

A Gendered Assessment of Highly Skilled Emigration

Frédéric Docquier^a, B. Lindsay Lowell^b and Abdeslam Marfouk^c

^a National Fund for Scientific Research and IRES, Université Catholique de Louvain

^b ISIM, Georgetown University

^c University Libre de Bruxelles

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Abstract

Although women's mobility accounts for a large and increasing proportion of international migration, it has generally been overlooked in the literature. Quantifying and characterizing female migration is clearly a first step on the path to a better understanding of the forces that shape the international migration of people. In this paper, we build an original data set providing gender-disaggregated indicators of international migration by educational attainment for 195 source countries in 1990 and 2000. The findings show that women represent an increasing share of the OECD immigration stock and exhibit relatively higher skilled emigration rates than men. The gender gap in high-skill migration is strongly correlated with the gender gap in educational attainment at origin.

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1 Introduction

International migration is a diverse phenomenon and its impact on source and destination countries has attracted increased attention of policymakers, scientists and international agencies. Understanding and measuring the consequences for migrants, host countries' residents and those left behind is a major and difficult task. In particular, the impact of the high-skill migration on sending countries results from a complex combination of direct and feedback effects which are extremely difficult to quantify. Due to the lack of harmonized data, the literature on the consequences of high-skill emigration has, until recently, remained essentially theoretical¹. New data sets have been developed to assess the magnitude of the phenomenon. In particular, Docquier and Marfouk (2006)² provided estimates of emigration stocks and rates by educational attainment for 195 source countries in 2000 and 174 countries in 1990. This data set gave rise to a couple of extensions as well as to a number of empirical studies on the determinants and consequences of high-skill emigration³.

One important extension which has been relatively disregarded in the literature concerns the gender dimension of international migration. Whilst a considerable strand of literature has focused attention on male migration, less research has addressed the issue of female migration⁴. Women have long been viewed as dependents, moving as wives, mothers or daughters of male migrants. This is ironic since the share of women in international migration increased over the last decades. According to the United Nations, this share increased from 46.8 to 49.6 percent between 1960 and 2005. Today, female migrants exceeds males in migration flows to developed regions (their share in flows increased from 48.9 to 52.2 percent on the same period)⁵. Intuitively, this results from many factors such as the rise in women's educational attainment, the increased demand for women's labor in health care sectors and other services, or cultural and social changes in the attitude towards female migration in many source countries. In 2004, 26.8 percent of women who received US employment-based visas were principal visa holders while 34,7% percent of men who received employment-based visas were dependents. Although family reunion programs admit many women in destination countries, women cannot be only considered as passive companion migrants (Pearce, 2006).

The increasing participation of women in international migration raises specific

¹See Commander et al. (2004) or Docquier and Rapoport (2007) for literature surveys.

²Henceforth, DM06.

³See Docquier et al. (2007), Beine et al. (2008), Cecchi et al. (2007), Krueger and Rapoport (2006), Nimii and Ozden (2006), Javorcik et al. (2006), Grogger and Hanson (2008), Easterly and Nyarko (2005), etc.

⁴Although the "non-economic" literature on the migration of women (mainly based on case studies) has increased since the early nineties. See among others Buys (1993), Hongagneu-Sotelo (1994), United Nations (1994), Zlotnik (1997), Sweetman (1998), Cerrutti and Massey (2001) or Morrison et al. (2007).

⁵In developing countries, the share of women has been relatively stable over time.

economic issues related to the gendered determinants and consequences of migration. In particular, the emigration of educated women is likely to affect sending countries in a very peculiar way:

- First, the recent study of Beine et al (2008) analyzes the impact of skilled emigration on human capital formation in developing countries. It shows that origin countries may experience a "beneficial brain drain" or "brain gain" at low levels of emigration rates, due to the positive impact of skilled migration prospects on the return to human capital. When the emigration rate exceeds a threshold estimated at 20 percent, the origin country experience a net loss of human capital. The net loss increases exponentially with the skilled emigration rate. This result might apply to women, with a higher risk of negative effects on female human capital at origin. Indeed, as women still face unequal access to tertiary education and high-skill jobs in less developed countries, the emigration of educated women is likely to generate higher relative losses than the emigration of skilled males. Many studies report that women's human capital is an even scarcer resource than men's human capital. At the world level, our estimates based on Barro and Lee (2000) and own calculations reveal that the percentage of women with post-secondary education rose from 7.3 to 9.8 percent between 1990 and 2000, while the male proportion rose from 10.9 to 12.5 percent. Similarly, the percentage of women with completed secondary education rose from 31.6 to 34.7 percent during the same period while the male proportion rose from 45.4 to 46.8 percent. Although the gender gap decreases over time, women are still lagging far behind men. In addition, the convergence movement is mainly perceptible in high-income countries where recent generations of women are as well or more educated than young men. In low-income countries, the gender gap is much greater (in 2000, only 2.4 percent of women had post-secondary education, against 5.5 percent for men) and the convergence is slow.
- Second, the links between women's migration and human capital accumulation are particularly important for developing countries since women's level of schooling is usually considered as fundamental ingredient for growth. Many studies demonstrate that women's education complements children's investments in school and has important effects on the human capital of future generations (see World Bank, 2007). Better educated mothers are superior teachers in the home, as demonstrated by Behrman et al. (1997) in the case of India. Hence, for a given investment in children, more educated mothers produce children with higher levels of human capital (Haveman and Wolfe 1995, Summers 1992). It can also be argued that schooled women contribute more income to the household, which leads to more investment in child schooling and lower fertility rates (see among others Basu, 2002). Another argument is that mothers with a high level of education have greater command of resources within the household (higher bargaining power), which they choose to allocate to children at higher

levels than do men (see Quisumbing, 2003). Unsurprisingly, at the aggregate level, many studies have emphasized the role of female education in raising labor productivity and economic growth, suggesting that educational gender gaps are an impediment to economic development. This is the result obtained in Knowles et al. (2000) who use Barro and Lee's human capital indicators, or Coulombe and Tremblay (2006) who relied on the International Adult Literacy Survey to build an homogenized indicator of human capital. These studies suggest that investment in the human capital of women is crucial in countries where the gender gap in education is high⁶. Societies that have a preference for not investing in girls or that lose a high proportion of educated women through emigration may experience slower growth and reduced income. Alternatively, societies that experience a "brain gain" linked to emigration prospects could experience higher growth.

- Third, regarding the determinants of migration, it is also argued that women and men do not respond to push and pull factors with the same intensity. Social networks are usually seen as more important for women who rely more strongly on relatives and friends for help, information, protection and guidance at destination. In addition, educated women are better able than uneducated women to escape from the oppression they must endure in many developing countries due to their gender. More educated men stay in those countries because they do not face the same barriers to career advancement as women do, especially women from profoundly sexist societies.
- Finally, as documented in Morrison, Schiff and Sjoblom (2007), the increasing participation of women in international migration is likely to affect future amounts of remittances, the size of diaspora externalities and the structure of activities in source countries. In this book, women are shown to send remittances over longer time periods, to send larger amounts to distant family members and have different impacts on household expenditures at origin. Chant (1992), Curran and Rivero-Fuentes (2003), Collinson (2003) or Vanwey (2004) showed that, after controlling for households' characteristics, women remit at higher rate than men in most societies.

