A gendered assessment of the brain drain

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Abstract

This paper updates and extends the Docquier-Marfouk data set on international migration by educational attainment. We use new sources, homogenize definitions of what a migrant is, and compute gender-disaggregated indicators of the brain drain. Emigration stocks and rates are provided by level of schooling and gender for 195 source countries in 1990 and 2000. Our data set can be used to capture the recent trend in women's brain drain and to analyze its causes and consequences for developing countries. We show that women represent an increasing share of the OECD immigration stock and exhibit relatively higher rates of brain drain than men. The gender gap in skilled migration is strongly correlated with the gender gap in educational attainment at origin. Equating women's and men's access to education would probably reduce gender differences in the brain drain.

JEL Classification: F22, J61.

Keywords: Brain drain, Gender, Human capital, Migration.

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1   Introduction

International migration is a diverse phenomenon and its impact on source and destination countries has attracted the increased attention of policymakers, scientists and international agencies. The migration pressure has increased over the last years and is expected to intensify in the coming decades given the rising gap in wages and the differing demographic futures in developed and developing countries. 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 brain drain 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 brain drain debate has, until recently, remained essentially theoretical[1]. New data sets have been developed to assess the magnitude of the brain drain. 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 the brain drain[3].

One important extension which has been strongly disregarded in the literature concerns the gender gap in international migration. In particular, a little research has adressed the issue of female migration while a considerable strand of literature focused attention on male migration. 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. This evolution is mostly due to the rising representation of women in the immigration stock of the most advanced countries (from 48.9 to 52.2 percent)[4]. It 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. Although family reunion programs admit many women in destination countries, women cannot be considered as passive companion migrants. The feminization of international migration raises specific economic issues related to the gendered determinants and consequences of migration. In particular, women's bain drain is likely to affect sending countries in a very peculiar way.

First of all, women's level of schooling is a fundamental ingredient for growth. Many studies demonstrated that women's education complements children's investments in school and has important effects on the human capital of future generations. Better educated mothers are superior teachers in the home, as demonstrated

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

[2]Henceforth, DM06.

[3]See Docquier et al. (2007), Beine et al. (2007b), Cecchi et al. (2007), Krueger and Rapoport (2006), Nimi and Ozden (2006), Beata et al. (2006), Grogger and Hanson (2007), Easterly and Nyarko (2005), etc.

[4]In developing countries, the share of women has been relatively stable over time.

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 may lead to more investment in child schooling and lower fertility rates. Another argument is that mothers with 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 would men. 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 high[5]. Societies that have a preference for not investing in girls or that loose a high proportion of skilled women through emigration may experience slower growth and reduced income.

Second, women's brain drain is a crucial issue as women's human capital is an even scarcer resource than men's human capital. At the world level, 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. As women still face a unequal access to tertiary education in less developed countries, women's brain drain may generate higher relative losses than male brain drain.

Finally, as documented in Morrison, Schiff and Sjoblom (2007), the feminization of migration is likely to affect future amounts of remittances, the size of diaspora externalities and the structure of activities in source countries. In this report, women are shown to send remittances over longer time periods, to send larger amount to distant family members and have different impacts on household expenditures at origin. In a study on South Africa, Collinson (2003) showed that employed men remit 25 percent less than employed women. Regarding the determinants of migration, it is also argued that women and men do not respond to push and pull factors with

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[5]In 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-Saharn Africa.

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. Without a gendered assessment of the brain drain, it is obviously impossible to conduct a complete analysis of these issues.

In this paper, 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 revised stocks and rates of emigration by level of schooling and gender. Our gross data reveal that the share of women in the 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 skilled female emigrants were always bigger than the growth rates obtained for unskilled women or skilled men. The evolution was particularly in the least developed countries. This feminization of the South-North brain drain 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 much lower than in stocks. On average, women's brain drain is 17 percent above men's. This gender gap in skilled emigration rate is strongly correlated with the gender gap in educational attainment of the source population, reflecting unequal access to education. Equating men and women's educational attainment at origin would strongly reduce the gender gap in skilled migration.

The remainder of this paper is organized as follows. Section 2 provides a brief survey of existing data sets on the brain drain. 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 skilled emigration to the OECD. 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 (2006) computes skilled emigration stocks and rates from 1975 to 2000 (one observation every 5 years). She used the same methodology as in DM06 but only focuses on the six major destination countries (USA, Canada, Australia, Germany, UK and France). She shows that, at the world level or at the level of developing countries as a whole, the average skilled migration rate has been extremely stable over the period. This suggests that the heterogeneity in the brain drain 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 brain drain. Beine, Docquier and Rapoport (2006) use immigrants' age of entry as a proxy for where education has been acquired and propose alternative measures of the brain drain by defining skilled immigrants 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. estimated the age-of-entry structure using a gravity model. They found that corrected skilled emigration rates are highly correlated to those reported in DM06[6].

- Third, general emigration rates may hide important occupational shortages (e.g. among engineers, teachers, physicians, nurses, IT specialists, etc). In

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

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 medical brain drain. The elasticity of medical brain drain rates (as measured by Docquier and Bhargava) to DM06 general rates amounts to 0.44 ($R^2 = 0.39$). Many observations are far from the overall trend. This suggests that the general brain drain may not reveal important aspects of occupational heterogeneity.

In this literature, the gender dimension has been largely disregarded. An exception is a paper by Dumont, Martin and Spielvogel (2007) which relies on a similar methodology than the one used here and analyze 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 recent feminization of the brain drain. 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 brain drain, as well as to analyze its causes and consequences for developing countries.

3 Emigration stocks by education level and gender

This section describes the methodology and data sources used to compute emigration stocks by educational attainment and gender for each source country in 1990 and 2000. Then we discuss the main insights.

3.1 Methodology and data sources

It is well documented that statistics provided by source countries do not provide a realistic picture of emigration. When available, which is very rare, they are incomplete and imprecise. 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 1 describes our data sources. 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.

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 available[7], 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. Hence, we probably underestimate the number of unskilled in the immigrant population, assuming that most illegal immigrants are uneducated. Nevertheless, this limitation should not significantly distort our estimates of the migration rate of highly-skilled workers.

