0.7	0.3	0.0	-	0.1	0.1
Cyprus	12.8	17.1	20.7	16.4	0.3	0.4	0.6	0.4
Czech Republic	3.3	1.7	2.9	2.1	0.5	1.1	0.5	0.7
Estonia	11.2	17.2	20.3	16.7	0.2	0.9	1.0	0.7
Hungary	1.2	1.6	3.0	1.6	0.3	0.7	0.6	0.5
Lithuania	3.3	5.8	5.1	4.9	0.3	0.8	0.5	0.5
Latvia	10.4	14.2	17.1	13.7	0.5	1.4	1.0	0.9
Malta	3.4	6.5	7.9	4.3	0.1	0.0	0.0	0.1
Poland	2.0	0.8	1.1	1.1	1.5	1.5	0.9	1.4
Romania	-	-	-	0.1	-	-	-	0.0
Slovenia	9.3	7.5	6.3	7.8	0.4	0.7	0.3	0.5
Slovak Republic	0.7	0.6	1.3	0.7	0.1	0.2	0.1	0.1

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5, averages 2006-2007, values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

3.3.2 The Receiving Region Perspective

Looking at the data from a receiving country perspective (see table 5) indicates that in the average of the years 2006 and 2007 8.1% of the resident population in the EU was foreign-born and that this share of foreign-born (with 9.1%) was highest among the highly skilled. Migration is, however, also strongly focused on the EU 15. According to LFS data around 94% of all migrants in the EU 27 and a slightly higher share of the highly skilled live in the EU 15. Only around 6% reside in the EU 12 countries. This strong focus of foreign-born on the EU 15 causes a number of problems with respect to the analysis of the structure of the foreign-born population among the EU 12 countries, on account of the small number of observations (and the subsequent low reliability of the data for many of these countries). In particular for Bulgaria and Romania the numbers of migrants reported in EU-LFS data are so low, that for most groups we cannot trust data to be informative. In addition among all the EU 12 countries only Poland receives a share of more than 1% of all EU migrants (but here reliability limits of the data are rather high) and the EU 12 countries where the share of the foreign-born in total resident population exceed the 10% mark (Cyprus, Estonia and Latvia) are very small.

Thus, in sum, data on the structure of migration in the EU 12 must be considered as highly unreliable. For the remainder of this chapter we thus (as far as reliability limits allow) report figures on the EU 12 countries, but primarily interpret data only for the EU 12 as a group making reference to individual countries only where there are particularly strong signs of important structural differences.

But even within the EU 15 migration is highly concentrated and the share of foreign-born is extremely varied. The three largest receiving countries in the EU 27 (France, the UK and Spain) in sum account for almost half (57,5%) of the total stock of foreign-born in the EU 15 – remembering that the data do not include Germany and Ireland -, and the share of foreign-born in total resident population (ignoring the obvious outlier of Luxemburg) is higher than 15% in Austria and Sweden but below 10% in Denmark, Greece, Italy and Portugal and below 3% in Finland, thus suggesting substantial variation among EU 15 countries as well as some potential data problems for the smaller countries

This heterogeneity is also reflected in a number of important indicators concerning the structure of migration. For instance when considering the share of highly educated foreign-born residing in a particular EU country by major sending regions of migration (see table 6) EU-LFS data suggest pronounced heterogeneity among EU countries with respect to the human capital structure received from migrants born in other EU countries and from migrants born outside the EU. In Austria and Greece the share of highly skilled among migrants born outside the EU (with 11.2% and 12.4% respectively) is clearly below the average of both the EU 27 and the EU 15, but when considering the share of highly skilled

migrants born in other EU countries this is higher than average for Austria (24.5%) and only modestly below average for Greece (20.4%).

Table 6

Share of EU population aged 15+ by place of residence, highest completed education, and region of birth

	Nativ born			Born in other EU 27 countries			Born in rest of the world		
				Skill level					
	low	medium	high	Low	medium	high	Low	medium	high
Receiving country EU 27	41.3	40.8	17.9	36.4	40.6	23.0	42.5	36.4	21.1
Receiving country EU 15	45.9	34.4	19.7	36.7	40.1	23.3	43.5	35.5	21.0
Austria	28.2	58.4	13.4	18.4	57.1	24.5	48.5	40.3	11.2
Belgium	41.4	33.8	24.8	49.0	27.1	24.0	51.8	26.5	21.7
Denmark	31.8	42.3	26.0	22.2	38.6	39.3	40.1	35.6	24.3
Spain	58.8	17.9	23.3	33.0	37.5	29.5	45.6	33.2	21.2
Finland	33.6	39.9	26.6	24.4	50.0	25.6	41.0	36.6	22.4
France	40.2	38.7	21.1	59.2	24.7	16.0	50.3	27.8	22.0
Greece	50.5	33.2	16.3	28.4	51.3	20.4	52.0	35.6	12.4
Italy	57.9	32.3	9.8	37.4	48.1	14.6	54.8	34.6	10.6
Luxembourg	42.7	42.3	15.1	41.7	31.1	27.3	32.7	38.6	28.7
Netherlands	36.5	38.7	24.8	19.9	50.3	29.8	39.3	41.3	19.4
Portugal	77.4	13.1	9.6	44.3	30.7	25.0	57.0	25.3	17.7
Sweden	22.6	51.9	25.6	22.1	48.2	29.7	28.6	44.4	27.0
UK	28.7	43.9	27.4	20.2	52.9	27.0	24.4	45.7	29.8
Receiving country EU 12	29.9	56.9	13.3	31.9	49.7	18.4	27.4	50.2	22.4
Bulgaria	37.0	46.0	17.0	-	-	-	-	50.1	44.8
Cyprus	40.6	35.1	24.2	26.8	37.8	35.4	33.2	36.6	30.2
Czech Republic	19.0	70.2	10.9	33.2	55.8	11.0	21.1	54.2	24.7
Estonia	23.6	50.3	26.1	-	45.3	41.5	15.0	52.4	32.6
Hungary	31.8	53.7	14.5	24.2	52.1	23.7	18.4	47.2	34.5
Lithuania	28.9	50.2	20.9	-	(56.0)	-	19.1	59.7	21.2
Latvia	27.4	55.6	17.1	33.9	48.1	18.1	18.6	58.8	22.6
Malta	75.5	14.4	10.1	64.8	-	-	55.0	(24.4)	(20.7)
Poland	26.2	59.6	14.2	42.1	43.9	14.0	47.3	38.5	14.2
Romania	39.3	52.0	8.8	-	-	-	-	-	-
Slovenia	26.9	56.0	17.1	(20.3)	59.9	(19.8)	33.9	53.1	13.0
Slovak Republic	23.9	65.0	11.1	22.6	59.8	17.7	-	(40.6)	-

Notes: Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5; averages 2006-2007; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

By contrast in France and the EU12 the share of highly skilled among those born in other countries is clearly below the average, but a relatively high share of high-skilled migrants from among those born outside the EU live in France. The only country where substantially lower shares of highly educated workers are found for both these regions is Italy. For the UK, Sweden, Luxemburg, Spain and Denmark the share of highly skilled is above average for persons born in both regions. Thus data on the structure of migration also suggests

substantial variation in the structure of migration from different sending countries, which in turn reflect different historical ties and migration experiences among EU 27 countries.

Aside from this EU-LFS data also provides information on the skill structure of the foreign-born of different ages and with respect to the gender specific skill structure (see tables 7 and 8). Here from a receiving country perspective, the foreign-born aged 25 to 44 are the ones with the highest share of tertiary educated, in almost all of the EU 15 as well as the EU 12 countries. The only exceptions here are Denmark, Spain, Finland, Greece and Italy.

Table 7

Share of EU population aged 15+ by place of residence, highest completed education, and age groups

	Foreign-born								
	15-24 years			25-44 years			45+ years		
	Skill level								
	low	medium	high	low	medium	high	low	medium	high
Receiving country EU 27	52.2	40.3	7.5	33.1	40.7	26.2	46.2	33.3	20.5
Receiving country EU 15	52.6	39.9	7.5	33.8	40.2	26.1	47.6	31.7	20.7
Austria	56.4	41.4	-	29.9	51.6	18.5	39.1	42.9	18.0
Belgium	57.4	36.4	6.2	36.4	31.9	31.7	60.7	20.3	19.0
Denmark	65.9	31.7	-	27.9	38.7	33.5	30.3	35.8	33.9
Spain	61.6	32.1	6.3	36.9	36.5	26.6	42.0	30.8	27.2
Finland	68.0	29.7	-	22.4	51.9	25.7	33.1	32.4	34.6
France	49.8	37.1	13.1	38.2	30.6	31.1	61.9	23.4	14.8
Greece	63.2	35.3	-	44.6	40.6	14.8	42.2	37.7	20.1
Italy	70.2	28.3	1.5	45.5	42.1	12.4	50.0	35.0	15.0
Luxembourg	59.3	35.2	(5.6)	32.4	32.3	35.3	45.4	31.2	23.4
Netherlands	58.4	35.9	5.8	30.8	45.3	23.9	34.1	42.8	23.1
Portugal	65.0	31.0	-	47.8	29.4	22.9	62.7	17.6	19.7
Sweden	48.1	45.6	6.3	18.2	46.6	35.3	27.9	45.5	26.6
UK	27.4	59.9	12.7	19.2	48.0	32.8	28.4	41.5	30.1
Receiving country EU 12	37.0	55.2	(7.7)	13.1	56.9	30.0	33.8	47.2	19.0
Bulgaria	-	-	-	-	(47.4)	(52.1)	-	(38.3)	(39.8)
Cyprus	41.5	46.8	11.6	25.9	37.3	36.8	33.8	32.2	34.0
Czech Republic	38.7	59.1	-	13.5	62.6	24.0	38.5	50.4	11.1
Estonia	-	(53.4)	-	-	63.1	34.8	17.7	49.3	33.0
Hungary	39.6	54.1	-	12.7	57.8	29.6	28.5	42.8	28.7
Lithuania	-	(64.4)	-	-	66.9	28.5	23.3	56.7	20.0
Latvia	30.9	60.6	-	6.4	67.0	26.7	23.0	55.4	21.6
Malta	-	-	-	56.4	(23.5)	-	65.6	-	-
Poland	-	-	-	-	(47.1)	51.4	49.9	39.3	10.8
Romania	-	-	-	-	-	-	-	-	-
Slovenia	(38.0)	(60.5)	-	23.8	62.7	13.5	36.2	49.4	14.4
Slovak Republic	-	-	-	-	65.5	(24.7)	24.0	55.7	20.3

Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, averages 2006-2007, values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Aside from this, evidence on gender differences in the skill structure of migrants is rather ambiguous, while on average both in the EU 15 and the EU 12 males have a higher share of highly educated among the foreign-born than females, the share of highly educated is higher among the foreign-born females than males in 6 out of the EU 15 countries and in 3 of the EU 12 countries considered.

Table 8

Share of EU population aged 15+ by place of residence, highest completed education, and gender

	Foreign-born								
	Males			Females			male & female		
	Skill level								
	low	medium	high	low	medium	high	low	medium	high
Receiving country EU 27	39.8	38.4	21.8	41.4	37.1	21.5	40.6	37.7	21.7
Receiving country EU 15	40.7	37.5	21.8	42.0	36.4	21.6	41.4	36.9	21.7
Austria	32.0	49.3	18.7	41.6	44.3	14.1	37.1	46.6	16.3
Belgium	48.0	27.8	24.2	52.5	25.9	21.6	50.4	26.8	22.8
Denmark	35.9	34.7	29.4	34.8	37.9	27.3	35.3	36.4	28.3
Spain	43.0	33.8	23.2	40.9	35.0	24.1	41.9	34.4	23.7
Finland	35.9	46.1	18.0	32.0	38.8	29.3	33.9	42.3	23.8
France	50.3	28.4	21.3	55.6	25.4	19.0	53.0	26.8	20.1
Greece	53.5	34.9	11.6	41.0	42.7	16.4	47.0	38.9	14.1
Italy	53.4	37.1	9.5	46.9	39.5	13.6	49.9	38.4	11.7
Luxembourg	39.6	31.8	28.6	41.4	32.3	26.3	40.5	32.1	27.4
Netherlands	34.0	43.2	22.8	36.5	43.1	20.3	35.3	43.2	21.5
Portugal	56.4	26.9	16.7	52.2	26.1	21.7	54.2	26.5	19.3
Sweden	26.1	47.6	26.4	25.8	44.5	29.7	25.9	46.0	28.1
UK	21.5	49.2	29.3	24.9	46.4	28.7	23.2	47.8	29.0
Receiving country EU 12	23.4	54.2	22.4	32.9	46.9	20.2	28.8	50.1	21.2
Bulgaria	-	(43.6)	(45.0)	-	(50.0)	(36.1)	-	47.3	39.8
Cyprus	31.0	38.5	30.5	30.1	36.2	33.7	30.5	37.1	32.4
Czech Republic	21.7	62.1	16.2	37.0	49.3	13.7	29.8	55.3	14.9
Estonia	13.9	55.0	31.2	15.6	50.0	34.4	14.9	52.1	33.0
Hungary	20.0	52.1	28.0	24.9	49.7	25.4	22.7	50.8	26.5
Lithuania	17.6	61.3	21.1	20.0	57.9	22.1	19.0	59.4	21.7
Latvia	19.4	58.3	22.4	20.5	57.5	22.0	20.0	57.8	22.2
Malta	55.5	(26.1)	-	61.3	-	-	58.6	22.2	(19.2)
Poland	35.2	46.0	18.8	52.4	36.5	11.1	45.6	40.3	14.2
Romania	-	-	-	-	-	-	-	-	-
Slovenia	22.4	61.9	15.7	43.7	45.0	11.3	32.7	53.7	13.6
Slovak Republic	-	62.4	25.6	31.4	52.4	(16.2)	22.8	56.8	20.4

Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, averages 2006-2007 values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

3.4 The Labour Market situation of migrants from the EU 27

3.4.1 Employment, unemployment and activity rates by skill groups

These figures thus provide some evidence on the skill structure of migration to the EU, which is by and large consistent with that provided in the last chapter. The central focus of this chapter, however, is on the labour market situation of foreign-born workers in the EU with respect to qualification. The reason for this is that recent comparative studies on the labour market situation of foreign-born (EC 2008, OECD 2007, 2008) as well as theoretical considerations suggest that more highly qualified foreign-born workers may differ substantially from less skilled workers with respect to labour market outcome.

In particular less skilled workers are (due to lower income levels and potentially financial constraints) more dependent on finding employment than highly educated workers to guarantee income and consumption when arriving in a new country. This may make them less choosy with respect to the type of work they will accept and this may increase their chances of employment in particular in early phases of migration. Furthermore, less skilled workers in general (due to their lower qualification levels) have a lower chance that any of the job offers they may receive abroad will be associated with over-qualification and thus more job offers will be acceptable to them than to highly educated workers hoping to find an employment matching their skill level abroad. This suggests that less skilled foreign workers will have higher labour market activity rates as well as potentially higher employment and lower unemployment rates relative to more highly skilled foreign-born workers.

Similarly institutions governing cross border migration of highly and less educated foreign-born workers vary substantially. Here less skilled migrants often enter a country in programs especially designed to attract temporary workers, that by definition are associated with employment and do not allow for family related migration. This will increase their employment rates by definition. For high-skilled workers, by contrast, the likelihood of entering in such programs is smaller and non job related migration is likely to be more important. In addition in particular young high-skilled foreign-born may be living in their country of residence as students, that by definition have lower participation rates. High-skilled workers, however, have access to low-cost migration options associated with the international posting of workers. Thus although the impact of institutions on employment, unemployment and activity rates is ambiguous, given the size of short-term migration flows of seasonal and temporary workers to the European Union, here too one could expect that institutional arrangements favour higher activity, employment and potentially lower unemployment rates among the less skilled than the high-skilled.

In addition there may also be differences in the problems associated with transferring human capital across borders between high-skilled and low-skilled workers, which arise

from differences in labour market institutions and skill recognition (or just plain discrimination) in receiving countries.

In this section we are thus interested in the differences in labour market outcomes between foreign and native workers of different skill groups in terms of employment, inactivity and unemployment rates. In particular we would like to address three central questions. First we would like to know how foreign-native employment, unemployment and inactivity rate differentials in the EU differ between workers of different skill levels. Second, we analyze which groups of foreigners (by sending country, age and gender) among different skill groups have the greatest problems in integrating into the EU's labour market. Third, we address the question, whether workers of different skill groups differ with respect to the effect of labour market experience in a receiving country (as for instance measured by the duration of stay within the country) on labour market outcomes.

Our hypotheses with respect to these research questions are that, first of all, foreign to native employment rate differentials should be increasing with skills of migrants, and that this "skill gradient" should be larger for recent migrant groups and migrant groups that come from more "exotic" places (where institutional labour market differences may make it difficult to transfer skills to the EU) and that, second, different receiving countries will differ with respect to the success at labour market integration of foreigners of different skill levels, on account of different migration regimes and labour market institutions.

Looking at the data from the European labour force survey on employment rates by receiving country (see Table 9) suggests that a number of these hypotheses can be confirmed. In particular the less educated foreign-born in general tend to have higher employment rates than their native-born peers. By contrast, employment rates among the highly educated foreign-born are lower than for the native-born of the same qualification level. In addition highly skilled foreign-born workers born outside the EU 27 have slightly lower employment rates than foreign-born workers born inside the EU. By contrast for less skilled workers born outside the EU 27 employment rates are higher than for those born in the EU 27 (see table 9).

There are also important differences between individual EU 27 receiving countries and among sending regions. For instance in Austria, Belgium, Denmark, Netherlands and Sweden the employment rates of foreign-born from other EU 27 countries with a low qualification level are lower than for natives. In the Netherlands and the UK the less qualified foreign-born in non-EU countries have lower employment rates than the less skilled natives. Similarly, with respect to the employment rates of the highly skilled foreign-born in other EU countries (Luxembourg, Portugal and the Netherlands) have higher employment rates than similarly qualified native-born, and in Portugal the employment rates of highly skilled foreign-born outside the EU 27 are higher than for natives. Finally, for

Austria and the southern European countries (Spain, Greece, Portugal and Italy) the employment rate among the highly educated foreign-born from outside the EU is higher than that of the foreign-born from other EU countries. In all EU 15 countries (except for Sweden), however, the employment rate differentials between natives and those born in other EU countries are increasing in education.

Table 9

Employment rates of EU population aged 15+ by place of residence, highest completed education, and region of birth

	Native-born			Born in other EU27 countries			Born in rest of the world		
	Skill level								
	low	medium	high	low	medium	high	low	medium	high
Receiving country EU 27	34.5	63.9	78.6	42.8	64.8	72.3	46.8	63.8	72.2
Receiving country EU 15	37.5	66.9	79.1	44.1	66.1	72.7	47.8	64.8	72.8
Austria	33.1	65.6	77.3	29.5	55.0	67.4	49.7	67.1	67.7
Belgium	26.9	59.0	76.5	26.3	52.9	73.4	27.2	48.8	64.3
Denmark	47.1	72.1	80.3	45.8	62.5	73.7	47.6	63.2	73.4
Spain	38.2	62.4	78.3	55.8	68.1	67.7	60.8	73.0	75.5
Finland	29.6	66.9	76.3	44.0	76.8	75.7	33.9	59.8	65.8
France	30.6	63.0	75.1	36.4	58.4	60.4	34.9	55.3	64.2
Greece	33.2	55.7	76.7	64.6	55.8	66.5	62.5	65.8	70.1
Italy	30.0	62.9	72.3	46.4	65.4	69.7	57.4	69.5	71.9
Luxembourg	29.4	55.9	72.6	53.4	62.4	81.6	43.4	56.4	66.2
Netherlands	44.9	71.6	79.0	43.3	62.9	77.0	42.4	58.7	66.1
Portugal	53.5	61.3	78.7	62.1	63.0	80.0	63.5	72.0	83.1
Sweden	44.6	75.1	82.0	41.1	63.7	80.1	40.9	63.1	67.9
UK	62.1	78.2	88.3	65.4	78.6	85.3	41.8	66.1	81.8
Receiving country EU 12	22.7	59.3	76.7	18.8	49.0	65.5	22.7	52.8	63.0
Bulgaria	19.4	62.0	71.5	-	-	-	-	(44.5)	(71.1)
Cyprus	36.8	69.5	85.8	36.5	65.2	70.2	76.8	67.7	73.0
Czech Republic	16.9	62.8	75.6	19.2	53.3	79.1	34.5	65.7	67.7
Estonia	29.0	69.3	82.9	-	(71.5)	(69.4)	21.3	61.6	67.5
Hungary	20.7	62.2	74.6	28.1	63.2	66.3	-	51.0	78.0
Lithuania	15.4	63.5	82.2	-	-	-	-	54.8	62.5
Latvia	31.9	69.4	84.7	32.1	63.8	71.6	27.6	62.8	64.5
Malta	37.9	71.3	79.1	-	-	-	(46.2)	-	-
Poland	17.5	54.6	75.9	-	(18.8)	(46.6)	-	(15.2)	(38.6)
Romania	32.4	60.5	79.1	-	-	-	-	-	-
Slovenia	30.7	61.7	79.4	(27.0)	(40.3)	(58.4)	46.0	63.2	61.5
Slovak Republic	9.9	62.9	77.2	-	50.7	67.1	-	-	-

Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Similar observations apply to inactivity and unemployment rate differentials between the foreign- and the native-born population (see Tables 10 and 11). With respect to inactivity rates for instance (see Table 10) less skilled foreign-born workers in the EU 27 aggregate

have lower inactivity rates than their native-born peers, while for high-skilled foreign workers inactivity rates are higher than for high-skilled natives. In addition as predicted these differences are more pronounced for non-EU-born workers (which may be deemed to come from more varied institutional backgrounds) than for other-EU-born residents. In general both high and low-skilled foreign-born workers born outside the EU thus have lower labour market inactivity rates than foreign workers born in other EU countries with the differences more pronounced for the less skilled workers.

Table 10

Inactivity rates of EU population aged 15+ by place of residence, highest completed education, and region of birth

	Native-born			Born in other EU 27 countries			Born in rest of the world		
	Skill level								
	low	medium	high	low	medium	high	low	medium	high
Receiving country EU 27	61.8	31.3	18.2	52.9	30.4	22.8	45.5	28.4	20.9
Receiving country EU 15	58.7	28.9	17.6	51.6	29.1	22.3	44.3	27.1	20.1
Austria	64.2	32.2	21.3	66.7	41.5	29.1	42.7	25.7	26.2
Belgium	69.7	36.7	20.8	69.4	40.8	22.4	61.1	36.5	24.7
Denmark	50.1	25.8	17.3	49.9	35.0	22.5	46.2	31.6	21.1
Spain	57.5	32.4	17.4	37.5	27.4	25.6	30.4	17.4	16.1
Finland	65.1	27.4	21.3	44.2	(17.2)	-	51.2	28.0	(20.4)
France	65.2	31.9	20.7	60.6	36.9	32.4	55.8	34.6	26.5
Greece	64.0	37.9	17.6	30.4	37.9	26.4	32.7	26.4	21.8
Italy	67.6	33.3	24.2	48.6	28.8	26.1	37.2	24.7	22.4
Luxembourg	68.7	42.7	25.5	43.8	34.1	16.0	47.1	34.6	(26.9)
Netherlands	52.3	26.3	19.5	52.9	33.1	20.1	51.8	34.2	29.3
Portugal	42.0	33.3	15.6	34.1	30.4	-	28.6	20.4	10.6
Sweden	49.4	20.9	15.4	54.9	31.5	16.5	46.5	26.9	22.3
UK	32.0	18.0	9.8	30.3	16.5	11.6	50.7	27.5	13.9
Receiving country EU 12	73.5	34.8	20.3	76.6	47.7	32.7	75.6	43.1	33.1
Bulgaria	76.2	33.5	26.2	-	-	-	-	(54.4)	-
Cyprus	61.3	28.0	10.9	60.7	29.1	26.5	20.1	27.1	23.5
Czech Republic	78.4	33.5	22.9	69.7	43.6	19.8	61.5	29.1	24.3
Estonia	66.8	27.0	15.1	-	-	-	77.4	33.1	28.9
Hungary	75.1	33.2	23.2	68.0	32.9	32.1	75.0	44.6	(19.8)
Lithuania	83.2	32.6	15.9	-	-	-	84.2	40.5	35.0
Latvia	63.5	26.2	12.2	65.7	31.3	-	70.4	33.0	31.4
Malta	58.4	25.9	19.0	(55.1)	-	-	(49.7)	-	-
Poland	78.4	37.5	20.0	91.7	79.0	(53.4)	96.2	83.7	56.7
Romania	65.1	34.6	18.2	-	-	-	-	-	-
Slovenia	67.0	34.6	18.0	(72.2)	57.1	(39.1)	50.0	32.7	35.6
Slovak Republic	81.4	29.6	19.8	80.7	44.6	-	-	-	-

Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability.
- = data provide too few observations to be reported.

Source: EU-LFS.

As with employment rates there are, however, also important differences by receiving countries. For instance low-skilled foreign-born workers have higher inactivity rates than low-skilled natives in Austria and Sweden as well as in the average of the EU 12 countries when coming from another EU 27 country, while high-skilled workers from other EU countries have lower inactivity rates than natives in Luxemburg. For low-skilled workers born outside the EU 27 by contrast inactivity rates are higher than among the low-skill native workers in the UK and the average of the EU 12, while they are lower than for the natives for the high-skilled foreign-born in Spain and Italy.

Finally, native-foreign-born unemployment rate differentials (see Table 11) are even more heterogeneous. In the EU27 average the low-skilled foreign workers born in the EU have lower unemployment rates than natives, while for workers born outside the EU unemployment rates are substantially higher than for the native less skilled. For the high-skilled foreign-born workers, by contrast, unemployment rates are higher than for natives irrespective of whether they are born inside or outside the EU, but differences are larger for workers born outside the EU.

Similarly, the heterogeneity in unemployment rate differentials between natives and foreign-born in receiving countries is substantial, in particular with respect to foreign-born worker from other EU countries.[55] Lower unemployment rates for less skilled foreign-born than native-born apply only to 6 countries of the EU15 (France, Sweden and the UK), while the remaining EU 15 countries, for which the number of observations is sufficient to allow interpretation of the data, have higher unemployment rates among their less skilled foreign-born population from other EU countries. Furthermore in the EU 12 average highly skilled foreign-born from other EU countries actually have lower unemployment rates than the native-born.

Low-skilled foreign-born from outside the EU, by contrast, have a lower unemployment rate than native-born only in Italy and only high-skilled foreign-born outside the EU have higher unemployment rates than highly skilled natives in all EU 15 countries.

Summing up therefore, descriptive evidence suggests that, first of all, the less skilled foreign-born in the EU in general are characterized by higher employment rates, higher labour market participation and also higher unemployment rates than the less skilled natives, while the high-skilled foreign-born have lower labour market participation rates, higher unemployment rates and lower employment rates. Second of all, the results point to substantial heterogeneity between different sending and receiving regions. In particular it seems that native vs. foreign unemployment, employment and inactivity rate differentials are more pronounced for the foreign-born from outside the EU than for migrants from other

[55] As can easily be seen from Table 11 this data on account of the small number of foreign-born unemployed in many countries is, however, much more unreliable than that on inactivity and employment rates.

EU countries, and that there is substantial and sometimes difficult to interpret variation for individual receiving countries.