Without a gendered assessment of high-skill migration, it is obviously impossible to conduct a complete analysis of these issues. In this paper, our purpose is to quantify and characterize the gender composition of the international migration by educational attainment. We build on the DM06 data set, update the data using new sources, homogenize 1990 and 2000 concepts, and introduce the gender breakdown. We provide new stocks and rates of emigration by level of schooling and gender. Our gross data

⁶In the same vein, Klasen (1999) or Dollar and Gatti (1999) demonstrated that gender inequality acts as a significant constraint on growth in cross-country regressions, a result confirmed by Blackden et al. (2006) in the case of sub-Saharan Africa.

reveal that the share of women in the highly skilled immigrant population increased in almost all OECD destination countries between 1990 and 2000. Consequently, for the vast majority of source regions, the growth rates of high-skill female emigrants were always bigger than the growth rates obtained for low-skill women or high-skill men. The evolution was particularly notable in the least developed countries. The increasing share of women in the South-North skilled migration flows mostly reflects gendered changes in the supply of education. We show that the cross-country correlation between emigration stocks of women and men is extremely high (about 97 percent), with women's numbers slightly below men's ones. However, these skilled female migrants are drawn from a much smaller population. Hence, in relative terms, the correlation in rates (88 percent) is lower than in stocks. On average, women's high-skill emigration rate is 17 percent above men's. This gender gap in high-skill emigration rate is strongly correlated with the gender gap in educational attainment of the source population, reflecting unequal access to education.

The remainder of this paper is organized as follows. Section 2 provides a brief survey of existing data sets on high-skill workers emigration. Section 3 then describes our methodology and presents the measure of emigrant stock in 1990 and 2000. Section 4 analyzes emigration rates. Section 5 summarizes the main results.

2 Background

The first serious effort to put together harmonized international data set on migration rates by education level was by Carrington and Detragiache (1998, 1999). They used US 1990 Census data and other OECD statistics on international migration to construct estimates of emigration rates at three education levels for 61 developing countries (including 24 African countries). Adams (2003) used the same technique to build estimates for 24 countries in 2000. Although Carrington and Detragiache's study initiated new debates on skilled migration, their estimates suffer from a number of limitations. The two most important ones were: i) they transposed the education structure of the US immigration to the immigration to the other OECD countries (transposition problem); ii) immigration to EU countries was estimated based on OECD statistics reporting the number of immigrants for the major emigration countries only, which led to underestimate immigration from small countries (under reporting problem).

Docquier and Marfouk (2006) generalized this work and provided a comprehensive data set on international migration to the OECD by educational attainment. The construction of the database relies on three steps: i) collection of Census and register information on the structure of immigration in all OECD countries (this solves the transposition and under reporting problems noted for Carrington Detragiache); ii) summing up over source countries allows for evaluating the stock of immigrants from any given sending country to the OECD area by education level, and iii) comparing the educational structure of emigration to that of the population remaining at home,

which allows for computing emigration rates by educational attainment in 1990 and 2000.

The DM06 data relies on assumptions, some of which were relaxed in a couple of extensions. Most of these extensions required additional assumptions but confirmed, to a large extent, the reliability of using DM06 data in descriptive analysis and empirical regressions.

- First, with only two points in time, DM06 does not give a precise picture of the long-run trends in international migration. To remedy this problem, Defoort (2008) computes high-skill emigration stocks and rates from 1975 to 2000 (one observation every 5 years). She uses the same methodology as in DM06 but only focuses on the six major destination countries (the USA, Canada, Australia, Germany, the UK and France). Her study shows that, at the world level or at the level of developing countries as a whole, the average emigration rate of high-skill workers has been extremely stable over the period. This suggests that the heterogeneity in high-skill migration is mostly driven by the cross-section dimension, thus reinforcing the value of the DM06 cross-country data set based on a much more comprehensive set of destination countries.
- Second, counting all foreign born individuals as immigrants independently of their age at arrival, DM06 does not account for whether education has been acquired in the home or in the host country. Controlling for the country of training can be important when dealing with specific issues such as the fiscal cost of the of skilled emigration. Beine, Docquier and Rapoport (2007) use immigrants' age of entry as a proxy for where education has been acquired and propose alternative measures by defining emigrants as those who left their home country after age 22, 18 or 12. Data on age of entry are collected in a dozen countries. For OECD countries where such data cannot be obtained, Beine et al. estimate the age-of-entry structure using a gravity model. They find that corrected high-skill emigration rates are highly correlated to those reported in DM06⁷.
- Third, general emigration rates may hide important occupational shortages (e.g. among engineers, teachers, physicians, nurses, IT specialists, etc). In poor countries shortages are particularly severe in the medical sector where the number of physicians per 1,000 inhabitants is extremely low. Clemens and Pettersson (2006), and Docquier and Bhargava (2006) provided data on the emigration of healthcare workers. The correlation between medical emigration rates (as measured by Docquier and Bhargava) and DM06 general emigration rates amounts to 40 percent. This suggests that the general rate of high-skill migration may not reveal important aspects of occupational heterogeneity.

⁷Regressing corrected rates on uncorrected rates gives R^2 of 0.9775, 0.9895 and 0.9966 for J=22,18,12.

The gender dimension has been largely undocumented. An exception is a paper by Dumont, Martin and Spielvogel (2007) which relies on a similar methodology than the one used here and analyzes emigration rates by gender and educational level from about 75 countries. Compared to this study, we use a slightly different definition of high-skill migration (including all post-secondary levels, even those with one year of US college), and rely on plausible estimates of the structure of the adult population in countries where human capital indicators are missing. We repeat the exercise for 1990 and 2000, thus shedding light on the increased participation of women in high-skill migration flows. We provide emigration stocks and rates for 195 countries in 1990 and 2000. Our data set can be used to capture the recent trend in women’s skilled migration, as well as to analyze its causes and consequences for developing countries.

3 Methodology

This section describes the methodology used to compute emigration stocks and rates by educational attainment and gender for each source country in 1990 and 2000.

Emigration stocks. It is well documented that, with a few exceptions (such as Australia and New Zealand), statistics provided by source countries do not provide a realistic picture of emigration. When available, which is very rare, they are incomplete, imprecise, and give no information on emigrants’ level of education, gender and country of residence. Whilst detailed immigration data are not easy to collect on an homogeneous basis, information on emigration can only be captured by aggregating consistent immigration data collected in receiving countries, where information about the birth country, gender and education of natives and immigrants is available from national population censuses and registers (or samples of them). More specifically, the receiving country j ’s census usually identifies individuals on the basis of age, gender g , country of birth i , and skill level s . Our method consists in collecting (census or registers) gender-disaggregated data from a large set of receiving countries, with the highest level of detail on birth countries and three levels of educational attainment: $s = h$ for high-skilled, $s = m$ for medium-skilled and $s = l$ for low-skilled. Let $M_{t,g,s}^{i,j}$ denote the stock of adults 25+ born in j , of gender g , skill s , living in country j at time t . Table A.1 in the appendix describes our data sources. Aggregating these numbers over destination countries j gives the stock of emigrants from country i : $M_{t,g,s}^i = \sum_j M_{t,g,s}^{i,j}$. This is the method used in DM06, without gender breakdown.