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

Table 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,c)	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,c)	National Statistical Service of Greece
Hungary	Foreign citizens	Estimates (a,c)	IPUMS-International
Iceland	Foreign Born	Statistics Iceland + Estimates	Statistics Iceland + Estimates (c)
Ireland	Foreign Born	Central Statistics Office Ireland	Central Statistics Office Ireland
Italy	Foreign citizens	Estimates (a,c)	Istituto Nazionale di Statistica
Japan	Foreign citizens	Estimates (b,c)	Statistics Japan + Estimates (c)
Korea	Foreign citizens	Estimates (b,c)	Statistics Korea + Estimates (c)
Luxemburg	Foreign Born	STATEC Luxemburg	STATEC Luxemburg
Mexico	Foreign Born	IPUMS-International	IPUMS-International
Netherland	Foreign Born	Statistics Netherlands + Estimates (c)	Statistics Netherlands + Estimates (c)
New Zealand	Foreign Born	Statistics New Zealand	Statistics New Zealand
Norway	Foreign Born	Statistics Norway	Statistics Norway
Poland	Foreign Born	Estimates (a,c)	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 (b,c)	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 (rescaled using the foreign-born/foreign citizens ratio in 2000)

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

(c) Education levels are estimated using household survey or the average change in education attainment observed in other OECD countries

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 brain drain for 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 mentionned above, Beine et al (2007a) provided corrected measures by age of entry and found a very high correlation with the uncorrected numbers.

- Migration is 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[8]. 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 naturalization[10]. 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). It is worth noting 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 birth. In a couple of countries, 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-skilled 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-skilled migrants are those with post-secondary education (this includes those with one year of post-secondary education in the US). This assumption is compatible with Barro and Lee's human capital indicators (based on the 1976-ISCED classification).

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[8]In some receiving countries such as Germany, immigrants' children (i.e. the second generation) usually keep their foreign citizenship.

[9]By 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).

[10]The 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).

Some migrants did not report their education level. As in DM06, we classify these unknowns as low-skilled migrants[11]. 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 data[12].

3.2 Women's share in OECD immigration

According to our estimates, the average share of women in the OECD immigrant population decreased from 51.6 to 50.6 percent between 1990 and 2000. Country-specific shares range from 41.8 in Iceland to 59.8 in Poland . It amounts to 53 percent in the United Kingdom, 52.3 in Canada, 51 in the United States, 49.5 in France and 46.2 in Germany. This share increased or stagnated in almost all countries over the 1990s. The only significant decreases are observed in Belgium (-3.8 percentage points) and Ireland (-2.8). Remarkable increases were observed in Austria (+11.3 percentage points), Portugal (+6.4) and, to a lower extent, in Turkey, Korea, Japan or Switzerland.

The average share of women in the OECD skilled immigrant population increased from 48.0 to 49.7 percent between 1990 and 2000. Country-specific shares range from 39.8 percent in Iceland to 56.4 in Poland . It amounts to 50.2 percent in the United Kingdom, 49.9 in the United States, 48.4 in Canada (the only country where there are more skilled women than skilled men), 46.6 in France and 45.2 in Germany. This share increased in almost all countries except in Belgium (-2.1) and Spain (-1.4). Remarkable increases in female share were observed in the Czech Rep (+18.6 percentage points), Finland (+9.2) and Turkey (+9.1).

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[11]Country 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 Debuisson et al. (2004) on Belgium data.

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

Figure 1.1. Women's share in total immigration
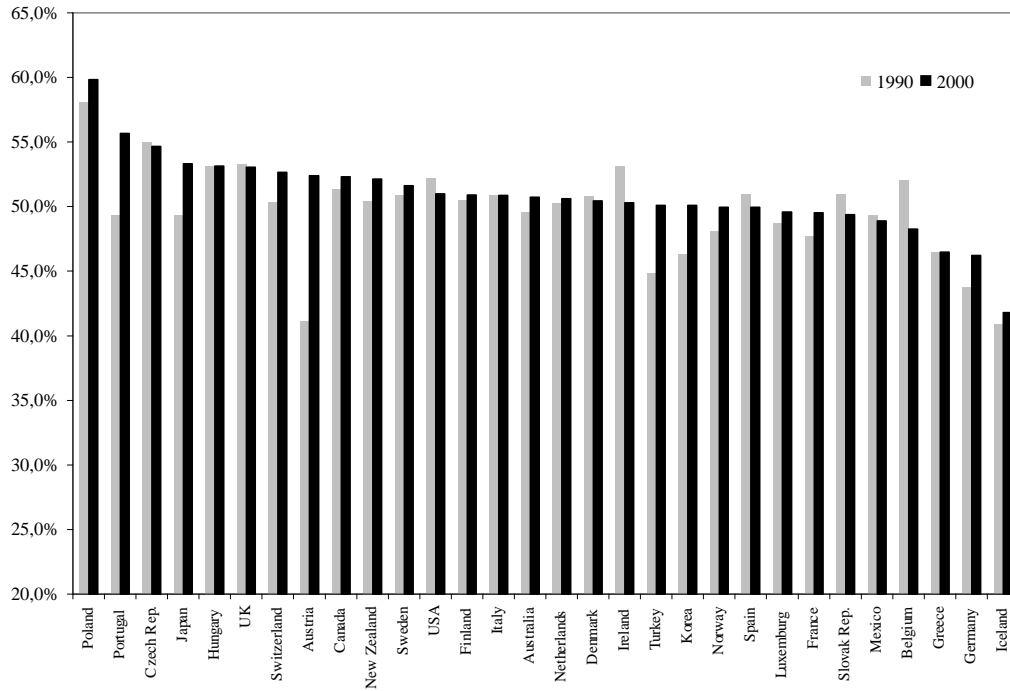
Figure 1.2. Women's share in skilled immigration
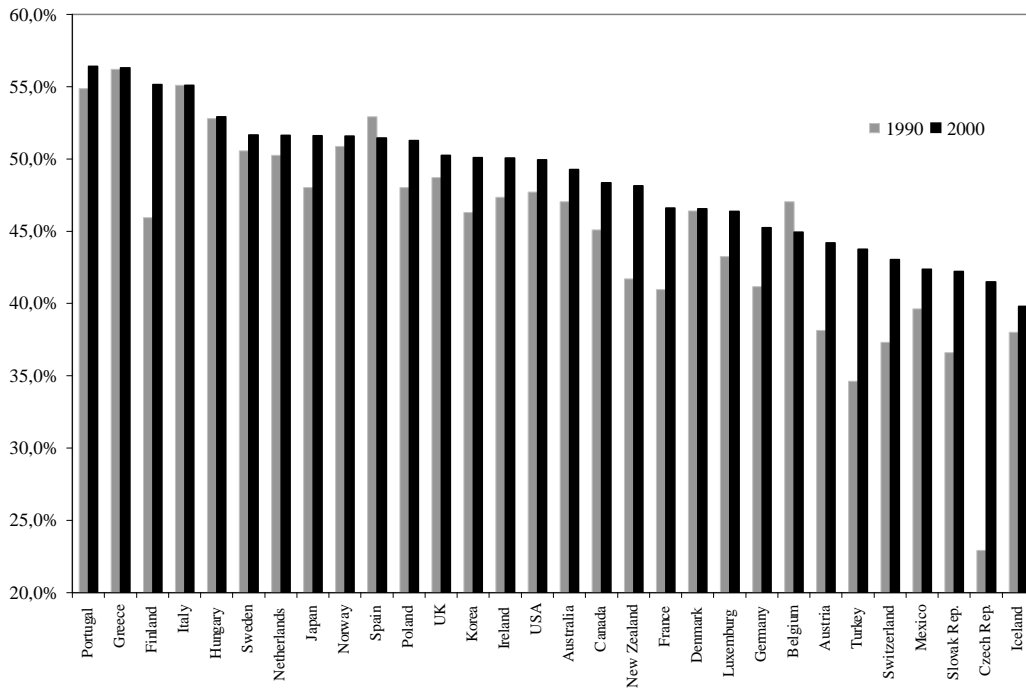
3.3 Stocks by education level and gender

