Heuer, Nina

Working Paper

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Tübinger Diskussionsbeitrag, No. 328

Provided in cooperation with:
Eberhard Karls Universität Tübingen

Suggested citation: Heuer, Nina (2010) : Occupation-specific south-north migration, Tübinger Diskussionsbeitrag, No. 328, urn:nbn:de:bsz:21-opus-47906 , http://hdl.handle.net/10419/40327

Wirtschaftswissenschaftliche Fakultät
der Eberhard-Karls-Universität Tübingen

Occupation-Specific South-North Migration

Nina Heuer

Tübinger Diskussionsbeitrag Nr. 328
April 2010

Wirtschaftswissenschaftliches Seminar
Mohlstraße 36, D-72074 Tübingen

Occupation-Specific South-North Migration*

Nina Heuer**

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Abstract

This paper presents occupation-specific data on south-north migration around the year 2000 using employment data for developing sending and OECD receiving countries from ILO and OECD.

These data reveal that the incidence of south-north migration was highest among *professionals*, one of the two occupational categories generally requiring tertiary education, and among *clerks* and *legislators, senior officials and managers*.

At a more disaggregated level, I find that the probability that a *professional* in the OECD worked as a *physical, mathematical and engineering science professional* or as a *life science and health professional* was significantly larger for south-north migrants compared to OECD natives. It is exactly these occupational categories, characterized by internationally transferable skills, that exhibited significantly larger brain drain rates than *teaching professionals*, whose skills are rather country-specific. The employment shares of most types of *professionals* and *technicians and associate professionals*, as well as of *clerks* and *corporate managers* were significantly smaller in the migrant-sending countries compared to the receiving countries.

The data further suggest a non-negligible "brain waste" due to imperfect transferability of skills acquired through formal education, since south-north migrants with a university degree more often worked in occupational categories requiring less than tertiary education compared to OECD natives.

Keywords: international migration, brain drain, human capital, transferability of skills, occupational employment structure

JEL Codes: F22, J24, O15

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*I would like to thank Wilhelm Kohler, Udo Kreickemeier, Markus Niedergesäß, and the participants of the Brown Bag Seminar at Tübingen University and of the Göttinger Workshop "Internationale Wirtschaftsbeziehungen" 2010 for helpful comments and discussion. I also want to thank Miriam Kohl, Michael Kölle, and Thomas Störk for excellent research assistance.

All remaining errors are mine.

**Eberhard-Karls-Universität Tübingen, Mohlstraße 36, 72074 Tübingen, Germany. Tel.: +49 70 71/ 29 721 21. Email: nina.heuer@uni-tuebingen.de.

1 Introduction

When compared to international trade or capital flows, international migration is often considered as the least complete aspect of globalization (cf. e.g. Freeman 2006, 149-151). However, migration from developing countries to member countries of the Organisation for Economic Co-operation and Development (OECD), and particularly the extent of migration of high-skilled workers are important phenomena of globalization (cf. Carrington and Detragiache 1998, Docquier and Marfouk 2006). In developing and developed countries, politicians are particularly concerned about the emigration of their highly skilled workers, considered as an important resource for economic development. Yet several empirical studies find that the propensity to emigrate is increasing in the skill level; an observation that Dos Santos (2006, 19-21) attributes to the fact that migration costs are decreasing in the skill level, as well as to the existing selective immigration policies.

The migration of high-skilled workers is generally known as "brain drain" if "[...] the net flow is heavily in one direction" (Salt, 1997, 5). This term was originally used to describe the migration of scientists from the U.K. to the U.S. and was characterized by a strong connotation of loss (Johnson, 1965, 299). According to the more recent definition by Docquier and Rapoport (2008), it generally refers to "[...] the international transfer of resources in the form of human capital and mainly applies to the migration of relatively highly educated individuals from developing to developed countries." Recently created datasets of south-north migration rates based on information on immigrants in OECD countries by country of origin and – partly imputed – educational attainment (Carrington and Detragiache 1998; Adams 2003; Docquier and Marfouk 2006; Defoort 2006; Beine et al. 2007; Docquier et al. 2008) have made possible to empirically analyze the extent of the brain drain and to test several hypotheses of the theoretical brain drain literature. This improvement notwithstanding, the available cross-country datasets do not allow to analyze which professions are disproportionately represented among the brain drain: Due to restricted data availability, they draw on the pure educational definition given above and define all tertiary-educated individuals as high-skilled, thus considering only one aggregate type of brain drain. The existing evidence in terms of the 'occupational drain' is of anecdotal nature: Several case studies analyze one or a few specific occupations or sectors in one or at most a few countries of emigration or immigration (e.g. Commander et al. 2004; Bhorat et al. 2002; Thomas-Hope 2002; Alburo and Abella 2002; Pellegrino 2002; Meyer et al. 2000; Watanabe 1969). The sector that has been most thoroughly analyzed is the medical sector (cf. e.g. Docquier and Bhargava 2008; Kangasniemi et al. 2004; Awases et al. 2003).

Benefiting from richer data on immigrants in OECD countries, this paper presents two new datasets on south-north migration rates by occupational categories at two distinct levels of disaggregation according to the International Standard Classification of

Occupations 1988 (ISCO-88). The datasets combine information about the labour market outcomes and educational attainments of immigrants in OECD countries around the year 2000 provided by the Database on Immigrants in OECD Countries (DIOC) by the OECD with employment data for the developing migrant-sending countries from the ILO, and constitute the first comprehensive datasets on south-north migration by major and sub-major occupational categories for cross-sections of, respectively, 91 and 17 developing countries of emigration. These data at hand, I am able to break down south-north migration along both the skill and the occupational dimension and thus to distinguish and compare several types of brain drain. I furthermore use the gathered employment data to study the differences in the employment distributions of the 'developing' migrant-sending and 'developed' migrant-receiving countries in order to sketch the structural background against which this south-north migration takes place. Comparisons of the occupational employment distributions of the native and foreign-born OECD populations are used to study the degree of "overeducation" among tertiary-educated south-north migrants, and serve as an indicator of whether skills that are specific to certain professional categories exhibit a rather low or high degree of international transferability. Stylized facts are derived presenting mean values for different populations and drawing on parametric and non-parametric statistics to test for distributional differences.

This paper is organized as follows: Section 2 assesses the extent of south-north migration and brain drain with data from the DIOC adopting an educational point of view. This serves as a benchmark for the occupational analysis. Section 3 then focuses on the occupational distribution of south-north migrants in contrast to that of OECD natives. Special attention is paid to the two types of human capital *professionals* as well as *technicians and associate professionals* in order to study the international transferability of *professionals'* skills. Section 4 introduces the new datasets of occupational emigration rates and studies the extent and composition of south-north migration and brain drain against the backdrop of the employment distributions in the migrant-sending countries, making use of both the educational and the occupational dimension of the data. Section 5 concludes. The data appendix documents the data preparation and presents summary statistics.

2 An Education-Based Assessment of the Brain Drain

This section summarizes employment data and emigration rates available from the DIOC in order to point out the extent of south-north migration from the perspective of both the receiving and the sending countries. Particular attention is paid to the migration of the most highly skilled. The assessment of the brain in this section is based on educational attainment as it is standard in the relevant literature. It will serve as a benchmark for the stylized facts that are derived in sections 3 and 4, where the definition of brain drain rests upon the educational qualification needed in the occupations that are actually exercised.

The Perspective of the North

The extent of south-north migration exceeds the one of north-north migration by far: In 2000, workers who had emigrated from developing countries[1] to the OECD represented about 65.7% of the total immigrant labour force in the OECD, whereas employees who had left high-income (OECD or non-OECD) countries to work in an OECD country accounted for only 25.4% of the total immigrant labour force in the OECD.[2]

A glance at the educational distribution of total south-north migrants reveals the importance of the phenomenon brain drain: Highly skilled migrants, defined as foreign-born individuals with tertiary education (comprising ISCED-97 levels 5 and 6, UNESCO 1997), born in developing countries represented 28.8% of total south-north migrants working in the OECD in 2000 for whom educational attainment is known. Of these, 44.1% were women. If only low-income countries are considered, the percentage of tertiary-educated migrants rises to 41.7%, with emigration of secondary (primary) educated workers amounting to 31.7% (26.6%). Thus, for the poorest sending countries, employment of south-north migrants was rising in qualification.

Since the considered version of the DIOC (OECD 2008a) only contains data on immigration to OECD member countries, it can neither be used to study south-south migration (migration from developing to other developing countries), nor migration from developing to non-OECD high-income countries.[3] However, disregarding the brain drain from the south to the 'non-OECD-north' might not be too problematic: Docquier and Marfouk (2006, 154) estimate from non-OECD census data that 90% of worldwide high-skilled migrants live in the OECD.

The Perspective of the South

The following summary statistics point out that the relative incidence of high-skilled emigration from developing countries to developed countries is generally higher compared to

[1] All countries classified as low- or middle-income countries in 2000 by the Worldbank are considered as 'developing' countries. A detailed definition is provided in the data appendix.

[2] The remaining 8.9% can be attributed to migration from dependent territories, not further specified regions, or no-longer existing states, which cannot be assigned to specific income groups.

[3] OECD and Worldbank have recently launched a project to extend the DIOC, especially to include data on south-south migration. Up to now, this extended version has not yet been completed and contains data only on one high-income non-OECD country (Slovenia).

the relative incidence of total south-north migration when abstracting from educational attainment. The DIOC provides tertiary emigration rates, defined as the percentage of a country's tertiary-educated native population living in the OECD, for 75 low- and middle-income countries in 2000. On average, the tertiary emigration rate amounted to 16.0%, while the total emigration rate from the same developing countries abstracting from educational attainment was 3.9% in 2000. Yet there were large regional differences.

Figure 1 illustrates mean total and tertiary emigration rates from these 75 developing countries to the OECD for different regions of origin. Sub-Saharan Africa as well as Latin America and the Caribbean are the regions with the highest average brain drain around 2000. This observation is in line with Docquier and Marfouk (2006).

Figure 1: Mean south-north migration and brain drain rates in 2000 (%), by regions
Source: Author's tabulations using data from the DIOC

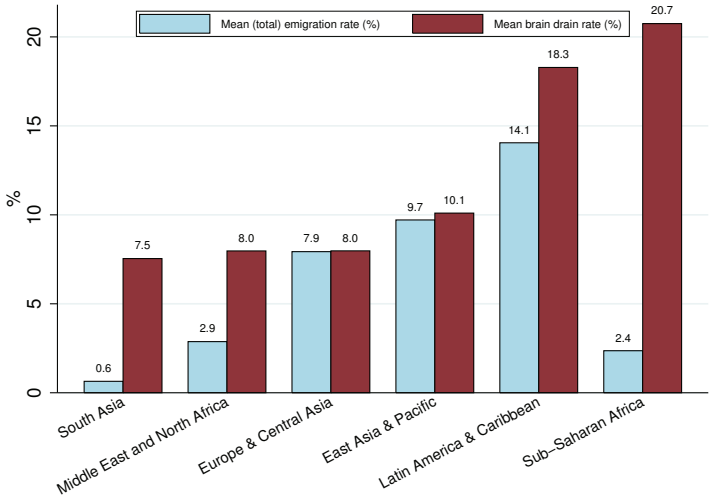


Table 1 reports different percentiles of the brain drain by regions. The interregional and intraregional differences are striking for the considered sample: The highest brain drain rate is observed for Latin America and the Caribbean and amounted to 76.9% (Guyana). By contrast, the maximal rates in Eastern Europe and Central Asia, Middle East and North Africa, and in South Asia were less than 20%. From the comparison of the different percentiles, one can further conclude that intraregional differences were highest in Latin America and the Caribbean, in sub-Saharan Africa, and in East Asia and the Pacific. In general, the highest rates can be attributed to small countries or islands.

Table 1: Different percentiles of the brain drain in 2000 (%), by regions
Source: Author's tabulations using data from the DIOC

Region	**5%**	**50%**	**75%**	**Max.(100%)**	**# Countries**
East Asia & Pacific	1.5	5.2	13.2	38.3	8
Eastern Europe & Central Asia	3.2	8.4	12.3	12.3	3
Latin America & Caribbean	1.9	6.2	14.1	76.9	22
Middle East & North Africa	3.7	6.8	11.3	15.4	8
Sub-Saharan Africa	3.8	15.5	26.5	71.5	28
South Asia	3.0	4.9	9.8	19.4	6

3 An Occupation-Specific Assessment of the Brain Drain

This section turns to the notion of 'high-skilled' based on the educational qualification that is generally required in the different occupational categories of ISCO-88. Using data from the DIOC, I compare the occupational employment distributions of total south-north migrants as well as of tertiary-educated south-north migrants to those of the native-born OECD populations in order to assess the incidence of formal "overeducation"[4] and the degree of transferability of higher education. Employing sign test statistics, this assessment goes beyond the report accompanying the DIOC, OECD (2008), which merely presents descriptive statistics. I then focus on *professionals* and *technicians and associate professionals*, the two most skill-intensive occupational categories, in order to shed some light on the differences in the transferability of *professionals'* skills.

On the relation between ISCO-88 and ISCED-76

The major advantage of the International Standard Classification of Occupations 1988 (ISCO-88)[5] by the ILO in the context of this assessment of the brain drain is its relation to the formal education levels of the International Standard Classification of Education 1976 (ISCED-76) by UNESCO: According to ILO (1990, 3-4), *professionals* (ISCO-88 major 2) are associated with ISCED-76 levels 6 and 7, and *technicians and associate professionals* (major 3) mostly require education at ISCED-76 level 5.[6] This implies that at the ISCO-88 major level, one can distinguish between two occupational categories requiring tertiary education, thus between two types of human capital and brain drain, which can be further broken down into eight sub-major and 39 minor occupational groups.