By focusing on census and register data, our methodology badly captures illegal immigration for which systematic statistics by education level and country of birth are not available⁸, except in the USA. Demographic evidence indicates most US illegal residents are captured in the census. However, there is no accurate data about the educational structure of these illegal migrants in other host countries. Although there

⁸Hatton and Williamson (2002) estimate that illegal immigrants residing in OECD countries represent 10 to 15 percent of the total stock.

may be some instances of undocumented high-skill migrants (like Indians overstaying H-1Bs in the USA), it is widely believed that the majority of undocumented residents are low skilled. Hence, we probably underestimate the number of low-skill migrants. This limitation should not distort our estimates of the migration rate of high-skill workers.

In this paper, we rely on the same principles as in DM06 and turn our attention to the homogeneity and the comparability of the data. This induces a couple of methodological choices:

- In what follows, the term "source country" usually designates independent states. We distinguish 195 source countries: 191 UN member states, Holy See, Taiwan, Hong Kong, Macao and Palestinian Territories. We aggregate North and South Korea, West and East Germany and the Democratic Republic and the Republic of Yemen. We consider the same set of source countries in 1990 and 2000, although some of them had no legal existence in 1990 (before the secession of the Soviet block, former Yugoslavia, former Czechoslovakia and the German and Yemen reunifications) or became independent after January 1, 1990 (Eritrea, East-Timor, Namibia, Marshall Islands, Micronesia, Palau). In these cases, the 1990 estimated stock is obtained by multiplying the 1990 value for the pre-secession state by the 2000 country share in the stock of immigrants (the share is gender- and skill-specific).
- The set of receiving countries is restricted to OECD nations. We thus focus on the structure of South-North and North-North migration. Generally speaking, the skill level of immigrants in non-OECD countries is expected to be very low, except in a few countries such as South Africa (1.3 million immigrants in 2000), the six member states of the Gulf Cooperation Council (9.6 million immigrants in Saudi Arabia, United Arab Emirates, Kuwait, Bahrain, Oman and Qatar), some Eastern Asian countries (4 million immigrants in Hong-Kong and Singapore only). According to their census and survey data, about 17.5 percent of adult immigrants are tertiary educated in these countries (17 percent in Bahrain, 17.2 percent in Saudi Arabia, 14 percent in Kuwait, 18.7 percent in South Africa). Considering that children constitute about 25 percent of the immigration stock, we estimate the number of educated workers at 1.9 million in these countries. The number of educated immigrants in the rest of the world lies between 1 and 4 million (if the average proportion of educated immigrants among adults lies between 2.5 and 10 percent). This implies that focusing on OECD countries, we should capture a large fraction of the world-wide educated migration (about 90 percent). Nevertheless, we are aware that by disregarding non-OECD immigration countries, we probably underestimate the number of high-skill emigrants from several developing countries (such as Egypt, Sudan, Jordan, Yemen, Pakistan or Bangladesh in the neighborhood of the Gulf states, Botswana, Lesotho, Namibia, Swaziland and Zimbabwe, etc.). Incorporating

data collected from selected non-OECD countries could refine the data set. To allow comparisons between 1990 and 2000, we consider the same 30 receiving countries in 1990 and 2000. Consequently, Czechoslovakia, Hungary, Korea, Poland and Mexico are considered as receiving countries in 1990 despite the fact that they were not members of the OECD.

- We only consider the adult population aged 25 and over. This excludes students who temporarily emigrate to complete their education. In addition, as it will appear in the next section, it will allow us to compare the numbers of migrants with data on educational attainment in source countries. It is worth noticing that we have no systematic information on the age of entry. It is therefore impossible to distinguish between immigrants who were educated at the time of their arrival and those who acquired education after they settled in the receiving country; for example, Mexican-born individuals who arrived in the US at age 5 or 10 and graduated from US high-education institutions are counted as highly-skilled immigrants. As mentioned above, Beine et al (2007a) provided corrected measures by age of entry and found a very high correlation with the uncorrected numbers.
- Migration is generally defined on the basis of the country of birth rather than citizenship. Whilst citizenship characterizes the foreign population, the "foreign-born" concept better captures the decision to emigrate. Usually, the number of foreign-born is much higher than the number of foreign citizens (twice as large in countries such as Hungary, the Netherlands, and Sweden)⁹. Another reason is that the concept of country of birth is time invariant (contrary to citizenship which changes with naturalization) and independent of the changes in policies regarding naturalization¹⁰. The number of foreign-born can be obtained for a large majority of OECD countries although in a limited number of cases the national census only gives immigrants' citizenship (Germany, Hungary, Italy, Japan and Korea)¹¹. In these five cases, migrants are defined on the basis of their citizenship. It is worth noticing that the concept of foreign born is not fully homogeneous across OECD countries. In most receiving countries, foreign born are individual born abroad with foreign citizenship at birth¹². In a couple

⁹By contrast, in other OECD countries with a restricted access to nationality (such as Japan, Korea, and Switzerland), the foreign population is important (about 20 percent in Switzerland).

¹⁰The OECD statistics report that 14.4 million foreign born individuals were naturalized between 1991 and 2000. Countries with a particularly high number of acquisitions of citizenship are the US (5.6 million), Germany (2.2 million), Canada (1.6 million), and Australia and France (1.1 million).

¹¹See column 2 in Table A1.

¹²For example, the U.S Census Bureau considers as natives persons born in the US, Puerto Rico or US island areas, or born abroad from a U.S. citizen parent (see Malone et al., 2003). France and Denmark use a similar concept. Statistics Netherlands defines first-generation immigrants as persons who are born abroad and have at least one parent who is also born abroad (Alders M., 2001).

of countries (Australia, New Zealand, Belgium), foreign born means “overseas-born”, i.e. an individual simply born abroad.

- We distinguish three levels of education. Medium-skilled migrants are those with upper-secondary education completed. Low-skill migrants are those with less than upper-secondary education, including those with lower-secondary and primary education or those who did not go to school. High-skill migrants are those with post-secondary education¹³. This assumption is compatible with Barro and Lee’s human capital indicators (based on the 1976-ISCED classification). Some migrants did not report their education level. As in DM06, we classify these unknowns as low-skilled migrants¹⁴. Educational categories are built on the basis of country specific information and are compatible with human capital indicators available for all sending countries. A mapping between the country educational classification is sometimes required to harmonize the data¹⁵.