Tables 2.1 and 2.2 respectively 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 substraction. Although the data set reveals specific information by country, we only report here data by country group. We consider income groups (following the World Bank classification), regional groups and groups of developing countries as defined in the UN classification, as well as a couple of groups of particular interest (OECD members, large countries with population above 75 million, sub-Saharan Africa, Latin America and the Caribbean, Middle East and Northern Africa and Islamic countries).

On the whole, we record 41.7 million immigrants aged 25+ and 58.2 million in 2000. The female share in adult OECD immigration was stable over the decade (50.6 percent in 1990 and 50.9 percent in 2000). These numbers are (for adults aged 25 and over) in line with the UNDP global numbers reported for the OECD countries (50.2 and 50.6 for these two years). However, the women's share varies across education level. The share in unskilled migration is above 51 percent (it decreased from 51.5 to 51.1 percent during the decade). The share in skilled migration is below 50 percent but strongly increased between 1990 and 2000 (from 46.7 to 49.3 percent).

The number of skilled women immigrants increased by 74 percent (from 5.8 to about 10.1 million). The rise was important for developing countries (both middle and low-income) where the number of skilled women emigrants was multiplied by 2.1 (+110 percent). Such an increase is in women skilled emigration is observed in every source region and is mainly due to the fact that women's rise in schooling level was more rapid than men's rise (supply effect). To a lesser extent, this also reflects the fact that skilled women are increasingly on the move. Indeed, as it will appear from the next section, the female skilled adult population increased by 67.9 percent at the world level and 83 percent in developing countries.

Figure 2 compares the average annual growth rates of women's total and skilled emigration stock and men's skilled emigration stock by region over the decade. In almost all regions the growth rate for skilled women is always bigger than for all women or skilled men. The evolution was particularly strong for migrants from the least developed countries, especially from low-income countries. The growth rate observed for Central and Southern Asia, sub-Saharan Africa and Central America are particularly high.

Table 3 reports countries sending the largest stocks of migrants to the OECD. In absolute terms (number of educated emigrants), the largest countries are obviously strongly affected by the brain drain. The elasticity of emigration stock to population size amounts to 63.2 percent, revealing that small countries are relatively more affected that large countries. The five largest diasporas (all education categories) originate from Mexico (6.434 million), 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, Ko-

rea, Poland and Morocco. In most of these countries, the women's share varies from 48 to 52 percent. However, women's share is particularly high for the Philippines (62.2 percent), Germany (57.4), Korea and Poland (around 56 percent).

Focusing on skilled emigrants, the ranking unsurpisingly shows that rich countries with highly educated population have better educated diasporas. The elasticity of skilled emigration to population size at origin amounts to 65.7 percent. The largest skilled 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 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 skilled migrants is large in Jamaica (62.1 percent), the Philippines (60.3) and other countries such as Japan, Russia, Ukraine, Poland and Colombia.

Figure 2. Annual average growth rate of total/skilled stock of emigrants Data by region (1990-2000)
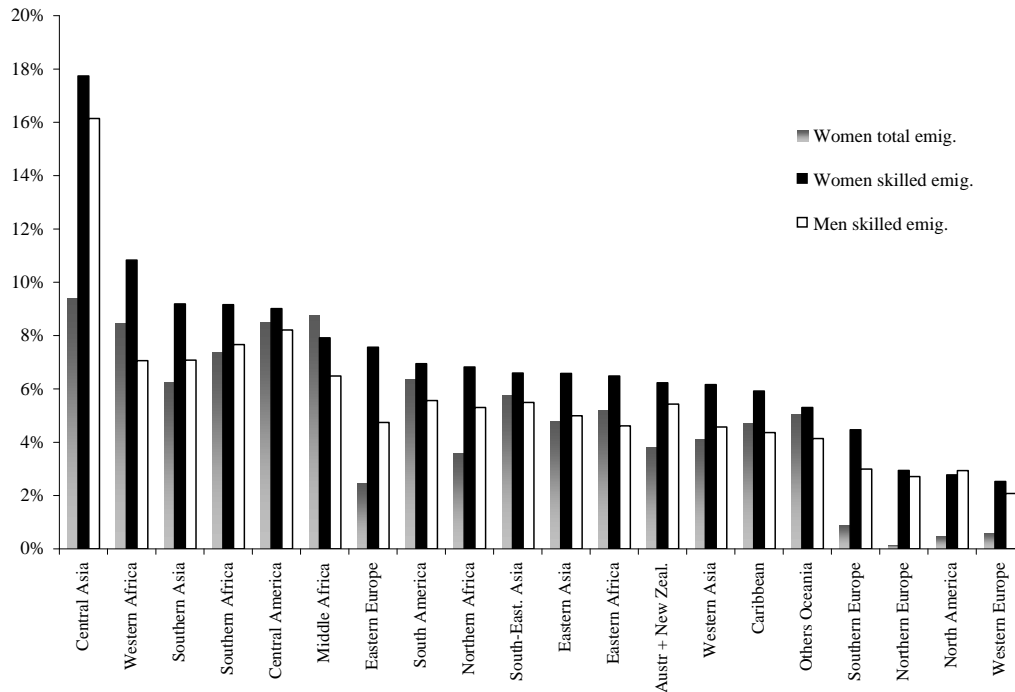
Table 2.1. Stock of emigrants by education and gender in 1990 (in thousands)