Table 11

Unemployment rates of EU population aged 15+ by place of residence, highest completed education, and region of birth

	Nativ born			Born in other EU 27 countries			Born in rest of the world		
	Skill level								
	low	medium	high	low	medium	high	low	medium	high
Receiving country EU 27	9.9	7.1	3.9	9.1	6.8	6.3	14.2	10.8	8.7
Receiving country EU 15	9.1	5.9	4.0	8.8	6.8	6.5	14.3	11.1	8.9
Austria	7.4	3.2	1.7	-	5.9	(5.0)	13.1	9.7	(8.4)
Belgium	11.4	6.9	3.5	14.1	10.6	5.4	30.1	23.1	14.6
Denmark	5.6	2.9	2.9	-	-	-	11.5	7.6	(6.9)
Spain	10.1	7.7	5.2	10.8	6.2	8.9	12.6	11.6	10.0
Finland	15.0	7.9	3.1	-	-	-	(30.5)	(17.0)	-
France	12.2	7.5	5.2	7.5	7.5	10.6	20.9	15.5	12.7
Greece	7.8	10.2	6.9	-	(10.1)	-	7.2	10.6	10.4
Italy	7.6	5.7	4.6	9.8	8.3	5.7	8.6	7.7	7.3
Luxembourg	6.1	(2.4)	(2.5)	(5.0)	(5.3)	(2.9)	(18.0)	(13.8)	-
Netherlands	6.0	2.9	1.9	(7.9)	6.0	(3.7)	12.1	10.7	6.6
Portugal	7.8	8.1	6.7	-	-	-	11.0	9.6	7.1
Sweden	11.9	5.0	3.0	8.9	7.1	4.1	23.6	13.7	12.7
UK	8.7	4.7	2.1	6.1	5.8	3.6	15.2	8.8	5.0
Receiving country EU 12	14.4	9.0	3.9	(19.8)	(6.4)	-	-	7.1	(5.9)
Bulgaria	18.8	6.7	3.1	-	-	-	-	-	-
Cyprus	4.8	3.5	3.7	-	(8.1)	-	(3.8)	(7.2)	(4.6)
Czech Republic	21.9	5.5	1.9	36.4	5.5	-	-	7.3	10.6
Estonia	12.6	5.1	2.4	-	-	-	-	8.0	(5.1)
Hungary	17.0	6.8	2.8	-	-	-	-	-	-
Lithuania	8.6	5.7	2.3	-	-	-	-	-	-
Latvia	12.6	6.0	3.4	-	-	-	-	6.3	6.0
Malta	9.0	-	-	-	-	-	-	-	-
Poland	19.0	12.6	5.2	-	-	-	-	-	-
Romania	7.3	7.4	3.4	-	-	-	-	-	-
Slovenia	7.0	5.7	3.2	-	-	-	(8.0)	(6.2)	-
Slovak Republic	46.8	10.6	3.7	-	-	-	-	-	-

Notes: Base population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability.
- = data provide too few observations to be reported.

Source: EU-LFS

3.4.2 An econometric analysis of employment, unemployment and inactivity probabilities

Given this substantial heterogeneity in labour market outcomes across different migrant groups and receiving countries, we were interested to check how general our findings with respect to native-foreign differentials in labour market outcomes are. We thus performed a

series of regression analyses based on (weighted) multinomial logit regressions[56]. Our hypothesis here was that labour market outcomes of a particular foreigner group may be influenced by the labour market and institutional situation of the receiving country as well as the country of origin. Thus we included in our regressions a series of dummy variables[57] for the country of residence as well as a set of dummy variables for the region of birth. Furthermore we also controlled for gender and age (by a set of variables which measure whether the group is in the age of 25 to 44, 45+ respectively and the age group of the 15 to 24 year olds representing the base category) and included a control for the year 2007 (see: Drinkwater, Eade and Garapich, 2008 for a similar approach to analyse the labour market outcomes of recent migrants to the UK).

Table 12

Regression Results for the probability of unemployment, employment and inactivity

	Skill level						
	high		medium		low		Test for difference among skill groups[1)]
	Marginal Effect	std. dev	Marginal Effect	std. dev	Marginal Effect	std. dev	
			Employment				
Female	–0.050 ***	0.006	–0.140 ***	0.006	–0.205 ***	0.009	a,b
Age 25-44	0.263 ***	0.010	0.348 ***	0.007	0.460 ***	0.008	a,b
Age 45+ years	0.043 ***	0.009	0.081 ***	0.008	0.079 ***	0.010	b
Foreign-born	–0.093 ***	0.006	–0.072 ***	0.005	0.029 ***	0.006	a,b
			Inactivity				
Female	0.045 ***	0.005	0.134 ***	0.007	0.221 ***	0.010	a,b
Age 25-44	–0.231 ***	0.010	–0.323 ***	0.008	–0.474 ***	0.009	a,b
Age 45+ years	0.001	0.009	–0.023 ***	0.009	–0.023 **	0.012	b
Foreign-born	0.054 ***	0.005	0.040 ***	0.005	–0.054 ***	0.007	a,b
			Unemployment				
Female	0.003 **	0.001	0.002	0.002	–0.004 ***	0.001	
Age 25-44	–0.023 ***	0.002	–0.018 ***	0.002	0.007 ***	0.002	a,b
Age 45+ years	–0.041 ***	0.002	–0.048 ***	0.002	–0.046 ***	0.002	b
Foreign-born	0.030 ***	0.002	0.027 ***	0.002	0.012 ***	0.001	a,b

Notes: Table reports marginal effects of a multinomial choice model, Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported. * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate. 1) column presents results of a test for the significance of coefficients across skill groups: a) indicates that the coefficient of the variable for the medium-educated differs from that of the less educated, b) that the coefficient of the variable for the highly educated differs from that of the less educated. All tests are at a significance level of 5%.

Source: EU-LFS.

[56] In these regressions the dependent variable was a dichotomous variable that took on the value of 1 if a particular group of workers was employed, 2 if it was unemployed and 3 if it was inactive and the weights were determined by the weight of a group in the labour force survey.

[57] These dummy variables take on the value of 1 if a resident lives in a particular EU 27 country and 0 else, thus there are 24 such dummy variables in our regression with Austria being omitted as the base category.

Table 12 displays a first set of results of these regressions, in which we did not include dummy variables for the sending region but only a variable which measures whether respondents are native- or foreign-born.[58] The coefficients reported in the table have the interpretation of marginal effects. For instance the value –0.050 next to the label `female´ (in the first row of the table) implies that after controlling for age, country of residence and age, highly skilled females have a 5 percentage points lower probability of being employed than highly skilled males (which are the base category) in the EU 27 countries.

Aside from presenting evidence on native foreign differentials in unemployment inactivity and employment probabilities Table 12 also points to a number of further interesting differences in the workings of labour markets by skill group that are highly consistent with existing descriptive evidence on EU labour markets. In particular these results suggest that gender differences in employment and inactivity probability are declining in education, but that this does not apply as strongly to gender differences in unemployment risks. Highly skilled females (after controlling for place of residence, age and foreign-born status) have an on average 5 percentage points lower employment and a 4.5 percentage points higher inactivity risk than highly skilled males. This is substantially lower than the gender differences for less skilled females which amount to a 20.5 percentage points lower employment and a 22.1 percentage points higher inactivity risk. For unemployment rates by contrast gender differences between different skill groups are relatively similar (although statistically still significatkly different from each other) and amount to somewhere between 0.3 percentage points (for the highly skilled) and –0.4 percentage points (for low-skilled).

At the same time age differences are more pronounced for the less educated than for the highly skilled. This applies in particular to the age group of the 25 to 44 year olds. Highly skilled residents of this age have a 26.3 percentage points higher chance of employment, a 23.1 percentage points lower probability of inactivity and a 2.3% lower unemployment risk than highly skilled in the age group 15 to 24. For less skilled these differentials are 46 percentage points for the employment rate, 47 percentage points for the inactivity rate and 0,7 percentage points for the unemployment rate.

The parameters of particular interest to us are, however, those that measure the effects of being foreign-born on the probability of being employed, unemployed or inactive. According to these results (after controlling for country of residence, age and gender) highly skilled foreign-born in the EU have a 9.3% lower probability of being employed, a 3 percentage points higher probability of being unemployed and a 5.4 percentage points higher probability of being inactive than comparable natives. Less skilled foreign-born, by contrast, have a 2.9 percentage points higher probability of being employed than comparable natives and face a 5.4 percentage points lower risk of inactivity but a

[58] Furthermore in this table – for the sake of brevity of the exposition - we do not report the coefficients of the country and year fixed effects included in the regression.

1.2 percentage points higher unemployment risk. Since all of these coefficients are highly significant, these results lend strong support to our original hypotheses. In particular (even after controlling for compositional effects) that highly skilled – in contrast to less skilled – migrants in the EU are substantially (by 9.3%) less likely to be employed than highly skilled natives. This points to substantial underutilization of highly skilled foreign labour in the EU 27.

Table 13

Regression Results for the probability of unemployment, employment and inactivity (sending region fixed effects)

	Employment probability			Unemployment Probability			Inactivity Probability		
	Skill level								
	high	medium	low	high	medium	low	high	medium	low
EU 15	–0.074***	–0.083***	0.027***	0.011***	0.006***	–0.003	0.063***	0.077***	–0.024*
EU 12	–0.093***	0.004	0.137**	0.040***	0.013***	0.011**	0.053***	–0.017*	–0.148***
Other Europe	–0.117***	–0.053***	0.085***	0.047***	0.023***	0.013***	0.070***	0.031***	–0.098***
Turkey	–0.081***	–0.211***	–0.090***	0.031***	0.051***	0.023***	0.051*	0.160***	0.067***
North Africa	–0.099***	–0.128***	–0.029***	0.060***	0.064***	0.028***	0.039**	0.064***	0.001
Other Africa	–0.053***	–0.096***	0.051***	0.058***	0.065***	0.038***	–0.005	0.031**	–0.089***
South & Central America	–0.032***	0.067***	0.230***	0.024***	0.030***	0.015***	0.008	–0.097***	–0.244***
East Asia	–0.334***	–0.199***	0.196***	0.018*	0.011	–0.013**	0.316***	0.189***	–0.183***
Near & middle East	–0.163***	–0.263***	–0.131***	0.070***	0.060***	0.015***	0.093***	0.203***	0.116***
South/southeast Asia	–0.137***	–0.146***	–0.055***	0.028***	0.021***	0.007*	0.109***	0.125***	0.047***
North America	–0.095**	–0.106**	–0.002	0.014**	0.001	–0.021***	0.082***	0.104***	0.023

Notes: Table reports marginal effects of a multinomial choice model, Base population aged 15+, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for other control variables (see table 12). * (**) (***) signifies significance at 10% (5%) (1%) significance.

Source: EU-LFS.

Sending country effects

With the data at our hands we are unable to discriminate between different potential causes for the sizeable differences in inactivity unemployment and employment rates between natives and foreigners. We can thus not determine whether they are due to difficulties in transferring human capital, reservation wages, discrimination or institutions governing the migration of highly and less skilled. In Table13, however, we report results of our regression when replacing the dummy variable for the foreign-born in Table 12 by sending region fixed effects.

These results provide evidence on the heterogeneity of labour market outcomes by different sending country groups and point to substantial heterogeneity. In general, however, marginal effects for more distant (i.e. non EU) sending regions tend to be larger than for closer ones, which corroborates our original hypothesis on migrants from further destinations having larger problems in labour market integration. This applies in particular to the marginal effects on unemployment probability. Here only less and medium-skilled

migrants born in Northern America and Oceania experience lower risks of unemployment than migrants from the EU, while the unemployment risk for highly skilled migrants born in the Near and Middle East is by 7 percentage points higher than that of comparable high-skilled natives.

As a second general result we find that even migrants born in the EU 15 and even more pronouncedly migrants from the EU 12 have substantially different labour market outcomes than natives. For instance focusing on the labour market situation of the highly skilled, highly educated migrants born in the EU 15 have an employment probability that is by 7.4 percentage points lower, an unemployment risk that is 1.1 percentage points higher and a by 6.3 percentage points higher probability of being inactive than natives, even after controlling for receiving region, gender and age effects. These results thus suggest that even within the EU 15 the transfer of skill across country borders is far from unproblematic.

This applies even more strongly to highly qualified amongst EU migrants born in the EU 12. Their employment chances are by 9.3 percentage points lower and their unemployment and inactivity risks are by respectively 4.0 and 5.3 percentage points higher than that of comparable highly skilled natives.

Finally, results also point to a number of sending country groups that are particularly problematic when considering the labour market behaviour of highly skilled migrants. With respect to unemployment risks this applies in particular to Northern and Other Africans as well as migrants born in the Near and Middle East since their unemployment probability is between 6 and 7 percentage points higher than that of comparable highly skilled native-born. With respect to the participation decision (i.e. the probability of inactivity) this applies to highly skilled migrants from South and Central America, who have a by over 30 percentage points higher probability of inactivity, but also to South and Southeast Asians whose probability of inactivity is by 10 percentage points higher than that of highly skilled natives.

Integration of foreign-born

Finally, we were also interested what influences the employment, unemployment and inactivity probability of the foreign-born when ignoring the comparison to natives. To focus on this issue we restrict our sample to only those persons that are foreign-born. This allows us to include another variable, which measures whether a person has spent less than 10 years in the country of residence. This variable is of interest because it measures the effect of increased integration on the unemployment, inactivity and employment probability of the foreign-born. The results of this estimation (in table 14) show that the probability of employment of the foreign-born of all skill levels increases with increased duration of stay and that the probability of unemployment and inactivity reduces with increased duration of stay.

Table 14

Regression Results for the probability of unemployment, employment and inactivity of foreign-born

	Skill level high		medium		Low		Test for difference among skill groups[1]
	Marginal Effect	Std. Err.	Marginal Effect	Std. Err.	Marginal Effect	Std. Err.	
			Employed				
Female	–0.120 ***	0.008	–0.210 ***	0.006	–0.271 ***	0.008	a,b
Age 25-44	0.244 ***	0.021	0.259 ***	0.009	0.381 ***	0.010	a,b
Age 45+ years	0.066 ***	0.020	0.077 ***	0.010	0.129 ***	0.013	a
Duration<10 years	–0.097 ***	0.010	–0.058 ***	0.008	–0.018 *	0.009	a,b
			Unemployed				
Female	0.010 ***	0.004	0.009 ***	0.003	–0.008 **	0.003	a,b
Age 25-44	–0.019 **	0.010	–0.021 ***	0.004	0.002	0.004	a,b
Age 45+ years	–0.033 ***	0.009	–0.048 ***	0.004	–0.045 ***	0.006	a
Duration<10 years	0.017 ***	0.005	0.014 ***	0.004	0.008 *	0.004	a,b
			Inactive				
Female	0.110 ***	0.007	0.202 ***	0.006	0.280 **	0.009	
Age 25-44	–0.225 **	0.019	–0.238 ***	0.009	–0.383 ***	0.010	
Age 45+ years	–0.033 ***	0.017	–0.029 ***	0.009	–0.084 ***	0.013	
Duration<10 years	0.081 ***	0.009	0.044 ***	0.007	0.009	0.010	

Notes: Table reports marginal effects of a multinomial logit model. Base foreign-born population aged 15+ excluding native-born population, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported (see below). * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate, 1) column presents results of a test for the significance of coefficients across skill groups: a) indicates that the coefficient of the variable for the medium-educated differs from that of the less educated, b) that the coefficient of the variable for the highly educated differs from that of the less educated. All tests are at a significance level of 5%.

Source: EU-LFS.

These changes are, however, larger for the highly skilled foreign-born than for the less skilled. The employment probability of a highly skilled foreign-born who has resided in the country of residence for more than 10 years is 9.7 percentage points higher than that of a foreign-born who has resided in the country for less than 10 years. His/her unemployment probability is by 1.7 percentage points and the inactivity probability by 8.1 percentage points lower. For the less skilled the respective changes are 1.8 percentage points for the employment chances and –0.8 respectively –0.9 percentage points for unemployment and inactivity risks. They are thus substantially smaller. Thus highly skilled foreign-born who stay in the country of residence for a longer period show significantly higher improvements in labour market performance than the less skilled. To the degree that these results are not solely due to different selection mechanisms among highly and lowly skilled, or to the fact that more established foreign-born are more likely to have received their education in their country of residence (which would reduce the problems of transferring skills across border

by definition) one could thus expect that in extension the highly skilled are likely to profit disproportionately from improved integration.[59]

In addition, however, the results by comparison to those for all residents (table 12), deliver additional insights in particular with respect to the gender differences in employment, unemployment and inactivity rates among the foreign-born residing in the EU. These are significantly higher when focusing only on the foreign-born, than when considering all residents (although they also decrease with increasing educational attainment of the foreign-born). This implies that gender differences (to the disadvantage of the women) among foreign-born are larger than among natives for all skill levels and thus draws attention to the fact that also female migrants (of all skill groups) must be considered as particularly disadvantaged with respect to labour market integration.

3.5. Overqualification

3.5.1 Measurement

Labour market access of highly skilled workers should, however, not only be measured against the yardstick of employment and unemployment, but also in terms of the match between qualifications and jobs (see OECD 2007). Here highly skilled migrants may face a number of difficulties which differentiate them from low-skilled migrants. These may arise from differences in the "value" of education in different sending countries, lacking (formal) recognition of skills abroad, lacking receiving country specific human capital (such as e.g. language skills and/or knowledge of labour market institutions), the labour market situation and various forms of discrimination.

Measures of jobs-skill mismatch are usually derived in the literature on over-qualification (see *Chiswick-Miller,* 2007 for a survey). This literature starts from the assumption that each job requires a certain minimal level of education to be successfully accomplished by a worker and distinguishes three approaches to measuring skill-job mismatch:

1. Self reporting – This method is based on interviews of the employed, in which they are asked whether they feel over-, under- or appropriately qualified for their job and is thus based on subjective evaluations of over-qualification by employees
2. Job analysis – This approach is based on "objective" evaluations of external experts on which qualification level is required from employees in a particular job. According to this definition over- and under-qualification is thus determined by the difference between the actual educational attainment of an employee and the level of qualification required according to expert opinion.

[59] However, according to additional estimates in which we included both native- and foreign-born and differentiated foreign-born by their duration of stay, suggest that even after 10 years the high-skilled foreign-born still have a lower employment probability as well as a higher risk of inactivity and unemployment than native-born.

3. Realised matches – This method starts from the empirical distribution of the educational level attained in a particular occupation. Here authors have either used the modal (Cohn-Khan, 1995, Kiker et al., 1997) or mean (Verdugo-Verdungo, 1989) value of the educational attainment in a particular occupation to define the level required for this occupation. If the actual level of education differs from this mean the individual is over- or underqualified (depending on whether the actual educational level is higher or lower than that required – see below)

Each of these methods has certain advantages and disadvantages, but Hartog (2000) argues that in general job analysis methods should be preferred to the realized matches method, since basing measures of over- and under-qualification on realized matches induces endogeneity in the definition of the appropriate qualification required for a particular occupation. For the OECD countries OECD (2007) provides a job analysis which links the standard international taxonomy of highest educational attainment (ISCED) to the international classification of occupations (ISCO) at the 1 digit level. This "bridge" between the two international classifications is displayed in table 15. As can be seen, according to this job analysis method high skill levels (i.e. ISCED levels 5 and 6) are required primarily from legislators, senior officials and managers as well as professionals and technicians and associate professionals, while low skill levels are required for elementary occupations and all other occupational groups are associated with intermediate skill levels. To ensure methodological comparability with other studies we use this "bridge" to define the required skill level for a particular job.[60]

Based on these reference levels of the educational attainment necessary to fulfill the tasks required in a particular occupation, over-qualification can be defined by comparing the actual level of highest completed education of a person to that required in her/his occupation. According to this definition a person is overqualified if the actual level of educational attainment is higher than that required for the occupation and under-qualified if the actual level of educational attainment is lower than that required for the occupation. Thus, over- and under-qualification is defined in terms of a characteristic of the employee relative to the occupation he/she holds.[61]

One problem with this measurement is that the occupational categories are relatively broadly defined. This may create problems if the broad categories used here include jobs

[60] In preparing this report we, however, also constructed a similar matrix between ISCO and ISCED qualifications based on the realized matches method using the modal value of a skill level in an occupational group to define the "required" skill level. This matching on a level of the EU suggests that only professionals require high-skilled work, and that there is only very little variance in the modal values of ISCED qualifications across EU countries.

[61] Note that as a consequence of this definition highly educated workers cannot be underqualified (since there are no occupations which are considered to require an educational attainment higher than a completed tertiary education). Similarly, low-skilled workers cannot be overqualified (since there are no occupations that require an education lower than a primary education). In this section we can thus only consider the over-qualification of highly and medium-skilled workers.

which require different educational attainment levels. Desite this caveat, however, our approach can be justified by the fact that our primary interest in this study is with differences in the rate of over-qualification between foreigners and natives. To the degree that the structure of occupations within the broad categories is similar between native and foreign-born, focusing on these differences between native- and foreign-born will reduce measurement error.[62]

There are a number of ways in which persons can become under- or overqualified. For instance a number of authors (e.g. *Groot-Maasen - van den Brink*, 2000) have argued that younger inexperienced workers – on account of these workers having lower information on the qualifications required on the local labour market – may be overqualified more often than more experienced workers. Similar arguments may apply to foreign-born workers when entering the labour market of a foreign country with markedly different labour market institutions, Thus one theoretical prediction would be that the level of over-qualification falls with labour market experience and age of workers.

Table 15

Correspondence of Major job groups (ISCO-88) and required skill levels (ISCED-97) Using the job analysis method according to the OECD

ISCO-88 Major groups	Demanded skill level	
1: Legislators, senior officials and managers	High-skilled	ISCED 5,6
2: Professionals		ISCED 5,6
3: Technicians and associate professionals		ISCED 5,6
4: Clerks	medium-skilled	ISCED 3,4
5: Service workers and shop and market sales workers		ISCED 3,4
6: Skilled agricultural and fishery workers		ISCED 3,4
7: Craft and related trades workers		ISCED 3,4
8: Plant and machine operators and assemblers		ISCED 3,4
9: Elementary occupations	Low-skilled	ISCED 0,1,2)
(0: Armed forces)	No assignment	

Source: OECD (2007).

Older workers – in particular when they have a long tenure with their current employer – may, by contrast, have higher rates of under-qualification (and lower rates of over-qualification) than younger workers, since (despite lower qualification) they may have gained substantial firm or industry specific human capital, which allows them to perform well, even in jobs, which usually require a higher level of education than they possess. Thus while learning by doing and learning on the job effects provide some basis for higher rates of under-qualification for older workers, technological change and the depreciation of knowledge – in particular when human capital is not acquired after initial training – may

[62] Furthermore country study evidence, with more detailed occupational grouping, suggests that focusing on e.g. the two digit ISCO level, results in only minor changes to the aggregate measures of over-qualification (see Bock-Schappelwein et al, 2009).

work in the opposite direction. To the degree that the knowledge acquired in more recent education is more relevant to the fulfillment of a particular occupation, older workers may also face higher rates of over-qualification than the average employee. Thus, for older workers the level of over and under-qualification relative to others is ambiguous on the basis of theoretical considerations.

For migrants in addition institutional differences between their country of birth and their country of residence such as lacking formal (non-formal or informal) recognition of the qualifications received abroad, lacking possibilities of employment in certain public sector jobs as well as different qualities and characteristics of the education systems and language barriers can represent a barrier to transferring human capital across borders and may thus additionally increase their levels of over-qualification, which suggests that in general levels of over-qualification should be higher among the foreign-born.

Finally, over-qualification may also be the result of labour market discrimination. Thus labour market groups which have often been found to be discriminated against in the literature (such as foreigners and women) should potentially also have higher rates of over-qualification than other groups.

3.5.2 Over- and under-qualification of highly and medium-skilled migrants

Given these theoretical expectations we display the rates of over- and underqualification of high- and medium-skilled native and foreign-born workers with respect to age and gender (tables 16 to 20). These results suggest that (for the average of the years 2006 and 2007) 19.4% of the native-born highly skilled, employed in the EU 27 (excluding Germany and Ireland) were overqualified and 33.0% of the foreign-born. Both natives as well as foreign-born highly skilled women have higher rates of over-qualification (of 20.7% and 34.9%) than men (18.1% and 31.2%, respectively) (see table 16). On average the rate of over-qualification was decreasing in age for high-skilled migrants and natives, thus suggesting a dominance of learning by doing and learning on the job effects over any effects of human capital depreciation with age. Rates of over-qualification for highly skilled foreign-born aged 15 to 24 were as high as 58.3% but only amounted to 25.3% for the over 45 year olds. For natives the equivalent figures were 43.3% and 13.3% (see table 18).[63]

For the medium-skilled workers, levels of over-qualification are substantially lower both for the foreign-born as well as natives. For the average of the years 2006 and 2007 around 7.7% of the natives with an educational level equivalent to the ISCED 3 or 4 categories were working in occupations which required a lower skill-level than they possessed in the

[63] In part this could be due to educational requirements increasing for younger age cohorts, provided some job heterogeneity between jobs undertaken by older and younger workers.

EU 27. Among the foreign-born the equivalent share of overqualified was 19.4%. As with high-skilled workers over-qualification among the medium-skilled female workers is substantially higher than among males. This applies in particular to foreign-born medium-skilled women (see table 17). While the over-qualification rate for native-born women in the EU 27 amounted to 8.4% in the EU 27 and was thus only by 1.2 percentage points higher than that of men, for foreign-born medium-skilled women gender differences amounted to 9.7 percentage points (men 15.2%, women 24.9%). In contrast to over-qualification rates for highly skilled, over-qualification rates for the medium-skilled are, however, less clearly falling in age, at least for the native-born. While for medium-skilled foreigners the EU 27 wide over-qualification rate decreases from 23.8% for the 15 to 24 year olds to 17.5% for those older than 45, for natives the EU 27 wide over-qualification rate (with 8.1%) is slightly higher than for the 25 to 44 year olds (for whom it amounted to 7.1%).