Clerks, *service workers and shop and market sales workers*, *skilled agricultural and fishery workers*, *craft and related trades workers*, as well as *plant and machine operators and assemblers* (majors 4-8) require skills that are often attained through formal education at ISCED-76 levels 2 or 3 (secondary education). *Elementary occupations* (major 9) are associated with ISCED-76 level 1 (primary education). "Although ISCO-88 avoids the terminology, 'Elementary Occupations' can be regarded as 'Unskilled', and 'Manual' or 'Blue-collar' occupations are concentrated within major groups 6 to 9" (Elias, 1997, 7). The *armed forces* and *legislators, senior officials and managers* (majors 0 and 1) do not have a skill coding, because the skills required in these categories exhibit great variation.

Whereas these broad skill categories allow to distinguish two skill-intensive and two less skill-intensive categories, it is important to highlight that the coding of occupations to the aggregated ISCED skill levels only applies "[...] where the necessary occupational skills are acquired through formal education or vocational training", and that "[...] the

[4] Following the review of the overeducation/undereducation literature in Chiswick and Miller (2009, 163), employees are regarded as "overeducated" if their educational attainment exceeds the educational reference level of the occupational categories of ISCO-88.

[5] For a summary of the principles underlying ISCO-88 and a list of the sub-majors see the data appendix.

[6] Note that under the current version ISCED-97, tertiary education is included in levels 5 and 6.

focus in ISCO-88 is on the skills required to carry out the tasks and duties of an occupation – and not on whether a worker having a particular occupation is more or less skilled than another worker in the same occupation" (ILO, 1990, 2).

3.1 The Occupational Distribution of Total South-North Migrants

Table 2 reports the distribution of employees in the OECD around 2000 for total foreign-borns from developing countries and for OECD natives by ISCO-88 sub-major categories.

Table 2: Occupational distribution of total south-north migrants (F) and OECD natives (N) around 2000, by ISCO-88 sub-major occupational categories (%)
Source: Author's tabulations using data from the DIOC

ISCO-88 Sub-Major Occupational Category		**F**	**N**	
Armed forces	(0)	0.2	0.7	
Legislators and senior officials	(11)	0.1	0.2	
Corporate managers	(12)	6.1	7.1	
General managers	(13)	1.4	2.1	
Physical, mathematical and engineering science professionals	(21)	4.5	2.8	ISCED 5-7
Life science and health professionals	(22)	3.3	2.1	
Teaching professionals	(23)	2.7	4.2	
Other professionals	(24)	3.8	4.5	
Physical and engineering science associate professionals	(31)	1.9	2.4	
Life science and health associate professionals	(32)	2.0	2.3	
Teaching associate professionals	(33)	0.7	0.8	
Other associate professionals	(34)	5.0	7.0	
Office clerks	(41)	7.2	9.2	ISCED 2,3
Customer service clerks	(42)	3.2	2.8	
Personal and protective services workers	(51)	11.7	8.6	
Models, salespersons and demonstrators	(52)	3.2	5.0	
Market-oriented skilled agricultural and fishery workers	(61)	3.6	8.3	
Subsistence agricultural and fishery workers	(62)	0.0	0.0	
Extraction and building trades workers	(71)	5.4	4.8	
Metal, machinery and related trades workers	(72)	7.0	6.0	
Precision, handicraft, printing and related trades workers	(73)	0.7	0.8	
Other craft and related trades workers	(74)	1.7	1.7	
Stationary-plant and related operators	(81)	0.6	0.9	
Machine operators and assemblers	(82)	6.3	3.4	
Drivers and mobile-plant operators	(83)	3.8	4.2	
Sales and services elementary occupations	(91)	8.5	4.8	ISCED 1
Agricultural, fishery and related labourers	(92)	0.3	0.2	
Labourers in mining, construction, manufacturing and transport	(93)	5.2	3.1	

Aggregating these numbers, I find that 23.9% of all south-north migrants with reported occupation worked in occupations requiring tertiary education (ISCED 5-7). This proportion is 4.9 percentage points lower than the share of tertiary-educated south-north migrants (cf. section 2). Thus from the perspective of the sending countries, there was 17% "overeducation" on the aggregate level. By contrast, there was no aggregate "overeducation" among OECD natives (26.9% of the latter with known education levels received tertiary education and 26.1% of those with known sub-major occupational categories worked in occupations requiring tertiary education). This observation suggests the existence of "brain waste"[7] due to the imperfect transferability of skills: Even though several south-north

[7] The understanding of this term is based on Salt (1997, 5), cf. also section 4.

migrants held university degrees enabling them to work as *professionals/technicians and associate professionals* at least in their country of birth, they did not find an adequate job in the OECD and worked in occupations requiring less than tertiary education.

14.0% of total south-north migrants worked in occupations presupposing primary education (ISCED 1), and a majority of 54.4% worked in occupations requiring secondary education (ISCED 2, 3). This latter proportion falls only slightly short of the percentage of OECD natives in occupations requiring secondary education (55.7%). Yet the relative numbers of south-north migrants working in occupations requiring primary education are considerably larger, and those working as *legislators, senior officials and managers* (sub-majors 11-13) slightly smaller than those of OECD natives.

When focusing on the sub-major categories of the skill-intensive major *professionals*, foreign-born employees in the OECD worked relatively more often as *physical, mathematical and engineering science professionals* or as *life science and health professionals*, and relatively less often as *teaching professionals* or as *other professionals* compared to the native OECD population. This constitutes a first indication that skills specific to occupations such as teaching or legal professions exhibit a smaller degree of international transferability than do skills of natural scientists. This issue will be further assessed in sections 3.3 and 4.3. In all sub-major categories of the major *technicians and associate professionals*, south-north migrants were relatively less frequent compared to OECD natives.

Concerning the occupational categories generally requiring less than tertiary education, pronounced differences are observed for sub-majors 82, 91, and 61: Whereas the percentages of south-north migrants working as *machine operators and assemblers* or in *sales and services elementary occupations* were considerably larger than those of OECD natives, the percentage of OECD natives working as *market-oriented skilled agricultural and fishery workers* was more than twice the respective percentage of south-north migrants. This observation is not astonishing when recognizing that the former types of occupations in general do not require many skills or prior experience, but can be easily learned by anyone – whereas for the latter type of occupations one needs skills and experience that are specific to large-scale agricultural production which can be seen as rather high-tech in OECD countries compared to developing countries.

A glance at the most frequent sub-major occupational categories of south-north migrants by region of origin reveals two interesting deviations from the overall distribution: Whereas the most common occupational categories among total south-north migrants figure in major categories requiring less than tertiary education, emigrants from South Asia most often worked as *physical, mathematical and engineering science professionals* (sub-major 21) in the OECD in 2000. Furthermore, large proportions of emigrants from South Asia as well as from the Middle East and North Africa worked as *corporate managers* in the OECD (sub-major 12), which might be considered as a skill-intensive category, too.

3.2 The Occupational Distribution of Tertiary-Educated South-North Migrants

This section takes advantage of the cross-classification of the OECD population by occupational category and educational attainment in the DIOC in order to further assess the incidence of "overeducation" among south-north migrants and the transferability of higher education. Whereas OECD (2008, 139) relate aggregate overqualification rates – calculated as the percentage of employed holding a job for which they are formally overqualified – of foreign-born individuals to those of OECD natives, I make use of the sign test statistic to check whether the employment distributions of tertiary-educated south-north migrants significantly differed from those of OECD natives in order to test whether south-north migrants were affected by "overeducation" to a comparable extent as OECD natives.

Since occupations in ISCO-88 major 2 (*professionals*) and 3 (*technicians and associate professionals*) normally require tertiary education, I expect that both most tertiary-educated OECD natives and south-north migrants worked in these occupational categories.

Table 3: Occupational distribution of south-north migrants (F) and OECD natives (N) around 2000, mean values across OECD countries by ISCED-97 levels (%)
Source: Author's tabulations using data from the DIOC

		ISCED 6		**ISCED 5**		**ISCED 5/6**	
Occupation, ISCO-88 Major		**F**	**N**	**F**	**N**	**F**	**N**
Armed forces	(0)	0.9	0.5	0.5	0.7	0.5	1.5
Legislators, senior officials and managers	(1)	10.8	11.5	11.9	12.6	14.7	16.1
Professionals	(2)	72.4	76.9	37.3	43.5	46.1	45.9
Technicians and associate professionals	(3)	7.8	6.8	17.8	20.8	17.4	21.1
Clerks	(4)	3.0	1.9	7.4	7.7	4.8	5.0
Service workers, shop and market sales workers	(5)	2.8	1.1	9.7	5.8	6.4	3.2
Skilled agricultural and fishery workers	(6)	0.4	0.4	0.9	1.6	0.4	1.4
Craft and related trade workers	(7)	1.0	0.4	5.1	3.9	3.5	3.9
Plant and machine operators and assemblers	(8)	0.8	0.3	3.6	1.8	2.1	1.0
Elementary occupations	(9)	1.6	0.4	6.1	1.7	4.0	0.8

Table 3 presents average values for the occupational distribution of the OECD population with tertiary education (ISCED-97 levels 5/6)[8] for the migrant population born in developing countries and for OECD natives separately. As expected, most tertiary-educated migrants (ISCED-97 levels 5/6) from developing countries in the OECD worked as *professionals* or *technicians and associate professionals*: On average 46.1% and respectively 17.4% worked in these skill-intensive categories around 2000. In addition, a non-negligible share (on average 14.7%) worked as *legislators, senior officials and managers*, whereas the shares of these highly educated migrants considered to constitute the brain drain who worked in occupations requiring only secondary or primary education (majors 4-9) were considerably smaller. South-north migrants with education at ISCED-97 level 6 were even more strongly concentrated in ISCO-88 major 2, while the distributional peak

[8] For some individuals, the exact level of tertiary education – ISCED-97 level 5 or 6 – has not been reported. Therefore, the populations considered for the distributions reported in columns 5 and 6 exceed the combined numbers of individuals considered in columns 1/3 and 2/4.

of the occupations of south-north migrants with education at ISCED-97 level 5 in the high-skill intensive occupational categories was less pronounced.

Using the sign test statistic[9] for the populations with education at ISCED-97 levels 6 and 5 separately, I find that the shares of the tertiary-educated south-north migrant population working in ISCO-88 majors 5, 7, 8, and 9 – occupational categories generally requiring less than tertiary education – were significantly larger than the respective shares of the native OECD population.[10] In addition, south-north migrants with education at ISCED-97 level 6 were more often employed in ISCO-88 majors 3 and 4, but less often in major 2 compared to OECD natives with the same educational attainment.[11] South-north migrants with education at ISCED-97 level 5 were relatively less represented in majors 2 and 3.[12] The sign tests yield no significant differences for major category 6, nor for the aggregated employment shares of south-north migrants and OECD natives with education at ISCED-97 levels 5/6.

The outlined distributional differences between the tertiary-educated foreign-born and native OECD population point out that significantly more tertiary-educated south-north migrants than OECD natives worked in occupational categories requiring less than tertiary education. This is in line with the observation that the percentage of total south-north migrants working in occupational categories generally requiring tertiary education was lower than the percentage of total south-north migrants with tertiary education (cf. sections 2 and 3.1). From the point of view of the sending countries, these emigrants worked in professions for which they were "overeducated". One of the reasons underlying this finding is the less-than-perfect transferability of human capital in general, and in this context of formal tertiary education in certain professions acquired in the migrant-sending countries. Whereas Chiswick and Miller (2009) explicitly consider the transferability of language skills and of pre-immigration labour market experience in addition to formal education for foreign-borns in the US, the data from the DIOC only enable me to study the transferability of human capital accumulated through formal education. However, I suppose that the importance of a high degree of proficiency of the receiving country's official language for some high-skilled occupational categories (such as teaching, legal, or social services professions), of work experience, and of the knowledge of the receiving country's institutions also contribute to the observation that relatively more highly educated foreign-borns from developing countries than OECD natives worked in occupational categories for

[9] This is a non-parametric test statistic which does not impose distributional assumptions and which is suitable in the context of two matched samples of metric data with small sample sizes (n_1,$n_2 < 30$) (Bamberg and Baur, 2009, 171,188). The null hypothesis of this test statistic is that the median of the differences between the values of the two considered criteria is equal to zero.

[10] The null hypothesis of the one-sided test that the median of the differences is zero against the alternative hypothesis that the median of the differences between foreign-born and native employment shares is larger than zero can be rejected at the 1- and 5-% levels, respectively.

[11] The null of the respective one-sided sign tests can be rejected at the 1-, 5-, and 10-% level, respectively.

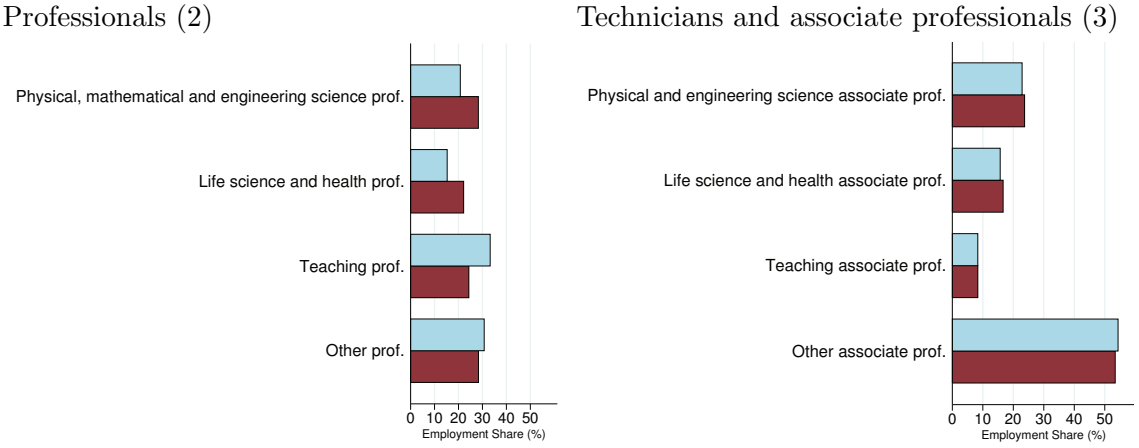
[12] The null of the respective one-sided sign tests can be rejected at the 10- and 1-% level, respectively.

which they were formally "overeducated". According to the review of overeducation theories in Chiswick and Miller (2009, 164), the theory of technological change predicts that overeducation is more common for immigrants from less developed countries.