	Total migration (All education levels)				Unskilled migration (Less than secondary)				Skilled migration (post-secondary)			
	Both	Men	Women	%	Both	Men	Women	%	Both	Men	Women	%
World (a)	**41705**	**20615**	**21090**	**50,6%**	**20414**	**9891**	**10523**	**51,5%**	**12501**	**6668**	**5833**	**46,7%**
World Bank Income Classification (b)												
High-income countries	18046	8496	9550	52,9%	7991	3680	4310	53,9%	5749	2952	2797	48,7%
Upper-Middle-income countries	9125	4717	4408	48,3%	5433	2766	2667	49,1%	2027	1114	913	45,0%
Lower-Middle-income countries	9843	4898	4945	50,2%	4753	2344	2409	50,7%	3144	1639	1505	47,9%
Low-income countries	3507	1915	1592	45,4%	1565	772	793	50,7%	1317	822	495	37,6%
United Nations Classification (c)												
Least Developed Countries	1354	748	606	44,8%	714	364	350	49,0%	412	258	153	37,2%
Landlocked Developing countries	783	420	362	46,3%	373	191	182	48,7%	264	152	112	42,3%
Small Island Developing countries	2643	1231	1411	53,4%	1149	529	620	54,0%	918	448	471	51,2%
United Nations Classification (d)												
Africa	2837	1676	1162	40,9%	1717	994	723	42,1%	724	464	260	35,9%
Eastern Africa	*516*	*268*	*248*	*48,0%*	*212*	*97*	*115*	*54,2%*	*204*	*123*	*81*	*39,6%*
Middle Africa	*103*	*60*	*43*	*41,6%*	*42*	*22*	*20*	*47,7%*	*38*	*25*	*13*	*34,0%*
Northern Africa	*1671*	*1021*	*650*	*38,9%*	*1226*	*737*	*489*	*39,9%*	*259*	*173*	*86*	*33,4%*
Southern Africa	*135*	*66*	*70*	*51,3%*	*30*	*12*	*17*	*58,4%*	*79*	*43*	*36*	*45,8%*
Western Africa	*412*	*261*	*151*	*36,7%*	*208*	*126*	*82*	*39,4%*	*143*	*100*	*44*	*30,4%*
Americas	8439	4080	4359	51,7%	4151	2048	2103	50,7%	2641	1302	1340	50,7%
Caribbean	*1954*	*905*	*1050*	*53,7%*	*839*	*389*	*450*	*53,7%*	*693*	*331*	*362*	*52,3%*
Central America	*3486*	*1826*	*1660*	*47,6%*	*2412*	*1273*	*1139*	*47,2%*	*604*	*321*	*283*	*46,8%*
South America	*1574*	*723*	*851*	*54,1%*	*492*	*211*	*281*	*57,1%*	*628*	*315*	*313*	*49,8%*
North America	*1424*	*625*	*798*	*56,1%*	*408*	*176*	*233*	*57,0%*	*717*	*335*	*382*	*53,3%*
Asia	9402	4737	4664	49,6%	3956	1894	2062	52,1%	3781	2067	1714	45,3%
Central Asia	*35*	*16*	*19*	*53,7%*	*19*	*9*	*10*	*51,8%*	*8*	*4*	*4*	*54,2%*
Eastern Asia	*2645*	*1220*	*1425*	*53,9%*	*789*	*327*	*462*	*58,5%*	*1282*	*661*	*621*	*48,4%*
Southern Asia	*1961*	*1102*	*859*	*43,8%*	*732*	*370*	*362*	*49,5%*	*853*	*540*	*312*	*36,6%*
South-Eastern Asia	*2577*	*1172*	*1405*	*54,5%*	*959*	*406*	*553*	*57,6%*	*1191*	*575*	*616*	*51,7%*
Western Asia	*2184*	*1227*	*957*	*43,8%*	*1457*	*782*	*675*	*46,3%*	*447*	*287*	*160*	*35,9%*
Europe	19318	9281	10038	52,0%	9788	4567	5221	53,3%	4869	2581	2288	47,0%
Eastern Europe	*3615*	*1699*	*1917*	*53,0%*	*1895*	*830*	*1065*	*56,2%*	*867*	*469*	*398*	*45,9%*
Northern Europe	*4513*	*2072*	*2441*	*54,1%*	*1513*	*663*	*850*	*56,2%*	*1564*	*796*	*767*	*49,1%*
Southern Europe	*6948*	*3663*	*3284*	*47,3%*	*4763*	*2427*	*2336*	*49,0%*	*965*	*572*	*393*	*40,8%*
Western Europe	*4242*	*1846*	*2395*	*56,5%*	*1617*	*647*	*970*	*60,0%*	*1473*	*744*	*729*	*49,5%*
Oceania	524	252	273	52,0%	129	59	71	54,6%	221	114	107	48,5%
Australia and New Zealand	*383*	*184*	*199*	*52,0%*	*75*	*34*	*41*	*55,1%*	*166*	*85*	*81*	*48,9%*
Others Oceania	*141*	*68*	*73*	*51,9%*	*54*	*25*	*29*	*53,8%*	*54*	*29*	*26*	*47,5%*
Groups of interest												
OECD members	22490	10886	11603	51,6%	11513	5537	5975	51,9%	6066	3157	2909	48,0%
Large countries (>75M)	10766	5220	5546	51,5%	4953	2366	2588	52,2%	3782	1964	1818	48,1%
Sub-Saharan Africa	1166	655	512	43,9%	491	257	234	47,7%	465	291	174	37,4%
LAC countries (e)	7015	3454	3561	50,8%	3743	1873	1870	50,0%	1925	967	958	49,8%
MENA countries (f)	2751	1652	1099	40,0%	1600	930	671	41,9%	748	495	253	33,8%
Islamic countries (g)	5845	3374	2471	42,3%	3624	2027	1597	44,1%	1309	840	469	35,8%

(a) In the World total, we include individuals with unknown origin country.