Table 16

Share of over-qualified employed aged 15+ with tertiary education by place of residence and gender

	Foreign-born			Native-born		
	Male	Female	Total	Male	Female	Total
Receiving country EU 27	31.2	34.9	33.0	18.1	20.7	19.4
Receiving country EU 15	31.6	35.2	33.3	19.2	22.6	20.9
Austria	27.0	32.2	29.3	26.1	15.7	22.0
Belgium	23.7	31.7	27.4	18.5	24.2	21.4
Denmark	26.0	25.2	25.6	14.5	12.8	13.6
Spain	56.9	58.5	57.6	33.7	31.4	32.6
Finland	-	37.9	30.4	13.5	21.1	17.8
France	23.3	29.7	26.2	16.4	23.4	20.1
Greece	59.7	59.3	59.5	16.7	17.0	16.8
Italy	42.9	41.5	42.1	9.1	14.2	11.6
Luxembourg	(3.0)	(6.2)	(4.5)	-	-	(1.9)
Netherlands	18.3	21.4	19.8	11.5	14.8	13.0
Portugal	23.5	23.8	23.7	10.0	12.7	11.6
Sweden	30.1	24.5	27.1	12.3	11.1	11.6
UK	21.8	26.7	24.2	19.0	26.0	22.4
Receiving country EU 12	24.5	30.0	27.3	13.8	13.8	13.8
Bulgaria	-	-	-	23.6	19.2	20.9
Cyprus	36.8	60.2	50.7	24.0	33.1	28.6
Czech Republic	14.3	14.4	14.3	5.7	6.0	5.8
Estonia	44.8	39.5	41.7	23.6	23.6	23.6
Hungary	-	(18.6)	(13.4)	10.1	10.7	10.4
Lithuania	-	-	(31.2)	27.7	18.0	22.0
Latvia	29.3	29.5	29.4	17.5	13.5	15.0
Malta	-	-	-	-	-	(7.3)
Poland	-	-	-	15.0	15.3	15.1
Romania	-	-	-	9.6	8.6	9.1
Slovenia	(10.8)	-	(9.1)	7.8	7.0	7.3
Slovak Republic	-	-	-	9.7	8.9	9.3

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Table 17

Share of Overqualified Employed aged 15+ with medium level education by place of residence and gender

	Foreign-born			Native-born		
	Male	Female	Total	Male	Female	Total
Receiving country EU 27	15.2	24.9	19.4	7.2	8.4	7.7
Receiving country EU 15	15.6	25.2	19.8	7.2	7.7	7.4
Austria	14.9	26.3	20.0	7.2	7.4	7.3
Belgium	13.6	15.2	14.3	8.3	10.7	9.3
Denmark	12.9	15.4	14.2	9.0	6.8	8.1
Spain	22.3	43.7	31.9	7.3	8.6	7.9
Finland	(11.8)	7	13.6	7.3	12.9	9.8
France	9.4	21.9	14.6	5.9	11.3	8.3
Greece	14.8	46.0	28.6	2.6	3.5	3.0
Italy	13.3	31.4	21.2	4.4	4.1	4.3
Luxembourg	(3.9)	11.8	7.3	2.2	(1.6)	2.0
Netherlands	12.1	15.4	13.7	6.3	4.9	5.6
Portugal	9.9	21.0	15.2	4.4	5.9	5.2
Sweden	8.6	10.5	9.5	4.9	6.3	5.5
UK	18.6	14.7	16.9	11.8	8.0	10.2
Receiving country EU 12	9.2	20.3	14.3	7.2	9.8	8.3
Bulgaria	-	-	-	11.6	12.8	12.1
Cyprus	22.0	49.0	37.4	10.8	8.6	9.9
Czech Republic	5.5	13.1	8.6	3.9	6.2	4.9
Estonia	14.0	27.8	21.0	6.2	13.5	9.5
Hungary	-	-	(8.9)	4.1	7.1	5.4
Lithuania	-	-	(13.2)	11.3	14.5	12.8
Latvia	11.8	19.6	15.8	11.3	13.1	12.2
Malta	-	-	-	-	-	-
Poland	-	-	-	6.4	11.1	8.4
Romania	-	-	-	10.0	9.2	9.7
Slovenia	(6.0)	(16.0)	9.7	3.8	6.2	4.8
Slovak Republic	-	-	-	8.3	9.5	8.8

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

While these stylized facts seem to be relatively stable across countries, there are some notable exceptions. Among the EU 15 countries, for instance, the over-qualification rates of highly skilled females are lower than those of highly skilled males in Austria and Denmark for natives and in Denmark, Italy and Sweden for migrants. By contrast, the over-qualification rate among the EU 15 is not uniformly falling in age for Luxemburg for the highly skilled natives and in Finland, Greece and Portugal for highly educated migrants. There is, however, no single EU 15 country where over-qualification rates for the highly skilled foreign-born do not exceed the level for highly skilled natives.

Table 18

Share of Overqualified Employed aged 15+ with tertiary education by place of residence and age groups

	Foreign-born			Native-born		
	15-24 years	25-44 years	45+ years	15-24 years	25-44 years	45+ years
Receiving country EU 27	58.3	35.9	25.3	43.3	20.8	13.3
Receiving country EU 15	59.1	36.3	25.1	44.5	22.4	14.2
Austria	-	31.1	26.0	(31.6)	21.9	21.6
Belgium	-	31.2	20.3	27.5	23.0	17.1
Denmark	-	25.5	24.7	47.2	13.2	13.1
Spain	76.7	60.1	46.0	49.6	35.7	21.1
Finland	-	(27.3)	(36.8)	-	18.6	16.5
France	49.5	31.9	16.4	42.8	21.6	9.3
Greece	-	59.8	59.1	44.7	19.2	9.6
Italy	-	43.7	38.9	36.5	15.0	4.9
Luxembourg	-	(4.2)	-	-	-	-
Netherlands	(48.0)	20.6	16.1	38.5	12.6	10.2
Portugal	-	26.3	-	21.6	13.3	6.2
Sweden	-	28.3	24.7	46.5	12.7	8.5
UK	58.2	23.8	20.2	49.1	21.0	19.3
Receiving country EU 12	34.6	26.4	27.7	36.6	14.6	9.9
Bulgaria	-	-	-	37.5	23.8	16.3
Cyprus	(58.2)	54.5	39.0	50.9	29.6	19.1
Czech Republic	-	14.0	14.3	14.7	6.0	5.1
Estonia	-	37.8	43.2	28.6	21.0	26.6
Hungary	-	(12.6)	(14.0)	24.5	10.9	8.6
Lithuania	-	34.1	26.7	37.6	23.0	17.3
Latvia	11.7	25.2	32.0	24.8	12.7	16.5
Malta	-	-	-	-	-	-
Poland	-	-	-	48.2	16.0	8.3
Romania	-	-	-	22.9	9.4	7.3
Slovenia	-	(11.7)	-	-	8.0	(5.0)
Slovak Republic	-	-	-	(18.6)	10.2	7.1

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Similar cross country variation can be found for the medium-skilled: here medium-skilled foreign-born women in Great Britain have lower rates of over-qualification (14.7%) than foreign-born men (18.6%) and for Italy, Luxemburg and the Netherlands rates of over-qualification are lower for native medium-skilled women than for native medium-skilled men. In addition in a number of EU 15 countries (Greece and Italy for the medium-skilled foreign-born and France and Luxemburg for the native-born) rates of over-qualification are increasing in age rather than decreasing.

Table 19

Share of Overqualified Employed aged 15+ with intermediary education by place of residence and age groups

	Foreign-born			Native-born		
	15-24 years	25-44 years	45+ years	15-24 years	25-44 years	45+ years
Receiving country EU 27	23.8	19.7	17.5	9.7	7.1	8.1
Receiving country EU 15	24.3	20.1	17.6	10.1	6.7	7.3
Austria	(13.9)	20.6	20.9	5.9	6.8	8.7
Belgium	-	16.4	11.1	11.2	10.0	7.3
Denmark	-	14.3	14.2	12.0	6.7	8.5
Spain	36.7	30.5	34.0	10.0	8.0	6.8
Finland	-	(12.8)	-	14.8	7.7	10.3
France	(16.5)	17.7	11.2	9.9	8.7	7.2
Greece	(15.2)	25.5	40.9	2.7	3.1	2.8
Italy	17.8	19.9	26.3	5.8	4.1	4.1
Luxembourg	-	(8.0)	(6.4)	-	(2.2)	-
Netherlands	22.5	12.9	12.8	13.0	4.0	4.5
Portugal	-	14.5	-	5.8	5.6	3.5
Sweden	12.6	8.8	9.6	9.8	4.6	5.4
UK	24.6	16.3	14.5	11.9	8.7	10.8
Receiving country EU 12	11.4	11.3	17.1	8.9	7.6	9.3
Bulgaria	-	-	-	13.3	11.2	13.2
Cyprus	(38.5)	37.5	36.5	13.0	10.5	7.9
Czech Republic	-	6.7	12.4	3.1	4.0	6.5
Estonia	-	(8.2)	27.1	7.8	6.0	15.0
Hungary	-	-	-	5.4	4.7	6.4
Lithuania	-	-	(15.3)	12.2	10.9	15.3
Latvia	-	11.2	18.4	9.7	9.9	16.1
Malta	-	-	-	-	-	-
Poland	-	-	-	8.6	7.5	9.6
Romania	-	-	-	12.9	9.8	8.6
Slovenia	-	(9.4)	(9.7)	9.8	3.8	4.6
Slovak Republic	-	-	-	9.1	7.8	10.5

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

For the EU 12 countries – due to the larger problems of representativity of the data – variations are much larger. On average, however rates of over-qualification are somewhat lower in the EU 12 than those for the EU 15. This applies to native- and foreign-born highly skilled of both genders as well as to foreign-born medium-skilled, but (on account of high female over-qualification rates) not to medium-skilled natives. In addition, in these countries rates of over-qualification are lower for both native- and foreign-born in all age and skill groups except for the highly skilled foreign-born that are older than 45 and the native-born medium-skilled in the age groups of 25 to 44 and 45+. This seems to suggest that the EU 12 countries in sum belong to a group where in particular young workers have relatively low levels of over-qualification.

Table 20

Share of Overqualified Employed aged 15+ with tertiary education by place of residence and duration of stay

	duration of stay less than 10 years		duration of stay more than 10 years	
	Medium-skilled	Highly skilled	Medium-skilled	Highly skilled
Receiving country EU 27	27.6	48.9	13.5	23.4
Receiving country EU 15	27.8	49.6	13.5	23.1
Austria	22.9	29.5	18.8	29.1
Belgium	19.3	31.9	12.2	25
Denmark	(17.4)	36.7	(10.4)	16.8
Spain	36.6	72.9	17.4	29.7
Finland	-	-	(12.8)	(27.8)
France	22.9	41.5	12.9	21.3
Greece	33.8	72.9	25.7	53.2
Italy	27.3	60.9	15.7	27.5
Luxembourg	(11.9)	(4.6)	(5.4)	(4.4)
Netherlands	23.1	29.1	11.6	17.5
Portugal	25.9	52.9	7.8	13
Sweden	17.4	39	8.9	26.1
UK	21.5	29.2	11.7	21.5
Receiving country EU 12	(19.1)	27.8	13.3	27.4
Bulgaria	-	-	-	-
Cyprus	51.7	62	-	37.9
Czech Republic	8.8	17.9	8.5	11.1
Estonia	-	-	21.3	43.1
Hungary	-	-	(7.8)	(12.8)
Lithuania	-	-	(13.8)	31.8
Latvia	-	-	(15.8)	29.9
Malta	-	-	-	-
Poland	7.6	-	9.3	-
Romania	14.8	-	6.4	-
Slovenia	-	-	9.7	(8.0)
Slovak Republic	-	-	-	-

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Over-qualification by duration or residence and sending region

This is not to say, however, that there are no systematic variations in the rate of over-qualification among different groups of highly skilled migrants in the EU 27. As with foreign-born in general, recent migrants among highly educated foreign-born have substantially higher rates of over-qualification than more established highly skilled foreign-born. Among the highly skilled foreign-born who live in their new country of residence for less than 10 years, EU27-wide rates of overqualification amount to 48.9%, while for more established highly skilled foreign-born this rate is 23.4% and thus still slightly higher than among natives (with 19,4%). Furthermore this tendency is more pronounced in the EU15 countries, where the rate of overqualification for high-skilled foreigners is at 49.6% and

may reach up to over 70% in countries such as Greece and Spain. In the EU 12 the rate of over-qualification among recent highly educated foreigners, by contrast, is only marginally higher than among the more established groups.

Table 21

Share of overqualified employed aged 15+ with tertiary education by place of birth, age and gender

	15-24 years	25-44 years	45+ years	Male	Female	Total
Native-born	43.3	20.8	13.3	18.1	20.7	19.4
EU-born	55.2	28.9	19.9	24.2	29.4	26.9
of this						
From EU 12 to EU 15	84.0	61.7	41.4	59.6	55.9	57.5
From EU 15 to EU 15	-	-	-	-	-	-
From EU 27 to EU 12	-	-	-	-	-	15.8
Non-EU-born	59.8	39.5	27.7	34.2	38.0	36.0
of this						
Other Europe (including CEEC)	-	49.8	43.3	48.7	46.6	47.5
Turkey	-	(37.8)	-	-	-	(34.8)
North Africa	-	47.3	16.3	36.6	27.9	33.5
Other Africa	-	31.8	21.4	30.4	27.0	29.0
South & Central America Caribean	-	50.0	41.1	44.2	51.2	48.1
East Asia	-	33.0	-	29.2	39.4	34.3
Near and middle East	-	34.3	29.4	29.0	38.8	32.5
South and southeast Asia	-	34.0	21.4	28.3	35.4	31.2
North America, Australia and Oceania (incl. other)	-	11.7	-	-	15.4	11.8
No answer	-	96.2	49.0	100.0	100.0	100.0

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries, EEA = European Economic area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

Similarly, for the medium-skilled the rate over-qualification among recent migrants is 27.6% in the EU 27 average, while it is 13.5% for the foreigners that reside in their country of residence for more than 10 years. For these more established medium-skilled migrants, however, the share of overqualified is still substantially higher than that of the native-born (which amounts to 7.7%).

Furthermore, over-qualification rates of highly skilled as well as medium-skilled workers are higher for workers born outside the EU 27 than for those born in the EU 27. Among the highly skilled born in other EU countries the share of overqualified workers is 26.9% (which is still substantially higher than the 19.4% of natives) and for the medium-skilled born in other EU countries this share is 18.4% (relative to 7.7% for natives). For those born outside the EU the share of overqualified is substantially higher. It amounts to 36% among the highly skilled and 20% among the medium-skilled.

Table 22

Share of overqualified employed aged 15+ with medium education by place of birth age and gender

	15-24 years	25-44 years	45+ years	Male	Female	Total
Native-born	9.7	7.1	8.1	7.2	8.4	7.7
EU-born	30.1	18.0	15.0	14.0	10.8	18.4
of this						
From EU 12 to EU 15	41.8	28.6	33.0	22.3	19.1	31.3
From EU 15 to EU 15	-	-	-	-	-	-
From EU 27 to EU 12	-	-	-	-	-	8.5
Non-EU-born	20.1	20.5	18.8	15.7	11.0	20.0
of this						
Other Europe (including CEEC)	(12.8)	18.9	22.5	12.0	13.0	19.6
Turkey	-	(15.1)	15.4	(13.3)	-	16.0
North Africa	-	21.8	11.8	14.9	7.1	17.3
Other Africa	(23.2)	19.9	14.2	20.3	7.1	18.5
South & Central America Caribbean	27.2	27.6	28.4	19.5	18.2	27.7
East Asia	-	-	-	-	-	(8.6)
Near and middle East	-	(13.3)		12.1	(5.3)	13.1
South and southeast Asia	18.8	19.5	20.4	17.7	9.2	19.7
North America, Australia and Oceania	-	(5.9)	-	(6.7)	-	(6.0)
No answer	22.1	22.0	22.1	98.4	95.5	95.5

Notes: Base employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Low-skilled = ISCED 0-2, medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6. CEEC = other non-EU Central and Eastern European countries, EEA = European Economic area, EU 12 countries acceding the EU in 2004 and 2007, EU 15 = EU member states before 2004; values in brackets have a low reliability. - = data provide too few observations to be reported.

Source: EU-LFS.

While these figures suggest that those from more distant sending regions have higher problems at transferring skills across the border, they also imply that skill transfer across borders within the EU27 is far from unproblematic. Even within EU migrants have higher rates of over-qualification than natives. In this respect migrants from the EU 12 to the EU 15 seem to be a particularly problematic group since they have over-qualification rates that exceed even those of persons born outside the EU for both highly skilled (where the over-qualification rate is 57.5% for this group of foreign-born) and for the medium-skilled (where the over-qualification rate is at 31.3%)

3.5.3 An econometric analysis of over-qualification risks

While these data thus provide some indication that the stylized facts found in most of the literature on over- and under-qualification also apply to the EU 27 countries, the purpose of this study is to identify differences for the reasons of over and under-qualification among highly skilled foreigners relative to natives. Given the substantial heterogeneity in results concerning the average levels of over-qualification with respect to receiving and sending countries, we ran similar equations to those on the risk of being unemployed, employed or

inactive on the over-qualification probability of native- and foreign-born[64]. As in the previous model we assume that the probability of being overqualified depends on receiving and sending country fixed effects and control for age, gender and year of observation. In addition, however – since the measurement of over-qualification is based on the employed only – we also include a series of variables which take on the value of 1 if a person was employed in manufacturing, energy and construction, market services and non-market services, respectively, and zero else. These "dummy" variables are intended to control for potential differences in the rates of over-qualification by sector of employment relative to the base category (which is agriculture).

Table 23

Regression results for the probability of overqualified employment

	High-skilled		Medium-skilled	
	Marginal effect	Standard deviation	Marginal effect	Standard deviation
Female	0.064***	0.003	0.011***	0.001
25-44 years	–0.155***	0.006	–0.041***	0.001
45+ years	–0.174***	0.004	–0.050***	0.001
		Sending country		
Native-born	Reference category		Reference category	
EU 15	–0.029***	0.007	–0.012***	0.002
EU 12	0.296***	0.017	0.192***	0.010
Other Europe	0.350***	0.015	0.148***	0.006
Turkey	0.188***	0.038	0.066***	0.012
North Africa	0.157***	0.021	0.051***	0.010
Other Africa	0.105***	0.014	0.043***	0.008
South & Central America	0.194***	0.019	0.177***	0.013
East Asia	0.103***	0.032	–0.001	0.009
Near and middle East	0.168***	0.021	0.025***	0.008
South and southeast Asia	0.123***	0.013	0.063***	0.008
US, Australia and Oceania	–0.079***	0.017	–0.040***	0.005
		Sector of Employment		
Agriculture and Mining	Reference category		Reference category	
Manufacturing	–0.155***	0.003	–0.030***	0.001
Energy and Construction	–0.122***	0.004	–0.019***	0.001
Market services	–0.216***	0.005	–0.057***	0.001
Non market services	–0.363***	0.007	–0.052***	0.001

Notes: Table reports marginal effects of an ordered logit model. Base foreign-born employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported (see below). * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate.

Source: EU-LFS.

[64] Methodologically these regressions differ from the previous ones only in that rather than using a multinomial logit model here in the case of the highly qualified we use a (weighted) logit model, where the dependent variable takes on a value of 1 if the group considered is overqualified and zero else, while for the medium-skilled an ordered logit model is used where the dependent variable takes on values of -1, 0, and 1 if the group under consideration is under-, appropriately, or over-qualified, respectively.

In a first step, we estimate regressions in which aside from control variables we include both sending and receiving region fixed effects and report marginal effects when estimating these regressions separately for highly skilled and medium-skilled (in table 23)[65]. Aside from providing results on the relative probability of over-qualification by sending region these results also suggest that first of all women have a higher probability of being over-qualified both if they are highly or medium-skilled. Gender differences are, however, larger for the highly qualified. According to the results (after controlling for differences in place of birth and residence as well as sector of employment and age) a highly qualified woman has a by 6 percentage points higher probability of being over-qualified than a highly qualified man. For the medium qualified, these differences amount to only 1.1 percentage points, by contrast.

Second of all, these results also indicate that the probability of being over-qualified is highest for the 15 to 24 year olds, both for the high- and medium-skilled.[66] For the age group of the 45 and more year olds this gain is, however, only slightly larger than for the 25 to 44 year olds. Thus (after controlling for other influences on the probability of being over-qualified) the probability of being over-qualified is highest for the low age groups and once more marginal effects suggest that the impact of age on the probability of being over qualified is larger for highly skilled than for the medium-skilled.

Third of all, the control variables also suggest that for both highly and lowly skilled workers irrespective of nationality the probability of over-qualification is largest in agriculture and lowest in market and non market services for both the highly and lowly skilled, with the sectoral impact once more being higher for the highly skilled.

The central variables of interest for us are, however, the sending country variables included in the regressions, since these provide information on which groups of foreign-born in the EU 27 have the highest probability of over-qualified employment. These results show that (relative to native-born) the probability of over-qualification is actually (significantly) lower for migrants born in the EU15. Our estimates imply that the risk of over-qualified employment is by 2.9 percentage points (for high-skilled) and 1.2 percentage points (for less skilled) lower than that of natives, when migrants are born in other EU 15 countries. Thus migrants born in the EU 15 seem to face no problems in transferring human capital across national borders.

This, however, does not apply to migrants that were born in the EU 12 countries. High-skilled migrant from the EU 12 face a by 29.6 percentage points higher probability of being overqualified than natives and medium-skilled migrants from the EU 12 have an over-

[65] Note that we do not focus on the less skilled here since they by definition cannot be overqualified.

[66] It should, however, be noted that in particular with respect to the highly skilled the age group of 15-24 year olds is rather small, on account of most people of this education group still being in education at this age.

qualification probability that is by 19.6 percentage points higher than that of natives. In the case of the medium-skilled migrants this is the highest marginal effect among all sending countries. Among the highly skilled migrants only migrants from the rest of Europe (which are primarily migrants from Eastern Europe and the Balkans) have even higher marginal effects. Migrants born in the EU 12 have a substantially higher risk of over-qualification than natives, which signals substantial difficulties in transferring human capital across borders.[67]

For most of the other sending country groups marginal effects are in the realms of a 10 to 20 percentage points higher over-qualification risk for highly skilled and a 3 to 7 percentage points increase in over-qualification risks for the medium-skilled. Comparing the magnitude of these marginal effects across specifications thus suggests that (relative to natives) highly skilled foreign-born have substantially larger problems in transferring human capital across borders than medium-skilled. The only exceptions are migrants that were born in the United States or Australia and Oceania. For them the risk of over-qualification is lower than for natives and this applies even more strongly for highly skilled migrants.

In sum the regression results reported in table 23 suggest that highly skilled migrants in general, migrants born in the EU 12 and the high-skilled migrants born in other European (in particular CEEC and Balkan) countries have the largest difficulties in transferring human capital across national borders in the EU 27.

While as with unemployment, employment and inactivity risks we are unable to determine the causes for the substantially higher risks of over-qualification among the foreign-born, the result that migrants from the EU 12 and the group of migrants from the Balkans and Eastern Europe, (which are relatively new European migrants suggests that more recent migrants are more strongly affected by over-qualification than more established migrant cohorts. Thus in table 24 we report results of regressions, in which we focus exclusively on the foreign-born, but include an indicator variable which takes on the value if the person has resided in the country of residence for more than 10 years.

These results suggest that indeed the duration of residence is an important variable in determining the risk of over-qualification among the foreign-born. Highly skilled foreign-born that lived in a country for more than 10 years, experience a reduction in their over-qualification risk of approximately 15.4 percentage points. For medium-skilled migrants this effect is more modest. More established medium-skilled migrants with a duration of residence exceeding 10 years face an over-qualification risk that is by 6 percentage points lower than that of more recent migrants and may – to some extent explain the differences across regions found above.

[67] One reason for this could be that migrants from the EU12 are often also more recent migrants, which increase their overqualification risk (see below).

Table 24

Regression Results for the probability of over-qualified employment (only foreigners)

	Highly skilled		Medium-skilled	
	Marginal effect	Standard deviation	Marginal effect	Standard deviation
Female	0.097***	0.011	0.063***	0.005
25-44 years	–0.209***	0.032	–0.056***	0.008
45+ years	–0.203***	0.026	–0.063***	0.007
Residence duration more than 10 years	–0.154***	0.012	–0.060***	0.005
Sector				
Agriculture and Mining	Reference category		Reference category	
Manufacturing	–0.166***	0.036	–0.115***	0.009
Energy and Constructiuon	–0.058	0.051	–0.099***	0.009
Market services	–0.227***	0.046	–0.162***	0.013
Non market services	–0.353***	0.042	–0.126***	0.010
Log-likelihood	–2,041.522		–5,596.6031	
Observations	3,929		6,137	

Notes: Table reports marginal effects of an ordered logit model. Base foreign-born employed aged 15+ excluding, excluding Germany and Ireland, excluding unknown highest completed education and unknown country of birth (see Section 2 for details of data construction). Medium-skilled = ISCED 3,4, high-skilled = ISCED 5,6, results for receiving country dummy variables and year 2007 not reported (see below). * (**) (***) signifies significance at 10% (5%) (1%) significance, Std. dev. – heteroscedasticity robust standard error of the estimate.

Source: EU-LFS.

Finally, comparing coefficients across specifications, in which we include the total resident population (table 23), suggests that gender differences are more pronounced for the foreign-born than for natives and that the positive effects of being employed in agriculture on the over-qualification risk of the medium-skilled foreign-born are much larger than for the overall population. This suggests that foreign-born women and medium-skilled agricultural workers are additional groups among the foreign-born population that face particularly high risks of over-qualified employment.

3.6 Conclusions

In this chapter we address three questions concerning the migration of highly skilled workers to the EU. First, we ask how important highly skilled migrants are for the EU as a source of human capital. Second, we want to know what difference education makes for the labour market outcomes of migrants in terms of employment, unemployment and inactivity rates. Third, we analyze to what extent human capital among highly skilled migrants is underutilised in the EU on account of job-skill mismatch.

How important are high-skilled migrants as a source of human capital for the EU?

We find that for the EU 27 as a whole the foreign-born are an important source of human capital: According to data from the European Labour Force Survey 9.1% of the total tertiary

educated resident population (as opposed to 8.1% of total resident population) in the EU 27 is foreign-born. The share of highly skilled among the resident population born outside the EU is 21.1%, while for within EU migrants it is 23% (as opposed to 17.9% for the native-born population). The foreign-born thus contribute more than proportionately to the share of highly skilled in the EU.

There is, however, also substantial variation in migration experencies in the EU 27 both with respect to receiving countries as well as with respect to sending regions. With respect to receiving regions highly skilled migration (as well as total migration) is highly concentrated on individual receiving countries. Around 94.2% of all highly skilled foreign-born in the EU 27 live in the EU 15. Only around 5.8% reside in the EU 12 countries. Furthermore, even within the EU 15 high-skill migration is highly concentrated and the share of foreign-born is extremely varied. The three largest receiving countries in the EU 27 (France, the UK and Spain) in sum account for 57,5% of the total stock of foreign-born in the EU 15 and 63.1% of the highly skilled. The share of foreign-born in total resident population (aside from the obvious outlier of Luxemburg) is higher than 15% in Austria and Sweden but below 10% in Denmark, Greece, Italy and Portugal and even below 3% in Finland.

From a sending region perspective non-EU countries are a more important source of human capital for most EU 27 countries than migrants from within the EU. 6.6% of the total tertiary educated resident population of the EU 27 was born outside the EU. 2.5% were born in another EU country than the one in which they currently reside. Highly skilled non EU-born migrants primarily come from the other (non-EU) European countries (in particular Eastern Europe), South and Southeast Asia and South America (with each of these groups contributing more than 0.8% to the total highly skilled population residing in the EU). Highly skilled intra-EU migrants by contrast are often migrants from one EU 15 country to another.

The evidence, however, also suggests that more recent migrants (that reside in the country of residence for less than 10 years) to the EU 27 are not always more highly qualified than earlier migrants. More recent migrants from the important African and Asian and South American sending regions, are less well qualified than more established migrants from these regions. Thus in aggregate the share of tertiary educated among non-EU-born residents living in the EU27 for less than 10 years is 20.5%, while it is 21.3% among the more established non-EU-born. The reason for this seems to primarily be a substantial share of lowly skilled seasonal and temporary workers coming to the EU from many of the important non-EU source countries.

More recent migrants within the EU27 are, however, substantially more highly qualified than more established migrants from the EU27. Here the share of highly skilled among

those residing abroad for less than 10 years is 25.9% (relative to 20.9% among the migrants with a duration of residence in excess of 10 years).

In sum thus with respect to the first central research question of this chapter we find that highly skilled migrants are an important source of human capital in the EU27. The evidence, however, also suggests that the importance of high-skilled migration as a source of human capital varies substantially among different sending and receiving countries and that more recent migrants from outside the EU are not better qualified than more established migrants.

What difference does education make for the labour market outcomes of migrants?

We also find substantial differences in the labour market outcomes as measured by employment unemployment and activity rates of foreign- and native-born EU27 residents by skill groups. In general the less skilled foreign-born in the EU27 are characterized by higher employment rates, higher labour market participation and also higher unemployment rates than the less skilled natives. The high-skilled foreign-born, by contrast, have lower labour market participation rates, higher unemployment rates and lower employment rates than high-skilled natives. In addition native foreign unemployment, employment and inactivity rate differentials are more pronounced for the foreign-born from outside the EU than for migrants from other EU countries, and there is substantial variation for individual receiving countries.