3.3 Assessing the International Transferability of *Professionals'* Skills

This section examines differences in the disaggregated employment distributions in the skill-intensive majors 2 and 3 (*professionals* and *technicians and associate professionals*) between south-north migrants and OECD natives on the one hand, and between south-north migrants and the respective populations in the origin countries on the other hand. The intention of these analyses is to shed more light on the different degrees of international transferability and applicability of tertiary education. Professional categories that were relatively more frequent among *professionals* from developing countries in the OECD than among OECD-native *professionals* or among *professionals* residing in the sending countries will be considered to require skills exhibiting a high degree of international transferability, whereas sub-major categories that were relatively less frequent among foreign-born *professionals* in the OECD will be considered to require rather country-specific skills.

Figure 2: Mean values of the distribution of south-north migrants (red) and natives (blue) in OECD countries (2000) in ISCO-88 majors 2 and 3 over sub-majors
Source: Author's tabulations using data from the DIOC



Whereas figure 2 depicts larger average shares of *professionals* working as *physical, mathematical and engineering science professionals* (sub-major 21) or as *life science and health professionals* (sub-major 22) for the immigrant OECD population born in developing countries than for the native OECD population around 2000, the average proportion of native *professionals* working as *teaching professionals* (sub-major 23) exceeded the one of foreign-born *professionals*. In line with these observations, the application of the sign test statistic[13] reveals that the shares of foreign-born *professionals* working in sub-majors 21 and 22 were significantly larger, and those working in sub-majors 23 and 24 significantly

[13] The reasoning for the adequacy of this test statistic is the same as in section 3.2.

smaller than the respective shares of native born *professionals*.[14]

By contrast, the differences in the average employment shares of foreign-born and native *technicians and associate professionals* (sub-majors 31-34) were less pronounced and significant (positive) differences between foreign-born and native employment shares can only be confirmed for sub-major category 31 (at the 5-% level of statistical significance).

Motivated by the difficulties of recoding the ISCO-1968 minor to the ISCO-88 sub-major occupational categories, as well as by the similar occupational structures of ISCO-88 majors 2 and 3,[15] I aggregate the eight ISCO-88 sub-major categories generally requiring tertiary education into four broad types of *(associate) professionals* in order to check the robustness of the above mentioned distributional differences. The results from the sign tests confirm those obtained for major category 2: The shares of aggregate *(associate) professionals* working as *physical, mathematical and engineering science (associate) professionals* or as *life science and health (associate) professionals* in the OECD were significantly larger for south-north migrants than for OECD natives. The native-born *professionals*, however, more often worked as *teaching (associate) professionals* or as *other (associate) professionals*.[16]

In addition, I relate the distributions of *(associate) professionals* from 17 developing countries working in the OECD over these four aggregated occupational categories to the respective distributions in the countries of origin and test for equality of distributions.[17] The results from the application of sign tests partly confirm the above picture: The shares of aggregate *(associate) professionals* from the considered developing countries working as *life science and health (associate) professionals* were significantly larger (at the 1-% level) for those working in the OECD compared to those in the origin countries around 2000. The proportions of *(associate) professionals* working as *teaching (associate) professionals* in the sending countries significantly exceeded those of the emigrant *(associate) professionals* in the OECD (at the 1-% level).

The significant differences in the occupational distributions of south-north migrants and OECD natives working as *(associate) professionals* on the one hand, and between *(associate) professionals* from developing countries working in the OECD and those working in the origin countries on the other hand suggest that skills related to *physical, mathematical and engineering science professions* and to *life science and health professions* exhibit a larger degree of international transferability than do skills related to *teaching occupations*. This has already been indicated by the aggregated figures presented in section 3.1.

[14] The null hypotheses of the relevant one-sided tests can be rejected at the 1- and 5-% level for sub-majors 22, 23 and 21, 24, respectively.

[15] For a detailed description of the data management and related problems see the data appendix.

[16] The null of the respective one-sided sign tests can be rejected at the 5-% level for *physical, mathematical and engineering science (associate) professionals* and *teaching (associate) professionals*, and at the 1-% level for *life science and health (associate) professionals* and *other (associate) professionals*.

[17] For a description of the employed data and the considered countries see the data appendix.

It is unclear, however, whether these *professionals* acquired their tertiary education *ex ante* or *ex post* migration, because the DIOC does not allow to distinguish between foreign-borns who pursued their studies in the sending countries and those who went to university in the OECD.

Whereas a similar analysis for the foreign-born and native OECD populations at the level of the ISCO-88 minor occupational categories reveals some interesting heterogeneity within the considered sub-major categories of *professionals* and *technicians and professionals*, the results from this assessment are not reported, because the highest level of disaggregation in the constructed occupational emigration rates is the ISCO-88 sub-major level.

There are several plausible explanations for the outlined distributional differences. On the one hand, *professionals* who acquired their university degrees in the sending countries – *ex ante* migration – and who managed to find jobs as *professionals* in the OECD most likely belong to occupational categories whose (formal and on-the-job) skills exhibit a high degree of international transferability, such as it is the case in the natural sciences. By contrast, *teaching professionals* face the problem that educational systems greatly differ across countries. It is unlikely that permissions to teach acquired in the developing sending countries are accredited in the OECD without further requirements. On the other hand, *professionals* born in developing countries who pursued their university degrees in the OECD – *ex post* migration – can be assumed to have mainly chosen majors procuring internationally transferable in contrast to country-specific skills, such that the acquired qualifications are also of use in the case of return migration. Against this background, the missing information about where (higher) education has been acquired is thus not problematic, since these considerations suggest that south-north migrants should be relatively more represented in occupational categories requiring internationally transferable skills irrespective of where they have pursued their studies. Further, a high degree of proficiency of the receiving country's official language is of less importance for *physical, mathematical, engineering, life science and health professionals* than for *teaching professionals*. Especially in the natural sciences, English is very often the more important working language. An empirical study that systematically analyzes the occupational choice of high-skilled immigrants in the US is Chiswick and Taengnoi (2007). They find that high-skilled immigrants who have limited proficiency of the host country's language – which is English in this case – and whose first language is linguistically distant from English are more likely to exercise professions in which English communication skills are not so important.

4 Two New Datasets on South-North Migration by Occupational Categories

This section presents south-north migration rates by occupational categories at the major and sub-major level of ISCO-88. These data allow to compare the extent of emigration in different occupational categories for several developing sending countries, which was not possible with the existing migration datasets until now. Occupation-specific emigration rates that can be compared across several developing sending countries are only available for doctors and nurses by OECD (2008b). Furthermore, data on the medical brain drain from sub-Saharan African countries is provided e.g in Docquier and Bhargava (2007), Clemens and Pettersson (2007), and Hagopian et al. (2004).

In order to analyze the extent of south-north migration from the perspective of the sending countries for various occupational categories, I combine data on immigrants in OECD countries from the DIOC with data on employment in the sending countries from LABORSTA in order to calculate 'occupational emigration rates'. Thus, similar to Docquier and Marfouk (2006, 166), who calculate emigration rates by broad ISCED skill categories, I relate the stock of migrants working in a specific occupational group in OECD receiving countries to the stock of total natives in this occupational category, consisting of the migrants and the corresponding occupational cohort remaining in the home country (residents), around the year 2000:

$$m_{ij} = \frac{M_{ij}}{M_{ij} + R_{ij}} \tag{1}$$

where M_{ij} refers to the number of migrants from country i working in occupational group j in the OECD, and R_{ij} denotes the number of residents in country i working in occupational group j around the year 2000. m_{ij} gives the likelihood that an individual from country i with occupation j worked in the OECD around 2000. In statistical terms, $m_{ij} = P(B|A)$ with event A occupation j and event B migration to the OECD, thus giving the probability that an individual from country i had emigrated to the OECD by 2000 conditional on that she worked in occupational category j. Depending on the level of disaggregation, j either refers to the ISCO-88 major (1-digit) or sub-major (2-digit) occupational categories.

The constructed dataset of occupational emigration rates at the major level includes information for 91 developing (low- or middle-income) countries around the year 2000. I am also able to calculate analogous emigration rates at the ISCO-88 sub-major level. However, due to scarce data availability, these emigration rates can only be constructed for 17 developing countries around 2000.

Using data from countries of immigration in order to study emigration is very common in the relevant empirical literature. This can be justified arguing that emigration data are less reliable than immigration data, because emigration declarations are often not compulsory and also include tourists (Beine et al., 2001, 284).

Whereas flow data would allow to capture the brain drain in terms of 'sunk costs' of higher education, i.e. foregone taxes etc. that were invested into the higher education of

the future emigrants, this is not possible with the stock data from the DIOC. The reason for this is that the available data do not allow to distinguish between the foreign-borns who acquired their tertiary education in the developing sending countries or the OECD receiving countries. However, south-north migrants who received at least part of their pre-tertiary education in the sending countries also produced educational costs borne by the latter that are captured in the data. Contrasting flow data, the available stock data on the OECD's foreign-born population in 2000 provide 'accumulated' information on migration to the OECD over the past years, excluding return migrants as well as migrants that arrived in the relevant period but that had already deceased by 2000. Since it is impossible to statistically evaluate emigration and return migration, stock data can be considered as more reliable than flow data (Docquier and Marfouk, 2006, 156).

Against this background, I consider the stock of migrants from developing countries in the OECD working in occupational categories requiring tertiary education (ISCO-88 majors 2 and 3) as potential but inavailable human capital of the developing sending countries. Hence, this is a broad notion of the brain drain which accounts for the extent to which the most able left the developing sending countries, since it comprises also emigrants who acquired their (tertiary) education in the host country. According to Meyer and Brown (1999), "[...] it is clear, today, that the majority of skilled people of foreign origin acquire their professional qualifications in the host country". In this context, Bhorat et al. (2002, 10) argue that stock data "[They] simply reveal the extent of the diasporas, which should not be confused with a basic result of earlier highly skilled outflows".

A further issue concerns the ignorance of the occupations performed by migrants in their home countries prior to emigration. Since these are not reported in the DIOC, I assume that migrants who acquired their highest education certificate in the sending countries would perform occupations in the same reported occupational category in their home country if they had not emigrated in order to interpret m_{ij} as occupational emigration rate. While the findings from section 3.3 suggest that this assumption may not be very problematic in the case of high-skilled occupations such as business or engineering professions generally requiring internationally transferable skills, it will be so in the case of occupations demanding skills that are rather country-specific, such as several teaching or legal professions. In this context, the term "brain waste" describes the "[...] deskilling that occurs when highly skilled workers migrate into forms of employment not requiring the application of the skills and experience applied in the former job" (Salt, 1997, 5). For the type of occupations which are associated with "brain waste" due to the imperfect transferability of acquired skills and diplomas, the calculated emigration rates will be likely to underestimate the absence of certain types of professionals from the migrant-sending countries. Being unaware of the place where (higher) education has been acquired, the interpretation of m_{ij} as occupation-specific emigration rate requires the implicit assump-

tion that all emigrants who went to university in the OECD would have pursued the same studies and acquired the same skills in the home countries if they had not emigrated.

Using employment data from LABORSTA and the DIOC, I calculate contrastable employment shares at the level of the ISCO-88 major and sub-major categories for residents in developing and OECD countries: $r_{ij} = \frac{R_{ij}}{\sum_j R_{ij}}$ (2)

In addition, I construct employment shares for total natives (residents plus migrants) of the considered developing countries. These shares give the probability $P(A)$ that an individual born or residing in country i worked in occupational category j around 2000:

$$n_{ij} = \frac{R_{ij} + M_{ij}}{\sum_j R_{ij} + \sum_j M_{ij}} \quad (3)$$

Native employment shares are instructive in two respects: First, n_{ij} can be interpreted as the total human capital of type j that would be available to country i if no emigration had occurred and all emigrants who went to university or acquired an occupational training in the OECD had acquired the same skills in the home country. The comparison of natives' employment shares to the respective shares of the residents in the sending countries provides some indication on the selectivity of south-north migration. Second, the occupational emigration rates can be directly related to natives' employment shares. I.e., the extent of migration in different occupational categories can be studied alongside the relative importance of the respective type of human capital in the migrant-sending countries' total native employment.

4.1 The Extent of High-Skilled Emigration Revisited with Occupational Data

In this section, I reassess the extent of aggregate high-skilled south-north migration with the described occupational data and compare it to the education-based evidence from the DIOC presented in section 2. Whereas the emigration rates from the DIOC (OECD, 2008) rest upon educational attainment to capture the brain drain, in my analysis the definition of 'highly skilled' is based on the educational qualification needed in the occupations that are actually exercised (cf. the paragraph on ISCO-88 in section 3). This brings about the advantage that I can make use of the employment data from ILO in order to measure the relevant populations in the migrant-sending countries, whereas OECD (2008, 174) have to construct information on origin populations by educational attainment using population data from the United Nations along with the Barro-Lee database for the educational structure of the population in origin countries.