Emigration rates. We count as migrants all adult (25 and over) foreign-born individuals living in an OECD country. However, it seems obvious that the labor market impact of the emigration of 1,036,000 high-skill Indians (4.3% of the educated total adult population) is less important than the impact of the emigration of 15,696 talented workers from Grenada (84% of the educated adult population). A more meaningful measure can then be obtained by comparing the emigration stocks to the total number of people born in the source country and belonging to the same gender and educational category. This method allows us to evaluate the relative impact on the labor market in the source country.

In the spirit of Carrington and Detragiache (1998), Adams (2003), Docquier and Marfouk (2006) or Dumont and Lemaitre (2004), our second step consists in calculating the high-skill emigration rate as a proportion of the total educated population born in the source country. Although our analysis is based on stocks (rather than flows), we will refer to these proportions as *emigration rates*. Denoting $N_{t,g,s}^j$ as the stock of individuals aged 25+, of skill s , gender g , living in source country i , at time t , we define the emigration rates as

$$m_{t,g,s}^i = \frac{M_{t,g,s}^i}{N_{t,g,s}^i + M_{t,g,s}^i}$$

In particular, $m_{t,g,h}^i$ is a gendered relative measure of high-skill emigration from the source country i .

¹³In the US case, this includes those with one year of college.

¹⁴Country specific data by occupation reveal that the occupational structure of those with unknown education is very similar to the structure of low-skilled workers (and strongly different from that of high-skilled workers). See Debuissson et al. (2004) on Belgium data.

¹⁵For example, Australian data mix information about the highest degree and the number of years of schooling.

This step requires using data on the size and the skill and gender structure of the adult population in the source countries. Population data by age are provided by the United Nations¹⁶. We focus on the population aged 25 and more. Data are missing for a couple of countries but can be estimated using the CIA world factbook¹⁷. Population data are split across educational group using international human capital indicators. Several sources based on attainment and/or enrollment variables can be found in the literature. As in Docquier and Marfouk (2006), human capital indicators are taken from De La Fuente and Domenech (2002) for OECD countries and from Barro and Lee (2001) for non-OECD countries. For countries where Barro and Lee measures are missing, we predict the proportion of educated using Cohen-Soto's measures (see Cohen and Soto, 2007). In the remaining countries where both Barro-Lee and Cohen-Soto data are missing (about 70 countries in 2000), we transpose the skill sharing of the neighboring country with the closest enrolment rate in secondary/tertiary education, the closest gender gap in enrollment rates and/or the closed GDP per capita. This method gives good approximations of the intensity of high-skill emigration, broadly consistent with anecdotal evidence.

4 Results

In this section, we describe the main results obtained for migration stocks and rates by country group, determine the most affected countries and discuss the sign of the gender gap in high-skilled migration.

Migration stocks. On the whole, we record 41.7 million immigrants aged 25+ in 1990 and 58.2 million in 2000 in the OECD area. According to our estimates, the average share of women in the OECD immigrant population increased from 50.6 to 50.9 percent between 1990 and 2000. These numbers (for adults aged 25 and over) are in line with the UNDP numbers (for all ages) reported for the OECD area (50.2 and 50.6 for these two years). At the national level, this share increased in 20 OECD countries; it decreased in 10 countries. In 2000, the national proportions of women in the adult immigrant population ranged from 41.8 percent in Iceland to 59.8 percent in Poland.

A first advantage of our data set is that it provides comparable statistics on the entry of high-skill immigrants. Our estimates show that the average share of women in the skilled immigrant population increased from 46.7 to 49.3 percent between 1990 and 2000. In 2000, country-specific shares range from 39.8 percent in Iceland to 56.4 in Poland¹⁸. The share increased in 27 countries and decreased in only 3 countries (Portugal, Spain and Belgium). Remarkable increases in female share were observed in the Czech Rep (+18.6 percentage points), Finland (+9.2) and Turkey (+9.1).

¹⁶See <http://esa.un.org/unpp>.

¹⁷See <http://www.cia.gov/cia/publications/factbook>.

¹⁸It amounts to 50.2 percent in the United Kingdom, 49.9 in the United States, 48.4 in Canada, 46.6 in France and 45.2 in Germany.

A second interesting feature of our data set is that it distinguishes migrants by country of birth. This allows us to quantify and characterize the structure of emigration by educational level and gender. Table 1 gives the emigration stocks for 1990 and 2000. We distinguish total, low-skill and high-skill emigration stocks, the medium skilled can be easily obtained by subtraction. Although the data set reveals specific information by country of origin, we only report here data by country group. We consider income groups (following the World Bank classification), regional groups as defined in the UN classification, as well as a couple of groups of particular interest (Sub-Saharan Africa, Latin America and the Caribbean, Middle East and Northern Africa and Islamic countries).

[INSERT TABLE 1 AROUND HERE]

The proportions of women in high-skill and low-skill emigration are positively correlated but not that much (correlation rate of 0.57 in 2000). Women account for a large proportion of highly skilled emigrants from high-income countries (50.3 percent in 2000), lower-middle income countries (51.5 percent), and small island developing countries (54.4 percent). On the contrary, their share is much lower in high-skill emigration from low-income countries (42.3 percent), the least developed countries (41.8 percent), Sub-Saharan Africa (42.4 percent), the MENA (38.2 percent) and Islamic countries (40.4 percent).

Between 1990 and 2000, the number of skilled women emigrants increased by 73 percent (from 5.8 to about 10.1 million). The rate of growth was much lower for low-skill women (+22 percent). The number of skilled women emigrants was multiplied by 1.5 in low-income countries and by more than 1.2 in the least developed and Sub-Saharan African countries. In all regions except Middle Africa, the growth rate of the stock of female skilled emigrants is always bigger than the rate obtained for skilled males. At the regional level, the major increases in female skilled emigration are observed in Central Asia (+412 percent), Western Africa (+180 percent), Southern Africa, Southern Asia and Central America (+140 percent),

The increase in the emigration of highly skilled women is observed in every source region and is partly due to the fact that women's rise in schooling level was more rapid than men's rise. At the world level, the female educated adult population increased by 67.9 percent (this growth rate reaches 105 percent for the least developed countries). In comparison, the male skilled adult population increased by only 42 percent on average (71 percent for the least developed countries). Besides this supply effect, the increasing participation of women in skilled emigration also reflects an increased demand for women's labor in health care sectors and other services, the increased importance of family reunion programs, as well as cultural and social changes in the attitude towards female migration in many source countries.

Emigration rates. As pointed out above, a more meaningful measure of the high-skill emigration rates can be obtained by comparing the emigration stocks to the total number of people born in the source country and belonging to the same

gender and educational category. Table 2 shows the emigration rates of low-skill and high-skill workers, as well as global emigration rates by country groups and region of origin in 1990 and 2000¹⁹.