(b) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(d) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(e) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(f) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(g) http://www.islamic-world.net/countries/index.htm

Table 2.2. Stock of emigrants by education and gender in 2000 (in thousands)

	Total migration (All education levels)				Unskilled migration (Less than secondary)				Skilled migration (post-secondary)			
	Both	Men	Women	%	Both	Men	Women	%	Both	Men	Women	%
World (a)	**58246**	**28623**	**29623**	**50,9%**	**25068**	**12248**	**12820**	**51,1%**	**20442**	**10372**	**10069**	**49,3%**
World Bank Income Classification (b)												
High-income countries	19717	9302	10415	52,8%	6936	3219	3717	53,6%	7911	3934	3977	50,3%
Upper-Middle-income countries	15339	7858	7482	48,8%	8572	4446	4126	48,1%	3729	1890	1839	49,3%
Lower-Middle-income countries	15505	7467	8037	51,8%	6432	3110	3322	51,6%	5691	2762	2929	51,5%
Low-income countries	6445	3381	3064	47,5%	2290	1069	1220	53,3%	2918	1683	1235	42,3%
United Nations Classification (c)												
Least Developed Countries	2364	1237	1127	47,7%	1049	507	542	51,7%	813	473	340	41,8%
Landlocked Developing countries	1333	681	652	48,9%	511	248	264	51,6%	524	282	241	46,1%
Small Island Developing countries	4123	1874	2249	54,6%	1598	730	868	54,3%	1536	701	835	54,4%
United Nations Classification (d)												
Africa	4352	2434	1918	44,1%	2136	1168	967	45,3%	1373	817	556	40,5%
Eastern Africa	*812*	*401*	*411*	*50,6%*	*234*	*98*	*136*	*58,2%*	*346*	*194*	*152*	*43,9%*
Middle Africa	*214*	*115*	*99*	*46,4%*	*88*	*41*	*47*	*53,3%*	*74*	*47*	*28*	*37,0%*
Northern Africa	*2252*	*1326*	*925*	*41,1%*	*1464*	*839*	*625*	*42,7%*	*457*	*289*	*167*	*36,6%*
Southern Africa	*272*	*130*	*142*	*52,1%*	*32*	*14*	*19*	*57,7%*	*177*	*90*	*87*	*49,3%*
Western Africa	*803*	*462*	*341*	*42,5%*	*318*	*177*	*141*	*44,2%*	*319*	*197*	*122*	*38,2%*
Americas	15493	7667	7826	50,5%	7599	3916	3682	48,5%	4631	2203	2428	52,4%
Caribbean	*3010*	*1347*	*1663*	*55,3%*	*1155*	*529*	*626*	*54,2%*	*1150*	*507*	*643*	*55,9%*
Central America	*8050*	*4301*	*3749*	*46,6%*	*5344*	*2899*	*2445*	*45,8%*	*1377*	*707*	*670*	*48,6%*
South America	*2899*	*1322*	*1577*	*54,4%*	*818*	*363*	*455*	*55,6%*	*1155*	*541*	*613*	*53,1%*
North America	*1534*	*697*	*837*	*54,6%*	*282*	*126*	*156*	*55,4%*	*950*	*448*	*502*	*52,9%*
Asia	15198	7405	7794	51,3%	5435	2525	2910	53,5%	7002	3595	3408	48,7%
Central Asia	*82*	*37*	*46*	*55,7%*	*26*	*12*	*14*	*52,7%*	*40*	*17*	*23*	*57,6%*
Eastern Asia	*4123*	*1845*	*2278*	*55,3%*	*1046*	*435*	*611*	*58,4%*	*2251*	*1077*	*1174*	*52,2%*
Southern Asia	*3472*	*1896*	*1575*	*45,4%*	*1054*	*513*	*541*	*51,3%*	*1823*	*1071*	*752*	*41,2%*
South-Eastern Asia	*4354*	*1889*	*2464*	*56,6%*	*1347*	*538*	*809*	*60,0%*	*2148*	*981*	*1167*	*54,3%*
Western Asia	*3168*	*1737*	*1431*	*45,2%*	*1962*	*1026*	*936*	*47,7%*	*740*	*448*	*292*	*39,4%*
Europe	21170	10120	11049	52,2%	8901	4159	4742	53,3%	6864	3467	3397	49,5%
Eastern Europe	*4436*	*1990*	*2445*	*55,1%*	*1687*	*712*	*975*	*57,8%*	*1571*	*745*	*826*	*52,6%*
Northern Europe	*4645*	*2172*	*2474*	*53,2%*	*1130*	*494*	*636*	*56,3%*	*2066*	*1040*	*1026*	*49,6%*
Southern Europe	*7494*	*3905*	*3589*	*47,9%*	*4682*	*2374*	*2308*	*49,3%*	*1377*	*768*	*609*	*44,2%*
Western Europe	*4595*	*2053*	*2542*	*55,3%*	*1402*	*579*	*823*	*58,7%*	*1850*	*914*	*936*	*50,6%*
Oceania	791	382	410	51,8%	159	76	83	52,3%	379	187	192	50,7%
Australia and New Zealand	*564*	*274*	*290*	*51,4%*	*80*	*40*	*40*	*50,5%*	*293*	*144*	*149*	*50,8%*
Others Oceania	*228*	*108*	*120*	*52,6%*	*79*	*36*	*43*	*54,2%*	*86*	*43*	*43*	*50,3%*
Groups of interest												
OECD members	28048	13832	14215	50,7%	13187	6594	6593	50,0%	8656	4356	4301	49,7%
Large countries (>75M)	18597	9138	9459	50,9%	7974	3963	4011	50,3%	7058	3510	3549	50,3%
Sub-Saharan Africa	2101	1108	993	47,3%	672	330	342	50,9%	916	528	388	42,4%
LAC countries (e)	13960	6971	6989	50,1%	7317	3791	3526	48,2%	3682	1755	1926	52,3%
MENA countries (f)	3823	2213	1610	42,1%	1938	1082	856	44,2%	1228	760	469	38,2%
Islamic countries (g)	8624	4813	3811	44,2%	4695	2527	2168	46,2%	2380	1428	952	40,0%

(a) In the World total, we include individuals with unknown origin country.