Table 4 depicts that the average south-north migration rate was highest for occupational categories requiring tertiary education (ISCED-76 levels 5-7), while developing countries' mean employment shares of residents and natives were concentrated in occupations requiring secondary education (ISCED-76 levels 2, 3) in 2000. The application of

one-sample (paired difference) t tests[18] yields that the mean aggregate emigration rate in occupations presupposing tertiary education was significantly larger (at the 1- and 5-% level) compared to the mean rates in the low-skill categories (ISCED-76 levels 2, 3 and 1).

Table 4: Average values of resident and native employment shares (%), mean emigration rates (%) of developing countries around 2000, by broad ISCED-76 levels
Source: Author's tabulations using data from the DIOC and LABORSTA

ISCED-76 Level	**Employment Residents**	**Employment Natives**	**Emigration Rate**	**# Dev. Countries**
Tertiary (5-7)	15.6	16.3	11.5	83
Secondary (2, 3)	64.5	64.0	6.7	83
Primary (1)	16.2	16.0	8.9	73

Concerning the employment distributions of residents and natives by broad skill categories, I find for both distribution types that the mean employment shares were significantly smaller in occupations requiring tertiary or primary education compared to the mean shares of occupations requiring secondary education.[19]

Thus, in addition to the observation that employment of south-north migrants from low-income countries was rising in qualification (cf. section 2), average south-north migration rates were highest for the most skill-intensive occupational categories. I.e., people from developing countries with professional skills specific to occupations figuring in the high-skill categories more easily secured a job in the OECD compared to their fellow countrymen with occupations in the low-skill categories.[20] This trend is in line with the immigration policies of many OECD countries favoring either high-skilled immigration in general, or immigration of specific types of professionals.

The second observation describes the relatively low importance of highly skill-intensive occupations in total employment in the sending countries as the background against which the brain drain takes place.

According to table 4, average employment shares of residents in skill-intensive occupations were smaller compared to average shares of natives, with the opposite being true for the less skill-intensive occupations. However, the application of paired difference t tests yields that the hypothesis that the mean employment shares of residents and natives are equal cannot be rejected at reasonable significance levels.

Taken together, whereas on average 16.3% of natives from developing countries were

[18] In the present case, the numbers of observations of the considered matched samples are sufficiently large ($n_1, n_2 > 30$). This allows me to employ this parametric test statistic for asymptotic normality, whereas with smaller samples sizes the sign test appears appropriate (cf. section 3.2). The null hypothesis of the one-sample (paired difference) t statistic is that the means of the two considered distributions are equal (Bamberg and Baur, 2009, 171).

[19] The null hypothesis of the relevant one-sided tests that the mean employment shares are equal in the aggregated skill categories for residents and respectively natives can be rejected at the 1-% level.

[20] Note that the assumption that migrants execute the same jobs in the OECD that they would execute in their home country had they not emigrated is not restrictive in this context. If some highly educated migrants from developing countries secured jobs in the low-skill occupational categories in the OECD, the emigration rates calculated for ISCED-76 levels 5-7 will be rather underestimated.

employed in occupations requiring education at the highest ISCED-76 levels, on average 11.5% of these highly skilled lived and worked in the OECD around 2000. This occupation-based average number of the brain drain is 4.5 percentage points lower than the mean brain drain rate resting upon migrants' educational attainment (cf. section 2). In section 3, a similar picture has emerged when comparing the respective aggregate shares of south-north migrants from the considered developing countries. This makes me conclude that the emigration rates for the skill-intensive occupational categories are likely to be downward biased from the point of view of the sending countries due to the less-than-perfect transferability of (formal) skills. Put differently, the occupation-based brain drain rates by construction are lower than the education-based counterparts, because the former already account for the fact that formal skills are not always transferable internationally.

4.2 South-North Migration by ISCO-88 Major Occupational Groups

This section presents mean emigration rates and employment shares by ISCO-88 major occupational groups for the considered 91 developing countries around 2000, as well as for the different world regions in which these low- and middle-income countries are located. This disaggregation allows to distinguish two broad types of human capital and brain drain (ISCO-88 majors 2 and 3), generally requiring tertiary education. Moreover, it provides additional insights on emigration and employment in occupational categories presupposing secondary education (ISCO-88 majors 4-8), as well as for *legislators, senior officials and managers* and the *armed forces*, which are not assigned any general skill category.[21]

Concerning the two types of brain drain, table 5 depicts a higher mean emigration rate for *professionals* than for *technicians and associate professionals*: On average, 14.1% of the former and 10.6% of the latter born or living in developing countries worked in the OECD around 2000. The application of the paired difference t test yields that this difference is statistically significant at the 1-% level. Whereas the differences between the average employment shares of natives and residents in these two categories are marginal, the mean employment shares of total natives were statistically larger (at the 1-% level) than those for residents in these highly skill-intensive categories.

Table 5 furthermore reveals large differences in emigration rates between the occupational groups generally requiring secondary education: Whereas the probability that a worker residing or born in one of the included developing countries working as a *clerk* lived and worked in the OECD around the year 2000 was 13.2% on average, the analogous probability for someone working as a *skilled agricultural and fishery worker* amounted to only 1.7%. Applying paired difference t tests for equality of mean values across the distributions of the major categories in this broad skill category yields that the mean emigration rate of *clerks* was significantly larger (at the 1-% level) than the mean rates in ISCO-88

[21] Sub-major 0 (*Armed forces*) has been excluded from the regional statistics due to small numbers of observations.

majors 5-8, while the mean emigration rate of *skilled agricultural and fishery workers* was significantly smaller (at the 1-% level) than the mean values in the other majors in this skill category. The average emigration rate of *plant and machine operators and assemblers* was with 11.4% on a high level, too, and significantly larger than the mean emigration rates in major categories 5-7.[22]

By contrast, employment of residents in developing sending countries in occupational categories generally requiring secondary education was concentrated to a large extent in the occupational category *skilled agricultural and fishery workers* (the average employment share of the 91 developing countries in the sample was 24.0%) around 2000, whereas on average only 6.1% of the employed in developing countries worked as *clerks*. The differences of residents' mean employment shares in these majors compared to the mean values in the other majors requiring secondary education are statistically significant (at the 1-% level). Confronting these mean employment shares to those of OECD countries, large differences are observed for all major categories except for the *armed forces*, *service workers and shop and market sales workers*, *craft and related trades workers*, and *plant and machine operators and assemblers*. Testing residents' employment shares in developing and OECD countries for equality of distributions using the Kolmogorov-Smirnov test statistic[23], I find that OECD countries exhibited significantly larger employment shares in the most skill-intensive majors 1-4, as well as in major categories 5 and 8.[24] By contrast, resident employment shares in major categories 6, 9, and 0 were significantly larger in developing countries compared to OECD countries.[25] Thus, in addition to the relatively small importance of *professionals* and *technicians and associate professionals* in total employment, developing countries were generally characterized by smaller employment shares of the human capital types *legislators, senior officials and managers*, *clerks*, and *service workers and shop and market sales workers* compared to OECD countries. The pronounced difference between developing and OECD countries in the employment share of *skilled agricultural and fishery workers* points to the importance that accrued to agriculture in these economies in 2000.

The comparison of average resident employment shares in developing countries to the shares of total natives reveals marginal differences (< 0.5 percentage points in absolute terms) which are statistically significant according to the employed paired difference t

[22] The null hypothesis of equal means of the respective one-sided tests can be rejected at the 5-% and 1-% level for majors 5 and 6, 7, respectively.

[23] This non-parametric test statistic is appropriate in the context of two independent samples of metric data with continuous distribution functions and small samples sizes ($n_1, n_2 < 30$) (Bamberg and Baur, 2009, 170). The null hypothesis of the one-sided tests for this statistic is that the values of one distribution are smaller/larger or equal the values of the second distribution (Büning and Trenkler, 1978, 133-134).

[24] Equality of distributions can be rejected at the 1-% level for majors 1-4, at the 5-% level in the case of major 5, and at the 10-% level for major 8.

[25] Equality of distributions can be rejected at the 1-% level for majors 6 and 9, and at the 5-% level in the case of major 0.

tests: On average, natives were relatively more often employed in major categories 1, 2, 3, 4, 5, and 8 – including the most skill-intensive occupations – and worked relatively less often in majors 0, 6, 7, and 9 compared to the resident populations in the sending countries.[26]

Relating the mean emigration rate of *professionals* to the respective mean native employment share, I find that while making up on average only 8.2% of employment of natives from developing countries, on average 14.1% of the *professionals* being potentially available to the less-developed countries lived and worked in the OECD around 2000.

Against the backdrop of the critical considerations about the recoding of the ISCO-68 major groups to the ISCO-88 major occupational categories,[27] I recalculated the mean emigration rates and employment shares and repeated the paired difference t tests excluding data originally reported at ISCO-68 in order to test the robustness of the above findings. Whereas I obtained larger average emigration rates and employment shares for some major occupational categories, these differences were rather small (< 1 percentage point). In addition, the results from the t tests applied to the smaller sample confirm the above described distributional differences. The summary statistics presented in section 4.1 can be considered as a robustness check for the considerably large emigration rates of *(associate) professionals*: By aggregating data over broad ISCED-76 education categories, most objections regarding the recoding of the ISCO-68 major to the ISCO-88 major categories should be dispelled.

According to table 6, average migration rates to the OECD were largest from developing countries situated in Latin America and the Caribbean for ISCO-88 major categories 1-7, and for developing countries in East Asia and Pacific for majors 8 and 9. Concerning the most skill-intensive occupational categories, on average 23.6% of the *professionals* and 18.5% of the *technicians and associate professionals* being potentially available to the developing countries in this region lived in the OECD around 2000. Furthermore, mean emigration rates from East Asia and the Pacific to the OECD were also on a high level (with mostly two-digit percentages) for most occupational categories.

A trend common to the different regions of developing countries except East Asia and the Pacific as well as Eastern Europe and Central Asia is that the largest mean emigration rates around 2000 are generally obtained for the most skill-intensive occupational categories *professionals* and *technicians and associate professionals*, for *legislators, senior officials and managers*, or for *clerks*. By contrast, for East Asia and the Pacific, the mean emigration rate was largest for the less skill-intensive occupational category of *plant and machine operators and assemblers*, and in the case of Eastern Europe and Central Asia

[26] The hypothesis of equal mean values across distributions can be rejected at the 1-% level for majors 1, 2, 3, 4, 6, at the 5-% level for majors 0, 7, 8, 9, and at the 10-% level for major 5.

[27] For a detailed discussion of the recoding procedures see the data appendix.

for *elementary occupations* and *craft and related trades workers*.[28]

Around 2000, the average resident employment shares of *professionals* and *technicians and associate professionals* were largest for developing countries in Eastern Europe and Central Asia, where each of these occupational groups on average accounted for approximately 11% of total employment. By contrast, sub-Saharan Africa exhibited the smallest mean employment shares in these skill-intensive occupational categories: On average, *professionals* represented only 2.9% and *technicians and associate professionals* 4.3% of employment in sub-Saharan African countries. *Skilled agricultural and fishery workers* constituted the largest occupational group in developing countries in all regions except for Latin America and the Caribbean, where most employees (19.9%) worked in *elementary occupations*. Whereas sub-Saharan Africa and South Asia exhibited the highest average resident employment shares of *skilled agricultural and fishery workers* (42.0% and 38.3% respectively), this share was only 10.5% in Latin America and the Caribbean.[29]

Table 6 furthermore depicts that the employment structure was very polarized in sub-Saharan Africa (with on average 20.4% of total employment in occupations requiring primary education, but only 2.9% in the most skill-intensive category *professionals*), in Latin America and the Caribbean, in East Asia and the Pacific, as well as in South Asia. By contrast, the 'skill gap' was much smaller in Eastern Europe and Central Asia, as well as in the Middle East and North Africa.

Compared to the analysis by broad ISCED-76 skill categories in section 4.1, the disaggregation of south-north migration rates by ISCO-88 major categories has revealed that in addition to the two skill-intensive occupational categories *professionals* and *technicians and associate professionals*, the occupational categories of *legislators, senior officials and managers*, *clerks*, and *plant and machine operators and assemblers* were characterized by similarly large average south-north migration rates around 2000.

In the considered sending countries, the employment shares of *professionals*, *technicians and associate professionals*, *legislators, senior officials and managers*, *clerks*, *service workers and shop and market sales workers*, and *plant and machine operators and assemblers* were significantly smaller in comparison with OECD countries. By contrast, the shares of *skilled agricultural and fishery workers* and of workers in *elementary occupations* were significantly larger in the developing countries than in the OECD.

The regional summary statistics have revealed that developing countries in Latin America and the Caribbean, and in East Asia and the Pacific exhibited the largest emigration rates around 2000, and that sub-Saharan Africa experienced relatively strong brain drain.

[28] When considering only employment data classified according to ISCO-88, the largest average emigration rates for East Asia and Pacific can be attributed to majors 4, 8, 1, and 2.

[29] When considering only employment data originally classified according to ISCO-88, the highest average resident employment shares of *skilled agricultural and fishery workers* is observed for East Asia and the Pacific (44.1%).