Econometric evidence based on the EU-LFS suggests that (after controlling for country of residence, age and gender,) highly skilled foreign-born in the EU have a by 9.3% lower probability of being employed, a 3 percentage points higher probability of being unemployed and a by 5.4 percentage points higher probability of being inactive than comparable natives. Less skilled foreign-born, by contrast, have a by 2.9 percentage points higher probability of being employed than comparable natives and face a 5.4 percentage points lower risk of inactivity but a 1.2 percentage points higher risk of unemployment. Thus (even after controlling for compositional effects) highly skilled – in contrast to less skilled – migrants in the EU 27 are substantially (by 9.3%) less likely to be employed than highly skilled natives. This points to substantial underutilization of highly skilled foreign labour in the EU 27 due to non employment.

This underutilization is larger for more distant (i.e. non EU) sending region. This applies in particular to the unemployment probability. Here only less and medium-skilled migrants born in Northern America and Oceania experience lower risks of unemployment than migrants from the EU, while the unemployment risk for highly skilled migrants born in the Near and Middle East is by 7 percentage points higher than that of comparable high-skilled natives.

But also migrants born in the EU 15 and even more pronouncedly migrants from the EU 12 have substantially different labour market outcomes than natives. Migrants born in the EU 15 have an employment probability that is by 7.4 percentage points lower, an unemployment risk that is 1.1 percentage points higher and a by 6.3 percentage points higher probability of being inactive than natives of the same skill group. These results thus suggest that even within EU 15 borders the transfer of skill across country borders is far from unproblematic.

In addition econometric evidence also indicates that highly skilled foreign-born profit more strongly from a longer duration of stay (and thus improved integration and potentially receiving some education in the country of residence) in the receiving country than less skilled. The employment probability of a highly skilled foreign-born who has resided in the country of residence for more than 10 years is 9.7 percentage points higher than that of a foreign-born who has resided in the country of residence for less than 10 years. For these migrants unemployment probability is by 1.7 percentage points and the inactivity probability by 8.1 percentage points lower. For the less skilled the respective changes are 1.8 percentage points for the employment chances and –0.8% respectively –0.9 percentage points for unemployment and inactivity risks. They are thus substantially smaller. Thus highly skilled foreign-born who stay in the country of residence for a longer of period time have significantly higher improvements in labour market performance than less skilled. The highly skilled are thus particularly likely to profit disproportionately from improved integration.

Finally, gender differences in unemployment employment and inactivity probabilities among the foreign-born are significantly higher than for all residents (although they also decrease with increasing educational attainment of the foreign-born). This thus draws attention to the fact that also female migrants (of all skill groups) must be considered as particularly disadvantaged with respect to labour market integration.

In sum with respect to the second central research question evidence suggests that high-skilled migrants differ substantially from low-skilled migrants in labour market outcomes. In contrast to low-skilled they have lower employment rates as well as higher inactivity and unemployment rates than natives. This tendency is more pronounced for migrants from destinations that are further away from the EU and for more recent migrants, thus providing a first indication of difficulties in transferring human capital across borders.

To what extent is human capital among migrants underutilised in the EU27 on account of job-skill mismatch

Aside from substantial differences in foreign-native differentials in employment, activity and unemployment rates highly skilled migrants also face substantially higher risks of overqualified employment in the EU 27 than both natives and medium-skilled migrants.

According to results from the EU-LFS 19.4% of the native-born highly skilled, employed in the EU 27 (excluding Germany and Ireland) were overqualified. For the highly skilled foreign-born this applied to 33.0%. Both native- as well as foreign-born highly skilled women have substantially higher rates of over-qualification (of 20.7% native women and 34.9% foreign-born women) than men (18.1% natives and 31.2% foreign-born men respectively).

For the medium-skilled, levels of over-qualification, by contrast, are substantially lower both for the foreign-born as well as natives. In average of the years 2006 and 2007 around 7.7% of the natives with an educational level equivalent to the ISCED 3 or 4 categories were over-qualified in the EU 27. Among the foreign-born the equivalent share was 19.4%. As with high-skilled workers over-qualification among the medium-skilled female workers is substantially higher than among males. While the over-qualification rate for native-born women in the EU 27 amounted to 8.4% in the EU 27 and was thus only by 1.2 percentage points higher than that of men, for foreign-born medium-skilled women gender differences amounted to 9.7 percentage points (men 15.2%, women 24.9%).
In addition econometric results show that

1. The probability of over-qualification is lower for migrants born in the EU 15 than for natives. The risk of over-qualified employment is by 2.9 percentage points (for high-skilled) and 1.2 percentage points (for medium-skilled) lower than that of natives, when migrants are born in other EU 15 countries. Thus migrants born in the EU 15 seem to face few problems in transferring human capital across national borders.
2. High-skilled migrant from the EU 12 face a substantially (by 29.6 percentage points) higher risk of being overqualified than natives and medium-skilled migrants from the EU 12 have an over-qualification risk that is by 19.6 percentage points higher than that of natives. Migrants born in the EU 12 thus belong to the groups of migrants with the largest difficulties in transferring human capital across borders.
3. For most of the other sending country groups the over-qualification risk is by 10 to 20 percentage points higher for highly skilled migrants than for highly skilled native and 3 to 7 percentage points higher for medium-skilled foreign.
4. Comparing the magnitude of overqualification between highly and medium-skilled foreign-born, highly skilled foreign-born have substantially larger problems in transferring human capital across border than less skilled workers.

Furthermore as with employment, inactivity and unemployment risks also the over-qualification risk reduces more substantially with increasing duration of residence for highly skilled than for medium-skilled foreign-born and gender differences are higher among the foreign-born than among the population at large. Highly skilled foreign-born who lived in a country for more than 10 years experience a reduction in their overqualification risk of approximately 15.4 percentage points. For medium-skilled migrants this effect is more

modest. Migrants with a duration of residence exceeding 10 years face an over-qualification risk that is by 6 percentage points lower than that of more recent migrants. Finally, also sectoral employment patterns (in particular employment in agriculture) increase the over-qualification risk of the foreign more substantially among foreign-born than among natives.

Summarising the results of the third central research question thus suggests that there is substantial over-qualification among the highly skilled foreign-born in the EU27, with highly skilled migrants, more recent migrants, women and migrants from the EU12 having the largest problems in transferring skills across EU borders

Chapter 4
Migrant labour and its impact on productivity growth

4.1 Introduction

Whether or not migrants affect productivity is likely to be dependent on the attributes that migrants have, relative to native workers. In part, this may be determined by domestic immigration policy – more selective policies enable governments to identify specific skills and professions that are required in the domestic labour market. In this chapter we attempt to estimate the impact of various aspects of migrant labour on productivity at the industry level across EU countries, incorporating skills and interactions with technology and differentiating the source of migrants. We note elsewhere the paucity of empirical evidence in this regard, particularly with respect to differentiating labour types and their interaction with technology.

Our analysis is conducted at the industry level over time, where we pool across countries. The data used consists of approximately 13 countries[68], 10 years and 28 industries, discussed in greater detail below. We consider productivity impacts of migrant shares within the workforce, its composition in terms of skills and worker interactions with ICT technologies. We begin this chapter with a detailed outline of the data used, with some description of the migration dimension in particular, and provide a discussion of the methodological approach to be used.

4.2 Data sources and migration data description

The primary data source for the analysis is the EUKLEMS Productivity Accounts Database, March 2008 release.[69] This database contains harmonised time series of sectoral information on value added, employment, hours worked and capital services for the period under consideration, 1995-2005. Detailed information on the share of migrants in each sector is available from the European Labour Force Survey (EU LFS) for the period 1995-2004.

Comparability with other studies conducted for the Competitiveness Report 2009 is reasonable since the EUKLEMS data utilised here are consistent with those used in the ICT/Regulation and the training chapters of this report but the data are augmented by different, additional information and in all cases, the constraints of the additional data are imposed on the EUKLEMS. Thus, coverage compared to these other chapters necessarily

[68] Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, UK.

[69] Available at http://www.euklems.net Updates to 2006/7 are anticipated in the summer of 2009

varies in terms of time and countries. In this chapter, data from the EU-LFS have been used to identify workers whose country of origin differs from the nation in which they work.

The EU LFS is available until 2008; however there are some definitional changes to the migration variables that we use in this analysis. Our migrant variable is split into non-native workers from elsewhere within the EU and those workers who originate from outside the EU (rest of the world, hereafter ROW). This classification is consistent over the period we are considering, but in 2005 and again in 2007 the EU is redefined to take account of its enlarged membership. The sectoral breakdown available in the EU-LFS is presented in table 1 below:

Table 1

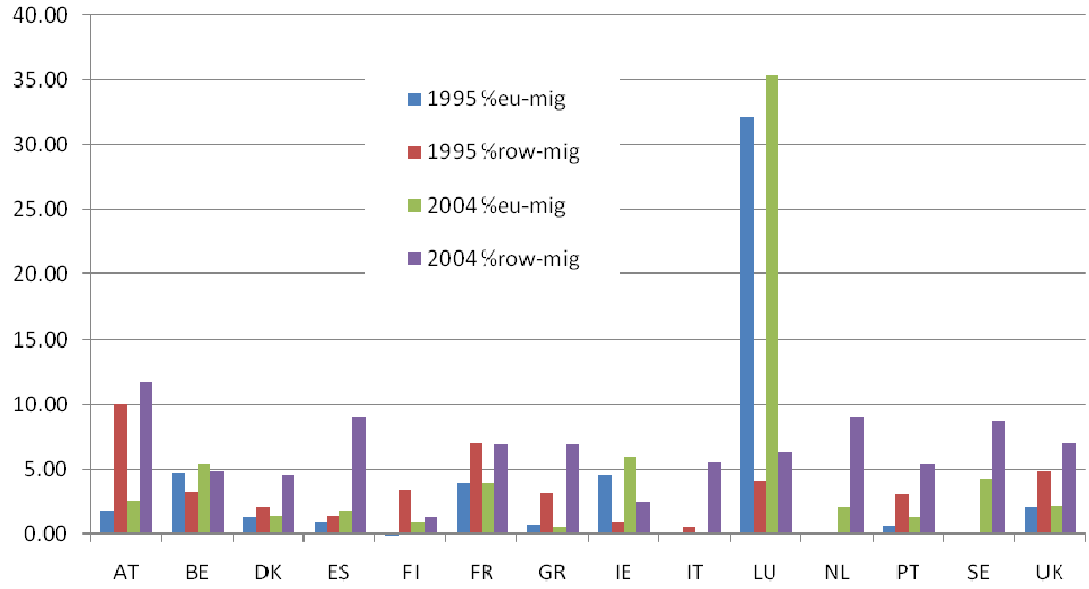
Industrial Sector Breakdown available in the augmented dataset

	Code	Description
1	A	Agriculture
2	B	Fishing
3	C	Mining
4	15t16	Food, Drink and Tobacco
5	17t19	Textiles and textile products, leather and footwear
6	21-22	Pulp, paper, paper products, printing and publishing
7	23	Coke, refined petroleum products and nuclear fuel
8	24	Chemicals and chemical products
9	25	Rubber and plastics
10	26	Other non-metallic mineral products
11	27t28	Basic Metals and Fabricated metal products
12	29	Machinery NEC
13	30t33	Electrical and Optical Equipment
14	34t35	Transport Equipment
15	36t37	Manufacturing NEC; recycling
16	E	Energy/utilities
17	F	Construction
18	G	Wholesale and Retail
19	H	Hotels and restaurants
20	60t63	Transport and Storage
21	64	Communications
22	J	Financial intermediation
23	70	Real estate activities
24	71t74	Renting of machinery and equipment and other business activities
25	L	public administration and defence
26	N	Health
27	O	Other social, personal and community
28	P	Private households

Migration data are available for a restricted number of European countries, from 1995 to 2004[70]. Figure 1 below shows the mix of EU/ROW employment at the start and the end of our period. Three things arise from the chart; firstly, Luxembourg is clearly dominated by migrant labour, which whilst it is not that surprising, is something to be mindful of when analysing the data. In addition, we see that generally EU migrants and ROW migrants are comparable with no clear evidence of one type of migration being dominant in terms of magnitude. We consider these two to be very different sorts of migrants so it is important to separate them in our analysis[71]. Finally, the end of the period shows a marked increase in foreign labour participation in many countries, except in Ireland, Belgium and Luxembourg.

Figure 1

Migrant share % of total employment by country, 1995 and 2004



Source: EU LFS

Figure 1 provides no information on the attributes that immigrants have, simply taking a head count of migrants. In reality, the skills set and qualifications amongst labour is likely to be very heterogeneous but extremely influential on the role that labour plays in productivity. Thus, some account of the quality of labour needs to feature in our analysis. We provide information on the breakdown by skill groups within each migrant category, derived from the EU LFS. The definition of high-skilled workers are those with ISCED equal to 5 or 6, for those with medium-skilled, ISCED is 3 or 4, and low-skilled workers are those classified as ISCED 1 or 2. There are of course a number of problems with harmonised skill groupings

[70] In previous versions of this analysis, data for some new member states were available; however, there is a tradeoff between country and industry coverage, and given the divergence of experience in relation to migration between NMS and the old EU, it seemed more appropriate to concentrate on industrial detail.

[71] Of course, it would be preferable to have even more detail on the source of immigrant labour but information is not available.

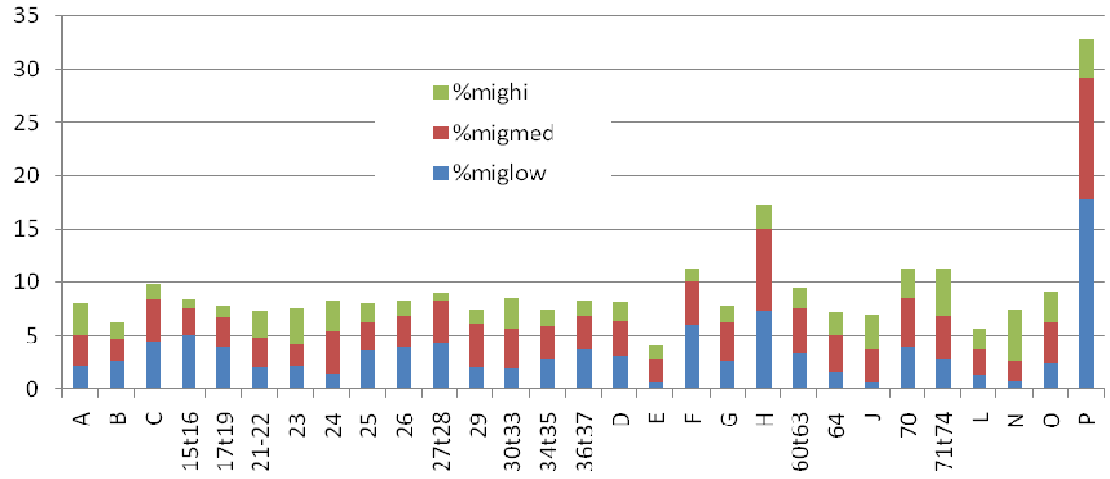
which are caused by the wide array of educational systems and (to a lesser extent) changes to systems over time. However, this is the best information available.

Taking a sectoral perspective, Figure 2 shows the extent to which, at an aggregated EU level, sectors are dominated by skill types. Figure 2 reveals that as a proportion of total employment, construction, hotels and restaurants, business services (70 and 71t74) and private households are sectors where there are a significant shares of migrants. In these sectors, the proportion of low-skilled migrants accounts for at least half of total migrants, except in business services, where higher skilled migrant workers are relatively important. Conversely, sectors where migrants play a relatively minor role are fishing, energy, public administration and defence.

The importance of low-skilled migrants in some sectors, such as construction, is not surprising, but it is perhaps more surprising to see that low skills are accounting for such a small proportion of migrant labour in some other sectors, such as agriculture. This may be taken as evidence of over-qualification in a sector such as this, where work is exceptionally seasonal and likely to be short-term.

Figure 2

Migrant share % of total employment by sector and skill group, 2004 ('EU total')

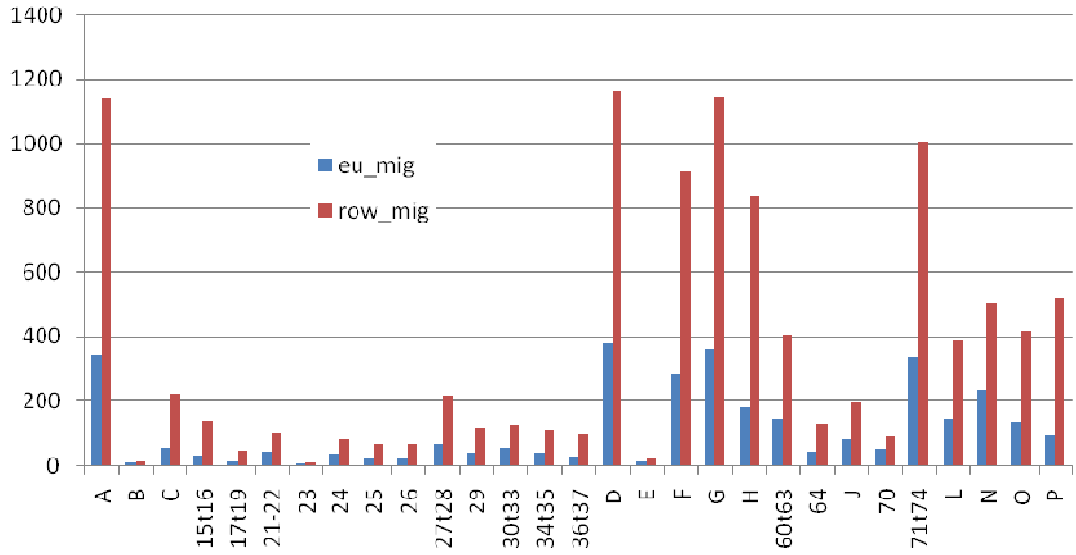


Source: EU LFS; EU total comprises of 13 countries, Austria, Belgium, Denmark, Spain, Finland, France, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Sweden, UK.

In Figure 3, the overall **levels** of migration are presented by sector for the 13 EU countries available in the EU LFS for 2004. It can be seen that ROW migrants account for generally around half the migrant workforce, more in sectors such as agriculture (AtB) and private households (P). Sectors where the EU migrants almost match the rest of the world include mining and energy supply (where overall levels are low), financial intermediation and education.

Figure 3

Numbers of migrants, EU and ROW in the 'EU 13' 2004 (thousands)



Source: EU LFS, own calculations

As well as levels of immigration, we are also interested in the growth in immigration in recent times. Indeed, in many respects, it is growth that is of greater interest from a performance perspective. Recent increases in immigration have been a feature of European politics, particularly since the EU expansions in 2004 and 2007. It should be emphasised that our analysis pre-dates the accession of the New Member States (NMS) and as such, NMS migration is classified into ROW migration. With this in mind, Table 2 contains growth rates by country from the initial position presented in Table 1, to 2004. Of course, migration growth takes place against a backdrop of organic population growth, and in many countries, increased labour market participation (eg Spain), so as a share of total employment, this may be greater or less than total employment growth. It is clear, that in general there has been positive growth in all countries in migrant labour.

In the 1995-2000 period, migrant growth is highest for Spain, Ireland and Portugal. In countries where migration is high, it tends to be high across the board, regardless of source or qualifications. The UK has seen some growth in medium and high skills, both from the rest of the world and the EU. This is also true for Austria. Finnish figures are generally strange because of the absolute numbers being so small, as we saw in Figures 1-3. Mediterranean countries appear to have experienced much greater growth in lower skilled migrants, especially in relation to ROW migrants. Turning to the latter half of the period, high-skilled EU growth is generally more modest and this is true, to a lesser extent for ROW migrant share too. There has been greater negative EU growth in a larger number of countries for low-skilled migrants. Fortunes are more mixed for medium-skilled workers.

Table 2

Average annual percentage growth in EU migrants by skill categories, total economy

	%growth pa 1995-2000						%growth pa 2000-2004					
	eu_low	eu_med	eu_hi	row_low	row_med	row_hi	eu_low	eu_med	eu_hi	row_low	row_med	row_hi
AT	-1.6	1.3	11.9	-4.8	1.8	5.2	-6.7	-1.0	4.9	3.6	3.6	2.6
BE	2.8	0.4	2.5	4.8	6.9	8.6	-4.4	1.2	1.7	-1.9	3.1	9.6
DK	4.4	5.7	-4.3	9.1	13.5	2.6	-2.4	-2.2	5.6	-2.1	-6.6	10.2
ES	11.1	18.4	17.1	22.3	17.8	14.9	-0.4	3.3	5.1	-0.8	7.6	15.0
FI		35.8		-62.4	-57.3	-33.6	-4.7	1.0	0.7	27.3	41.0	60.6
FR	-2.4	0.3	1.6	1.1	0.3	2.9	-0.3	1.4	3.7	3.0	4.2	7.8
GR	-2.2	-11.2	1.3	9.1	9.7	6.3	-5.0	3.2	6.2	-18.1	3.7	7.5
IE	9.3	16.1	9.1	0.4	10.0	10.7	-1.4	0.4	8.0	-3.1	-2.2	6.1
IT				12.5	14.9	4.9	-1.5	1.5	4.3			
LU	-3.4	12.3	10.1	3.7	13.8	17.5	0.0	-2.3	4.4	-0.5	0.5	12.3
NL							-1.5	-0.9	5.7	-15.2	5.2	2.9
PT	9.9	6.9	20.5	11.6	7.0	2.4	-1.3	3.0	8.0	2.7	8.1	20.7
SE										-80.0	-76.1	-74.1
UK	-13.4	9.9	13.7	-10.0	10.7	12.6	-3.4	2.1	2.0	-10.6	9.6	-1.7

Source: EU-LFS, own calculations.

4.3 Methodology and descriptive analysis

We wish to measure the effect that migrant labour has on productivity and so we begin with a standard Cobb Douglas production function, following broadly the approach presented in Paserman (2008). Output (measured here as value added) is determined by capital (K) measured separately as ICT capital (KIT) and non-ICT capital (KNIT) and labour, measured as hours worked (Hrs) plus an adjustment for migrant labour (Lm), where μ captures the productivity difference between native and migrant labour. Thus the relationship may be written as:

(1a) $VA = AKNIT^{\alpha} KIT^{\beta} \left[L_d + (1+\mu)L_m\right]^{\gamma}$

(1b) $VA = AKNIT^{\alpha} KIT^{\beta} \{Hrs\left[(1-s_d) + (1+\mu)s_m\right]\}^{\gamma} = AKNIT^{\alpha} KIT^{\beta} Hrs^{\gamma}\left[1+\mu s_m\right]^{\gamma}$

We have no a priori assumptions regarding the sign associated with μ. Migrants are likely to face barriers in the workplace such as problems with language and may suffer general difficulties adapting to different social environments. Conversely, one may argue that migrants are positively selected and therefore more motivated than native workers. In addition, migrants are likely to bring with them different skills to native workers which may make their interactions different. The production function equation is specified in log form thus (where we use the approximation $\ln(1+\mu s_m) \approx \mu s_m$):

(2a) $$LnVA_{c,t,i} = \alpha_1 + \beta_1 \ln hrs_{c,t,i} + \beta_2 \ln capit_{c,t,i} + \beta_3 \ln capnit_{c,t,i} + \beta_4 eu\_share_{c,t,i} + \beta_5 row\_share_{c,t,i} + C_{it} + I_{ct} + T_{ci} + e_{cit}$$

(2b) $$\Delta LnVA_{c,t,i} = \alpha_1 + \beta_1 \Delta\ln hrs_{c,t,i} + \beta_2 \Delta\ln capit_{c,t,i} + \beta_3 \Delta\ln capnit_{c,t,i} + \beta_4 eu\_share_{c,t,i} + \beta_5 row\_share_{c,t,i} + C_{it} + I_{ct} + T_{ci} + e_{cit}$$

Where the *eu_share* is the proportion of migrant workers in the workforce from EU countries and *row_share* is the rest of the world proportion for each country (c), industry (i) and year (t). e_{cit} is the idiosyncratic error term, assumed to be uncorrelated with firm inputs. We estimate the relationship in both the difference and the levels forms, as specified above. In this way, we consider the extent to which the relationship is long or short run. The additional migrant regressors are included as proportions in total employment and are not differenced in order to see how far the proportion of migrants affects both productivity levels and growth. Equations 2a and 2b are estimated using standard pooled OLS, including industry, time and country dummies. A number of variants of the equation are considered, including time*country effects to take explicit account of business cycle effects, which are reported below.

As a robustness check, we take the measure of Multi-Factor Productivity (hereafter MFP) provided in EU KLEMS for each country and each industry over time. We use both MFP growth and MFP levels and regress them on a number of additional explanatory variables that relate to the migrant workforce, as specified below:

(3a) $\Delta LnMFP_{cti} = \alpha + \beta_1 eu\_share_{cti} + \beta_2 row\_share_{cti} + C_{it} + I_{ct} + T_{ci} + e_{cit}$

(3b) $LnMFP_{cti} = \alpha + \beta_1 eu\_share_{cti} + \beta_2 row\_share_{cti} + C_{it} + I_{ct} + T_{ci} + e_{cit}$

In the case of the MFP regressions, we effectively adopt a two-stage procedure. MFP is constructed through growth accounting mechanisms with all its underlying assumptions including constant returns to scale. These estimates already incorporate adjustments for labour quality (averaged over the labour force, thus inclusive of migrants but not taking explicitly account of the heterogeneity of migrants vs. non-migrants productivity effects which provides the rationale for estimating equs. (3a) and (3b)) and allow for different types of capital inputs. These are directly provided in the EU KLEMS. Implicit in their construction in the Cobb Douglas production function; further details are available in Timmer et al. (2007).

Similar assumptions are made in the value added estimations, where the production function is estimated in one-step, including the additional regressors that relate to migrant labour and its interactions, presented here. Alternative functional forms are available, and indeed may be more appropriate such as the translog (Mas el al, 2008). However, this functional form is adopted in order to explore the complementarity or substitutability between the two types of labour, native and migrants and since this is not a focus of this report, we do not specify a translog function.

4.3.1 Data description

The two output variables under consideration are obviously related and Figure 4 reveals the extent to which the relationship is observable. Clearly, there is a positive correlation between MFP and value added (VA) measured in levels, with a number of outliers close to the x-axis. For the sake of more accurate estimation, values of value added levels greater than 160,000 have been excluded from subsequent analysis[72].