(b) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(d) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(e) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(f) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(g) http://www.islamic-world.net/countries/index.htm

Table 3. Top-30 total and skilled emigration stocks in 2000

Country	Total migration				Country	Skilled			
	Both	Men	Women	Fem%		Both	Men	Women	Fem%
Mexico	6434391	3518573	2915818	45,3%	United Kingdom	1478477	771923	706553	47,8%
United Kingdom	2990352	1443664	1546688	51,7%	Philippines	1111075	441227	669848	60,3%
Italy	2336966	1242585	1094381	46,8%	India	1034373	590412	443960	42,9%
Germany	2299491	978663	1320828	57,4%	Mexico	949334	501324	448010	47,2%
Turkey	1942452	1055113	887339	45,7%	Germany	936523	446085	490438	52,4%
India	1695646	896624	799022	47,1%	China	783369	391455	391914	50,0%
Philippines	1677762	634329	1043434	62,2%	Korea	612939	294123	318816	52,0%
China	1675535	787353	888182	53,0%	Canada	523463	244693	278770	53,3%
Vietnam	1261395	622004	639391	50,7%	Vietnam	505503	279239	226264	44,8%
Portugal	1209175	619630	589545	48,8%	Poland	454560	206348	248213	54,6%
Korea	1205118	523637	681480	56,5%	United States	426103	202872	223231	52,4%
Poland	1122078	492106	629972	56,1%	Italy	395233	232840	162393	41,1%
Morocco	1067016	616834	450182	42,2%	Cuba	331908	162359	169549	51,1%
Cuba	871708	417785	453923	52,1%	France	310754	145310	165444	53,2%
Canada	853941	374095	479846	56,2%	Iran	303385	181744	121642	40,1%
France	796016	357298	438717	55,1%	China, Hong Kong SAR	292575	146980	145595	49,8%
Ukraine	747673	308590	439083	58,7%	Jamaica	286932	108865	178068	62,1%
Greece	713826	381491	332335	46,6%	Japan	278272	115096	163176	58,6%
Spain	710653	336202	374451	52,7%	Taiwan	274168	124078	150089	54,7%
Serbia and Montenegro	683512	358190	325322	47,6%	Russia	270445	114504	155940	57,7%
Jamaica	681075	293053	388022	57,0%	Netherlands	254734	142438	112296	44,1%
Ireland	680459	312741	367719	54,0%	Ukraine	249015	112195	136821	54,9%
United States	679598	322456	357141	52,6%	Colombia	233073	105745	127328	54,6%
El Salvador	664942	328652	336290	50,6%	Ireland	228144	111497	116646	51,1%
Algeria	609099	357386	251713	41,3%	Pakistan	220591	138144	82447	37,4%
Pakistan	581903	329264	252638	43,4%	New Zealand	174872	88391	86481	49,5%
Dominican Republic	578987	245058	333930	57,7%	Turkey	174689	110977	63712	36,5%
Colombia	574924	240415	334509	58,2%	South Africa	173021	87561	85461	49,4%
Netherlands	570984	293226	277758	48,6%	Peru	163931	78561	85371	52,1%
Russia	552731	224711	328019	59,3%	Romania	162904	82107	80797	49,6%

4 Emigration rates

We count as migrants all adult (25 and over) foreign-born individuals living in an OECD country. However, it is obvious that the pressure exerted by 1,036,000 Indian skilled emigrants (4.3% of the educated total adult population) is less important than the pressure exerted by 15,696 skilled emigrants 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 pressure imposed on the labor market in the source country.

4.1 Methodology and data sources

In the spirit of Carrington and Detragiache (1998), Adams (2003), Docquier and Marfouk (2006) or Dumont and Lemaitre (2006), our second step consists in calculating the brain drain 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

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

In particular, $m_{t,g,h}^{i}$ can be used as a proxy of the brain drain in the source country i.

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 Nations[13]. 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 factbook[14]. 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 enrolment rates and/or the closed GDP per capita. This method gives good approximations of the brain drain rate, broadly consistent with anecdotal evidence.

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[13]See http://esa.un.org/unpp.
[14]See http://www.cia.gov/cia/publications/factbook.

Tables 4.1 and 4.2 in appendix give the structure of the adult population (25+) by country group and region of origin.

The world adult population increased from 2.559 to 3.180 billion people between 1990 and 2000 (+24.3 percent). This global growth rate hides important changes across education categories. While the unskilled population increased by 19.7 percent, the skilled populaiton rose by 52.5 percent. Consequently, the proportion of post-secondary educated workers in the world adult population increased from 9.1 to 11.1 percent over the period. Although women still face unequal access to education in many countries, is worth noticing that women's share in the skilled adult population increased from 40.4 to 44.5 percent (their share in the unskilled population remains above 55 percent). Our data reveal that gender gaps in human capital are strongly linked to the level of economic development. The share of women in the skilled population is still very low in low-income countries (30.3 percent) and in the least developed countries (28.5 percent). The educational achievement of women is particularly worrisome in Western Africa (13.3 percent) and Northern Africa (14.7 percent). Figure 3 compares the average annual growth rates of women's total/skilled and men's skilled adult population by region over the decade.