Table 5: Average values of resident employment shares (%) of developing and OECD countries, average native employment shares of developing countries (%), mean south-north migration rates (%) around 2000, by ISCO-88 majors
Source: Author's tabulations using data from the DIOC and LABORSTA

ISCO-88 Major Occupational Category		**Employment Residents**	**Employment Natives**	**Employment OECD**	**Emigration Rate**	**# Dev.Countries**	**# OECD**
Armed forces	(0)	1.6	1.5	0.7	2.9	86	24
Legislators, senior officials and managers	(1)	4.8	5.0	8.6	13.7	91	27
Professionals	(2)	7.8	8.2	13.1	14.1	91	27
Technicians and associate professionals	(3)	8.0	8.2	14.8	10.6	91	27
Clerks	(4)	6.1	6.5	11.1	13.2	91	27
Service workers, shop and market sales workers	(5)	13.5	13.6	13.8	8.5	91	27
Skilled agricultural and fishery workers	(6)	24.0	22.9	6.0	1.7	91	27
Craft and related trades workers	(7)	14.8	14.6	14.1	7.5	91	27
Plant and machine operators and assemblers	(8)	7.9	8.1	8.6	11.4	90	27
Elementary occupations	(9)	16.2	15.8	9.2	9.0	91	27

Table 6: Average values of south-north migration rates and mean employment shares of residents in developing countries around 2000, by ISCO-88 majors and regions (%)
Source: Author's tabulations using data from the DIOC and LABORSTA

South-North Migration Rates, by ISCO-88 Majors and Regions (%)

ISCO-88 Major Occupational Category		East Asia & Pacific	Eastern Europe & Central Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa
Legislators, senior officials and managers	(1)	17.2	4.5	21.2	10.2	1.4	17.4
Professionals	(2)	16.5	4.3	23.6	8.6	6.3	16.1
Technicians and associate professionals	(3)	12.7	3.9	18.5	6.1	1.5	11.4
Clerks	(4)	19.0	5.7	21.6	5.1	2.8	10.4
Service and shop and market sales workers	(5)	10.1	4.8	15.4	4.0	2.1	4.1
Skilled agricultural and fishery workers	(6)	1.7	1.8	2.9	0.3	0.0	0.6
Craft and related trades workers	(7)	9.4	6.5	12.9	2.2	0.4	2.2
Plant and machine operators and assemblers	(8)	24.0	5.7	17.0	5.2	2.2	5.4
Elementary occupations	(9)	17.0	7.3	12.9	3.1	0.6	3.0

Employment in Developing Countries, by ISCO-88 Majors and Regions (%)

ISCO-88 Major Occupational Category		East Asia & Pacific	Eastern Europe & Central Asia	Latin America & Caribbean	Middle East & North Africa	South Asia	Sub-Saharan Africa
Legislators, senior officials and managers	(1)	4.0	6.1	5.5	4.7	5.7	1.8
Professionals	(2)	7.7	11.1	7.1	9.3	4.2	2.9
Technicians and associate professionals	(3)	5.7	11.3	9.0	7.4	4.6	4.3
Clerks	(4)	5.6	4.9	8.0	7.0	5.8	3.9
Service and shop and market sales workers	(5)	10.6	11.6	18.2	16.0	7.9	10.8
Skilled agricultural and fishery workers	(6)	37.7	19.7	10.5	20.0	38.3	42.0
Craft and related trades workers	(7)	13.9	13.7	16.9	17.0	14.8	10.8
Plant and machine operators and assemblers	(8)	6.0	9.6	8.6	9.4	4.4	5.3
Elementary occupations	(9)	15.3	11.3	19.9	13.6	16.7	20.4

4.3 South-North Migration by ISCO-88 Sub-Major Occupational Groups

Table 8 depicts average south-north migration rates and employment shares of residents and natives of developing migrant-sending countries and of the resident OECD population around 2000 by ISCO-88 sub-major categories.[30] This disaggregation allows to study eight highly skill-intensive occupational categories, thus eight different types of human capital and brain drain (sub-majors 21-24 and 31-34), as well as 16 less skill-intensive categories (sub-majors 41-93) and the three sub-majors (11-13) contained in major category 1.

Of the skill-intensive sub-majors, *life science and health occupations* exhibited the largest emigration rates: On average 11.1% and 6.2% of developing countries' natives working in sub-majors 22 and 32 resided and worked in the OECD around 2000. Similarly high brain drain rates are obtained for *physical, mathematical and engineering science professionals*: On average, 10.5% of developing countries' natives working in sub-major 21 lived and worked in the OECD around 2000. By contrast, the average south-north migration rate of *teaching professionals* and *teaching associate professionals* were only 3.8% and 4.1% respectively. Somewhat larger mean emigration rates (5.9% and 5.5%) are obtained for *other professionals* and *other associate professionals* (sub-majors 24 and 34), comprising amongst others economists and lawyers. The use of the sign test statistic to test for distributional differences within ISCO-88 major 2 (*professionals*) confirms that the emigration rates of *physical, mathematical and engineering science professionals* and of *life science and health professionals* were higher than those of *teaching professionals* and *other professionals*.[31] In addition, emigration rates of *other professionals* were significantly larger compared to those of *teaching professionals* (at the 1-% level). In major category 3 (*technicians and associate professionals*), emigration rates of *other associate professionals* significantly exceeded the emigration rates of *physical and engineering science associate professionals* (at the 1-% level).

Motivated by the difficulties of recoding the ISCO-1968 minor to the ISCO-88 sub-major occupational categories[32] as well as by the similar occupational structures of ISCO-88 majors 2 and 3, I aggregated the eight ISCO-88 sub-major categories generally requiring tertiary education into four broad types of *(associate) professionals* in order to check the robustness of the above mentioned distributional differences. Table 7 contains the corresponding emigration rates. On average, 8.0% of the *life science and health (associate) professionals* and 6.8% of the *physical, mathematical and enigneering science (associate) professionals* born in one of the 17 considered developing countries worked in the OECD

[30] Observations with zero reported resident employment and positive migrant employment have been excluded for the summary statistics reported in table 8, because the resulting emigration rates of 100% are considered as distorting outliers. Most often, this concerned the armed forces, for which data on resident employment was missing or reported ambiguously.

[31] The hypothesis that the median of the differences in the distributions is zero can be rejected at the 1-% level.

[32] For a detailed description of the data preparation see the data appendix.

around 2000. The mean emigration rate of *other (associate) professionals* amounted to 5.3%, whereas only 2.8% of the *teaching (associate) professionals* from developing countries worked in the OECD. The application of sign tests to these four broad categories of *(associate) professionals* strenghtens the findings from above: The emigration rates of *teaching (associate) professionals* were significantly smaller than the emigration rates of all other types of *(associate) professionals* (at the 1-% level).

Table 7: Average values of south-north migration rates (%) for 17 developing countries in 2000 by aggregated ISCO-88 sub-major categories of professionals
Source: Author's tabulations using data from the DIOC and LABORSTA

Aggregated Categories of Professionals and Associate Professionals	**ISCO-88 Sub-Majors**	**Emigration Rate**
Physical, mathematical and engineering science (associate) professionals	21, 31	6.8
Life science and health (associate) professionals	22, 32	8.0
Teaching (associate) professionals	23, 33	2.8
Other (associate) professionals	24, 34	5.3

The observation of higher emigration rates for health professionals and engineers compared of teaching professionals is in line with the many studies focusing on these professionals. Due to different educational systems across countries and the importance of good proficiency of the host country's language in contact with pupils and administrations, skills of teachers are less easily applicable in foreign countries than skills related to the natural sciences. Therefore it is not surprising that a medical doctor or an engineer from a developing country more likely found a job as a doctor or engineer in the OECD than a teacher from a developing country found a corresponding position, and that south-north migrants studied more often natural sciences in the OECD rather than becoming a teacher.

Table 8 furthermore reveals high emigration rates (9.7% and 7.4% on average) for the sub-majors *corporate managers* and *general managers* (12 and 13), which can be considered to require relatively high education levels, too. Other occupational groups exhibiting high mean emigration rates (>5%) are *office clerks* and *customer service clerks*, *personal and protective services workers*, as well as *machine operators and assemblers* (sub-majors 41, 42, 51 and 82). In the case of *service workers* and *machine operators and assemblers* this observation might be triggered by a high degree of international transferability of (formal) skills acquired in the home countries, by a strong preference for these occupations by south-north migrants who got educated in the OECD, or by both considerations. Concerning the high emigration rates in the occupational categories of *clerks* and *managers* however, the driving force is likely to be a preference of south-north migrants for these occupations in the case when education or professional training was pursued in the OECD, since the occupational skills of the latter professions are often rather country-specific.

The lowest emigration rates (<2%) can be attributed to occupational categories related to agriculture, which are *market-oriented skilled agricultural and fishery workers*, *subsistence agricultural and fishery workers*, as well as *agricultural, fishery and related labourers*

(sub-majors 61, 62, and 92). This observation is not astonishing, because workers who cultivated land with probably dated machinery in developing countries are unlikely to work in the same occupations in the OECD.

When comparing the disaggregated resident employment shares in the developing countries of emigration to the employment shares in OECD countries using Kolmogorov-Smirnov tests, the finding from section 4.2 of significantly higher employment shares of *professionals* (major 2) and *clerks* (major 4) in OECD compared to developing countries is confirmed for all sub-categories except *teaching professionals*. Concerning the occupational category *technicians and associate professionals* (major 3), significantly higher employment shares of OECD compared to developing countries are obtained for *physical and engineering science associate professionals* and *other associate professionals*. Furthermore, employment shares of *corporate managers* and *personal and protective services workers* (sub-majors 12 and 51) were significantly smaller, and those of *models, salespersons and demonstrators*, of *other craft and related trades workers*, of *drivers and mobile-plant operators*, as well as of *agricultural, fishery and related labourers* (sub-majors 52, 74, 83, and 92) significantly larger in the migrant-sending compared to the receiving countries.[33]

Testing for distributional differences between resident and native employment shares in the most skill-intensive sub-major categories 21-24 and 31-34 yields that natives worked with a significantly higher probability (at the 1-% level) in sub-majors 21, 22, 24, and 34 compared to residents. In addition, the former worked significantly more often in sub-majors 41 and 42 compared to the latter.[34]

The distinction of eight different types of brain drain and human capital as well as the aggregation of these different types of *(associate) professionals* has revealed that *physical and engineering science (associate) professionals*, *life science and health (associate) professionals*, as well as *other (associate) professionals* exhibited significantly larger emigration rates compared to *teaching (associate) professionals*. This is in line with the considerations about the different degrees of international transferability of *professionals'* skills presented in section 3. Furthermore, the comparison of resident employment shares confirms the relatively small endowment with human capital in developing migrant-sending countries compared to OECD countries for all types of *professionals* except *teaching professionals*, for some *technicians and associate professionals*, as well as for *clerks*. Relating the average emigration rate of *life science and health professionals* to the respective native employment share yields the following numerical example of the medical brain drain: Whereas on average only 1.1% of the total native workforce being potentially available to the considered migrant-sending countries worked as *life science and health professionals*, around 11.1% of the latter worked in the OECD around 2000.

[33] Equality of distributions can be rejected at the 1-% level for sub-major categories 21, 22, 24, 41, 42, 74, 83, 92, at the 5-% level for sub-majors 31, 34, 51, 52, and at the 10-% level for category 12.

[34] The corresponding significance levels at which the null hypothesis of the sign tests can be rejected are the 1-% level (21, 22, 41), the 5-% level (24, 42), and the 10-% level (34).

Table 8: Average values of resident employment shares (%) of developing and OECD countries, native employment shares of developing countries (%), mean south-north migration rates (%) around 2000, by ISCO-88 sub-majors
Source: Author's tabulations using data from the DIOC and LABORSTA

ISCO-88 Sub-Major Occupational Category		**Employment Residents**	**Employment Natives**	**Employment OECD**	**Emigration Rate**	**# Dev. Countries**	**# OECD Countries**
Legislators and senior officials	(11)	0.3	0.3	0.3	3.8	17	24
Corporate managers	(12)	3.2	3.2	5.2	9.7	17	23
General managers	(13)	2.8	2.7	3.2	7.4	15	21
Physical, mathematical and engineering science professionals	(21)	1.7	1.8	2.8	10.5	17	25
Life science and health professionals	(22)	1.1	1.1	2.0	11.1	17	25
Teaching professionals	(23)	3.6	3.6	4.2	3.8	17	25
Other professionals	(24)	2.9	2.9	4.2	5.9	17	25
Physical and engineering science associate professionals	(31)	2.4	2.4	3.4	4.8	17	24
Life science and health associate professionals	(32)	2.1	2.1	2.4	6.2	16	25
Teaching associate professionals	(33)	1.0	0.9	1.3	4.1	16	22
Other associate professionals	(34)	4.3	4.4	7.5	5.5	17	25
Office clerks	(41)	4.6	4.6	8.8	5.0	17	25
Customer service clerks	(42)	1.2	1.2	2.3	7.6	16	23
Personal and protective services worker	(51)	6.6	6.6	8.5	5.7	17	25
Models, salespersons and demonstrators	(52)	7.1	7.0	5.4	2.6	17	25
Market-oriented skilled agricultural and fishery workers	(61)	10.6	10.4	6.4	1.6	17	24
Subsistence agricultural and fishery workers	(62)	12.7	12.7	0.4	0.0	6	4
Extraction and building trades workers	(71)	4.9	4.8	5.4	3.3	17	25
Metal, machinery and related trades workers	(72)	5.4	5.4	5.4	3.8	17	25
Precision, handicraft, printing and related trades workers	(73)	1.0	1.0	0.8	3.9	17	24
Other craft and related trades workers	(74)	4.0	3.9	2.3	2.5	16	24
Stationary-plant and related operators	(81)	1.2	1.2	1.0	4.2	17	24
Machine operators and assemblers	(82)	3.3	3.3	3.5	6.6	17	25
Drivers and mobile-plant operators	(83)	6.0	5.9	4.1	2.5	17	25
Sales and services elementary occupations	(91)	6.5	6.5	5.4	4.5	17	25
Agricultural, fishery and related labourers	(92)	3.3	3.2	0.4	1.8	16	19
Labourers in mining, construction, manufacturing and transport	(93)	4.6	4.6	3.2	4.5	17	23

5 Conclusion

This paper has introduced two new datasets of south-north migration rates at the level of the major and sub-major occupational categories of the ISCO-88 for cross-sections of, respectively, 91 and 17 developing countries around the year 2000. Most interestingly, these disaggregated data have allowed to study south-north migration for two broad and eight more specific types of brain drain.