Interacting migrant workers with technology

A point of discussion in much of the migration literature is the role that migrant labour can play in the absorption and spread of technology. This impact is likely to be correlated with skills but is distinct on the basis of its tacit nature (Teece et al., 1997). In order to incorporate some allowance for this more indirect productivity impact, we include a term

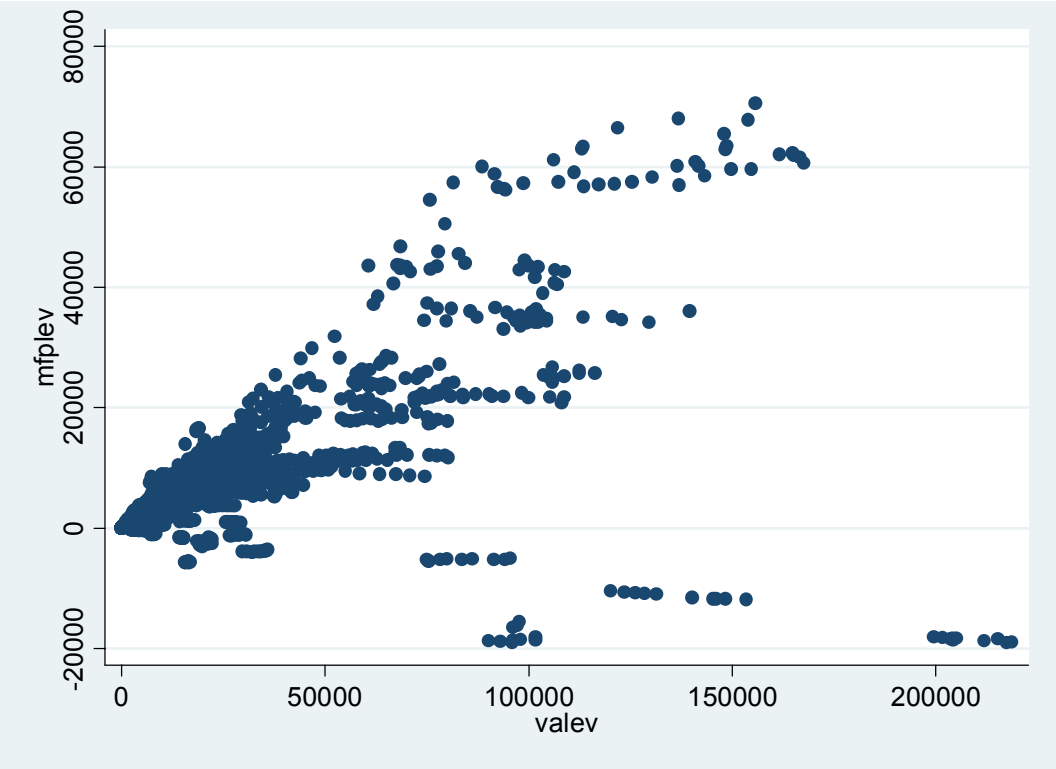
[72] Around 25 observations.

whereby highly skilled migrant labour is interacted with ICT intensity. Thus, we aim to glean information on the absorptive capacity of the firm that is driven by migrant labour.

Finally, as the quality of the EU LFS (educational indicators particularly) is thought to be significantly worse farther back in time, we consider our findings over the full period – 1995-2004 and also over the shorter post-1999 period in order to detect if there are any differences to our findings. These are reported in the results section.

Figure 4

MFP levels and Value added Levels (1995-2004), 13 EU countries



Source: Own calculations, EUKLEMS

4.3.2 Descriptive analysis of migrant and productivity data

In Tables 3 and 4 we summarise the main variables used in the analysis, including the composite variables. Full details on how these variables are defined and constructed are provided in Annex 1 at the end of this chapter. Here we report the frequencies, means and their standard deviations. Mean values are averaged over the 1995-2004 period firstly by country (Table 3) and then by industry (Table 4). Taking first the EU share of migrant labour, we see that, with the exception of Luxembourg and Sweden (both countries have high standard deviation), Belgium, Ireland and France display the highest share of EU workers. We see very low shares in Finland and Portugal. Regarding the share that ROW

workers account for, we see that Austria shows very high levels (presumably an Eastern Europe effect) and aside from Austria, The Netherlands, France, Sweden and the UK have an ROW migrant share of greater than 5%. Considering the quality of labour the extent to which migrants comprise of high skills is revealed in the hi_share variable. Ireland, Spain and the UK show the highest shares of high-skilled migrants. In part this is due to selectivity involved in granting access to domestic labour markets. Looking at the composite variable, ict_int, Sweden, the UK and Spain have the highest interaction between high-skilled workers and ICT capital. Italy and Austria have the lowest.

Table 3

Descriptive statistics of migration variables by EU country, 1995-2004

	eushare			Rowshare		
	freq.	**mean**	**stdev**	**freq.**	**mean**	**stdev**
Austria	280	0.019	0.016	280	0.115	0.069
Belgium	280	0.058	0.033	280	0.040	0.028
Denmark	278	0.014	0.015	278	0.032	0.030
Spain	280	0.014	0.011	280	0.034	0.048
Finland	280	0.006	0.007	280	0.012	0.014
France	280	0.041	0.027	280	0.066	0.027
Ireland	249	0.059	0.021	249	0.012	0.013
Italy				280	0.020	0.036
Luxembourg	242	0.381	0.219	242	0.050	0.054
Netherlands	252	0.023	0.020	252	0.083	0.038
Portugal	280	0.011	0.009	280	0.049	0.031
Sweden	280	0.123	0.273	280	0.057	0.048
United Kingdom	252	0.021	0.011	252	0.053	0.026
	ictint			**hishare**		
	freq.	**mean**	**stdev**	**freq.**	**mean**	**stdev**
Austria	267	0.001	0.003	277	0.160	0.175
Belgium	268	0.004	0.005	278	0.291	0.215
Denmark	244	0.004	0.006	246	0.319	0.282
Spain	267	0.005	0.006	277	0.379	0.237
Finland	228	0.003	0.006	236	0.199	0.233
France	270	0.003	0.004	280	0.209	0.154
Ireland	240	0.003	0.003	246	0.385	0.191
Italy	259	0.001	0.002	269	0.152	0.195
Luxembourg	230	0.002	0.004	239	0.177	0.186
Netherlands	242	0.003	0.004	251	0.209	0.196
Portugal	265	0.002	0.004	275	0.173	0.194
Sweden	240	0.006	0.009	241	0.257	0.202
United Kingdom	243	0.005	0.007	252	0.326	0.203

Source: EU LFS (note: Italy includes all migrants in ROW)

By sector (Table 4), we can see that EU migrants have a more substantial representation in private households, construction, fishing and electrical and optical equipment. Rest of the

world migrants are most abundant in the hotels sector and in private households, as well as food, drink and tobacco. In the case of high-skilled migrants, they particularly feature in health, coke and nuclear fuel and business activities. It is interesting to note the importance of high-skilled labour in agriculture, which we saw earlier, is a reflection of part time or student labour that is involved with highly seasonal work. This sector is relatively well known for being an employer of migrant labour and as such might also be an entry point for migrants. Turning to the high-skilled interaction with ICT, the relationships are especially strong in financial intermediation and other business activities, followed by health and communications.

Table 4

Descriptive statistics of migration variables by industry, 1995-2004

		Share of EU migrants			Share of ROW migrants			Share of high-skilled migrants			ICT share*high-skilled migrant		
		freq.	mean	stdev	freq.	mean	stdev	freq.	mean	stdev	freq.	mean	stdev
A	Agriculture	126	0.043	0.102	126	0.040	0.024	125	0.366	0.136	125	0.003	0.009
	Fishing	126	0.074	0.190	126	0.028	0.035	105	0.271	0.320	105	0.001	0.001
C	Mining	126	0.051	0.121	126	0.056	0.047	124	0.129	0.111	124	0.001	0.001
15t16	Food, Drink and Tobacco	126	0.062	0.138	126	0.071	0.078	123	0.127	0.166	123	0.001	0.001
17t19	Textiles and textile products, leather and footwear	126	0.065	0.176	126	0.032	0.039	122	0.111	0.173	122	0.001	0.002
21-22	Pulp, paper, printing and publishing	126	0.045	0.099	126	0.038	0.032	122	0.264	0.175	122	0.004	0.003
23	Coke, refined petroleum products and nuclear fuel	115	0.030	0.087	115	0.038	0.047	80	0.440	0.398	80	0.004	0.009
24	Chemicals and chemical products	126	0.061	0.128	126	0.044	0.034	119	0.383	0.222	119	0.002	0.002
25	Rubber and plastics	126	0.051	0.110	126	0.056	0.058	125	0.156	0.162	125	0.001	0.001
26	Other non-metallic mineral products	126	0.070	0.156	126	0.044	0.043	121	0.126	0.143	121	0.001	0.001
27t28	Basic and Fabricated metal products	126	0.051	0.103	126	0.047	0.041	125	0.126	0.111	125	0.001	0.001
29	Machinery NEC	126	0.052	0.116	126	0.043	0.037	125	0.221	0.170	125	0.003	0.003
30t33	Electrical and Optical Equipment	126	0.074	0.168	126	0.053	0.041	124	0.299	0.199	124	0.006	0.005
34t35	Transport Equipment	125	0.061	0.159	125	0.050	0.053	121	0.207	0.214	121	0.002	0.003
36t37	Manufacturing NEC; recycling	126	0.057	0.154	126	0.043	0.039	120	0.139	0.140	120	0.001	0.002
E	Energy/utilities	126	0.030	0.091	126	0.020	0.021	117	0.322	0.287	117	0.001	0.001
F	Construction	126	0.080	0.183	126	0.047	0.044	124	0.106	0.088	124	0.001	0.001
G	Wholesale and Retail	126	0.052	0.117	126	0.044	0.027	125	0.173	0.074	125	0.002	0.002
H	Hotels and restaurants	126	0.081	0.157	126	0.109	0.067	125	0.117	0.078	125	0.001	0.001
60t63	Transport and Storage	126	0.045	0.097	126	0.047	0.032	125	0.184	0.094	125	0.002	0.002
64	Communications	126	0.031	0.091	126	0.038	0.028	124	0.271	0.199	124	0.007	0.007
J	Financial intermediation	126	0.052	0.125	126	0.030	0.022	122	0.404	0.184	122	0.012	0.009
70	Real estate activities	126	0.066	0.132	126	0.054	0.064	120	0.266	0.242	120	0.000	0.000
71t74	Renting of machinery and equipment and other business activities	126	0.068	0.136	126	0.068	0.042	125	0.420	0.138	125	0.012	0.007
L	Public administration and defence	126	0.027	0.088	126	0.028	0.023	125	0.329	0.154	125	0.003	0.003
O	Other social, personal and community	126	0.055	0.109	126	0.051	0.031	125	0.298	0.120	125	0.004	0.003
P	Private households	123	0.100	0.219	123	0.087	0.084	104	0.082	0.139	0		

4.3.3 Correlations between key variables

This section and especially table 5 shows the extent to which our migration variables are correlated with output and input variables traditionally contained in production function estimation. We see that the share of EU migrants has a negative and significant correlation with almost all input and output variables. In the case of the ROW, the evidence is more mixed and generally more positive in significant associations. Generally, the share of high-skilled migrants is positively associated with output and input variables as is the ict_int term.

Table 5

Correlation coefficients between migration variables and other input and output variables, 1995-2004 across time, country and industry

	lnmfp	dlnmfp	lnva	dlnva	hours	IT cap	Non-ITcap
eu_share	-0.37	0.01	-0.33	0.02	-0.13	-0.05	-0.06
(sig)	*0.00*	*0.51*	*0.00*	*0.19*	*0.00*	*0.00*	*0.00*
row_share	-0.03	0.02	0.02	-0.02	0.06	0.06	0.01
(sig)	*0.11*	*0.19*	*0.16*	*0.28*	*0.00*	*0.00*	*0.45*
hi_share	0.16	-0.01	0.16	0.05	0.08	0.13	0.02
(sig)	*0.00*	*0.48*	*0.00*	*0.00*	*0.00*	*0.00*	*0.24*
ict_int	0.22	0.01	0.20	0.09	0.16	0.53	-0.05
(sig)	*0.00*	*0.58*	*0.00*	*0.00*	*0.00*	*0.00*	*0.00*

Source: EUKLEMS/EU-LFS/ own calculations

Table 6

Correlation coefficients between migration variables, 1995-2004 across time, country and industry

	Eushare	Rowshare	hishare
eu_share	**1.00**		
(sig)	*0.00*		
row_share	0.05	**1.00**	
(sig)	*0.00*	*0.00*	
hi_share	-0.07	-0.19	**1.00**
(sig)	*0.00*	*0.00*	*0.00*
ict_int	-0.01	-0.02	**0.54**
(sig)	***0.52***	*0.28*	*0.00*

Source: EUKLEMS/EU-LFS/ own calculations

If we consider specifically the interaction of migrant variables with each other (Table 6), we see that with the exception of ict_int/eu_share and row_share/ict_int, all correlations are significant. The ICT interaction term is only positively associated to the hi_share (and hi_share is the numerator in its construction). Thus, our initial exploration of the data suggests a very mixed picture in relation to output variables but significant but low

correlations amongst the migrant variables themselves. We now go on to consider these relationships within a more robust framework.

4.4 Results

Following the equations specified in section 3, this section is structured as follows: firstly we present a series of baseline models of the production function before going on to consider the role of migrants on productivity. This is the value added levels and growth specifications which offer basic information on the relationship between inputs and outputs before we introduce our additional regressors. We then go on to present our initial findings from the MFP levels and growth estimations before going on to consider the more fully specified production function, based on value added levels and growth. We explore the role of migration on the full sample, as well as a truncated time frame, to take account of changes in educational classifications. In addition, we consider the relationship in separate sectors, identifying manufacturing and services sectors separately. We then go on to consider a reduced number of countries to see how sensitive our findings are to a more homogeneous set of countries. In addition to our variables of interest, it is worth emphasising that in our OLS specifications we include industry, country and time dummies, as well as country*time dummies. The latter are included to detect the role of country specific business cycles. These coefficients are not reported here but their inclusion controls for unidentifiable differences across these dimensions. Our OLS regressions are weighted by shares in total employee compensation, to take account of the relative sizes of sectors.

Finally, for a number of specifications we estimate the impact of migrant shares on productivity using a GMM specified equation to take account of endogeneity in the relationship. We conduct the usual specification tests which indicate whether or not the approach is more appropriate in this instance.

4.4.1 Baseline production functions

The EUKLEMS data have been analysed elsewhere, however, as a result of our limited information on migrants we know that our sample is somewhat restricted. Thus as a first step, tables 7 and 8 below show the baseline models with and without country, industry, time and business cycle dummies. The first thing to note is that the coefficients in table 7 seem consistent with a priori expectations, approaching constant returns, and we note that the differenced equations in table 8 show lower but generally plausible coefficients. It is interesting to note the sign change on the ICT capital coefficient in the levels model when appropriate dummy control variables are included. This is typically found in other studies (O'Mahony and Vecchi, 2005). In table 8, all three inputs are significant and positive, despite the coefficients being smaller. Thus, we are generally satisfied that the productivity

data yields sensible findings. We now augment our productivity equations with additional measures to capture the role that migrant labour may play in explaining productivity and productivity growth.

Table 7

Baseline models – value added production function, levels

	(1)	(2)	(3)
Lnhrs	0.5908***	0.5599***	0.5621***
	[0.0096]	[0.0241]	[0.0245]
Lnkit	0.0322***	-0.0228**	-0.0243**
	[0.0078]	[0.0105]	[0.0108]
Lnknit	0.3261***	0.3016***	0.3023***
	[0.0102]	[0.0168]	[0.0171]
Constant	3.0570***	2.8042***	2.7467***
	[0.0651]	[0.1316]	[0.1583]
country dummies	n	y	y
year dummies	n	y	y
industry dummies	n	y	y
C*y dummies	n	n	y
Observations	3305	3305	3305
R-squared	0.825	0.933	0.934
F	5173	911.2	297.8
Rmse	0.473	0.294	0.298

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above; ***, **, * indicate 1%, 5% and 10% significance respectively.

Table 8

Baseline models – value added production function, first difference

	(1)	(2)	(3)
Dlnhrs	0.2744***	0.2875***	0.2998***
	[0.0237]	[0.0242]	[0.0251]
Dlnkit	0.0328***	0.0510***	0.0453***
	[0.0080]	[0.0085]	[0.0089]
Dlnknit	0.1878***	0.1196***	0.1273***
	[0.0241]	[0.0256]	[0.0265]
Constant	0.0122***	0.0145*	-0.0014
	[0.0014]	[0.0077]	[0.0247]
country dummies	n	y	y
year dummies	n	y	y
industry dummies	n	y	y
c*y dummies	n	n	y
Observations	2974	2974	2974
R-squared	0.123	0.314	0.337
F	138.9	27.26	10.50
Rmse	0.0411	0.0367	0.0366

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above; ***, **, * indicate 1%, 5% and 10% significance respectively.

4.4.2 MFP Specifications

Firstly, we specify a function with MFP derived from the growth accounting exercise of EUKLEMS (see Timmer et al., 2007 for details). Table 9 contains 5 estimates, firstly with the MFP levels regressed against a share of migrants in the workforce. This is negative and significant in relation to MFP, implying that migrant labour has a negative impact on productivity levels. In model 2 this effect is smaller, with a positive and significant impact of a higher share of high-skilled migrants. Specifications 4 and 5 in table 9 show migrants entered as separate shares for EU and ROW workers. Note that they seem to be operating in opposite directions, with a strong negative and significant impact of EU share of migrant workers. In table 9 we extend the models further by considering the interaction of high-skilled migrants with technology and find a positive effect (although the negative effect of the EU workers remains).

Table 9

MFP levels specifications 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
mig_share	-0.7815**	-0.7719**			
	[0.3146]	[0.3185]			
hi_share		0.2422***	0.2551***		0.2319***
		[0.0738]	[0.0736]		[0.0731]
eu_share				-4.9132***	-4.8824***
				[0.6367]	[0.6428]
row_share				0.7560**	0.7487**
				[0.3740]	[0.3775]
Observations	3075	2957	2957	3075	2957
R-squared	0.898	0.898	0.898	0.900	0.900
F	180.1	173.9	174.8	182.5	176.3
Rmse	0.385	0.381	0.382	0.381	0.378

VARIABLES	(6)	(7)
eu_share	-4.2582***	
	[0.6817]	
row_share	0.1395	
	[0.4107]	
ict_int	6.6211***	5.6802***
	[1.9925]	[1.9979]
Observations	2909	2909
R-squared	0.897	0.896
F	169.2	169.1
Rmse	0.374	0.377

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Standard errors in parentheses.

Turning to the growth equation of MFP, in table 10 we see that there is some evidence of a positive impact of combined migrant share on MFP growth. Including the proportion of

high-skilled migrants (as a proportion of total migrants) fails to make a significant impact, however. In models 3 and 4 of table 10, the share of EU and rest of the world migrants are separated and it can be seen that both remain significant and positive, although including the proportion of high-skilled migrants separately adds nothing to the explanatory power of the model (cf model 4 in table 9). In models [5] and [6] we consider the impact of migrants interacted with technology and find only a positive and significant effect of ROW share.

Table 10

MFP growth specifications 1995-2004

VARIABLES	(1)	(2)	(3)	(4)
mig_share	0.0943***	0.0979***		
	[0.0342]	[0.0345]		
hi_share		0.0034		0.0035
		[0.0082]		[0.0082]
eu_share			0.1158*	0.1224*
			[0.0699]	[0.0706]
row_share			0.0864**	0.0891**
			[0.0407]	[0.0411]
Observations	2785	2697	2785	2697
R-squared	0.211	0.212	0.212	0.212
F	5.389	5.182	5.347	5.143
Rmse	0.0401	0.0398	0.0401	0.0398
VARIABLES	(5)	(6)		
eu_share		0.1012		
		[0.0753]		
row_share		0.0890**		
		[0.0451]		
ict_int	0.0133	-0.0349		
	[0.2155]	[0.2162]		
Observations	2654	2654		
R-squared	0.211	0.213		
F	5.139	5.121		
Rmse	0.0397	0.0397		

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above.

4.4.3 Sensitivity of the data to the time period chosen

The data period covered includes pre-2000 when it is recognised that the quality of the definitions of educational attainment was less good than the later period. In addition, we note that the end point in our analysis is a time of considerable change for the EU as expansion took place from 15 to 25 members. Given these two effects, we test for differences in our findings by excluding 2004 from analysis and also for running the models on 2000-2004 separately. In the case of exclusion of 2004, we note that there is no change

to the coefficients that were found to be significant in Tables 8 and 9, however there is, if anything, a larger coefficient attached to the significant migration variables. There were significant changes when the period was cut from 10 to 4 years, but this is stronger in the levels equations than the growth equations, and again, there is little change in the coefficients, if anything, they suggest a stronger effect. These results are available in Annex 2 of this chapter.

Table 11

Value added Production function augmented with migration indicators, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
Lnhrs	0.5106***	0.5198***	0.5192***	0.5100***	0.5194***
	[0.0264]	[0.0267]	[0.0267]	[0.0264]	[0.0267]
Lnkit	-0.0290**	-0.0350***	-0.0380***	-0.0288**	-0.0349***
	[0.0116]	[0.0118]	[0.0117]	[0.0116]	[0.0118]
Lnknit	0.3684***	0.3651***	0.3649***	0.3676***	0.3646***
	[0.0197]	[0.0198]	[0.0199]	[0.0198]	[0.0199]
mig_share	-0.6860***	-0.5504**			
	[0.2530]	[0.2547]			
hi_share		0.3904***	0.4020***		0.3900***
		[0.0574]	[0.0572]		[0.0574]
eu_share				-0.8745*	-0.6853
				[0.5095]	[0.5113]
row_share				-0.6002*	-0.4894
				[0.3232]	[0.3240]
Observations	3103	2987	2987	3103	2987
R-squared	0.934	0.935	0.935	0.934	0.935
F	285.2	278.9	280.5	283.1	276.9
Rmse	0.305	0.300	0.300	0.305	0.300

VARIABLES	(6)	(7)
Lnhrs	0.4569***	0.4571***
	[0.0264]	[0.0263]
Lnkit	-0.1109***	-0.1071***
	[0.0129]	[0.0129]
Lnknit	0.4601***	0.4605***
	[0.0207]	[0.0207]
eu_share		-1.1060**
		[0.4995]
row_share		-0.7684**
		[0.3167]
ict_int	23.0305***	23.3410***
	[1.7768]	[1.7757]
Observations	2987	2987
R-squared	0.937	0.938
F	292.8	289.9
rmse	0.294	0.294

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

4.4.3 Value added specifications

Turning now to the value added specifications of the production function. Table 11 provides the initial results. Our production function seems to be sensibly specified (Tables 8 and 9). In table 11 [1] shows a significant and negative migration share as in the MFP levels models. Again we see a similar situation in model 2 to that observed in the MFP tables as high-skilled migrants as a proportion of the total migrant population has a positive and significant coefficient. When the EU and ROW are separately entered, ([4] and [5]) we see slightly significant and negative impacts to both the EU and ROW worker shares, although the inclusion of a high-skilled migrant variable [5], these effects become insignificant. Further extensions to this analysis result in a highly significant measure of ict_int throughout.

Table 12

Value added growth production functions

VARIABLES	(1)	(2)	(3)	(4)
Dlnhrs	0.3349***	0.3309***	0.3351***	0.3311***
	[0.0274]	[0.0277]	[0.0274]	[0.0277]
Dlnkit	0.0433***	0.0435***	0.0435***	0.0437***
	[0.0096]	[0.0097]	[0.0096]	[0.0097]
Dlnknit	0.1326***	0.1333***	0.1328***	0.1335***
	[0.0295]	[0.0300]	[0.0295]	[0.0300]
mig_share	0.1242***	0.1293***		
	[0.0326]	[0.0329]		
hi_share		0.0082		0.0083
		[0.0076]		[0.0076]
eu_share			0.1392**	0.1470**
			[0.0656]	[0.0661]
row_share			0.1176***	0.1215***
			[0.0413]	[0.0416]
Observations	2811	2727	2811	2727
R-squared	0.330	0.332	0.330	0.332
F	9.745	9.447	9.670	9.375
Rmse	0.0379	0.0376	0.0379	0.0376

VARIABLES	(5)	(6)
Dlnhrs	0.3234***	0.3302***
	[0.0276]	[0.0276]
Dlnkit	0.0437***	0.0432***
	[0.0097]	[0.0097]
Dlnknit	0.1299***	0.1309***
	[0.0301]	[0.0300]
eu_share		0.1334**
		[0.0662]
row_share		0.1154***
		[0.0415]
ict_int	0.4388**	0.3661*
	[0.2022]	[0.2029]
Observations	2727	2727
R-squared	0.329	0.332
F	9.396	9.398
Rmse	0.0376	0.0376

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Table 12 presents the findings of the growth production functions in contrast to the MFP findings we see that migrants have a positive impact on value added growth but see no role for higher skilled migrants. In [5] we see that foreign labour positively interacts with technology.

Thus, there are mixed findings overall. We do see that productivity levels appear to be more noticeably affected by migrant labour, but that there are effects that are present in the growth estimates too. Positive evidence in relation to the ICT interaction term and for the share of high-skilled migrants suggest there is a positive effect of having more trained migrants.

Table 13

ICT typology of industries

	Code	Description
Non-ICT	15t16	Food, Drink and Tobacco
Non-ICT	17t19	Textiles and textile products, leather and footwear
ICT-Using	21-22	Pulp, paper, paper products, printing and publishing
Non-ICT	23	Coke, refined petroleum products and nuclear fuel
Non-ICT	24	Chemicals and chemical products
Non-ICT	25	Rubber and plastics
Non-ICT	26	Other non-metallic mineral products
Non-ICT	27t28	Basic Metals and Fabricated metal products
ICT-Using	29	Machinery NEC
ICT-Producing	30t33	Electrical and Optical Equipment
Non-ICT	34t35	Transport Equipment
ICT-Using	36t37	Manufacturing NEC; recycling
Non-ICT	E	Energy/utilities
Non-ICT	F	Construction
ICT-Using	G	Wholesale and Retail
Non-ICT	H	Hotels and restaurants
Non-ICT	60t63	Transport and Storage
ICT-Producing	64	Communications
ICT-Using	J	Financial intermediation
ICT-Using	71t74	Renting of machinery and equipment and other business activities

Source: Derived from Inklaar et al. (2003).

4.4.4 Sectoral differences

Our analyses average across countries, sectors and over time and give us an overview of the potential impact, but implicit in pooling across industries we are imposing a common production function on all sectors within the economy. It may be reasonable to assume that this is not the case. We therefore go on now to distinguish firstly between manufacturing and service sectors. Secondly we adopt a technology based split of industries following the

classification developed in Inklaar et al. (2003) and in Conway et al. (2006)[73]. Here industries are allocated to a group depending on whether they are considered to be mostly ICT-using, ICT-producing or non-ICT sectors. Table 13 below lists the industry allocations.

When estimating productivity across industries, it is assumed that a common underlying relationship between all inputs and output holds. Whilst this is a useful approximation, it is worth considering that for broad groups of industries, such as manufacturing and services, operate differently and the underlying relationships are fundamentally different between inputs and outputs. To partially control for these differences, industry dummy variables are included, however to understand the nature of the differences, we estimate below the models including migration indicators separately for manufacturing and services to see if this affects our results significantly.

Services

Tables 14 and 15 deal with MFP levels and growth for services, respectively, and we note that the high-skilled share of migrants is stronger than in the full same (table 9, [3]). The eu_share is no longer negative or significant but the ROW share is now both, in contrast to the positive sign before (table 9[5]). There is also a marked change in the relevance of the ict_int term which is now strongly positive and significant.

Table 14

Services MFP levels, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
hi_share	0.5783***		0.5297***		
	[0.1286]		[0.1288]		
eu_share		-0.0029	0.0005		-0.023
		[0.1932]	[0.1928]		[0.1926]
row_share		-2.3571***	-2.2025***		-2.4246***
		[0.6784]	[0.6937]		[0.6893]
ict_int				10.4623***	10.1120***
				[2.4557]	[2.4402]
Observations	746	756	746	746	746
R-squared	0.926	0.925	0.927	0.926	0.927
F	334.6	321.7	315.4	333.6	315.5
Rmse	0.293	0.297	0.292	0.294	0.292

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry and country dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

[73] This classification has also been used in Rincon-Aznar et al (2009).