Figure 3. Annual average growth rate of total/skilled adult population (25+)
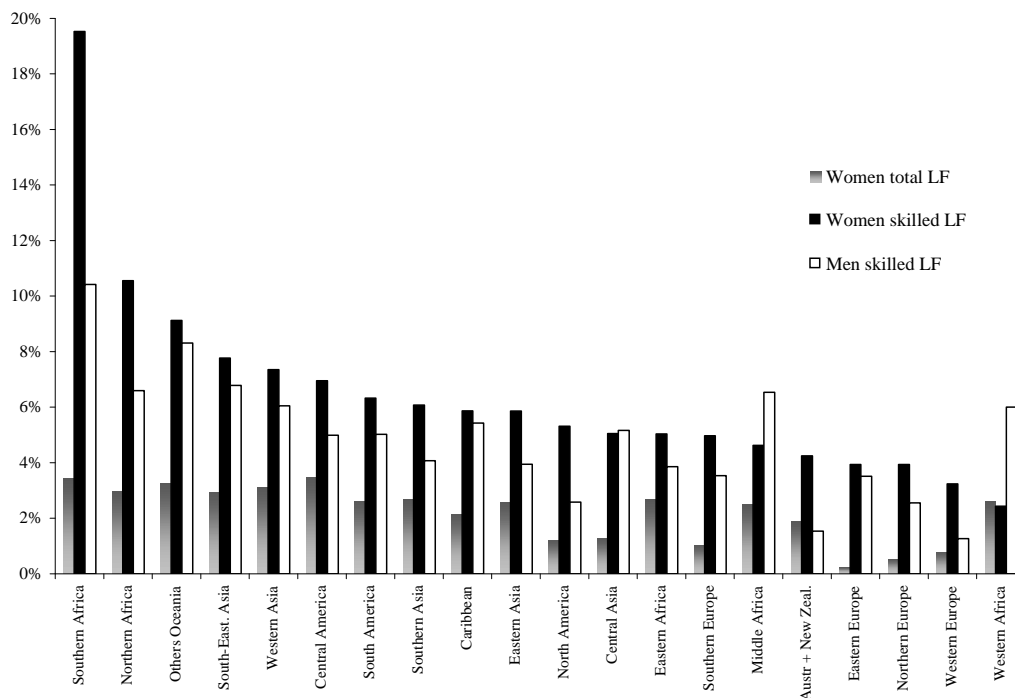**Data by region (1990-2000)**

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Table 4.1. Adult population (25+) by education and gender in 1990 (in thousands)

	Total adult population (All education levels)				Unskilled adult population (Less than secondary)				Skilled adult population (post-secondary)			
	Both	**Men**	**Women**	**%**	**Both**	**Men**	**Women**	**%**	**Both**	**Men**	**Women**	**%**
World	**2558790**	**1265409**	**1293381**	**50,5%**	**1575685**	**690634**	**885051**	**56,2%**	**232292**	**138405**	**93887**	**40,4%**
World Bank Income Classification (a)												
High-income countries	585129	281305	303824	51,9%	198735	90484	108251	54,5%	138946	78689	60256	43,4%
Upper-Middle-income countries	359928	170519	189409	52,6%	198041	82375	115666	58,4%	34850	19222	15628	44,8%
Lower-Middle-income countries	919340	463152	456187	49,6%	599891	249743	350148	58,4%	35787	23907	11880	33,2%
Low-income countries	694394	350433	343961	49,5%	579018	268032	310986	53,7%	22710	16586	6123	27,0%
United Nations Classification (b)												
Least Developed Countries	189008	92640	96368	51,0%	167550	76941	90609	54,1%	3203	2403	800	25,0%
Landlocked Developing countries	108517	52310	56207	51,8%	80333	35299	45034	56,1%	5055	3047	2008	39,7%
Small Island Developing countries	24960	12517	12444	49,9%	19253	9373	9880	51,3%	1213	732	481	39,7%
United Nations Classification (c)												
Africa	228448	111422	117026	51,2%	197578	91085	106492	53,9%	5720	4314	1406	24,6%
Eastern Africa	*67073*	*32384*	*34689*	*51,7%*	*60242*	*27730*	*32512*	*54,0%*	*1031*	*721*	*310*	*30,1%*
Middle Africa	*25338*	*12141*	*13197*	*52,1%*	*22195*	*9940*	*12255*	*55,2%*	*351*	*291*	*60*	*17,2%*
Northern Africa	*56322*	*27827*	*28495*	*50,6%*	*46804*	*21427*	*25376*	*54,2%*	*2557*	*1905*	*651*	*25,5%*
Southern Africa	*16960*	*8184*	*8777*	*51,7%*	*12448*	*5968*	*6480*	*52,1%*	*620*	*442*	*178*	*28,7%*
Western Africa	*62756*	*30886*	*31870*	*50,8%*	*55889*	*26020*	*29869*	*53,4%*	*1162*	*955*	*207*	*17,8%*
Americas	372244	179763	192480	51,7%	163146	80129	83018	50,9%	88679	48877	39802	44,9%
Caribbean	*13321*	*6539*	*6782*	*50,9%*	*9362*	*4470*	*4892*	*52,3%*	*883*	*487*	*396*	*44,8%*
Central America	*43350*	*20862*	*22487*	*51,9%*	*30665*	*14276*	*16390*	*53,4%*	*3806*	*2348*	*1458*	*38,3%*
South America	*135012*	*65713*	*69298*	*51,3%*	*101872*	*49100*	*52771*	*51,8%*	*12382*	*6647*	*5735*	*46,3%*
North America	*180561*	*86649*	*93913*	*52,0%*	*21247*	*12283*	*8964*	*42,2%*	*71607*	*39395*	*32213*	*45,0%*
Asia	1473723	748424	725300	49,2%	1021116	447196	573920	56,2%	69339	47075	22264	32,1%
Central Asia	*22159*	*10485*	*11674*	*52,7%*	*6273*	*1387*	*4886*	*77,9%*	*2650*	*1492*	*1158*	*43,7%*
Eastern Asia	*701412*	*356889*	*344523*	*49,1%*	*413492*	*165775*	*247717*	*59,9%*	*33388*	*23046*	*10342*	*31,0%*
Southern Asia	*499396*	*256417*	*242979*	*48,7%*	*408891*	*190467*	*218424*	*53,4%*	*18313*	*13730*	*4583*	*25,0%*
South-Eastern Asia	*187498*	*92150*	*95348*	*50,9%*	*147308*	*68337*	*78971*	*53,6%*	*9820*	*5510*	*4310*	*43,9%*
Western Asia	*63258*	*32483*	*30775*	*48,7%*	*45152*	*21230*	*23922*	*53,0%*	*5168*	*3296*	*1871*	*36,2%*
Europe	469662	218494	251168	53,5%	188040	69492	118548	63,0%	64797	35838	28959	44,7%
Eastern Europe	*196640*	*89051*	*107589*	*54,7%*	*56758*	*12251*	*44507*	*78,4%*	*23405*	*12524*	*10881*	*46,5%*
Northern Europe	*60675*	*28691*	*31984*	*52,7%*	*25100*	*11334*	*13766*	*54,8%*	*9265*	*5034*	*4231*	*45,7%*
Southern Europe	*92936*	*44267*	*48669*	*52,4%*	*68214*	*30850*	*37364*	*54,8%*	*7449*	*4067*	*3382*	*45,4%*
Western Europe	*119411*	*56485*	*62926*	*52,7%*	*37969*	*15058*	*22911*	*60,3%*	*24678*	*14213*	*10465*	*42,4%*
Oceania	14713	7306	7407	50,3%	5805	2731	3073	52,9%	3757	2301	1456	38,7%
Australia and New Zealand	*12489*	*6122*	*6366*	*51,0%*	*3881*	*1732*	*2150*	*55,4%*	*3722*	*2277*	*1445*	*38,8%*
Others Oceania	*2224*	*1184*	*1041*	*46,8%*	*1923*	*999*	*924*	*48,0%*	*35*	*24*	*11*	*30,6%*
Groups of interest												
OECD members	647623	309840	337783	52,2%	241987	108823	133163	55,0%	142651	80926	61726	43,3%
Large countries (>75M)	1697740	848562	849178	50,0%	1031939	448934	583005	56,5%	150862	91585	59277	39,3%
Sub-Saharan Africa	172127	83595	88532	51,4%	150774	69658	81116	53,8%	3164	2408	755	23,9%
LAC countries	191682	93115	98568	51,4%	141899	67846	74054	52,2%	17072	9483	7589	44,5%
MENA countries (e)	97083	49678	47405	48,8%	75184	35317	39866	53,0%	5878	4044	1834	31,2%
Islamic countries (f)	393474	196851	196623	50,0%	314663	144283	170380	54,1%	14885	10478	4407	29,6%