The combination of the evidence on occupation-specific south-north migration with data on south-north migration by educational attainment, as well as with the distributional differences observed between foreign-born and native employees in the OECD has produced the following major insights:

The percentage of total south-north migrants with tertiary education exceeded the percentage of south-north migrants working in occupational categories generally requiring tertiary education. Furthermore, the shares of tertiary-educated south-north migrants working in occupational categories requiring less than tertiary education were significantly larger than the respective shares among tertiary-educated natives in the OECD. I considered these findings as indicators at the aggregate level for the fact that the skills and diplomas acquired by the most highly educated exhibit only imperfect international transferability, resulting in "overeducation" and "brain waste" from the perspective of the migrant-sending countries.

The mean value of aggregate south-north migration rates for occupations presupposing tertiary education was significantly larger compared to the mean rates for occupations requiring primary or secondary education. The incidence of south-north migration was highest for the occupational category of *professionals*, one of the two broad types of human capital which generally require tertiary education, as well as for *clerks* – presupposing secondary education – and *legislators, senior officials and managers*. Whereas developing countries situated in Latin America and the Caribbean and in East Asia and the Pacific exhibited the largest emigration rates for all occupational categories, sub-Saharan Africa experienced relatively strong brain drain around 2000.

At the more disaggregated level, the comparison of the distributions of south-north migrants and OECD natives in the most skill-intensive occupational category *professionals* has revealed that south-north migrants working as *professionals* were with a higher probability employed in the *physical, mathematical and engineering sciences* and in *life science and health professions*, and worked with a lower probability as *teaching professionals* compared to OECD natives. In line with these observations, *physical and engineering science (associate) professionals*, *life science and health (associate) professionals*, as well as *other (associate) professionals* have been found to exhibit significantly larger emigration rates than *teaching (associate) professionals*.

Worryingly from a development perspective, this migration took place against the

background of rather small shares accruing to almost all types of *professionals*, some *technicians and associate professionals*, to *clerks* and to *corporate managers* in the total employment of the developing sending countries around 2000. This has been revealed by the comparison of resident employment shares in developing sending and OECD receiving countries.

The critical discussion of the constructed occupation-specific 'emigration rates' has revealed the following: On the one hand, these rates constitute rather broad measures of the brain drain due to the ignorance of the country where south-north migrants acquired (higher) education and the occupation performed in the home country prior to emigration. Whereas the ignorance of the country where migrants pursued their studies impedes the assessment of whether south-north migrants working as *professionals* preferentially chose the relevant fields *ex ante* or *ex post* migration, it does not restrict the assertion about the different degrees of transferability of professional skills on theoretical grounds. On the other hand, the presented 'emigration rates' allow for both an inter-country and an inter-occupation comparison of the extent to which the most able left developing countries to work in the OECD until 2000. They constitute good measures of the occupation-specific diasporas in the OECD. Therefore, they can also be used to study the potential gain that might be exploited by the creation of further highly skilled diaspora networks, constituting another channel through which the brain drain might positively impact on the economic development of the migrant-sending countries. Furthermore, drawing on the educational qualification generally needed in the occupational categories for the definition of 'highly skilled' allows me to use employment data to measure the relevant populations in the migrant-sending countries. This is an advantage compared to conventional emigration rates, which rest upon educational attainment and therefore have to construct information on origin populations using several data sources due to restricted data availability. By construction, the presented occupation-based brain drain rates are lower than the conventional education-based counterparts, because the former already account for the fact that formal skills are not always transferable internationally.

In a companion paper, I approach the welfare implications of the brain drain: The cluster sample structure of the constructed occupation-specific south-north migration rates and employment shares in the developing migrant-sending countries allows me to employ the technique of fixed effects estimation in order to empirically test the hypothesis of "brain gain". This hypothesis predicts that the perspective of migration to high wage economies fosters human capital accumulation in developing sending countries (c.f. e.g. Mountford 1997, Stark et al. 1997, 1998). In addition, I assess the hypothesis whether there are stronger "brain gain" effects for *professionals* with internationally transferable skills compared to those with rather country-specific skills.

Data Appendix

Definition of *Developing Countries*

In 2000, the World Bank considered all countries with a GNI per capita $\leq$755 US$ (Atlas methodology) as "low-income" countries, and all countries with a GNI per capita between 756 and 9,265 US$ as "middle-income" countries, differentiating between "lower middle income" (756 up to 2,995 US$) and "upper middle income" (2,996 up to 9,265 US$) countries. Following this grouping, I consider all countries classified as low- or middle-income countries in 2000 as *developing countries*.

Developing Countries by World Regions

The considered developing countries have been grouped into six world regions according to the (developing) country groups defined by the World Bank. However, several countries that fell into the group of developing countries in 2000 as defined by the above income definition but that are not listed in the World Bank's current list of developing countries by region have been assigned by hand. The resulting grouping for the 91 countries included in the dataset at the ISCO-88 major level is the following:

East Asia and the Pacific (16):
Cambodia, China, Fiji, Indonesia, Kiribati, Laos, Malaysia, Marshall Islands, Mongolia, Palau, Papua New Guinea, Philippines, Samoa, Thailand, Tonga, Viet Nam.
Eastern Europe and Central Asia (21):
Armenia, Azerbaijan, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Hungary, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Former Yugoslav Republic of Macedonia, Republic of Moldova, Poland, Romania, Russian Federation, Serbia and Montenegro, Slovakia, Turkey, Ukraine.
Latin America and the Caribbean (27):
Antigua and Barbuda, Argentina, Belize, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guyana, Honduras, Jamaica, Mexico, Nicaragua, Panama, Peru, Puerto Rico, Saint Lucia, Suriname, Trinidad and Tobago, Uruguay, Venezuela.
Middle East and North Africa (11):
Algeria, Bahrain, Arab Republic of Egypt, Islamic Republic of Iran, Lebanon, Morocco, Oman, Occupied Palestinian Territory, Saudi Arabia, Syrian Arab Republic, Yemen.
Sub-Saharan Africa (11):
Botswana, Eritrea, Ethiopia, Lesotho, Madagascar, Mauritius, Namibia, South Africa, Uganda, United Republic of Tanzania, Zambia.
South Asia (5):
Bangladesh, Maldives, Nepal, Pakistan, Sri Lanka.

Employment Data for OECD Countries of Immigration from the DIOC

The Database on Immigrants in OECD Countries (DIOC) has been made available online in May 2008 and constitutes an extension of the OECD Database on Foreign-born and Expatriates, published in 2005. The latter was the first comprehensive database containing information on the educational attainment of the population of all OECD countries by place of birth and thus allowed an assessment of south-north and north-north migration by educational level. Yet, the DIOC provides supplementary information on several demographic and labour market characteristics of the native and – most interestingly for the assessment of the brain drain – of the foreign-born population in OECD countries around the year 2000: In addition to the place of birth and educational attainment, the database includes information on the age and gender, duration of stay, fields of study, as well as on labour market outcomes such as labor market status, sector of activity, and occupational category in separate datafiles. Data has mainly been collected from population censuses and population registers of the OECD member countries (OECD, 2008, 3).

Employed people working in the OECD around 2000 who are foreign-born are considered as immigrants, or respectively as emigrants when taking the perspective of the source countries. This definition thus abstracts from nationality and seems preferable to a nationality-based definition of immigrants, since the concept of nationality varies between countries (cf. OECD 2008, 56).

In sections 2-4, I make use of the broad educational categories reported in dataset D of the DIOC in order to distinguish primary-educated workers (ISCED-97 levels 0, *pre-primary education*, 1, *primary education or first stage of basic education*, and 2, *lower secondary or second stage of basic education*), secondary-educated workers (ISCED-97 levels 3, *secondary education*, and 4, *post-secondary non-tertiary education*), and tertiary-educated employees (ISCED-97 levels 5, *first stage of tertiary education*, and 6, *second stage of tertiary education*).

The DIOC records occupations of native and foreign-born employees according to the International Standard Classification of Occupations 1988 (ISCO-88) (ILO, 1990). In dataset D, which contains data on 463,758,788 employees at the sub-major (2-digit) level, occupations have been reported from 28 OECD countries, excluding Iceland and Korea, covering 39,911,124 immigrants (8.6% of total employees). At the minor (3-digit) level, comparable information on occupations is available from 22 OECD countries and for 33,583,212 foreign-born workers (dataset E). In addition to containing information from less OECD countries, the latter dataset does not provide educational attainments. Yet, this information is simultaneously available for occupations reported at the 2-digit level in dataset D. Therefore, the information from dataset D has been preferred for the calculation of the occupational emigration rates and for the summary statistics presented in sections 2 and 3.

For 8.1% of total foreign-borns in the OECD only the region but not the country of origin is reported, and for 1.1% of the foreign-borns information on occupational categories is missing in dataset D. These observations have not been further considered for the calculation of the emigration rates. Furthermore, for 9.4% of total foreign-borns, employment is only reported at the ISCO-88 major level in datafile D. This concerns e.g. all employment reported from Germany and Italy. When calculating the occupational emigration rates at the ISCO-88 sub-major level using the information from dataset D, the reported major occupational categories have been recoded as missing. Therefore, these migrants are still included in the total number of considered migrants. Comparable information at the ISCO-88 sub-major level is available for 150 developing countries around 2000.

For most OECD countries that did not report professions according to ISCO-88 but made use of national classification systems instead, dataset D of the DIOC already contains the information matched with ISCO-88 if the national classifications are close to it. However, for the U.S. and Japan, occupations are reported according to national classifications, and for Turkey according to ISCO-68, a former version of ISCO-88.

Concerning the U.S. employment data, I have matched the occupational categories from the U.S. census reported in datafile E to the ISCO-88 unit groups based on a table of translation between US OCC 2000 and ISCO-88 by Elliott and Gerova (2006). I then have aggregated the recoded U.S. employment data over the corresponding ISCO-88 sub-major categories and used the resulting data to replace the U.S. employment data in dataset D. In doing so, I miss information on 1% of the U.S. employees reported in dataset D. However, the resulting data are of better quality than could be obtained by establishing a recoding scheme of the broad U.S. OCC 2000 major groups reported in datafile D to the ISCO-88 sub-major groups. Somewhat more inconvenient however is the fact that due to this data substitution, I cannot include information on U.S. employment in section 3.2, because information on educational attainment is not simultaneously available with the occupational employment data in datafile E.

Since the reported categories from the Japan Standard Classification of Occupations (JSOC) are very broad, they cannot be appropriately matched to the ISCO-88 sub-major groups. Most impedimental is the fact that the Japanese occupational category *professionals and technical workers* does not allow for a distinction between occupations that are included in the ISCO-88 majors 2 (*professionals*) and 3 (*technicians and associate professionals*), thus preventing an appropriate matching even at the 1-digit level (cf. OECD 2008, Annex A). Since these two ISCO-88 major categories are at the focus of this paper, I prefer to exclude foreign-born employees working in Japan, accounting for 1.7% of foreign-born employees in the OECD around 2000. The resulting dataset contains information on native and foreign-born workers in 26 OECD countries.[35]

[35] Note that no information about the country of origin is available for foreign-born employees in Norway.

The 83 occupational categories reported at the ISCO-68 minor (2-digit) level have been matched to the 28 ISCO-88 sub-major (2-digit) groups drawing on the table of correspondence between the ISCO-68 occupational (5-digit) categories and the ISCO-88 unit (4-digit) groups provided in ILO (1990): Each ISCO-68 minor category has been assigned to the ISCO-88 sub-major that appears most frequently among the ISCO-88 4-digit categories corresponding to the 5-digit categories of the considered ISCO-68 minor category. Table 12 provides the resulting recoding.

While this method results in an unambiguous match for 13 ISCO-68 minor groups, the mode of the possible ISCO-88 sub-majors is taken for the recoding of all other minors.[36] In nearly all of these cases of multiple matches, the mode is with a relative frequency of at least 50% very prominent.[37] This can be cosidered to weaken the ambiguity of these mappings to some extent. When working with data aggregated over ISCO-88 major occupational categories, the ambibuity can be relaxed even further, because multiple matches in terms of the aggregated major categories are seldom. In addition, they mostly concern ISCO-88 major categories related to the same broad ISCED-76 educational categories, such as e.g. majors 2/3 or 7/8. The skill-intensive majors 2 and 3 exhibit similar structures concerning the included disaggregated occupational categories. In sections 3.3 and 4.3, this similarity is exploited for robustness checks by combining sub-majors 21+31, 22+32, 23+33, and 24+34. Concerning the recoding of ISCO-68 minor categories 16, 33, 40, and 94, the relative frequencies of the mode are much less distinguished. Yet inspecting the ISCO-88 sub-majors with the second highest relative frequencies yields that these ambiguities are weakened, too, when considering data aggregated over ISCO-88 major categories.

The resulting recoding does not provide matchings for ISCO-88 sub-majors 32, 33, 42, 62, and 92. This does not imply that the considered occupational categories do not exist under ISCO-68, but is rather due to the fact that for these specific occupational groups, ISCO-88 provides more detailed 2-digit categories than ISCO-68 – even though the total number of 2-digit categories of ISCO-68 exceeds the one of ISCO-88.

In order to assess the quality of the presented recoding, table 9 depicts the occupational distribution of total employment in Turkey at the ISCO-88 major level for 2000 and 2001. For 2000, the employment data from the DIOC has been recoded according to the described method and then aggregated over ISCO-88 major categories, whereas the employment data for 2001, already coded at the ISCO-88 major level, have been taken from LABORSTA. Comparing these employment distributions, only small differences (< 1.5) are observed for the most skill-intensive majors 2 and 3, as well as for majors 4 and 8. However, there seems to be a recoding bias from major 3 to 2, because the employment share of *professionals* is

[36] Considering the mode as an adequate selection criterion, I implicitly assume that there is no imbalance of the total number of sub-categories assigned to the aggregate occupational groups by ISCO-88.