Table 15

Services MFP growth, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)
hi_share		0.0064		
		[0.0156]		
eu_share	-0.0104	-0.0101		-0.0105
	[0.0217]	[0.0218]		[0.0217]
row_share	0.0465	0.0485		0.0427
	[0.0815]	[0.0822]		[0.0818]
ict_int			-0.1565	-0.1502
			[0.2873]	[0.2880]
Observations	684	680	680	680
R-squared	0.253	0.252	0.251	0.252
F	8.242	7.817	8.424	7.822
rmse	0.0329	0.0330	0.0329	0.0330

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Table 16

Service Sectors, Value Added specifications, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
lnhrs	0.1903***	0.1601***	0.1768***	0.1408**	0.1252**
	[0.0592]	[0.0596]	[0.0593]	[0.0561]	[0.0562]
lnkit	-0.0526**	-0.0344	-0.0462**	-0.1356***	-0.1280***
	[0.0217]	[0.0218]	[0.0218]	[0.0220]	[0.0221]
lnknit	0.3527***	0.3460***	0.3668***	0.4812***	0.4991***
	[0.0395]	[0.0399]	[0.0398]	[0.0395]	[0.0398]
mig_share	-0.0410				
	[0.1634]				
hi_share	0.5767***		0.5516***		
	[0.1113]		[0.1115]		
eu_share		0.0337	0.0697		0.0280
		[0.1698]	[0.1693]		[0.1600]
row_share		-1.7155***	-1.4414**		-1.6578***
		[0.5970]	[0.6078]		[0.5715]
ict_int				26.2249***	26.0978***
				[2.3427]	[2.3341]
Observations	866	882	866	866	866
R-squared	0.929	0.927	0.929	0.936	0.937
F	339.9	337.1	331.7	394.4	373.6
Rmse	0.280	0.285	0.280	0.266	0.264

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Tables 16 and 17 present the findings of the value added levels and growth specifications. In contrast to the full dataset findings, the standard production function coefficients have much lower values although are generally appropriatvely signed and significant (the negative impact of ICT is not unusual in econometric estimates, as discussed earlier; see O'Mahony and Vecchi (2005)). Again we see a positive and significant effect to the high-skilled migrant share and the ICT interaction. The ROW share is negative and significant but the EU_share is insignificant.

In the growth equation in table 17, the coefficients on capital are less satisfactory, however services are less capital intensive and thus this is not an unreasonable finding. Once again there is no significant impact of our migrant labour measures in the growth specification.

Table 17

Service sectors, Value Added growth specifications, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
dlnhrs	0.1918***	0.1931***	0.1919***	0.1933***	0.1930***
	[0.0437]	[0.0437]	[0.0440]	[0.0436]	[0.0440]
dlnkit	0.0710***	0.0712***	0.0710***	0.0718***	0.0719***
	[0.0166]	[0.0165]	[0.0166]	[0.0166]	[0.0166]
dlnknit	0.0591	0.0587	0.0591	0.0594	0.0596
	[0.0409]	[0.0403]	[0.0411]	[0.0409]	[0.0410]
mig_share	0.0071				
	[0.0172]				
hi_share	0.0067		0.0067		
	[0.0125]		[0.0125]		
eu_share		0.0066	0.0071		0.0066
		[0.0178]	[0.0179]		[0.0179]
row_share		0.0042	0.0078		0.0068
		[0.0659]	[0.0666]		[0.0662]
ict_int				0.2370	0.2384
				[0.2402]	[0.2406]
Observations	791	798	791	791	791
R-squared	0.414	0.414	0.414	0.414	0.414
F	17.27	17.45	16.70	17.90	16.74
rmse	0.0296	0.0296	0.0296	0.0296	0.0296

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Thus, the story for services appears to be a levels one, where the high-skilled and interaction with technology have a role to play. However, this interpretation should be taken with some caution regarding the estimation techniques in particular, which so far take no account of potential endogeneity problems that plague production function estimation. In section 5 we make some attempt to evaluate this. For now though, we focus on the manufacturing sector.

Manufacturing

The results for manufacturing are presented in tables 18 to 21. In the case of MFP levels we see a strongly positive and significant impact of high-skilled share of migrants; sectors with higher proportion of high-skilled migrants have higher productivity. The ROW share of workers is significant and negative and the interaction with technology is both positive and significant.

Table 18

Manufacturing MFP

VARIABLES	(1)	(2)	(3)	(4)	(5)
mig_share	-0.1064				
	[0.1807]				
hi_share	0.4134***		0.3928***		
	[0.0980]		[0.0983]		
eu_share		0.0595	0.0155		0.0121
		[0.1862]	[0.1874]		[0.1871]
row_share		-1.3290**		-1.5295**	
		[0.6006]	[0.6194]		[0.6157]
Obs	1544	1616	1544	1544	1544
R-squared	0.824	0.821	0.824	0.824	0.825
F	201.1	206.4	196.3	207.7	197.1
Rmse	0.473	0.483	0.472	0.472	0.471

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Table 19

Manufacturing MFP growth

VARIABLES	(1)	(2)	(3)	(4)	(5)
mig_share	-0.0153				
	[0.0222]				
hi_share	0.0299**		0.0335**		
	[0.0131]		[0.0131]		
eu_share		-0.0386*	-0.0360		-0.0364
		[0.0228]	[0.0229]		[0.0229]
row_share		0.2219***	0.2489***		0.2359***
		[0.0777]	[0.0784]		[0.0781]
ict_int				2.0481***	2.0734***
				[0.7657]	[0.7633]
Observations	1405	1462	1405	1405	1405
R-squared	0.194	0.197	0.201	0.195	0.201
F	9.686	10.31	9.839	10.03	9.868
rmse	0.0578	0.0584	0.0576	0.0578	0.0576

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Table 20

Manufacturing Value Added, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
Lnhrs	0.7974***	0.7969***	0.7992***	0.7994***	0.8003***
	[0.0571]	[0.0571]	[0.0573]	[0.0570]	[0.0572]
Lnkit	-0.0560*	-0.0559*	-0.0560*	-0.0901***	-0.0903***
	[0.0306]	[0.0306]	[0.0306]	[0.0313]	[0.0313]
Lnknit	0.3216***	0.3216***	0.3210***	0.3395***	0.3394***
	[0.0492]	[0.0492]	[0.0493]	[0.0492]	[0.0493]
mig_share	0.0863				
	[0.1447]				
hi_share	0.3688***	0.3662***	0.3715***		
	[0.0786]	[0.0785]	[0.0789]		
eu_share			0.0702		0.0671
			[0.1504]		[0.1502]
row_share			0.2751		0.1231
			[0.4991]		[0.4963]
ict_int				25.0393***	25.1268***
				[4.9504]	[4.9572]
Observations	1513	1513	1513	1513	1513
R-squared	0.885	0.885	0.885	0.885	0.885
F	297.4	305.5	289.6	306.4	290.4
Rmse	0.375	0.375	0.375	0.374	0.374

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

Table 21

Manufacturing Value Added growth, 1995-2004

VARIABLES	(1)	(2)	(3)	(4)	(5)
Dlnhrs	0.3215***	0.3364***	0.3347***	0.3244***	0.3376***
	[0.0524]	[0.0520]	[0.0526]	[0.0524]	[0.0526]
Dlnkit	0.0338	0.0357*	0.0365*	0.0323	0.0353*
	[0.0208]	[0.0206]	[0.0207]	[0.0208]	[0.0208]
Dlnknit	0.1621**	0.1550**	0.1567**	0.1741***	0.1677**
	[0.0667]	[0.0660]	[0.0666]	[0.0674]	[0.0674]
mig_share	-0.0083				
	[0.0214]				
hi_share	0.0283**		0.0308**		
	[0.0127]		[0.0127]		
eu_share		-0.0261	-0.0236		-0.0243
		[0.0221]	[0.0222]		[0.0222]
row_share		0.1604**	0.1837**		0.1713**
		[0.0757]	[0.0762]		[0.0760]
ict_int				1.5062**	1.5255**
				[0.7523]	[0.7515]
Observations	1378	1430	1378	1378	1378
R-squared	0.296	0.298	0.300	0.295	0.299
F	15.22	15.96	15.07	15.61	15.00
Rmse	0.0553	0.0559	0.0552	0.0553	0.0552

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above

In the growth equations presented in table 19 there is general support for the findings in the levels models, but there is a positive and significant association of ROW share with productivity growth, an interesting finding which contrasts with the levels negative relationship. Other migration variables behave as before or are not significantly different from zero. Table 20 contains the results of the production function specifications and reflect what has already been observed for the MFP levels. In terms of growth (table 21) we again see the significant ROW share positive affected although the levels of value added models do not show any significance. From the perspective of the production function specification, the coefficients seem more plausible in manufacturing than in services.

4.4.5 ICT sector breakdowns

An alternative industry breakdown has also been undertaken based on the way in which technology is used in sectors. We adopt a fairly widely used breakdown of sectors, outlined in table 13 above. We report here only the findings for ICT using and producing specifications in growth and levels for MFP and value added specifications. The estimations were also carried out for non ICT using sectors; these are not reported here but are available on request. Table 22 contains the MFP growth and levels equations for ICT producing sectors (Optical and electrical equipment and telecommunications). Note that the number of observations on which these coefficients is based is much smaller than any of those above.

Table 22

MFP specifications, ICT producing sectors

	D(1)	D(2)	D(3)	L(1)	L(2)	L(3)
mig_share	-0.1337*			0.0840		
	[0.0696]			[0.2683]		
hi_share	-0.0148	-0.0194		0.2109		
	[0.0550]	[0.0544]		[0.1984]		
eu_share		-0.1445**	-0.1411**		0.0895	0.0095
		[0.0690]	[0.0681]		[0.2655]	[0.2647]
row_share		0.6302*	0.7866**		3.0351**	1.7715
		[0.3444]	[0.3576]		[1.1924]	[1.3151]
ict_int			-1.6945			7.0152*
			[1.1104]			[4.0666]
Observations	210	210	210	230	234	230
R-squared	0.322	0.340	0.347	0.945	0.943	0.946
F	4.029	4.162	4.307	153.9	152.5	150.9
Rmse	0.0777	0.0769	0.0764	0.300	0.304	0.297

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively. Estimated on dataset excluding Luxembourg and valev outliers discussed above.

From table 22, the MFP growth equations seem to have more significant coefficients in the estimated models (D(1-3)) and indicate a positive and significant effect of ROW share of workers and a negative and significant effect from the EU share, which supports our observations in the full dataset models. The levels equations suggest that the inclusion of the ICT interactive term with high-skilled labour detracts from the positive significance of ROW workers.

Table 23

MFP specifications, ICT using sectors

	D(1)	D(2)	D(3)	L(1)	L(2)	L(3)
mig_share	0.0171			-0.0068		
	[0.0234]			[0.1856]		
hi_share	0.0240	0.0233		0.1643	0.1647	
	[0.0173]	[0.0173]		[0.1301]	[0.1303]	
eu_share		0.0130	0.0121		-0.0047	-0.0119
		[0.0238]	[0.0237]		[0.1890]	[0.1891]
row_share		0.1388	0.1303		-0.0650	-0.0643
		[0.1250]	[0.1248]		[0.9531]	[0.9548]
ict_int			0.8675*			2.9357
			[0.4420]			[3.3755]
Observations	515	515	515	565	565	565
R-squared	0.153	0.155	0.158	0.947	0.947	0.947
F	3.539	3.441	3.533	371.1	356.7	356.1
Rmse	0.0356	0.0356	0.0355	0.281	0.281	0.282

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and outliers. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

Table 23 provides the same estimations for ICT using sectors. It is surprising that we find no significant migrant variables in relation to the levels estimates, and indeed in the growth equations of MFP, we see only a slightly significant positive finding in relation to ICT and high-skilled migrant workers (the ict_int term). Thus, there is little evidence that migrant labour has much of an impact on MFP in ICT using sectors, in contrast to the findings for ICT producing. We turn now to the fully specified production functions.

Table 24 shows that the production coefficients are insignificant in all but the non-ICT capital in ICT producing sectors, and the levels estimates show evidence of strong increasing returns to scale, but turning to the migrant worker regressors, we see that the EU and the ROW share of migrants are once again working in opposite directions in the growth equations and insignificantly in the levels estimates. There is however a very strong and statistically significant role for the ICT interaction term in model 3. Table 25 shows the importance of migrant labour in the value added specifications in ICT using sectors. The standard production function variables are more plausible in the differenced equation, but are still very low. Labour has a very small role in the levels specifications and none of the

standard input variables are significant, except for non-ICT capital. Again, the evidence of any additional significant impact from migrant labour is scant, with only a positive impact of the ROW share of migrants in the differenced equations, and there is weak evidence of it being negatively significant in the levels specifications. In both the levels and the differenced equations, we do observe a significant and positive effect of the share of high-skilled migrants as a ratio of ICT capital, suggesting that the interaction of appropriately skilled migrants with technology in using sectors has a positive effect on productivity.

Table 24

Value added specifications, ICT producing sectors

VARIABLES	D(1)	D(2)	D(3)	L(1)	L(2)	L(3)
dlnhrs	0.0868	0.0612	0.0875	1.0571***	1.0392***	0.8647***
	[0.1675]	[0.1647]	[0.1702]	[0.1838]	[0.1860]	[0.1849]
dlnkit	0.1272	0.1091	0.1071	0.1493***	0.1434***	0.0225
	[0.0838]	[0.0825]	[0.0827]	[0.0388]	[0.0399]	[0.0511]
dlnknit	0.2486	0.2875*	0.2686	0.2280*	0.2166*	0.4128***
	[0.1761]	[0.1734]	[0.1732]	[0.1215]	[0.1229]	[0.1306]
mig_share	-0.1075			-0.0011		
	[0.0685]			[0.2568]		
hi_share	0.0269	0.0245		0.0941	0.0985	
	[0.0546]	[0.0536]		[0.1936]	[0.1940]	
eu_share		-0.1171*	-0.1210*		-0.0074	0.0359
		[0.0673]	[0.0668]		[0.2573]	[0.2477]
row_share		0.8130**	0.8315**		0.8632	-0.0622
		[0.3345]	[0.3483]		[1.3190]	[1.2990]
ict_int			-0.2336			20.2701***
			[1.1334]			[5.5540]
Observations	210	210	210	230	230	230
R-squared	0.413	0.438	0.437	0.950	0.950	0.953
F	5.188	5.479	5.467	149.4	143.5	153.3
rmse	0.0752	0.0738	0.0739	0.284	0.284	0.276

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and valev outliers discussed above. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

The differences between MFP and value added estimation stem in part from the differences in the underlying assumptions that we have already outlined; MFP already incorporates a quality adjustment for labour and essentially for capital also. As such, one would anticipate the additional impact of migrant labour and its interaction with ICT to be weaker in these specifications. In reality, the findings for the value added models appear less strong. This may be due to small sample sizes, since the coefficients on the production function variables seem less plausible.

Table 25

Value added specifications, ICT using sectors

	D(1)	D(2)	D(3)	L(1)	L(2)	L(3)
Dlnhrs	0.1130*	0.1143*	0.1189*	0.0288	0.0383	0.0261
	[0.0622]	[0.0621]	[0.0618]	[0.0662]	[0.0665]	[0.0658]
Dlnkit	0.0599***	0.0583***	0.0501**	0.0280	0.0291	0.0068
	[0.0223]	[0.0223]	[0.0224]	[0.0301]	[0.0301]	[0.0301]
Dlnknit	0.0970*	0.0996*	0.1176**	0.5503***	0.5564***	0.6045***
	[0.0548]	[0.0548]	[0.0549]	[0.0483]	[0.0484]	[0.0493]
mig_share	0.0236			-0.0198		
	[0.0189]			[0.1482]		
hi_share	0.0050	0.0051		0.1597	0.1632	
	[0.0134]	[0.0134]		[0.1020]	[0.1020]	
eu_share		0.0176	0.0174		0.0221	0.0011
		[0.0193]	[0.0191]		[0.1510]	[0.1490]
row_share		0.1661*	0.1519*		-0.9951	-1.3618*
		[0.0915]	[0.0911]		[0.7067]	[0.7038]
ict_int			0.9481**			12.4372***
			[0.3726]			[2.9059]
Observations	611	611	611	669	669	669
R-squared	0.269	0.272	0.280	0.956	0.956	0.958
F	7.364	7.222	7.512	466.0	451.7	463.3
rmse	0.0318	0.0318	0.0316	0.248	0.248	0.245

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg and outliers. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

4.4.6 Country restrictions

Another source of sensitivity of our findings may be due to the heterogeneity amongst the EU member states experiences with migrant labour. Thus we now consider the impact of reducing the country coverage by excluding a number of outlying countries. We exclude Finland, where migration is very low, Luxembourg, where it is very high, and also Spain and Portugal, where there has been very rapid change over the period in question. Our results are presented in Table 26 below.

These tables compare directly to selected specifications included in tables 9, 10, 11 and 12, where the full dataset has been used. By excluding a number of outlier countries, our findings do seem to change a little, but not drastically. We note that in the MFP specifications presented in table 27 D[2], the coefficient on the eu_share variable becomes insignificant, whereas in the levels equations, the row_share becomes insignificant in comparison to the full dataset results. Overall we see that generally the sizes, signs and significances are broadly similar. It therefore seems as though our results are not substantially improved by reducing the variability across countries in our dataset.

Table 26

Value added specifications, restricted country set, 1995-2004, differences and levels estimations

VARIABLES	D(1)	D(2)	L(1)	L(2)
Lnhrs	0.2998***	0.2997***	0.4791***	0.4791***
	[0.0321]	[0.0321]	[0.0317]	[0.0318]
Lnkit	0.0457***	0.0457***	-0.0468***	-0.0466***
	[0.0120]	[0.0120]	[0.0143]	[0.0143]
Lnknit	0.1324***	0.1326***	0.3526***	0.3520***
	[0.0367]	[0.0367]	[0.0235]	[0.0236]
mig_share	0.1471***		-0.5108*	
	[0.0374]		[0.2847]	
hi_share	0.0096	0.0097	0.5392***	0.5385***
	[0.0095]	[0.0095]	[0.0697]	[0.0698]
eu_share		0.1597**		-0.6399
		[0.0739]		[0.5613]
row_share		0.1407***		-0.4448
		[0.0493]		[0.3770]
Observations	2083	2083	2267	2267
R-squared	0.332	0.332	0.937	0.937
F	9.006	8.921	277.7	275.2
Rmse	0.0374	0.0374	0.294	0.294

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg, Finland, Portugal and Spain. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

Table 27

MFP growth and levels specifications, 1995-2004, restricted country data

VARIABLES	D[1]	D[2]	L[1]	L[2]
mig_share	0.1225***		-0.6511*	
	[0.0399]		[0.3436]	
hi_share	0.0039	0.0039	0.5327***	0.5116***
	[0.0103]	[0.0104]	[0.0867]	[0.0862]
eu_share		0.1191		-3.8485***
		[0.0796]		[0.6796]
row_share		0.1239**		0.6685
		[0.0487]		[0.4187]
Observations	2037	2037	2220	2220
R-squared	0.208	0.208	0.913	0.914
F	4.780	4.733	196.2	197.3
Rmse	0.0399	0.0399	0.357	0.355

Source: EUKLEMS and EU-LFS data, own calculations estimated on dataset excluding Luxembourg, Finland, Portugal and Spain. D(1-3) refer to MFP growth, L(1-3) refer to levels of MFP. Note that all models include time, industry, country and business cycle dummies; ***, **, * indicate 1%, 5% and 10% significance respectively.

4.5 GMM estimations

Finally, one further possible way of improving our estimation would be to attempt more comprehensively to address endogeneity in the various explanatory variables. The problem of endogeneity arises because explanatory variables are often subject to the same influences as the outcome variables. The issue is particularly well documented with respect to production functions, where capital and labour may be endogenous to output due to the simultaneity of output and input decisions. Other problems include measurement error and omitted variables. One of the possible solutions to this problem is to use an instrumental variables method. Here we use a GMM approach which incorporates a lag of the dependent variable in the estimation procedure to correct for endogeneity[74]. The more sophisticated GMM systems approach (Arellano and Bond, 1998), which uses a mixture of lags and differences as instruments, is often employed. However, the method is notoriously unstable and the number of observations in the industry dataset is not thought to be sufficiently large to ensure reliability. Here, because of the nature of the modelling command, data are included unweighted for sector size and only year dummies are included

We have experimented with this approach below in table 28, in growth rates and levels, respectively. In terms of growth equations in table 28, our diagnostic tests suggest that a GMM model is appropriate. The AR(2) test on the residuals in first differences is used to detect AR(1) in the underlying levels variables, thus we expect to find the AR(1) test significant, but AR(2). For the Sargan test, an insignificant value allows us to say that we have no overindentification problems. Where the Sargan test is significant, we reject the overidentifying restrictions and casts doubt on the original model (Greene 2008, p452). In the models specified below, in all but one instance do we see that the GMM model is the most appropriate form. Turning to the coefficients in table 28 the production function input coefficients on hours, and both types of capital are very low and in some cases insignificant in the growth equations. When we look at the migration indicators, we see that they are all now insignificant. This is largely true when we look at the levels specifications.

Although a large literature considers that least squares produces biased estimates of the dynamic model parameters (Arellano and Bond 1991), there is also evidence that the use of ordinary least squares with panel corrected errors may produce satisfactory results if the unit specificity and dynamic properties of the model and are taken into account (Beck and Katz 1996). Thus GMM estimations are to be reported with equal caution to the OLS results.

[74] Calculated using the xtabond command in STATA 10; the xtabond2 command differs in that it estimates the GMM system, which uses both levels and differences.

Table 28

Growth and levels equations, MFP and Value added, 1995-2004, all countries

VARIABLES	dlnmfp	Lnmfp	dlnva	lnva
dlnmfp L1	0.0280	0.839***		
	[0.025]	[0.056]		
dlnva L1			0.007	0.803***
			[0.026]	[0.044]
Dlnhrs			0.2157*	0.165***
			[0.0410]	[0.032]
Dlnkit			0.0148	0.0059
			[0.014]	[0.0084]
Dlnknit			0.0522	-0.033
			[0.063]	[0.0099]
hi_share	0.0121	0.0084	0.0099	0.0109*
	[0.010]	[0.0082]	[0.008]	[0.0067]
eu_share	0.0128	0.0160	0.003	0.0047
	[0.014]	[0.0102]	[0.0101]	[0.0099]
row_share	0.0006	0.0153	0.065	0.088
	[0.076]	[0.0636]	[0.076]	[0.0617]
Observations	2128	2450	2143	2464
Wald	47.16***	508.38***	214.67***	4173.42***
AR1	-6.020***	-5.463***	-6.143***	-5.263***
AR2	0.3797	0.425	1.34	1.674
Sargan	36.98	39.71	36.04	32.61

Source: EUKLEMS and EU-LFS data, own calculations. Note that all models exclude all but year dummies and in contrast to earlier models are run unweighted by share in employee compensation; ***, **, * indicate 1%, 5% and 10% significance respectively.

4.6 Conclusions

The role of migration on productivity is an under-researched area, particularly in view of the increased mobility of labour in recent years. The findings in this section are mixed but are in line with other studies of the productivity impact of migrant labour (Mas et al., 2008; Paserman, 2008). Overall, we find some evidence of a significant effect of migrant labour at the industry level across Europe.

Our approach has been to take the Multi-Factor Productivity estimates from EUKLEMS, generated using standard growth accounting techniques, corrected for capital quality and composition, and to explore the extent to which we can identify an additional productivity effect from migrant labour. In addition to taking the pre-constructed productivity measure, we have also specified value added production functions incorporating additional regressors that measure the intensity and nature of migrant labour in a sector across EU countries and over time.

In summary, the levels estimates appear stronger than growth estimates. Thus, the ratio of migrants to total employment is negatively related to sectors where productivity levels are higher, but they are significantly positively related to growth in productivity. When considering a simple share of migrant labour in total labour by industry, country, year, we find that the impact is negative in relation to MFP and value added levels. In growth rate specifications the impact is positive.

It is important to split EU and ROW migrants, since the productivity effects of these two groups of migrant workers appear to operate in opposite directions, with the EU effect being negative when significant. This is likely to be influenced by national immigration policies that are geared towards the selective inclusion of ROW workers. Restrictions towards EU nationals are much fewer. However, we acknowledge that the breakdown of migrants into ROW and EU is crude; ROW includes workers from technology leading as well as technology laggard countries. Ideally, more disaggregated data would be available and would allow us to distinguish more specifically between different source countries.

A more disaggregated approach by sector also seems to tell us more about the nature of the relationship between migrants and productivity. We consider two sectoral disaggregations, firstly separating manufacturing from services and secondly, based on patterns of technological usage. The manufacturing and services split is particularly important since these are two distinct sectors that operate very differently. The contribution of manufacturing is generally falling in European economies, whilst the relative growth in services is has been increasing. However, services are more difficult to measure since information on inputs and outputs to these sectors is less quantifiable. It is therefore reasonable to assume that they are unlikely to operate under the same production function. When industries are grouped according to whether they use or produce ICT, there is little evidence that in ICT using or producing sectors the use of migrant labour has any significant impact on productivity in the MFP estimations and very little in the value added specifications.

Our findings do suggest a positive impact of migration, particularly in relation to the growth of productivity. Evidence on growth of productivity is less strong (than the level effects), but largely positive, and in both cases, interactions with ICT and the proportion of high-skilled migrants generally has a positive impact. Refinements to measurement may improve our estimation and we have explored a number of possible changes to our variables and data to test how sensitive the findings are to specifications and the dimensions of the data (truncating time periods, grouping by industry and reducing the number of countries included). More sophisticated modelling techniques do weaken the impacts as they adjust for endogeneity, however, it is questionable the extent to which these techniques are suited to industry data.

ANNEX 1: Migration variables defined

Table A1

Variables included in the econometric analysis

var name	description	calculation
Va	value added	From EUKLEMS
Lnva	logged value added	ln(va)
Dlnva	logged value added growth	d.ln(va)
Mfp	multifactor productivity calculated in EUKLEMS - quality adjusted	From EUKLEMS
Lnmfp	logged mfp	ln(mfp)
Dlnmfp	logged mfp growth	d.ln(mfp)
ict_ratio	the ratio of ict capital to total capital (ICT+nonICT)	ict_ratio=capitlev/(capitlev+capnitlev)
ict_int	the ict ratio multiplied by the share of high-skilled migrants	ict_int=(hi_share*ict_ratio)/10
eu_share	the share of EU migrants in total employment	eu_share=(eu_hi+eu_med+eu_low)/totl_lfs
row_share	the share of ROW migrants in total employment	row_share=(row_hi+row_med+row_low)/totl_lfs
hi_share	the share of high-skilled migrants in total migrant employment	hi_share=(eu_hi+row_hi)/totl_mig

ANNEX 2: Results over 2000-2004 period

Table A2

Selected models over reduced time period, Productivity levels and growth, 2000-2004

VARIABLES	dmfp	dmfp	mfp	mfp
mig_share	0.0963**		0.4127	
	[0.0454]		[0.4314]	
hi_share	0.0101	0.0101	0.0998	0.0989
	[0.0121]	[0.0121]	[0.1153]	[0.1141]
eu_share		0.1598*		-3.9064***
		[0.0931]		[0.8757]
row_share		0.0761		1.7922***
		[0.0523]		[0.4918]
Observations	1535	1535	1535	1535
R-squared	0.228	0.229	0.894	0.896
F	4.918	4.868	139.6	141.3
rmse	0.0410	0.0410	0.390	0.385

Table A3

Selected models over reduced time period, value added levels and growth, 2000-2004

VARIABLES	lnva	lnva	dlnva	dlnva
lnhrs	0.5198***	0.5194***	0.3309***	0.3311***
	[0.0267]	[0.0267]	[0.0277]	[0.0277]
lnkit	-0.0350***	-0.0349***	0.0435***	0.0437***
	[0.0118]	[0.0118]	[0.0097]	[0.0097]
lnknit	0.3651***	0.3646***	0.1333***	0.1335***
	[0.0198]	[0.0199]	[0.0300]	[0.0300]
mig_share	-0.5504**		0.1293***	
	[0.2547]		[0.0329]	
hi_share	0.3904***	0.3900***	0.0082	0.0083
	[0.0574]	[0.0574]	[0.0076]	[0.0076]
eu_share		-0.6853		0.1470**
		[0.5113]		[0.0661]
row_share		-0.4894		0.1215***
		[0.3240]		[0.0416]
Observations	2987	2987	2727	2727
R-squared	0.935	0.935	0.332	0.332
F	278.9	276.9	9.447	9.375
rmse	0.300	0.300	0.0376	0.0376

Chapter 5
High-skilled migration and regional performance

5.1 Introduction

In this part of the study we will analyze the effects of migration on economic performance and innovation variables at the NUTS 2-digit level in EU-15 countries. We first discuss selected descriptive features though not going into detail. In particular, we discuss the structure of migration with respect to high-skill migration at the regional level. We look at the share of high-skilled migrants and the difference of the share of high-skilled migrants to the share of high-skilled natives. The high-skilled share is defined as the share of employed persons with tertiary educational attainment level (i.e. ISCEC 5 and 6). In the second part of this chapter, we study the effects of migration on regional performance indicators, notably on GDP per capita growth and on patenting using panel regression techniques.