[INSERT TABLE 2 AROUND HERE]

In all regions, high-skill emigration rates are much bigger than low-skill ones. The skill-related gap is particularly strong in poor countries where the propensity to move among high-skill workers is 10 to 20 times larger than among the lowly skilled. The largest high-skill emigration rates are obtained in Caribbean (43.0 percent) and Pacific islands (52.3 percent). Figures above 10 percent are also observed in Middle, Eastern and Western Africa, Central America, Northern and Southern Europe. On the whole, the high-skill emigration rates are strong in poor regions with small countries.

At the world level, women and men exhibit almost the same total emigration rates (1.6 percent in 1990 and 1.8 in 2000). Women's average emigration rates are, however, lower than men's in the less developed countries, especially in Northern and Sub-Saharan Africa. On the contrary, high-skilled emigration rates are more pronounced among women. In 2000, the average (weighted) female/male ratio of high-skill emigration rates amounted to 1.20. Huge differences were observed in regions where women have a poor access to education such as Middle Africa, Eastern Asia, Southern Africa and Western Africa. Women's high-skill emigration rate exceeds men's one in 81 percent of the cases (160 countries). Countries exhibiting the highest ratios of emigration rates are Sub-Saharan African countries (such as Nigeria, Cameroon, Sao Tome and Principe, the Democratic Republic of Congo, etc.) as well as Bangladesh or Thailand. On the contrary, high-skill men are more mobile than women in the Middle East or in some particular Asian countries (such as Bhutan, Cambodia, Burma, Vietnam, etc.).

Most affected countries. Table 3 reports countries sending the largest stocks of migrants to the OECD. In absolute terms (number of educated emigrants), the largest countries are the main exporters of high-skill emigrants. However the elasticity of emigration stock to population size amounts to 63.2 percent (less than one), revealing that small countries are relatively more affected than large countries. The five largest diasporas (all education categories) originate from Mexico (6.434 million), the United Kingdom (2.990 million), Italy (2.337 million), Germany (2.299 million) and Turkey (1.942 million). Eight other countries have diaspora above 1 million: India, the Philippines, China, Vietnam, Portugal, Korea, Poland and Morocco. In most of these countries, the women's share varies from 48 to 52 percent. However, the women's share is particularly high for the Philippines (62.2 percent), Germany (57.4), Korea and Poland (around 56 percent).

[INSERT TABLE 3 AROUND HERE]

¹⁹Our cross-country results are very similar to those described in Docquier and Marfouk (2006). The correlation between the old and updated skilled emigration rates in 2000 is 94 percent.

Focusing on high-skill emigrants, the ranking unsurprisingly shows that rich countries with highly educated populations have better educated diasporas. The elasticity of high-skill emigration to population size at origin amounts to 65.7 percent. The largest high-skill diasporas originate from the United Kingdom (1.487 million), the Philippines (1.111 million) and India (1.034 million). Germany and Mexico send more than 0.9 million highly skilled natives abroad. Four other countries have diasporas above 0.5 million: China, Korea, Canada and Vietnam. In these top-countries, the share of women among high-skill migrants is large in Jamaica (62.1 percent), the Philippines (60.3) and other countries such as Japan, Russia, Ukraine, Poland and Colombia.

The right panel of Table 3 depicts the situation of the 30 most affected countries in 2000 regarding high-skill migration rates. Small islands are the most affected. The emigration rate exceeds 80 percent in nations such as Guyana, Jamaica, St. Vincent, Grenada, Haiti, Cape Verde and Palau. Only three of these top-30 countries have a population above 4 million.

After eliminating small countries with less than 4 million inhabitants, about one-third of the most affected countries are located in Sub-Saharan Africa and 7 are Central American or Caribbean countries. The high-skill emigration rate exceed 30 percent in nine countries, including five Sub-Saharan African ones.

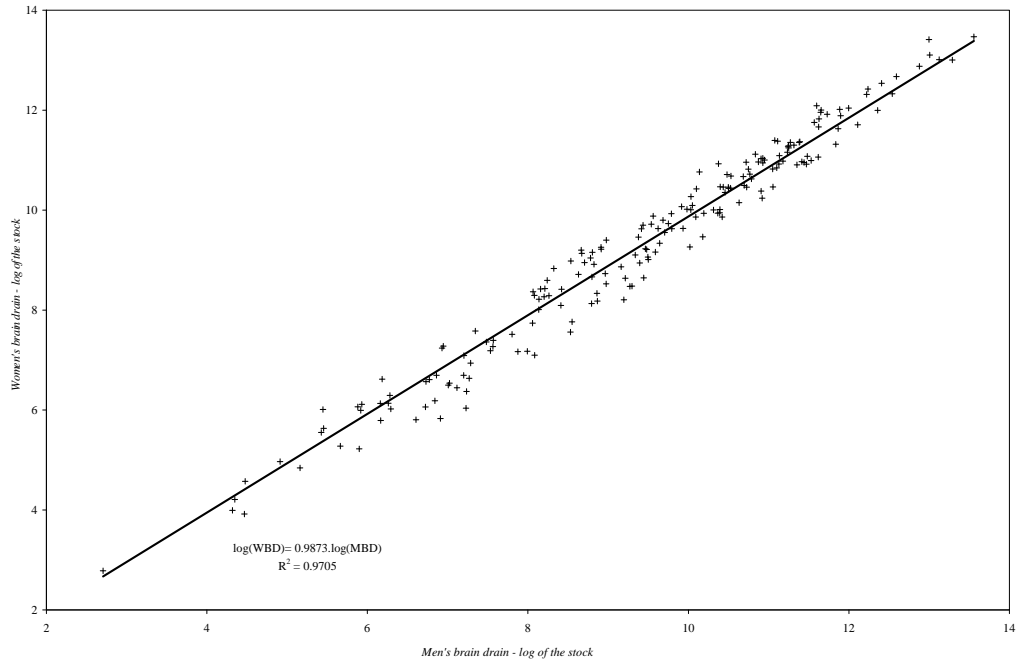
Gender gap in highly skilled migration. Regarding gender disparities, Figure 1 and 2 compares stock and rates of high-skill migration by gender. Figure 1 shows that the correlation in stocks is extremely high (97 percent). This is mainly due to an important size effect in international migration stocks: large countries send larger numbers of both men and women abroad than small countries. On average, the number of highly skilled female migrants is slightly lower than the number of highly skilled men. About 61 percent of developing countries (and only 48 percent of developed countries) have more male skilled migrants than females.

As argued above, a more meaningful measure of the gender gap can then be obtained by controlling for the total number of people born in the source country and belonging to the same gender and educational category (i.e. by focusing on high-skill emigration rates). Figure 2 reveals that the correlation is lower in rates (88 percent) and that women's high-skill emigration rate is on average 17 percent above men's. This confirms the results presented in Docquier, Lohest and Marfouk (2007). They provide a simple multiplicative decomposition of the high-skill emigration rate into two components: degree of openness of sending countries (as measured by average or total emigration rate) and schooling gap (as measured by the relative education level of emigrants compared with natives). Econometrically, the schooling gap negatively depends on natives' human capital. Since native women are less educated than native men, we can expect women to be more affected by high-skill emigration.