[37] The distributions of the ISCO-68 minor groups over ISCO-88 sub-major categories can be obtained from the author upon request.

higher and the one of *technicians and associate professionals* smaller for the recoded data compared to the data originally reported at ISCO-88. The differences in the occupational employment shares are more striking for majors 5-7, and 9, generally requiring secondary and primary education respectively, as well as for major category 1. The recoded data suggest that in 2000 a larger proportion of the employed Turkish population worked as *skilled agricultural and fishery workers*, and smaller proportions as *service workers, shop and market sales workers*, as *craft and related trades workers*, in *elementary occupations*, and as *legislators, senior officials and managers* compared to 2001. I suppose that these differences mainly constitute a bias caused by the proposed recoding.

Table 9: Distribution of total employment in Turkey over ISCO-88 major categories (%)
Source: Author's tabulations with data from the DIOC (2000) and LABORSTA (2001)

ISCO-88 Major Occupational Category		**2000**	**2001**
Legislators, senior officials and managers	(1)	5.3	8.0
Professionals	(2)	7.2	5.7
Technicians and associate professionals	(3)	3.7	4.9
Clerks	(4)	4.9	4.4
Service workers, shop and market sales workers	(5)	6.3	9.0
Skilled agricultural and fishery workers	(6)	47.9	36.1
Craft and related trades workers	(7)	12.9	15.3
Plant and machine operators and assemblers	(8)	7.5	8.0
Elementary occupations	(9)	4.3	8.5

Employment Data for Developing Countries of Emigration from LABORSTA

The data on employment in the migrant-sending countries that has been used to calculate the south-north migration rates as well as the resident and native employment shares for the countries of emigration have been taken from LABORSTA, the main ILO database on labour statistics. Employment by detailed occupational categories is available at the major and sub-major level of ISCO-88. Contrasting the DIOC, these data do not simultaneously provide information on the education attainments of the employees.

Employment data at the ISCO-88 major level is available from the file "Total employment, by occupation" (Main statistics, annual, 2C). I considered data from the period 1995-2005 in order to maximize observations. The exact years from which data have been considered for each of the 91 developing countries are reported in table 13. At the ISCO-88 sub-major level, data have been taken from the file "Employment for detailed occupational groups by sex" (SEGREGAT) and the period 1996-2001. However, for 13 of the considered 17 developing countries, data stem from 2000.

The considered samples of 91 and respectively 17 developing migrant-sending countries have resulted from the following order of priority: If available, data classified according to ISCO-88 have been preferred to data coded at ISCO-68. For those countries, for which data are only available at ISCO-68, the occupational categories have been recoded to

match ISCO-88 according to the above described mechanism. At the sub-major level, only the employment data for Colombia have been recoded, whereas at the major level, employment data of 21 developing sending countries have been recoded (cf. tables 13, 14). Table 10 provides the mode-based translation between the major groups of ISCO-68 and -88. An unambiguous match in terms of all involved sub-categories (the relative frequency of the mode is 100%) is obtained for administrative and managerial workers (major 2 and respectively 1 of ISCO-68 and -88). For all other ISCO-68 major groups, the relative frequencies of the mode exceed 50%. Problematic however is the fact that in these cases there are even multiple matches in terms of aggregate ISCED-76 education levels: E.g., whereas in the case of ISCO-68 minor 3 (clerical and related workers) the mode ISCO-88 major category 4 is appropriate in 64.7% of the involved ISCO-68 5-digit categories, further 25.1% of the involved 5-digit categories should be rather attributed to ISCO-88 major 3 at the aggregate level. In addition, no satisfying recoding is obtained for the most skill-intensive occupational categories. Therefore, the only reasonable way to assess the robustness of the stylized facts derived from the originally coded and the recoded employment data at the major level consists in the exclusion of the recoded data.

If data are available from several sources or cover different worker populations, data from labour force surveys and data covering total employment have been preferred.

Similarly as for the migrant data, observations with missing occupational categories have been excluded and reported sub-major categories that turned out to be major categories have been recoded as missing. For some countries, employment is classified at the ISCO-88 minor level and had to be transferred to the sub-major categories.

Whereas data on employment in the Republic of Korea is available, it has not been further considered, since the data on employees in the OECD that were born in the Republic of Korea is not utilizable due to the fact that for several individuals it is unclear whether they were born in North or South Korea.

Table 10: Major groups of ISCO-68 and ISCO-88. *Own mapping, drawing on ILO (1990)*

ISCO-68	**ISCO-68**	**ISCO-88**
Occupation Description	**Major**	**Major**
Professional, technical and related workers	0/1	2
Administrative and managerial workers	2	1
Clerical and related workers	3	4
Sales workers	4	3
Service workers	5	5
Agriculture, animal husbandry and forestry workers, fishermen and hunters	6	6
Production and related workers, transport and equipment operators and labourers	7/8/9	7

Tables 13 and 14 present aggregate data on resident and migrant employees for the considered developing countries. In addition, they include the number of ISCO-88 major and respectively sub-major categories for which occupational emigration rates are calculated, as well as some further information about the considered data.

The International Standard Classification of Occupations 1988: ISCO-88

The International Standard Classification of Occupations 1988 (ISCO-88) is a revised version of the International Standard Classifications of Occupations 1968, the successor of ISCO 1958, and was endorsed by the fourteenth International Conference of Labour Statistics (ICLS) (Hoffmann, 2003, 2.).

ISCO-88 is based on the two concepts *job* and *skill* (ILO, 1990, 2-4). A *job*, consisting of a set of tasks and duties executed, is the statistical unit of the classification. A set of similar jobs constitutes an *occupation*. The concept of *skill*, considered as the ability to carry out the tasks and duties of a job and comprising the dimensions *skill level* and *skill specialization*, is used to further delineate and aggregate occupational groups:

Occupational categories are grouped into four broad *skill levels*, reflecting information about the complexity and the range of tasks and duties (with priority on complexity over range), with reference to the educational categories and levels of the International Standard Classification of Education (ISCED-76) by UNESCO. These four skill levels have already been introduced in section 3.

The second dimension of skill, *skill specialization*, defined by the field of knowledge required, the materials and machinery worked with, and the type of goods and services produced, is used for the successive disaggregation of the occupational groups. By this means, the ISCO-88 distinguishes 10 broad occupational groups (majors), which can be further broken down into 28 sub-major, 116 minor, and 390 unit groups. Even the finest categories often consist of more than one occupation. Two rules apply to the classification of jobs with a broad range of tasks and duties (ILO, 1990, 8-9): If the tasks and duties concern different stages of the production and distribution process, the tasks and duties related to the production process should be given priority over associated ones. Furthermore, if the involved tasks and duties require skills that are acquired by different levels of training and experience, priority should be on those tasks and duties requiring the highest level of skills. Since the number and delineation between occupations will depend on the size of an economy, its level of economic development etc., no detailed descriptions of the occupations at the level of the unit groups are provided for ISCO-88 (ILO, 1990, 4).

Concerning the appropriateness of cross-country comparisons of occupational data, according to Elias (1997, 15-17) the reliability of such comparisons can be improved by aggregating data, whereby the sub-major level represents a useful level of aggregation. This notwithstanding, Elias stresses that misinterpretation of the international standard within the national context is a major problem in this context.

A list of the major and sub-major occupational categories of the ISCO-88 is provided in table 11.

Table 11: International Standard Classification of Occupations (ISCO-88): Major and sub-major groups
Source: ILO (1990)

ISCO-88 Major and Sub-Major	**ISCO-88** Occupation Description
0	**Armed forces**
01	Armed forces
1	**Legislators, senior officials and managers**
11	Legislators and senior officials
12	Corporate managers
13	General managers
2	**Professionals**
21	Physical, mathematical and engineering science professionals
22	Life science and health professionals
23	Teaching professionals
24	Other professionals
3	**Technicians and associate professionals**
31	Physical and engineering science associate professionals
32	Life science and health associate professionals
33	Teaching associate professionals
34	Other associate professionals
4	**Clerks**
41	Office clerks
42	Customer services clerks
5	**Service workers and shop and market sales workers**
51	Personal and protective services workers
52	Models, salespersons and demonstrators
6	**Skilled agricultural and fishery workers**
61	Market-oriented skilled agricultural and fishery workers
62	Subsistence agricultural and fishery workers
7	**Craft and related trades workers**
71	Extraction and building trades workers
72	Metal, machinery and related trades workers
73	Precision, handicraft, printing and related trades workers
74	Other craft and related trades workers
8	**Plant and machine operators and assemblers**
81	Stationary-plant and related operators
82	Machine operators and assemblers
83	Drivers and mobile-plant operators
9	**Elementary occupations**
91	Sales and services elementary occupations
92	Agricultural, fishery and related labourers
93	Labourers in mining, construction, manufacturing and transport

Table 12: ISCO-68 minor and ISCO-88 sub-major groups
Source: Own mapping, drawing on ILO (1990)

ISCO-68 Occupation Description	**ISCO-68 Minor**	**ISCO-88 Sub-Major**
Professional, Technical and Related Workers	01	21
Architects, Engineers and Related Technicians	02-03	21
Aircraft and Ships' Officers	04	31
Life Scientists and Related Technicians	05	22
Medical, Dental, Veterinary and Related Workers	06-07	22
Statisticians, Mathematicians, Systems Analysts and Related Technicians	08	21
Economists	09	24
Accountants	11	24
Jurists	12	24
Teachers	13	23
Workers in Religion	14	24
Authors, Journalists and Related Writers	15	24
Sculptors, Painters, Photographers and Related Creative Artists	16	34
Composers and Performing Artists	17	24
Athletes, Sportsmen and Related Workers	18	34
Professional, Technical and Related Workers Not Elsewhere Classified	19	24
Legislative Officials and Government Administrators	20	11
Managers	21	12
Clerical Supervisors	30	41
Government Executive Officials	31	34
Stenographers, Typists and Card- and Tape-Punching Machine Operators	32	41
Bookkeepers, Cashiers and Related Workers	33	41
Computing Machine Operators	34	41
Transport and Communications Supervisors	35	41
Transport Conductors	36	51
Mail Distribution Clerks	37	91
Telephone and Telegraph Operators	38	31
Clerical and Related Workers Not Elsewhere Classified	39	41
Managers (Wholesale and Retail Trade)	40	12
Working Proprietors (Wholesale and Retail Trade)	41	13
Sales Supervisors and Buyers	42	34
Technical Salesmen, Commercial Travellers and Manufacturers' Agents	43	34
Insurance, Real Estate, Securities and Business Services Salesmen and Auctioneers	44	34
Salesmen, Shop Assistants and Related Workers	45	52
Sales Workers Not Elsewhere Classified	49	91
Managers (Catering and Lodging Services)	50	13
Working Proprietors (Catering and Lodging Services)	51	13
Housekeeping and Related Service Supervisors	52	51
Cooks, Waiters, Bartenders and Relaters Workers	53	51
Maids and Related Housekeeping Service Workers Not Elsewhere Classified	54	51
Building Caretakers, Charworkers, Cleaners and Related Workers	55	91
Launderers, Dry-Cleaners and Pressers	56	82
Hairdressers, Barbers, Beauticians and Related Workers	57	51
Protective Service Workers	58	51
Service Workers Not Elsewhere Classified	59	51
Farm Managers and Supervisors	60	13
Farmers	61	61
Agricultural and Animal Husbandry Workers	62	61
Forestry Workers	63	61
Fishermen, Hunters and Related Workers	64	61
Production Supervisors and General Foremen	70	82
Miners, Quarrymen, Well Drillers and Related Workers	71	81
Metal Processers	72	81

Continuation on the next page

Table 12 *continued*

ISCO-68 Occupation Description	**ISCO-68 Minor**	**ISCO-88 Sub-Major**
Wood Preparation Workers and Paper Makers	73	81
Chemical Processers and Related Workers	74	81
Spinners, Weavers, Knitters, Dyers and Related Workers	75	82
Tanners, Fellmongers and Pelt Dressers	76	74
Food and Beverage Processers	77	82
Tobacco Preparers and Tobacco Product Makers	78	74
Tailors, Dressmakers, Sewers, Upholsterers and Related Workers	79	74
Shoemakers and Leather Goods Makers	80	74
Cabinetmakers and Related Woodworkers	81	74
Stone Cutters and Carvers	82	71
Blacksmiths, Toolmakers and Machine-Tool Operators	83	72
Machinery Fitters, Machine Assemblers and Precision Instrument Makers (except Electrical)	84	72
Electrical Fitters and Related Electrical and Electronics Workers	85	72
Broadcasting Station and Sound Equipment Operators and Cinema Projectionists	86	31
Plumbers, Welders, Sheet Metal and Structural Metal Preparers and Erectors	87	72
Jewellery and Precious Metal Workers	88	73
Glass Formers, Potters and Related Workers	89	73
Rubber and Plastics Product Makers	90	82
Paper and Paperboard Products Makers	91	82
Printers and Related Workers	92	73
Painters	93	71
Production and Related Workers Not Elsewhere Classified	94	73
Bricklayers, Carpenters and Other Construction Workers	95	71
Stationary Engine and Related Equipment Operators	96	81
Material-Handling and Rel. Equipment Operators, Dockers and Freight Handlers	97	83
Transport Equipment Operators	98	83
Labourers Not Elsewhere Classified	99	93

Note that the recoding of ISCO-68 minor categories 30 and 70 is self-contained, because these occupations are not included in the considered table of correspondence from ILO (1990).