The data sources we use is the European Labour Force Survey (EU-LFS) as already described above and the Eurostat regional database. The analysis in this part is restricted to the EU-15 countries as the shares of migrants in the other EU countries are quite low. Second, we restrict the analysis to the period 2000-2006[75]. The main reason for this is that the European Labour Force survey data exhibits methodological breaks for some countries in the years before and data after 2006 are not available at the regional level so far.

5.2 Selected descriptive analysis

The most important indicators are summarized in Table 1. This table shows the arithmetic average over regions of the share of high-skilled workers, the share of migrants, the share of high-skilled migrants in total migrants together with the minimum and maximum for each of the respective indicators and each country. The last three columns present the arithmetic mean of the difference between the share of high-skilled migrants (in total migrants) and the share of native high-skilled employed persons (in total native employed persons).[76]

The first variable (‘Share of high-skilled workers) indicates that there are quite large differences across countries. The shares range from a minimum of 13.5% in Portugal to a maximum of 38.4% in Belgium. This reflects mostly specificities of the

[75] In some cases only 2000-2005 for data availability reasons.

[76] Note that in this table we report arithmetic averages (i.e. unweighted means) over regions for the respective variables. Figures thus are not comparable with those presented in the other sections.

Table 1

Descriptive results in %, 2005

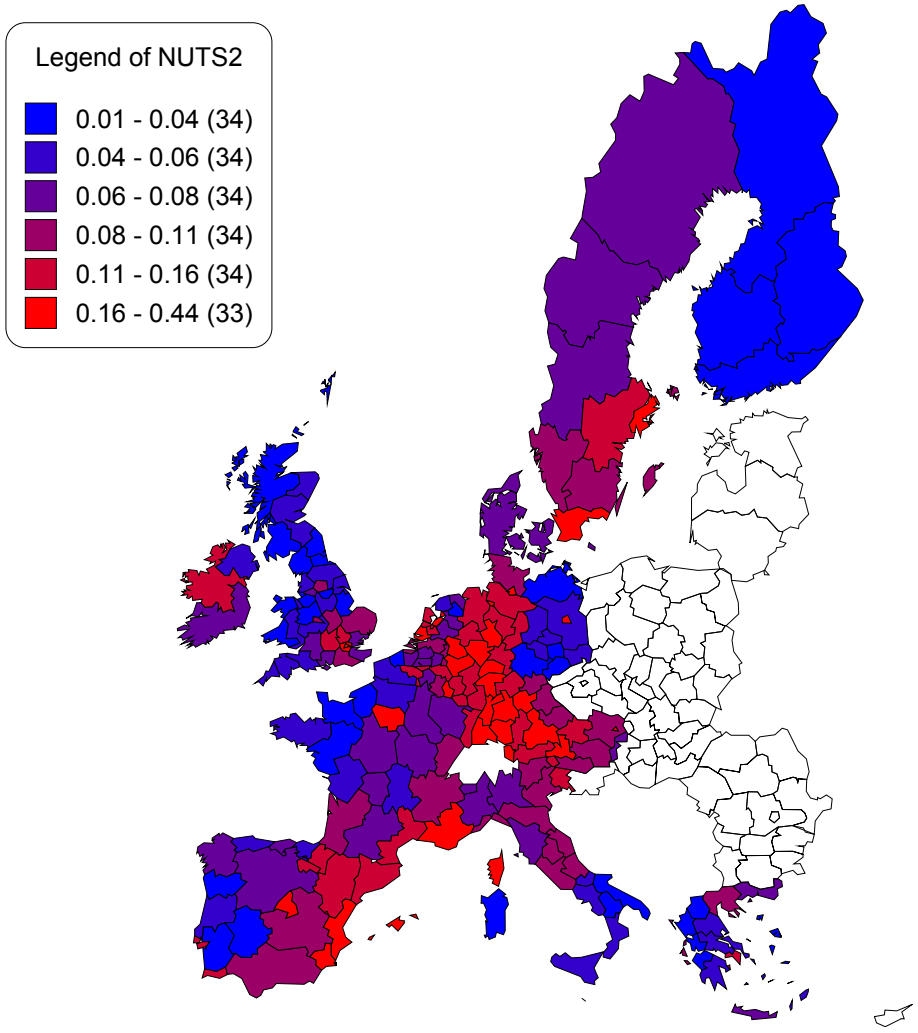
	Share of high-skilled workers			Share of migrants			Share of high-skill migrants in total migrants			Difference		
	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum	Mean	Minimum	Maximum
Austria	17.6	13.8	25.9	13.5	6.3	31.7	17.3	10.8	22.4	-0.7	-6.0	5.3
Belgium	38.4	30.8	50.9	12.1	3.2	37.0	36.3	22.7	57.4	-2.4	-9.2	8.2
Germany	25.7	18.5	38.8	14.1	3.2	24.5	23.1	13.8	51.8	-3.3	-11.6	16.5
Denmark	32.3			6.1			37.5			5.5		
Spain	32.2	21.9	47.8	11.4	4.0	21.4	27.3	11.5	46.3	-5.7	-22.6	11.5
Finland	31.5	22.4	37.3	3.6	1.3	9.6	27.0	10.4	35.3	-4.9	-13.3	4.5
France	25.3	16.3	41.6	9.0	2.7	31.5	25.3	8.2	52.2	-0.3	-13.7	22.9
Greece	19.9	13.2	29.4	6.2	2.6	12.3	14.1	5.8	27.7	-6.2	-17.4	7.5
Ireland	30.3	25.9	34.6	11.4	11.1	11.7	43.2	36.0	50.4	14.6	11.3	17.9
Italy	14.3	11.1	19.7	7.3	3.1	12.7	12.6	4.4	18.5	-1.9	-8.2	7.9
Luxembourg	29.9			43.9			36.2			11.3		
Netherlands	28.8	22.3	39.2	10.2	4.3	17.9	25.6	19.9	35.4	-3.6	-11.9	3.3
Portugal	13.5	9.1	22.8	7.9	3.9	14.5	22.0	16.2	27.7	9.0	2.2	17.9
Sweden	27.8	22.7	36.9	11.7	6.5	21.9	32.7	24.5	38.4	5.4	0.4	10.7
United Kingdom	29.2	20.6	49.6	7.8	2.7	43.2	34.4	19.8	45.8	5.2	-20.1	15.3

Note: The means represent unweighted averages over regions.

national educational systems (further note that these numbers are the arithmetic means over regions for each country). Even more important, however, is the range of high-skilled workers across regions. This range is lowest in Ireland and Italy with less than 10 percentage points and goes up to about 25 percentage points in France and Spain and is even higher in the United Kingdom with almost 30 percentage points.

Figure 1

Share of migrants in total employed, 2005

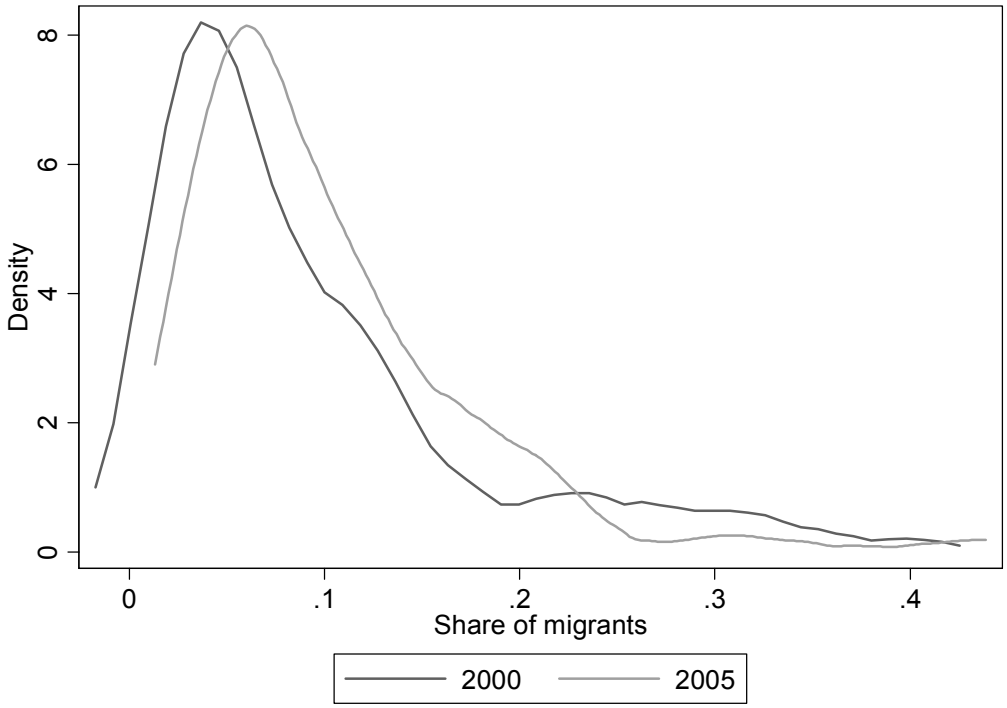


The next variable we look at is the share of migrants in total employed persons. The corresponding figures are reported in the next three columns of Table 1. Again we report the arithmetic mean over regions for each country. These average shares range from less than 4% in Finland to about 14% in Germany (not considering the case of Luxembourg). In Figure 1 we present the share of employed migrants in total employed for EU-15 regions. As one can see there is a wide variation of migrant shares ranging from almost zero to more than 40% at the regional level. One can clearly see that there seems to be a country-specific element in the share of migrants across countries. Second, the distribution of

migrant shares within countries also differs quite a bit in some countries whereas in other countries migrants tend to be more evenly distributed. This partly reflects the country specific patterns of migration already discussed above in more detail. Let us thus again come to the distribution of these shares measured – for simplicity – by the range, i.e. the difference between the maximum and the minimum as reported in Table 1. This range goes from little less than 10 percentage points in Finland, Greece and maybe Portugal (not considering the special case of Ireland) to even more than 40 percentage points in the United Kingdom. Though these quite high numbers are on the one hand maybe caused by data problems they nonetheless show that migrants within countries are highly concentrated in particular regions (at least in some countries). In many cases the highest migrant shares observed in the capital cities or other larger urban areas. These areas can be spotted when looking at the map drawn in Figure 1.

Figure 2

Density plot of share of migrants in total employed persons, 2000 and 2005



This leads us to the question whether the share of migrants has increased over the period considered. In Figure 2 we present a kernel density plot of this variable. First, the density plots show that the mass of regions exhibits migrant shares in the range between 0 and about 20% whereas only very few regions exhibit migrant shares larger than this. Second, this plot shows that the distribution has shifted to the right between 2000 and 2005 and especially so for the regions with migrant shares up to 20%. This implies that one can observe higher migration shares in most regions. For the regions with higher shares the pattern of change is not clear.

Figure 3

Difference between the shares of employed high-skilled migrants and high-skilled of employed persons, 2005

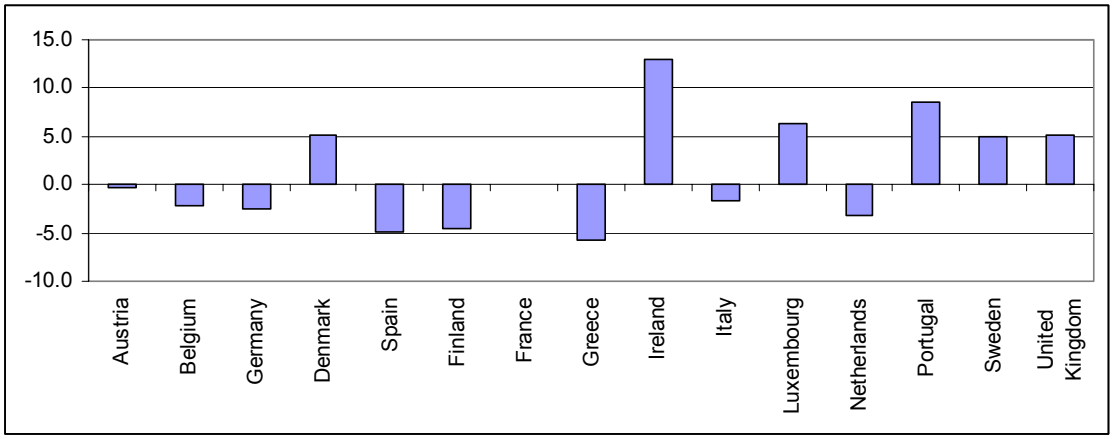
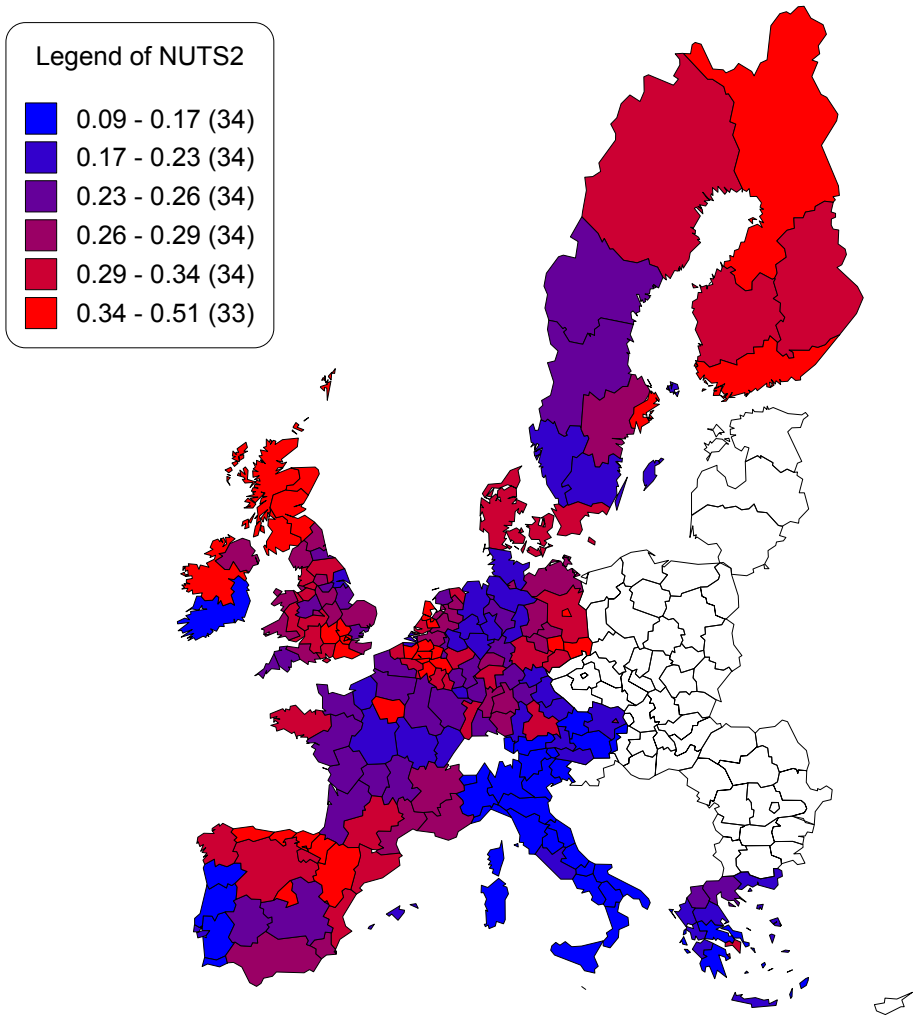


Figure 4

Share of high-skilled migrants in total migrants



The next variable concerns the share of high-skilled migrants in total migrants which is reported in the next three columns of Table 1. A first observation is that these shares positively correlate with the overall shares of high-skilled employed persons. Second, there is no clear pattern across countries to which extent the patterns of migrant workers (with respect to educational attainment levels) differ from the total employed persons. This can better be seen in Figure 3 which shows the difference of these two means; a positive bar indicates that the average share of high-educated migrants in total migrants is higher than the average share of high-educated workers in total employed persons.

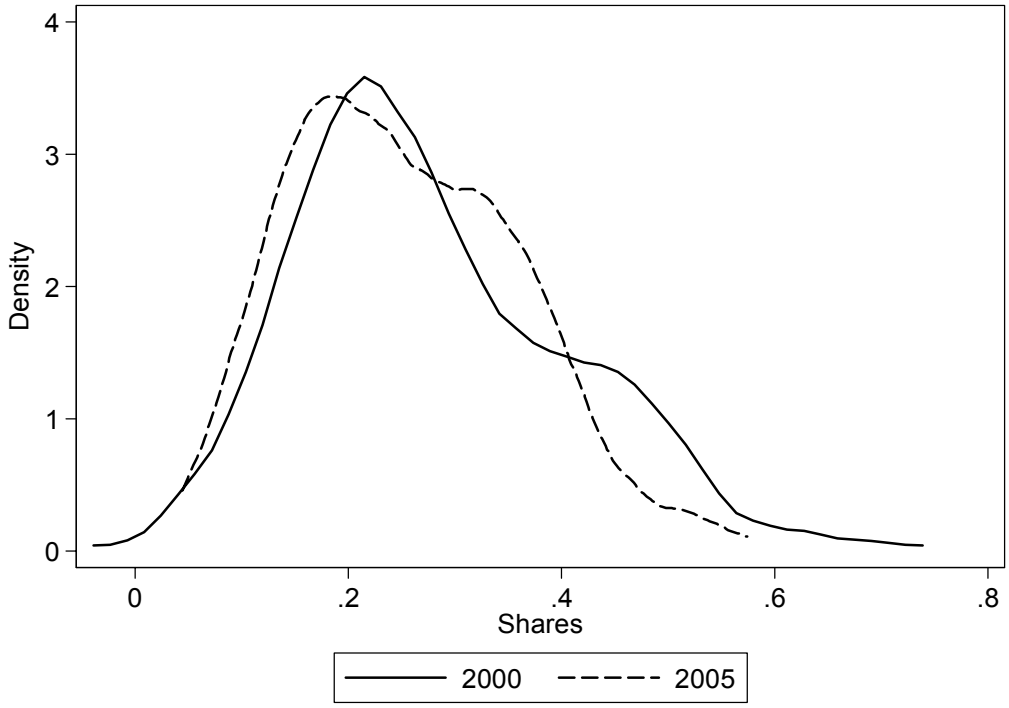
In some countries these differences are negligible as in Austria, France and maybe Italy. The difference is negative in Belgium, Germany, Spain, Finland, Greece and Netherlands and strongly positive in Ireland, Luxembourg, Portugal, Sweden and the United Kingdom.

Again, however, these arithmetic means mask the regional heterogeneity of high-skilled migrants across regions. Looking at the minima and maxima. one can see that the range goes from about 11.5% in Portugal and Austria to more than 40% in France. This is again presented in Figure 4 which shows the regional distribution of high-skilled migrants.

It is further interesting to have a look at the dynamics over time. The ongoing dynamics is presented in the density plot graphed in Figure 5 which shows the share of high-skilled migrants (in total migrants) in 2000 and 2005, respectively.

Figure 5

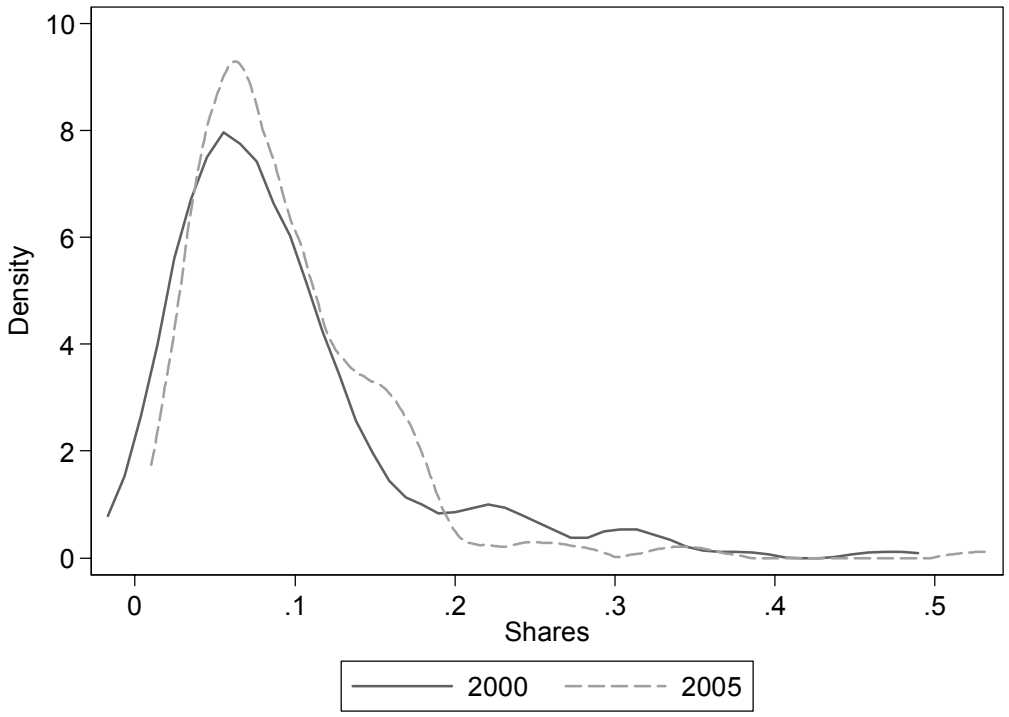
Share of high-skilled migrant workers in total migrants, 2000 and 2005



The most interesting point to make is that the distribution for lower shares in 2005 is above the line for 2000 (i.e. the broken line for 2005 is above the solid line for 2000); this is similarly the case for shares between 30% and 40%. (For the even higher shares the density plot might not be representative due to the lower number of regions.) This in particular shows that both the number of regions with lower shares (below 20%) of high-skilled migrants and higher shares (above 30%) is increasing.

Figure 6

Share of high-skilled migrant workers in total high-skilled, 2000 and 2005



Similarly, Figure 6 presents the density plot of the share of high-skilled migrant workers in total high-skilled employed persons. Again, one can see that this share tended to increase for all regions and in particular the share of high-skilled migrants (in total high-skilled) increased for the regions at the left hand side of the distribution.

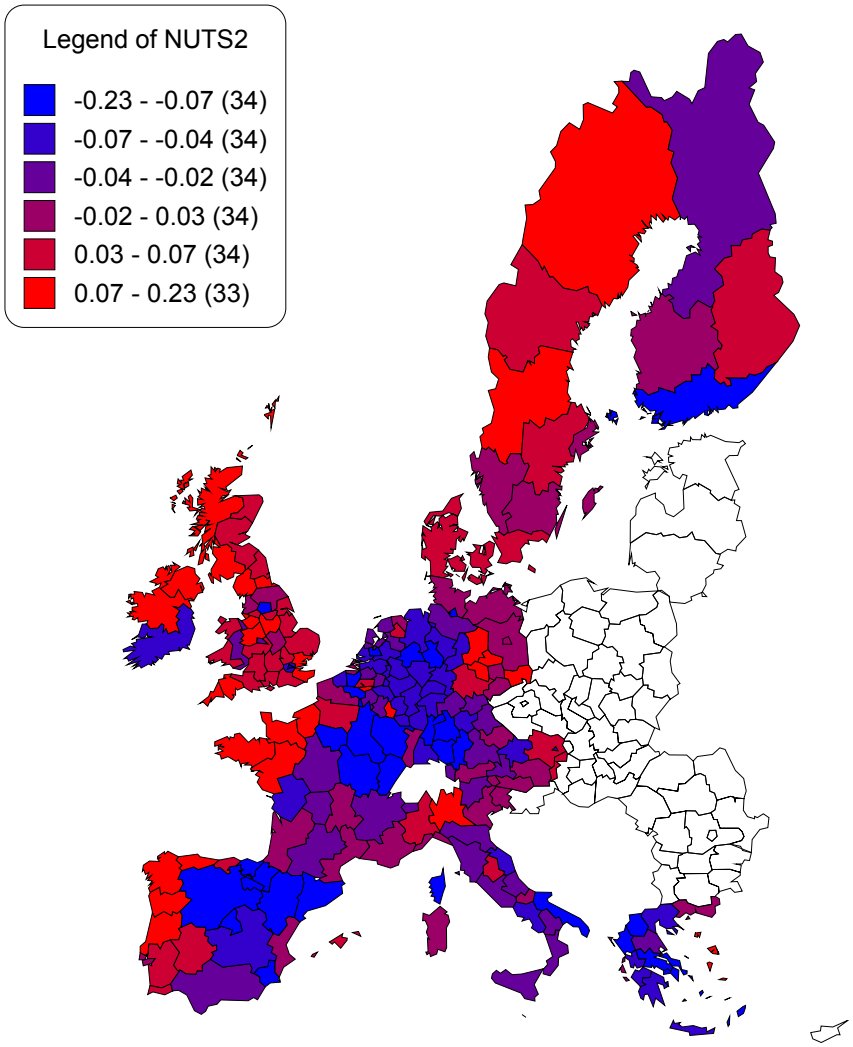
Let us finally come to the differences in the high-skill shares between natives and migrants. The last three columns in Table 1 report the averages over this difference together with the minima and maxima in the last three columns.[77] First, let us note that the mean is negative for most countries. Exceptions are Denmark, Ireland, Luxembourg, Portugal, Sweden and the United Kingdom. Even more important the minimum for these countries with negative means together with the United Kingdom is negative implying that in these countries there are regions with an unfavourable migrant structure (with respect to skill endowment).

[77] Note that in Figure 3 we reported the difference of the means whereas here we look at the mean over differences.

Finally, the ranges, i.e. the difference between the maximum and the minimum, are again quite large. The lowest range is found for Ireland (though this covers only two regions) to more than 30% in Spain, France and the United Kingdom. The regional pattern of these differences is documented in Figure 7.