This is confirmed on Figure 3 which clearly shows that the gender gap in high-skill emigration rate (labelled as *GGBD*) is strongly and negatively correlated with the gender gap in educational attainment of residents (*GGHC*). In other words, the

gender gap in migration is especially strong in countries where women have little access to education. A simple regression of the log of the female/male ratio in high-skill emigration rates on the log of the female/male ratio in post-secondary educated adult population gives an elasticity of -50 percent ($R^2 = .54$) and an intercept which is not significantly different from zero²⁰. Obviously, a rigorous empirical analysis is required to assess the determinants of the gender gap. Given the assortative matching between high-skill men and women and family reunion program at destination, it is especially important to account for the interdependencies between women's and men's decisions to emigrate. In addition, gender discrimination practices could explain why women from sexist countries are willing to migrate more and are less educated on average. Figure 3 disregards causality issues and only suggests that equating men and women's educational attainment would potentially reduce the gender gap in high-skilled migration.

Figure 1. Women's and men's high-skill migration in 2000 - Stocks



²⁰Interestingly, the correlation between the gender gap in highly skilled migration and variables such as the UN gender empowerment measure or the proportions of seats held by women in the parliament is almost equal to zero.

Figure 2. Women's and men's high-skill migration in 2000 - Rates

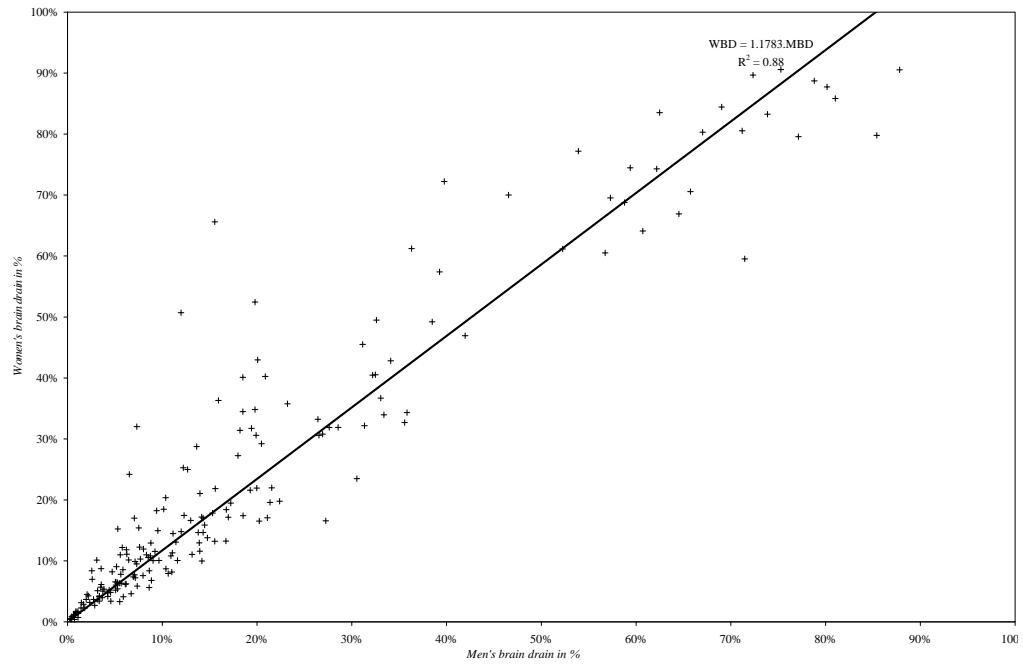
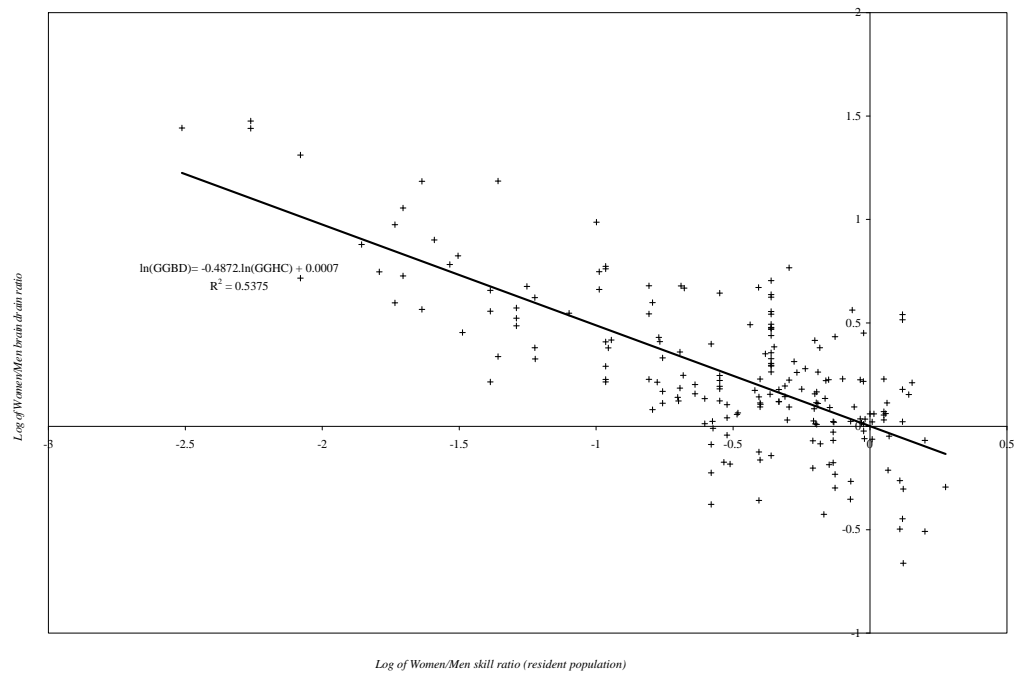


Figure 3. Gender gaps in high-skill migration and human capital



5 Conclusion

The important contributions of women to economic development have been widely acknowledged, but their unique roles in international migration have received attention only more recently. In "World Survey on the Role of Women in Development: Women and International Migration", the United Nations recently stated that a gender perspective is essential to understanding migration and development²¹. The report goes on to state that a dearth of data has made it difficult to evaluate the full implications of female migration; and that the understanding of the role of women requires improvement in data collection. This article presents data constructed to help address the need to better understand the part of women in international migration.

We build on the DM06 data set, update the data using new sources, homogenize 1990 and 2000 concepts, and introduce a breakdown by gender. We provide revised stocks and rates of emigration by level of schooling and gender. We repeat the exercise for 1990 and 2000, thus shedding light on the increasing participation of women in high-skill migration. We provide emigration stocks and rates for 195 countries in 1990 and 2000. Although our data set would benefit from extensions (e.g. adding points in time and accounting for migration to non OECD destination countries), it can be used to capture the recent trend in women's high-skill emigration, as well as to analyze its causes and consequences for developing countries.