Table 13: Description of the data at the ISCO-88 major level
Source: Author's tabulations using data from the DIOC and LABORSTA

Country	Residents	S-N Migrants	Emigration Rate (%)	# ISCO Majors	Years Residents	Original Class. Residents	Source Residents
East Asia and the Pacific (16)							
Cambodia	5,275,176	128,120	2.4	10	2000	ISCO-88	Labour force survey
China	668306176	964,159	0.1	4	2005	ISCO-88	Official estimates
Fiji	217,178	74,682	25.6	9	1996	ISCO-88	Population census
Indonesia	90,412,000	109,271	0.1	7	2001	ISCO-1968	Labour force survey
Kiribati	9,200	310	3.3	7	2000	ISCO-1968	Population census
Laos	2,144,951	149,988	6.5	9	1995	ISCO-88	Population census
Malaysia	9,357,000	129,264	1.4	9	2001	ISCO-88	Labour force survey
Marshall Islands	9,928	14	0.1	7	1999	ISCO-1968	Population census
Mongolia	779,100	1,083	0.1	10	2000	ISCO-88	Population census
Palau	9,383	54	0.6	7	2000	ISCO-1968	Population census
Papua New Guinea	2,344,734	15,071	0.6	10	2000	ISCO-88	Population census
Philippines	29,020,750	1,241,153	4.1	9	2001	ISCO-88	Labour force survey
Samoa	50,325	33,806	40.2	10	2001	ISCO-88	Population census
Thailand	33,469,400	133,534	0.4	9	2001	ISCO-88	Labour force survey
Tonga	34,570	19,729	36.3	10	2003	ISCO-88	Labour force survey
Viet Nam	37,913,748	812,768	2.1	9	2000	ISCO-88	Labour force survey
Eastern Europe and Central Asia (21)							
Armenia	840,730	37,136	4.2	10	2001	ISCO-88	Population census
Azerbaijan	3,377,800	14,190	0.4	9	2003	ISCO-88	Labour force survey
Bulgaria	2,581,582	318,214	11.0	10	2001	ISCO-88	Population census
Croatia	1,552,000	195,497	11.2	10	2000	ISCO-88	Labour force survey
Czech Republic	4,730,000	94,967	2.0	10	2000	ISCO-88	Labour force survey
Estonia	571,000	8,407	1.5	9	2000	ISCO-88	Labour force survey
Georgia	1,813,500	39,483	2.1	10	2000	ISCO-88	Labour force survey
Hungary	3,849,100	113,819	2.9	10	2000	ISCO-88	Labour force survey
Kazakhstan	6,680,000	191,037	2.8	9	2001	ISCO-88	Labour force survey
Kyrgyzstan	1,850,101	14,894	0.8	9	2002	ISCO-88	Labour force survey
Latvia	939,700	18,962	2.0	9	2000	ISCO-88	Labour force survey
Lithuania	1,397,900	32,176	2.2	10	2000	ISCO-88	Labour force survey
Macedonia	561,341	79,294	12.4	10	2002	ISCO-88	Labour force survey
Moldova	1,514,600	23,494	1.5	10	2000	ISCO-88	Labour force survey
Poland	14,527,000	982,918	6.3	10	2000	ISCO-88	Labour force survey
Romania	10,763,300	476,199	4.2	8	2000	ISCO-88	Labour force survey
Russian Federation	65,069,000	668,469	1.0	9	2000	ISCO-88	Labour force survey

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Table 13 *continued*

Country	Residents	S-N Migrants	Emigration Rate (%)	# ISCO Majors	Years Residents	Original Class. Residents	Source Residents
Serbia and Montenegro	3,092,506	271,980	8.1	10	2003	ISCO-88	Labour force survey (Serbia) Population census (Montenegro)
Slovakia	2,101,500	152,762	6.8	9	2000	ISCO-88	Labour force survey
Turkey	21,525,000	811,939	3.6	9	2001	ISCO-88	Labour force survey
Ukraine	20,175,000	246,208	1.2	9	2000	ISCO-88	Labour force survey
Latin America and the Caribbean (27)							
Antigua and Barbuda	36,233	15,835	30.4	10	2001	ISCO-88	Population census
Argentina	8,192,028	177,061	2.1	10	2000	ISCO-88	Labour force survey
Belize	77,755	26,767	25.6	9	1999	ISCO-88	Labour force survey
Bolivia	2,096,000	44,414	2.1	10	2000	ISCO-88	Labour force survey
Brazil	64,678,400	347,133	0.5	10	2000	ISCO-88	Population census
Chile	4,693,899	116,573	2.4	10	2002	ISCO-88	Population census
Colombia	15,585,537	389,114	2.4	6	2001	ISCO-88	Labour force survey
Costa Rica	1,312,280	44,949	3.3	9	2000	ISCO-88	Labour force survey
Cuba	4,379,274	442,213	9.2	3	2000	ISCO-1968	Labour force survey
Dominica	25,096	15,054	37.5	9	2001	ISCO-88	Population census
Dominican Republic	3,000,200	338,622	10.1	9	2000	ISCO-88	Labour force survey
Ecuador	3,376,122	307,832	8.4	10	2000	ISCO-88	Labour force survey
El Salvador	2,192,657	492,922	18.4	9	2000	ISCO-88	Labour force survey
Grenada	33,068	27,582	45.5	9	1998	ISCO-88	Labour force survey
Guyana	232,409	193,661	45.5	10	2002	ISCO-88	Population census
Honduras	2,334,391	157,152	6.3	7	2001	ISCO-1968	Labour force survey
Jamaica	934,800	491,366	34.5	6	2000	ISCO-88	Labour force survey
Mexico	38,034,400	4,514,403	10.6	10	2000	ISCO-88	Labour force survey
Nicaragua	1,916,345	127,046	6.2	10	2003	ISCO-88	Labour force survey
Panama	984,144	85,114	8.0	9	2001	ISCO-88	Labour force survey
Peru	7,128,375	251,713	3.4	10	2000	ISCO-88	Labour force survey
Puerto Rico	1,162,000	595,463	33.9	9	2000	ISCO-88	Labour force survey
Saint Lucia	62,425	14,572	18.9	9	2000	ISCO-88	Labour force survey
Suriname	156,705	593	0.4	10	2004	ISCO-88	Population census
Trinidad and Tobago	502,800	177,380	26.1	8	2000	ISCO-88	Labour force survey
Uruguay	1,067,600	43,774	3.9	10	2000	ISCO-88	Labour force survey
Venezuela	8,924,710	130,970	1.4	7	2000	ISCO-1968	Labour force survey
Middle East and North Africa (11)							
Algeria	6,229,412	536,052	7.9	10	2001	ISCO-88	Labour force survey

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Table 13 *continued*

Country	Residents	S-N Migrants	Emigration Rate (%)	# ISCO Majors	Years Residents	Original Class. Residents	Source Residents
Bahrain	286,780	3,095	1.1	8	2001	ISCO-88	Population census
Arab Republic of Egypt	17,203,300	160,847	0.9	9	2000	ISCO-88	Labour force survey
Islamic Republic of Iran	14,571,572	299,872	2.0	9	1996	ISCO-88	Population census
Lebanon	1,107,958	163,751	12.9	10	2004	ISCO-88	Household survey
Morocco	9,818,987	644,794	6.2	9	2004	ISCO-88	Labour force survey
Oman	280,462	410	0.1	9	2000	ISCO-88	Labour force survey
Palestinian Territory (occupied)	596,756	5,922	1.0	9	2000	ISCO-88	Labour force survey
Saudi Arabia	5,710,931	12,083	0.2	7	2000	ISCO-1968	Labour force survey
Syrian Arab Republic	4,723,000	59,045	1.2	3	2001	ISCO-1968	Labour force survey
Yemen	3,620,154	15,141	0.4	10	1999	ISCO-88	Labour force survey
Sub-Saharan Africa (11)							
Botswana	466,695	921	0.2	9	2000	ISCO-88	Labour force survey
Eritrea	57,205	25,904	31.2	9	1996	ISCO-88	Labour-rel. establ. survey
Ethiopia	24,851,416	73,308	0.3	9	1999	ISCO-88	Labour force survey
Lesotho	617,235	331	0.1	9	1999	ISCO-88	Labour force survey
Madagascar	9,570,397	40,942	0.4	10	2005	ISCO-88	Household survey
Mauritius	465,570	52,526	10.1	9	2000	ISCO-88	Population census
Namibia	428,981	1,384	0.3	10	2000	ISCO-88	Labour force survey
South Africa	12,179,000	230,300	1.9	9	2000	ISCO-88	Labour force survey
Tanzania, United Republic of	16,914,806	45,056	0.3	9	2001	ISCO-88	Labour force survey
Uganda	9,259,800	54,478	0.6	9	2003	ISCO-88	Labour force survey
Zambia	2,692,376	20,427	0.8	7	2000	ISCO-1968	Population census
South Asia (5)							
Bangladesh	44,323,000	131,631	0.3	6	2003	ISCO-88	Labour force survey
Maldives	71,700	35	0.0	10	2000	ISCO-88	Population census
Nepal	9,891,838	15,606	0.2	9	2001	ISCO-88	Population census
Pakistan	37,481,000	312,970	0.8	9	2001	ISCO-88	Labour force survey
Sri Lanka	6,452,013	176,223	2.7	9	2002	ISCO-88	Labour force survey

Coverage of workers is total employment for all countries except Eritrea (All persons engaged).

Employment data reported without the information on occupational categories have been disregarded.

Ambiguous occupational codings have have been recoded as missing.

The total population of 90 of the considered 91 developing countries (excluding Palau) amounted to 3.4 billion people in 2000. This corresponds to circa 67% of the total population living in the 150 low- or middle-income countries for which data are available from the WDI in 2000.

The average GDP per capita in PPP available for 88 of the 91 developing countries was 6118 constant 2005 international $ in 2000 (data is missing for Cuba, Palau, and Puerto Rico). This exceeds the average GDP per capita in PPP in the 142 developing countries for which data is available from the WDI, amounting to 5043 constant 2005 international $ in 2000.

Table 14: Description of the data at the ISCO-88 sub-major level
Source: Author's tabulations using data from the DIOC and LABORSTA

Country	Residents	S-N Migrants	Emigration Rate (%)	# ISCO Sub-Majors	Year Residents	Original Class. Residents	Source Residents
East Asia and the Pacific (2)							
Mongolia	752,299	1,083	0.1	25	2000	ISCO-88	Population census
Thailand	33,027,200	133,534	0.4	28	2000	ISCO-88	Labour force survey
Eastern Europe and Central Asia (9)							
Bulgaria	2,863,809	318,214	10.0	26	2000	ISCO-88	Labour force survey
Czech Republic	4,670,181	94,967	2.0	27	2000	ISCO-88	Labour force survey
Estonia	604,406	8,407	1.4	26	2000	ISCO-88	Labour force survey
Hungary	3,805,976	113,819	2.9	26	2000	ISCO-88	Labour force survey
Latvia	968,095	18,962	1.9	26	2000	ISCO-88	Labour force survey
Lithuania	1,524,657	32,176	2.1	26	2000	ISCO-88	Labour force survey
Poland	14,455,840	982,918	6.4	26	2000	ISCO-88	Labour force survey
Slovakia	2,082,780	152,762	6.8	26	2000	ISCO-88	Labour force survey
Ukraine	20,191,500	246,208	1.2	26	2000	ISCO-88	Labour force survey
Latin America and the Caribbean (2)							
Colombia	17,231,066	389,114	2.2	22	2001	ISCO-1968	Labour force survey
Ecuador	5,526,205	307,832	5.3	28	2000	ISCO-88	Labour force survey
South Asia (1)							
Pakistan	22,443,546	312,970	1.4	27	1998	ISCO-88	Population census
Middle East and North Africa (1)							
Islamic Republic of Iran	13,328,872	299,872	2.2	27	1996	ISCO-88	Population census
Sub-Saharan Africa (2)							
Mauritius	465,400	52,526	10.1	25	2000	ISCO-88	Population census
Seychelles	30,969	3,545	10.3	28	1997	ISCO-88	Population census

Coverage of workers is total employment for all countries except Ecuador (economically active population).
Employment data reported without the information on occupational categories have been disregarded.
Employment data reported only with information on ISCO-88 major occupational categories have not been disregarded; the occupational codes have simply been recoded as missing.
The total population of the considered 17 developing countries amounted to 449 million people in 2000. This corresponds to 8.8% of the total population living in developing countries in 2000.
The average GDP per capita in PPP of the considered 17 developing countries was 8641 constant 2005 international $.

Data Sources

Country groups by region

The World Bank, Data & Statistics

URL: *http://go.worldbank.org/D7SN0B8YU0 [visited on 11-17-2008].*

Database on Immigrants in OECD Countries (DIOC)

OECD (2008a)

URL: *http://www.oecd.org/document/51/0,3343,en_2649_33931_40644339_1_1_1_1,00.html [visited on 11-05-2008].*

Employment for detailed occupational groups by sex (SEGREGAT)

Total employment, by occupation (Main statistics, annual, 2C)

ILO, LABORSTA Internet

URL: *http://laborsta.ilo.org/ [visited on 10-15-2009].*

Expatriation rates by country of birth for nurses and doctors, circa 2000

OECD (2008b)

URL: *http://www.oecd.org/statisticsdata/0,3381,en_2649_33931_1_119656_1_1_1,00.html [visited on 11-05-2008].*

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URL: *http://perso.uclouvain.be/frederic.docquier/oxlight.htm [visited on 11-15-2008].*

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World Bank GNI per capita Operational Guidelines & Analytical Classifications (low, lower middle, upper middle, and high income countries in 2000)

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