Figure 7

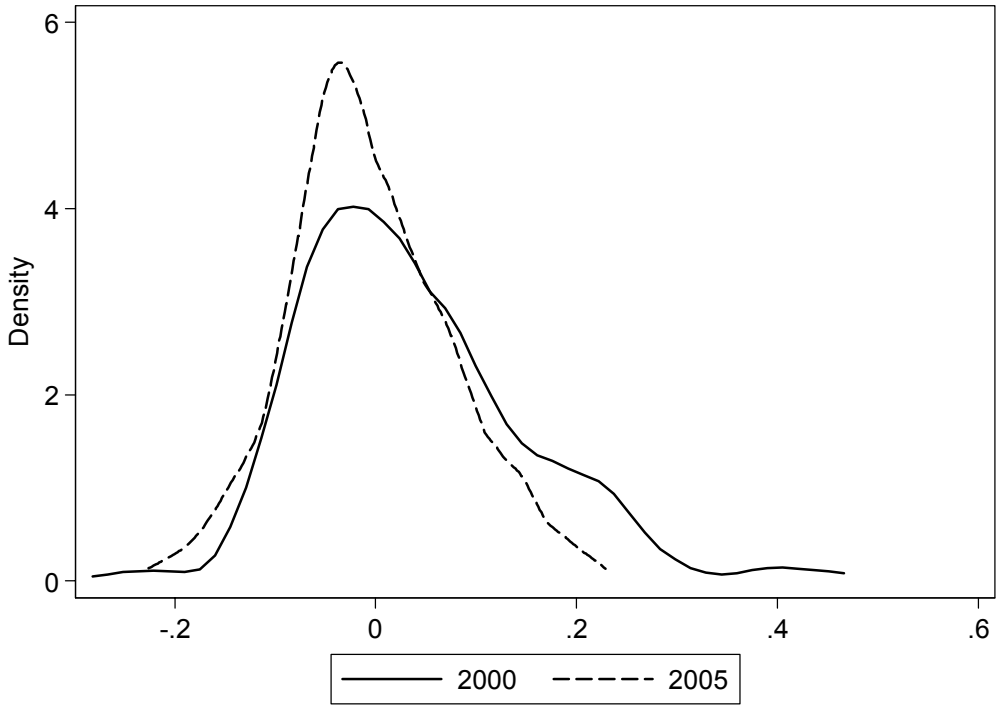
Difference between the share of high-educated natives to share of high-educated migrants, 2005



Finally, we show the density plot of these differences in Figure 8 which shows that the distribution has shifted somewhat to the left and is more skewed in unfavourable terms.

Figure 8

Difference in shares of high-skilled workers of total and migrants, 2000 and 2005



5.3 Econometric evidence

Let us now examine the effects of migration on regional performance. In this study we employ two regional performance measures, GDP per capita growth and patents per inhabitant. For data reasons we are forced to restrict the period to 2000-2005. There are only few studies on the effect of migration on innovative activities (i.e. patenting) which are summarized in Hunt and Gauthier-Loiselle (2008). Most of the studies mentioned in this paper relate to the US. A study on German regions is Niebuhr (2006). Thus to our knowledge this is the first attempt to study the link between high-skill migration and patenting at the European level. As outlined in the literature review there are various channels how migrants might affect productivity. These channels include an improvement of the overall quality of the workforce, a positive effect on technology adoption and adaptation. The latter aspect might come as a direct contribution to innovation and allowing for knowledge spillovers. From this we would expect a positive effect of migration and high-skill migration in particular on productivity and innovation outcomes. However, one should be aware that the empirical literature is less conclusive on this.

However, as mentioned above, we also present results analysing the effects of migration on GDP per capita growth. In a first specification we estimate growth in GDP per capita, γ, taken from Eurostat Regio database, on the initial gap in GDP per capita defined as $Gap = (GDP\ per\ capita / \max\{GDP\ per\ capita\})$ (where $\max\{GDP\ per\ capita\}$ denotes

region with highest GDP per capita in the particular year), the share of gross fixed capital formation in total output, $ShGFCF$, the share of high-skilled workers (workers with ISCED levels 5 and 6), $ShSH$, the share of migrants, ShM, and the share of high-skilled migrants, $ShSHM$. In another specification we also use the difference in the shares of native high-skilled workers to migrant high-skilled workers, i.e. $Diff = ShSH - ShSHM$. Thus the estimated equation is

$$\gamma_{it} = \beta_1 Gap_{i,t-1} + \beta_2 ShGFCF + \beta_3 ShSH_{it} + \beta_4 ShM_{it} + \beta_5 ShSHM_{it} + Dummies + u_{it},$$

where i refers to the NUTS 2-digit region and t denotes the year. In all regressions we included country and year dummies. In some cases other control variables are included as will become apparent in the tables presented below. The error term is of the form $u_{it} = \mu_i + \nu_{it}$ with $\mu_i \sim iid(0, \sigma_\mu^2)$ and $\nu_{it} \sim iid(0, \sigma_\nu^2)$; this means that we estimate a one-way random effects model. To not overload this part with too many results we only present our preferred versions of the model in Table 2. This table includes various specifications with respect to the variables included. Generally, we find that the share of gross fixed capital formation and the number of patents (per million inhabitants) is not significant in any of these specifications. Further, the gap lagged by one period is significant with the proper (negative) sign, i.e. a lowering of the gap also reduces the growth rate. The share of migrants ShM does not turn out to be significant in any case. More important, the variables of interest are significant and also show the expected sign in most cases. These are the share of high-skilled workers, $ShSH$, and in particular the share of high-skilled migrants, $ShMSH$, or the difference, $Diff$, though these are only significant in specifications (1) and (2) and (5) and (6), respectively.

With respect to the size of the coefficients the results indicate that an increase in the share of high-skilled migrants (or the increase in difference) by one percentage point increase the growth rate by 0.03 percentage points.

In specifications (5) and (6) reported in Table 2 we report the results when instead of the gap we include the interacted variable $Int = ShSH(1 - Gap)$ again lagged by one period. This is inspired by the contributions of Benhabib and Spiegel (2005) and Vandenbussche et al. (2006). However, this variable is not significant as only the share of high-skilled migrants or the difference variable remains significant.

The share of migrants as well as the share of high-skill migrants might be endogenous. We tried to instrument for this using the lagged shares as instruments. The results of this exercise are qualitatively similar to those reported in Table 2. In particular, the share of high-skilled migrants remains significantly positive in the first two specifications. In

specification (6) the interacted variable and the difference become significant at the 10% level.[78]

Table 2

Econometric results I

Dependent variable: Growth of GDP per capita

	(1)	(2)	(3)	(4)	(5)	(6)
ln Gap_{t-1}	-0.035 ***	-0.034 ***	-0.048 ***	-0.048 ***		
	0.001	0.001	0.001	0.001		
Int_{t-1}					0.058	0.058
					0.113	0.113
$ShSH_t$	0.028	0.061 ***	0.046 **	0.063 ***	-0.002	0.016
	0.117	0.000	0.026	0.000	0.938	0.466
$ShGFCF_t$	-0.004	-0.004	-0.022	-0.021	-0.012	-0.012
	0.789	0.802	0.333	0.336	0.594	0.600
ShM_t	0.006	0.006	-0.004	-0.004	-0.020	-0.020
	0.658	0.642	0.783	0.804	0.200	0.212
$ShMSH_t$	0.033 ***		0.017		0.018 *	
	0.001		0.114		0.098	
$Diff_t$		0.028 ***		0.015		0.016 *
		0.002		0.146		0.131
$PTcap_t$			0.000	0.000	0.000	0.000
			0.995	0.992	0.513	0.509
Chi2	600.499	597.809	564.622	563.984	549.189	548.447
R2 within	0.252	0.251	0.275	0.275	0.261	0.261
R2 between	0.731	0.729	0.695	0.694	0.698	0.698
R2 overall	0.352	0.351	0.407	0.407	0.401	0.400
Obs.	1132	1132	846	846	846	846
Nr. of groups	194	194	187	187	187	187

z-values reported below coefficients; ***, **, * denote significance at the 1, 5, and 10 % level, respectively.
All regressions include country dummies, time dummies and a constant.

In Table 3 we use the log of patents per million inhabitants as the dependent variable which is regressed on the lagged skill share, the share of migrants and the skill share of migrants or the difference variable. In the random effects specifications (1) and (2) we see that the lagged skill share and the share of migrants are highly significant and positive whereas the variables capturing high-skill migration are not significant.[79] The significance of the share of migrants might point towards an explanation that ethnic diversity matters. When allowing for a lagged dependent variable in specifications (3) and (4)[80] the share of migrants remain significantly positive; more important, the variables capturing high-skill migration are significant at the 10% level.

[78] We also used the share of high-skilled migrants in total high-skilled as a regressor. As this is highly correlated with the share of migrants we replaced the latter variable in these specifications. However, this variable is negative though insignificant in specifications (1) to (4) and becomes negatively significant in specifications (5) and (6).

[79] When using the share of high-skilled migrants in total high-skilled instead of the share of high-skilled migrants in total migrants we find no significant results.

[80] For this we use a GMM type estimator. Instruments in the differenced equation are the further lags of the dependent variable and first differences of the independent variables. In the level equations the instrument used is the first lagged difference of the dependent variable.

Table 3

Econometric results II

Dependent variable: ln $PTcap_t$

	Random effects		Arellano-Bover/Blundell-Bond GMM estimator	
	(1)	(2)	(3)	(4)
ln $PTcap_{t-1}$			0.247 ***	0.251 ***
			0.000	0.000
$ShSH_{t-1}$	1.688 ***	1.661 ***	1.311	1.283
	0.006	0.006	0.130	0.140
ShM_t	2.043 ***	2.001 ***	1.766 ***	1.876 ***
	0.000	0.000	0.005	0.003
$ShMSH_t$	-0.085		0.380	
	0.643		0.113	
$Diff_t$		-0.146		0.457 *
		0.430		0.065
Chi2	633.678	634.646	179.279	179.173
R2 within	0.158	0.158		
R2 between	0.742	0.742		
R2 overall	0.712	0.712		
Obs.	850	850	832	832
Nr. of groups	187	187	184	184
Sargan			225.341	223.581

z-values reported below coefficients; ***, **, * denote significance at the 1, 5, and 10 % level, respectively.
Specifications (1) and (2) include country dummies, time dummies and a constant; specifications (3) and (4) include time dummies and a constant.

The results suggest that an increase in the share of high-skilled workers by one percentage point will increase the patents per million inhabitants by little less than 2%. Similarly, a one percentage point higher share of migrants will increase it by about 2%. With respect to the size of the coefficients the results are in line with the findings by Hunt and Gauthier-Loiselle (2008) when taking into account that we estimated a yearly panel whereas in the paper mentioned the effects are estimated over 10 year periods. The share of migrants might be endogenous or predetermined. When considering this in the dynamic panel specification the lagged share of migrants is significantly positive.[81] When running these regressions in first differences the coefficients in the random effects model become insignificant. In the dynamic panel analysis the share of migrants remain positive with about the same magnitude.

However, the Sargan test statistics might suggest heteroscedasticity in the error terms or that instruments are not exogenous. With respect to the first problem we estimated the model allowing for heteroscedasticity in the errors. In this case however there are no significant results. Thus, though we get some indication of a positive relationship between migration and patenting these results are not robust with respect to specifications.

[81] When including the contemporaneous share and the lagged share only the first is significant.

5.4 Conclusions

In this part we analyzed the impact of migrants on productivity and patenting outcomes at the regional NUTS 2-digit level over the period 2000 – 2005. The descriptive analysis has shown the regional disparities with respect to migrant shares together with some trends over time. This pointed towards some marked differences with respect to the concentration of migrants and the skill distribution of migrants (also compared to the domestic workforce) across countries (as also documented in the other parts of the project) and between regions within countries. With respect to the time dimension, first, there is evidence that the share of migrants (in total employed) increased in most regions; second, both the number of regions with lower (below 20%) and higher (about 30%) shares of high-skilled migrants increased pointing towards an increased concentration of high-skilled migrants.

In an econometric exercise we studied the relationship between migration and regional performance measured by GDP per capita growth and patenting employing (dynamic) panel methods. Here we especially focused on the educational attainment variables and the shares of high-skilled migrants. The results suggest a positive relationship between the share of high-skilled employed persons and of high-skilled migrants on the growth rate of regional GDP per capita as dependent variable. When looking at patenting (per capita) as the dependent variable we find a positive significant relationship with the share of migrants and with a higher share of skilled migrant workers (relative to natives). These results are however not robust to changes in specifications when trying to take potential endogeneity into account. Though the results are not fully robust, in general however, one might conclude that migrants contribute to better regional performance by exploiting tacit knowledge, ethnic diversity and spillovers which have both significant local effects.

Chapter 6
Major Findings and Policy Implications

6.1 Introduction

This study provides an overview of the extent and the potential effects of high-skilled migration to the EU27. We wanted to know first of all, how many high-skilled migrants live in the EU, where these migrants come from, and how the European Union is positioned in the international competition for talent. Second we wanted to know how high-skilled migrants fare in European labour markets. To this end we analysed employment, unemployment and inactivity rates by skill groups as well as issues of job-skill mismatch for natives and foreign-born in the EU. Finally we address the issue of the effects of high-skilled migration on productivity and other measures of competitiveness at sectoral and regional levels.

We find that – despite substantial heterogeneity among individual EU countries – high-skilled foreign-born are an important source for high-skilled labour in the EU27. According to data from the European Labour Force survey 9.1% of the total tertiary educated resident population (as opposed to 8.1% of total resident population) in the EU 27 is foreign-born. The share of highly skilled among the resident population born outside the EU is 21.1%, while for within EU migrants it is 23% (as opposed to 17.9% for the native-born population). The foreign-born thus contribute more than proportionately to the share of highly skilled in the EU. Highly skilled migration is, however, also strongly concentrated on individual receiving countries. Around 94.2% of all highly skilled foreign-born in the EU 27 live in the EU 15. Only around 5.8% reside in the EU 12 countries. The three largest receiving countries in the EU 27 (France, the UK and Spain) in sum account for 57,5% of the total stock of foreign-born in the EU 15 (with Germany and Ireland excluded from this sample) and 63.1% of the highly skilled. The share of foreign-born in the total resident population (aside from the obvious outlier of Luxemburg) is higher than 15% in Austria and Sweden but below 10% in Denmark, Greece, Italy and Portugal and even below 3% in Finland.

6.2 Immigration policy vis-à-vis high-skilled third-country migrants

There was some evidence that – on average – EU OECD economies (EU) had a lower share of highly qualified migrants than the (arithmetic) average of the (high migration) non-EU OECD economies; and that the distance to the average of the major migration receiving countries (such as Australia, Canada, New Zealand) is larger for short-term than long-term migrants. The distance to the US, by contrast, was much smaller and – in many instances – not significant.

Although these international comparisons could not be conducted separately for migration flows inside the EU and from outside the EU, evidence from the European labour force survey suggests that the share of high-skilled among migrants from outside the EU is lower than among migrants from within the EU, despite non-EU countries being a more important source of human capital for most EU 27 countries than migrants from within the EU.

Increasing the skill selectivity of European Migration policy

Thus one possible policy initiative to improve the skill structure of migrants is to increasingly target highly skilled migrants in immigration laws. Most EU27 countries, have undertaken major steps to change immigration in this direction in recent years, and this has resulted in an increasing share of high-skilled migrants settling in the EU.

However, our results also suggest that this increasing selectivity of immigration regimes is countered by a relatively low qualification structure of short-term migrants in the EU. In particular more recent migrants (having arrived in the EU less than 10 years ago) from the important African, Asian and South American sending regions, are less well qualified. In the aggregate the share of tertiary educated among non-EU-born residents living in the EU27 for less than 10 years is 20.5%, and 21.3% among the more established non-EU-born. For within EU migrants, by contrast, the share of highly skilled among those residing abroad for less than 10 years is 25.9% (relative to 20.9% among the migrants with a duration of residence in excess of 10 years).

Thus the evidence provided in this study also suggests that attempts of improving the qualification structure of migrants to the EU27 are countered by an opposing tendency of increasing labour market demand for low-skilled workers that often enter the EU-labour market as temporary or seasonal workers or illegal migrants. While international competition for migrants is focusing primarily on the high-skilled, comprehensive migration policies thus need to address future labour market needs across the full skill spectrum. Realistically migration policy will thus also need to develop strategies towards less skilled migrants. From the point of view of competitiveness, however, highly skilled migration should be preferred over low-skilled migrants.

Making the EU more attractive for high-skilled migrants

With respect to these high-skilled migrants, however, increasing the selectivity of migration regimes alone will not suffice to attract more highly skilled foreign labour. To be fully effective such measures have to be accompanied by increased efforts at making the European Union more attractive as a destination for highly skilled migrants. In this respect the still fragmented nature of EU labour markets, which make both the mutual recognition of qualifications as well as the transparent portability of entitlements to social security systems difficult even for intra-EU migrants also act as an impediment to attracting high-

skilled migrants from abroad. Thus a closer coordination of migration policies with respect to highly skilled migrants among the member states could help to increase the attractiveness of the European Union as a destination for high-skilled workers. Initiatives that enable migrants to work within the entire EU and which focus on the highly skilled, such as the “blue card”, but also the creation of European networks with the aim of cross-linking national agencies and providing job exchange platforms are good examples of the kinds of initiatives that could provide substantial policy returns in this respect.

In addition, increasing the share of highly skilled migrants also has to go hand in hand with structural change in labour demand in the EU, since ultimately labour migration will only occur in sectors, occupations and regions where high-skilled labour is in high demand. Thus there is also a high need to develop migration and labour market policy with respect to the integration of high-skilled foreign-born in co-ordination industrial, thecnology and educational policies and the needs of employers dictated by structural change within the European Union.

Furthermore, results of the previous literature suggest that - aside from tax and social security related arrangements, which may act as a deterrent to high-skilled migration – different subgroups of the high-skilled migrants will be drawn to receiving countries for different reasons. Researchers for instance move abroad to keep up-to-date with the state of the art in their field, to get qualified feedback on the originality, relevance and quality of their research and as an additional source of inspiration. By contrast, political repression, social constraints, no (or only limited) access to research funding, over-regulated bureaucracies as well as precarious conditions of employment or a generally low quality level of universities and other institutions of higher education and research on the other hand deter migration by scientists and researchers. Especially for young researchers this also holds true for rigid career advancement schemes tied to seniority instead of performance. For entrepreneurially-minded individuals, by contrast, the societal and administrative climate for innovation, business-start-ups and self-employment can play important roles (either as push or pull factors) in becoming a migrant. Thus increasing the share of highly skilled migrants, moving to the EU - aside from measures designed to make immigration laws more selective - may also involve a plethora of measures that focus on increasing the attractiveness of the EU27 for high-skilled migrants that may reach far into other policy fields, usually considered to be unrelated to migration policy.

Using the potentials of student mobility

One group of particular interest in this respect are students. With respect to this group the few results available in the literature on international student flows suggest that many EU countries have been relatively successful in attracting foreign students. This, however, seems to be mostly due to high student mobility within the EU (and thus points to the success of programs enhancing student mobility, such as the ERASMUS program). With

respect to student mobility from third countries and students studying in advanced research programs, by contrast, many of the EU countries still seem to be lagging behind the major non-EU receiving countries. Thus initiatives with the aim to increase the attractivity of European universities for students from third countries and for students intending to participate in advanced programs (e.g Ph.Ds) could also be expected in the long run to increase high-skilled migration to the EU.

The success of such initiatives will, however, also hinge on the possibility of these students to work in the receiving countries after completing their degree, here success so far seems to have been rather limited, since the share of highly educated migrants working in EU countries is by and large uncorrelated to the number of students studying in a country. Recently, however, a number of EU27 countries have shifted to migration policies designed to encourage foreign-born students to remain and work in the receiving country at least for some time period after they graduate and it is currently too early to evaluate how successful these measures are in increasing the skill content of migration to the EU.

Return Migrants

Another group of particular interest are highly skilled emigrants from the EU that intend to return. Here results from international comparisons suggest that a number of EU countries have a large share of highly educated migrants working abroad and the return intentions of these migrants are still an open question in international migration research. Despite this lack of research, from a policy perspective, ensuring frictionless return and encouraging models of repeat migration (i.e. brain circulation) also with non-EU partner countries are central policy concerns, which have received some attention in the recent migration debate. In particular it has to be expected that in future return and repeat migration will become increasingly common among high-skilled migrants and that migration and labour market management systems will increasingly have to accommodate for this group.

6.3 Improving labour market integration of high-skilled third-country migrants

A second important policy relevant finding of this study is that high-skilled migrants in the EU face a number of challenges when entering the European labour market, that make them distinct from other migrant groups such as less skilled migrants. In particular the high-skilled migrants – in contrast to less skilled migrants - have lower labour market participation rates, higher unemployment rates and lower employment rates than comparable natives and face substantially higher risks of being employed in jobs that do not fit their skill structure.

Econometric evidence based on the EU-LFS suggests that (after controlling for country of residence, age and gender,) highly skilled foreign-born in the EU have a lower probability of

being employed (by 9.3 percentage points), a 3 percentage points higher probability of being unemployed and a by 5.4 percentage points higher probability of being inactive than comparable natives. Less skilled foreign-born, by contrast, have a by 2.9 percentage points higher probability of being employed than comparable natives and face a 5.4 percentage points lower risk of inactivity but a 1.2 percentage points higher risk of unemployment. Thus (even after controlling for compositional effects) highly skilled – in contrast to less skilled - migrants in the EU27 are substantially (by 9.3%) less likely to be employed than highly skilled natives. In addition according to results from the EU-LFS 19.4% of the native-born highly skilled, employed in the EU27 (excluding Germany and Ireland) were overqualified, but 33.0% of the highly skilled foreign-born. This thus points at a substantial underutilization of highly skilled foreign labour in the EU27 due to non employment and over-qualification.

These results thus suggest that aside from policies directed at attracting more high-skilled migrants, there is also a need for increased efforts at integrating highly skilled foreign-born into the labour market. Here aside from measures directed at improving foreign language knowledge of migrants, improving the mutual acceptance of professional qualifications, increased training and actions to fight discriminatory practices in the workplace, a number of EU27 countries have recently adopted measures that increasingly acknowledge that improved integration requires a more broad-based approach, that is backed by measures to improve the social, cultural and political integration of foreign-born. Often in such policies national approaches are also augmented by more regionally focused initiatives to improve the integration of foreign-born.

Aside from this our results, however, also point to a number of particular focus groups among the high-skilled that may require particular policy attention. This applies in particular to highly skilled foreign-born women. Virtually all our results indicate that gender differences to the disadvantage of women with respect to employment, unemployment and inactivity as well as over-qualification rates are larger among the foreign-born than among natives. This points to the double disadvantage often faced by foreign-born women when integration into the labour market of host societies.

A further target group for such measures, highlighted, by our results, are more recent migrants. Here our results suggest that differences in activity, unemployment and employment as well as over-qualification rates between more recent migrants and established migrants is larger for the high-skilled foreign-born than among the low-skilled foreign-born. High-skilled migrants thus often have to accept a sizeable ‘transferability discount’, which is strongly borne out by the high degree of overqualification (but also by lower employment rates) in our analysis. On the other hand low-skilled migrants find it easier to transfer their skills, which are lower in any case. Thus almost by definition high-skilled migrants are also more likely to profit from measures aimed at better labour market

integration (such as for example improving language proficiency and training in the host country), than less skilled.

In addition our results also indicate that highly skilled migrants from more distant destination countries also have larger problems in integrating in EU labour markets. Thus it has to be expected that increased efforts at attracting high-skilled migrants, which will almost by necessity also entail an increased share of migration from countries that are more remote from Europe (such as for instance Asian countries), will also have to be accompanied by increasing efforts at labour market integration of foreign-born.

Finally, a number of results in the literature (see Chiswick and Miller, 2007, Bock-Schappelwein et al., 2009) also suggest that aside from labour market integration, integration of foreign-born children into the school system of the receiving country requires close attention. Persons migrating in their late teens (i.e. above the ages where compulsory education has ended) often end up, with substantially lower educational attainment, than migrants migrating earlier or later in their lives.

6.4 Policies directed at high-skilled migrants within the EU

Finally, it should be noted that aside from highly skilled migrants from third countries also high-skilled migrants within the EU are often faced with a sizeable “transferability discount” of their human capital, which is reflected in higher rates of over-qualification and lower employment rates. This applies even to migrants migrating from one EU15 country to another, but even more strongly to the more recent group of migrants from the EU12 to the EU15, who are often faced with very high rates of over-qualification. According to our results high-skilled migrants from the EU 12 (even after controlling for differences in age and gender structure) face a by 29.6 percentage points higher risk of being overqualified than natives and medium-skilled migrants from the EU 12 have an over-qualification risk that is by 19.6 percentage points higher than that of natives.

While the policy instruments to reduce these substantial rates of over-qualification among within EU migrants clearly should follow similar lines as initiatives directed at third country migrants (i.e. giving high priority to formal and informal transferability of qualification, language proficiency and training), it would seem that in particular with respect to these intra-EU migrants the role of the European Commission in devising such policy instruments and supervising their efficient implementation should be particularly important.

6.5 Policies directed at exploiting sectoral and regional allocation patterns of migrants

Our analysis regarding the impact of migration and of high-skilled migration in particular on sectoral productivity and gross value added (levels and growth) was still preliminary (in the sense of endogeneity issues not being fully resolved), but yielded a number of interesting results regarding the relationship between migration and productivity using sector level data. Particularly interesting was the difference of the impact of the share of migrants in levels and growth specifications, as well as the importance of a break-down by different groups of migrants (from EU and RoW). There was also a relatively robust result of a positive impact of the share of high-skill migrants and of an interactive effect of high-skill migrant share and ICT technology. Furthermore, it was shown that industry heterogeneity specifically with respect to a manufacturing vs. services sectors breakdown was important.

The overall implications of the result support the insights gained from other (country-specific) studies (see e.g. Paserman, 2008) and also from our analysis of the pervading phenomenon of 'over-qualification' that the allocation of migrants to jobs/firms/sectors is negatively related to the productivity levels in these jobs/firms/sectors – the result obtained from our level specifications – but that they contribute positively to productivity growth. It was interesting to see that migrants which undergo more skill-screening (RoW migrants) do not show the negative allocation effect in the same way – in fact the effect is often positive – and that the share of high-skill migrants mostly yields positive level and growth effects. Taking these results at face value (i.e. forgetting about the still unresolved endogeneity issue) one can conclude that there is a positive relationship between migrant shares and productivity (and output) growth and the level relationship between migration and productivity (which is an allocation effect of migrants across sectors) can be influenced through skill screening. However, one might also argue that migrants perform an important 'greasing of the wheels' function (see Borjas, 2001) in that they contribute to productivity growth also in industries with lower productivity levels which might be important in itself.

As regards the analysis of migrants and regional growth and regional technological development (proxied by patents per capita) we found a positive relationship between the share of high-skilled employed persons and of high-skilled migrants and the growth rate of regional GDP per capita. When looking at patenting (per capita) as the dependent variable we also found a positive significant relationship with the share of migrants. However, also these results were not robust to changes in specifications when trying to take potential endogeneity into account, so further work on this will be important. There are various avenues open to deal with this issue (exploring particular instrumental variables) but the data-base did not allow us to make much progress so far. Nonetheless the results obtained do point to a positive relationship between the share of high-skill migrants and regional growth and of the share of migrants in a region and a region's patenting activity. The analysis of the dynamics of migrants' shares across regions revealed another interesting

phenomenon: migrants' shares (and this is true also for their shares amongst skilled workers) are increasing particularly in two types of regions: in those in which they traditionally occupied a relatively low share – which amounts to a dispersion effect – and in those in which there was already a relatively high share – which is an agglomeration or network effect. The results on skilled migrants shares and regional growth (and that of migrants' shares and patenting) thus results from a possible positive relationship in both these two types of regions. On the one hand, they might contribute through an increased degree of 'dispersion' which amounts again to a 'greasing of the wheels' effect and on the other hand they might contribute through an 'agglomeration effect' which might take account of possible complementarity or externality effects on the productivity of existing stocks of migrants or of domestic workers. A possible way to disentangle these two effects would be to analyse the relationships separately for different groups of regions and test for complementarity effects explicitly. This will be explored in further research.

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