Our gross data reveal that the share of women in the high-skill immigrant population increased in almost all OECD destination countries between 1990 and 2000. Consequently, for the vast majority of source regions, the growth rates of highly skilled women emigrants were always bigger than the growth rates obtained for low-skill women or high-skill men. This evolution particularly occurs in the least developed countries. The increased participation of women in South-North emigration partly reflects gendered changes in the supply of education. The cross-country correlation between emigration stocks of women and men is extremely high (about 97 percent), with women's numbers slightly below men's ones. However, these female high-skill migrants are drawn from a much smaller population. Hence, in relative terms, the cross-country correlation in rates (88 percent) is much lower than in stocks. On average, women's high-skill emigration rate is 17 percent above men's. This gender gap in is strongly correlated with the gender gap in the educational attainment of adult populations, reflecting unequal access to education in many source countries. Our database now allows to investigate the causal links between these variables and to analyze the consequences and determinants of women's skilled migration.

²¹See United Nations (2006).

References

- [1] Adams, R. (2003): International migration, remittances and the brain drain: a study of 24 labor-exporting countries, World Bank Policy Research Working Paper, n. 2972.
- [2] Alders, M. (2001): Classification of the population with foreign background in the Netherlands, Statistics Netherlands, Paper for the conference "The measure and Mismeasure of Populations. The statistical use of ethnic and racial categories in multicultural societies", CERI-INED, Paris, 17-18 December.
- [3] Barro, R.J. and J.W. Lee (2000): International data on educational attainment: updates and implications, Oxford Economic Papers 53, 541-563.
- [4] Basu, A.M. (2002): Why does Education Lead to Lower Fertility? A Critical Review of Some of the Possibilities, World Development 30 (10), 1779-1790.
- [5] Berhman, J.R., A.D. Foster, M.R. Rosenzweig and P. Vashishtha (1997): Women's schooling, home teaching, and economic growth, Manuscript.
- [6] Beine, M., F. Docquier and H. Rapoport (2007): Measuring international skilled migration: a new database controlling for age of entry, World Bank Economic Review 21: 249 - 254.
- [7] Beine, M., F. Docquier and H. Rapoport (2008): Brain drain and human capital formation in developing countries: winners and losers, Economic Journal 118 (4): 631-652.
- [8] Blackden, M., S. Canagarajah, S. Klase and D. Lawson (2006): gender and growth in Sub-Saharan Africa, UNU-WIDER Research Paper n. 2006-37.
- [9] Bhorat, H., J-B. Meyer and C. Mlatsheni (2002): Skilled labor migration from developing countries: study on South and southern Africa, International migration papers, International Labor Office (ILO), Geneva.
- [10] Buijs, (1993): Migrant Women - Crossing Boundaries and Changing Identities, Cross-cultural perspectives on women, vol 7, BERG Publishers: Oxford.
- [11] Carrington, W.J. and E. Detragiache (1998): How big is the brain drain?, IMF Working paper WP/98/102.
- [12] Carrington, W.J. and E. Detragiache (1999): How extensive is the brain drain, Finance and Development, June: 46-49.
- [13] Checchi, D., G. De Simone, R. Faini (2007): Skilled Migration, FDI and Human Capital Investment, IZA Discussion Paper, 2795.

- [14] Cerrutti, M. and D.S. Massey (2001), On the Auspices of Female Migration from Mexico to the United States, *Demography* 38 (2), 187-200.
- [15] Chant, S.(1992), *Gender and Migration in Developing Countries*, New York: Belhaven Press.
- [16] Clemens, M.A. and G. Pettersson (2006): A New database of health professional emigration from Africa, Working Paper, 95, Center for Global Development.
- [17] Collinson, M., S. Tollman, K. Kahn and S. Clark (2003): Highly prevalent circular migration: households, mobility and economic status in rural South Africa, paper presented at the Conference on Migration in Comparative Perspective, Johannesburg, Sout Africa, 4-7 June.
- [18] Commander, S., M. Kangasniemi and L.A. Winters (2004): The brain drain: a review of theory and facts, *Brussels Economic Review*, 47(1), Special issue on skilled migration, 29-44.
- [19] Cohen, D. and M. Soto (2007): Growth and human capital: good data, good results, *Journal of Economic Growth* 12(1), 51-76.
- [20] Coulombe, S. and J-F. Tremblay (2006): Literacy and growth, topics in macroeconomics 6(2), article 4.
- [21] Curran, S.R. and E. Rivero-Fuentes (2003), Engendering Migrant Networks: The Case of Mexican Migration, *Demography*, 40, 289-307.
- [22] Debuisson, M., F. Docquier, A. Noury, M. Nantcho (2004): Immigration and aging in the Belgian regions, *Brussels Economic Review* 47(1), Special issue on skilled migration, 138-158.
- [23] Defoort, C. (2008): Long-term trends in international migration: an analysis of the six main receiving countries, *Population-E* 63 (2): 285-318.
- [24] De la Fuente, A. and R. Domenech (2002): Human capital in growth regressions: how much difference does data quality make? Un update and further results, CEPR Discussion Paper, n. 3587.
- [25] Docquier, F. and A. Bhargava (2006): Medical brain drain - A New Panel Data Set on Physicians' Emigration Rates (1991-2004), Report, World Bank, Washington DC.
- [26] Docquier, F., O. Lohest, and A. Marfouk (2007): Brain drain in developing countries, *World Bank Economic Review* 21: 193 - 218.

- [27] Docquier, F. and A. Marfouk (2006): International migration by educational attainment (1990-2000), In C. Ozden and M. Schiff (eds). International Migration, Remittances and Development, Palgrave Macmillan: New York.
- [28] Docquier, F. and H. Rapoport (2007): Skilled migration - The perspective of sending countries, In J. Baghwati and G. Hanson (eds), Skilled migration: prospects, problems and policies, Russell Sage Foundation: New York, forthcoming.
- [29] Dollar, D. and R. Gatti (1999): Gender inequality, income and growth - Are good times good for women?, Policy Research Report on Gender and Development, Working paper series, n.1, World Bank.
- [30] Dumont, J.C. and Lemaître G. (2004): Counting immigrants and expatriates in OECD countries: a new perspective, Mimeo: OECD.
- [31] Dumont, J.C., J.P. Martin and G. Spielvogel (2007): Women on the move: the neglected gender dimension of the brain drain, IZA Discussion Paper, n. 2920.
- [32] Easterly, W and Y. Nyarko (2005): Is the brain drain good for Africa?, Mimeo: New York University.
- [33] Grogger, J. and G.H. Hanson (2008): Income maximization and the sorting of emigrants across destinations, paper presented at the conference on "Migration and Development" in Lille (France), June 23-28, 2008.
- [34] Haveman, R. and B. Wolfe (1995): The determinants of children's attainments - A review of methods and findings, *Journal of Economic Literature* 33(4), 1829-1878.
- [35] Hatton, T.J. and J.G. Williamson (2002): What fundamentals drive world migration?, NBER Working paper, n. 9159.
- [36] Hondagneu-Sotelo, P. (1994), *Gendered transitions - Mexican experiences of immigration*, University of California Press: Berkeley CA.
- [37] Javorcik, B. S., C. Ozden, M. Spatareanu, C. Neagu (2006): Migrant networks and foreign direct investment, Policy, Research working paper ; no. WPS 4046, World Bank.
- [38] Klasen, S. (1999): Does gender inequality reduce growth and development? Evidence from cross-country regressions, Policy Research Report on Gender and Development, Working paper series, n.7, World Bank.
- [39] Knowles, S., P.K. Lorgelly and P.D. Owen (2000): Are educational gender gaps a brake on economic development? Some cross-country empirical evidence. Manuscript.

- [40] Kugler, M. and H. Rapoport (2007): International labour and capital flows: Substitutes or complements? *Economics Letters* 92 (2), 155-162.
- [41] Malone, N., K. F. Baluja, J. M. Costanzo and C.J. Davis (2003): The foreign-born population: 2000, *Census 2000 brief, C2KBR-34*, U.S. Census Bureau.
- [42] Morrison, A.R., M. Schiff and M. Sjöblom (2007), *The international migration of women*, Palgrave MacMillan.
- [43] Nimii, Y. and C. Ozden (2006): *Migration remittances and the brain drain: causes and linkages*, mimeo (World Bank).
- [44] OECD (2002): *Trends in international migration*, Paris: OECD Editions.
- [45] Pearce, S.C. (2006), *Immigrants Women in the United States: A demographic Portrait*, Special report, Immigration Policy Center, Summer 2006.
- [46] Quisumbing, A. (2003), *Household decisions, gender and development: a synthesis of recent research*, Baltimore MD: John Hopkins University Press for the International Food Policy Research Institute.
- [47] Ruggles, S., M. Sobek, T. Alexander, C.A. Fitch, R. Goeken, P.K. Hall, M. King and C. Ronnander (2004): *Integrated Public Use Microdata Series: Version 3.0*. Minneapolis, MN: Minnesota Population Center.
- [48] Sobek, M., S. Ruggles, R. McCaa, M. King, and D. Levison (2002): *Integrated Public Use Microdata Series-International: Preliminary Version 1.0*. Minneapolis: Minnesota Population Center, University of Minnesota.
- [49] Summers, L.H. (1992): Investing in all the people, *Pakistan Development Review* 31(4), 367-406.
- [50] Sweetman, C. (1998): *Gender and Migration*, Oxfam Focus on Gender, Oxfam: UK.
- [51] United Nations (1994): *The Migration of Women: Methodological Issues in the Measurement and Analysis of Internal and International Migrants*, United Nations International Research and Training Institute for the Advancement of Women (INSTRAW): Santo Domingo, Dominican Republic.
- [52] United Nations (2002): *International Migration Report 2002*, New York: United Nations.
- [53] United Nations (2006): *World Survey on the Role of Women in Development: Women and International Migration*, Department of Economic and Social Affairs, New York: United Nations.

- [54] Vanwey, J.L.K. (2004), Altruistic and Contractual Remittances between Male and Female Migrants and Households in Rural Thailand, *Demography* 41 (4), 739-756.
- [55] World Bank (2007): *Confronting the challenges of gender equality and fragile states*, Global Monitoring Report, Washington: The World Bank.
- [56] Zlotnik, H. (1990), International Migration Policies and the Status of Female Migrants, *International Migration Review* 24 (2), 372-381.
- [57] Zlotnik, H. (1995), The South-to-North Migration of Women, *International Migration Review* 29 (1), 229-254.

6 Appendix

For countries where population registers (mainly Scandinavian countries) are used, data is based on the whole population. In countries where Census data are used, statistics are either based on the whole population (Australia, New Zealand, Belgium, etc.) or on a sample of it (e.g. 25 percent in France, etc.). In some cases, we combine comprehensive register data on the numbers of adult males and females, but use sample data to estimate the educational structure (the UK is estimated on 10 percent of the population; in Germany, the microcensus is based on 1 percent of the population). The education structure is sometimes given by region or groups of countries; we then assume a constant share within the region. In a couple of countries, we use household and labor force surveys to estimate the educational structure. Finally, we also use IPUMS International data set for Mexico, Spain and the United States.

Table A.1. Data sources

Receiving country	Definition	1990	2000
Australia	Foreign Born	Australian Bureau of Statistics	Australian Bureau of Statistics
Austria	Foreign Born	Statistik Austria	Statistik Austria
Belgium	Foreign Born	Institut National de Statistiques	Institut National de Statistiques
Canada	Foreign Born	Statistics Canada	Statistics Canada
Czech Rep	Foreign Born	Estimates (a)	Czech Statistical Office
Denmark	Foreign Born	Statistics Denmark	Statistics Denmark
Finland	Foreign Born	Statistics Finland	Statistics Finland
France	Foreign Born	INSEE	INSEE
Germany	Foreign citizens	Microsensus + Federal Statistical Office	Microsensus + Federal Statistical Office
Greece	Foreign Born	Estimates (a)	National Statistical Service of Greece
Hungary	Foreign citizens	Estimates (a)	IPUMS-International
Iceland	Foreign Born	Statistics Iceland + Estimates	Statistics Iceland + Estimates
Ireland	Foreign Born	Central Statistics Office Ireland	Central Statistics Office Ireland
Italy	Foreign citizens	Estimates (a)	Istituto Nazionale di Statistica
Japan	Foreign citizens	Statistics Japan + Estimates	Statistics Japan + Estimates
Korea	Foreign citizens	Statistics Korea + Estimates	Statistics Korea + Estimates
Luxemburg	Foreign Born	STATEC Luxemburg	STATEC Luxemburg
Mexico	Foreign Born	IPUMS-International	IPUMS-International
Netherland	Foreign Born	Statistics Netherlands + Estimates	Statistics Netherlands + Estimates
New Zealand	Foreign Born	Statistics New Zealand	Statistics New Zealand
Norway	Foreign Born	Statistics Norway	Statistics Norway
Poland	Foreign Born	Estimates (a)	Poland Statistics
Portugal	Foreign Born	Instituto Nacional de Estatistica	Instituto Nacional de Estatistica
Slovak Rep	Foreign Born	Statistical Office of the Slovak Republic	Statistical Office of the Slovak Republic
Spain	Foreign Born	Estimates	IPUMS-International
Sweden	Foreign Born	Statistics Sweden	Statistics Sweden
Switzerland	Foreign Born	Swiss Statistics	Swiss Statistics
Turkey	Foreign Born	Turkish Statistical Institute	Turkish Statistical Institute
United Kingdom	Foreign Born	Office for National Statistics	Office for National Statistics
United States	Foreign Born	Bureau of Census + IPUMS	Bureau of Census + IPUMS

(a) Immigration stocks are estimated using the SOPEMI data set by country of citizenship

(b) Immigration stocks are estimated using the United Nations Population Division data set

(a)-(b) Education levels are estimated using the average changes observed in other OECD countries