(a) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(c) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(d) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(e) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(f) http://www.islamic-world.net/countries/index.htm

Table 4.2. Adult population (25+) by education and gender in 2000 (in thousands)

	Total adult population (All education levels)				Unskilled adult population (Less than secondary)				Skilled adult population (post-secondary)			
	Both	Men	Women	%	Both	Men	Women	%	Both	Men	Women	%
World	**3179718**	**1571014**	**1608705**	**50,6%**	**1885976**	**835349**	**1050627**	**55,7%**	**354282**	**196657**	**157625**	**44,5%**
World Bank Income Classification (a)												
High-income countries	662506	320073	342433	51,7%	187105	85076	102030	54,5%	197637	101680	95958	48,6%
Upper-Middle-income countries	426226	201629	224597	52,7%	229680	97447	132233	57,6%	56532	30122	26410	46,7%
Lower-Middle-income countries	1187136	594021	593115	50,0%	743374	317291	426083	57,3%	64353	39946	24407	37,9%
Low-income countries	903851	455291	448560	49,6%	725817	335535	390282	53,8%	35760	24910	10851	30,3%
United Nations Classification (b)												
Least Developed Countries	249873	122450	127423	51,0%	215479	99367	116112	53,9%	5777	4131	1646	28,5%
Landlocked Developing countries	136479	65749	70729	51,8%	102761	45971	56790	55,3%	8220	4858	3363	40,9%
Small Island Developing countries	33181	16588	16593	50,0%	23333	11364	11970	51,3%	2206	1273	933	42,3%
United Nations Classification (c)												
Africa	300244	146437	153808	51,2%	237175	108413	128762	54,3%	11813	8112	3701	31,3%
Eastern Africa	87250	42114	45136	51,7%	75730	35271	40458	53,4%	1560	1053	507	32,5%
Middle Africa	32615	15739	16876	51,7%	26346	11481	14865	56,4%	642	547	95	14,7%
Northern Africa	75418	37220	38197	50,6%	55457	25233	30225	54,5%	5386	3610	1777	33,0%
Southern Africa	23453	11149	12304	52,5%	10507	4456	6052	57,6%	2250	1190	1060	47,1%
Western Africa	81509	40214	41295	50,7%	69134	31971	37163	53,8%	1975	1712	263	13,3%
Americas	455273	219276	235997	51,8%	181841	86948	94894	52,2%	134569	66349	68220	50,7%
Caribbean	16450	8066	8384	51,0%	9945	4800	5145	51,7%	1527	827	700	45,8%
Central America	60580	28895	31685	52,3%	38669	17961	20708	53,6%	6679	3822	2857	42,8%
South America	173793	83980	89814	51,7%	120930	57977	62953	52,1%	21447	10853	10595	49,4%
North America	204449	98335	106114	51,9%	12298	6209	6088	49,5%	104916	50847	54069	51,5%
Asia	1907394	963284	944110	49,5%	1263557	560154	703403	55,7%	114803	73439	41363	36,0%
Central Asia	25338	12062	13276	52,4%	9106	2735	6371	70,0%	4366	2469	1897	43,4%
Eastern Asia	896953	452397	444556	49,6%	508642	211117	297525	58,5%	52231	33946	18286	35,0%
Southern Asia	648079	331300	316779	48,9%	507936	235540	272396	53,6%	28739	20470	8269	28,8%
South-Eastern Asia	250518	122921	127598	50,9%	180363	83883	96479	53,5%	19729	10622	9107	46,2%
Western Asia	86506	44605	41900	48,4%	57510	26879	30631	53,3%	9737	5932	3805	39,1%
Europe	499035	233352	265684	53,2%	197347	76869	120378	61,0%	88175	46051	42124	47,8%
Eastern Europe	200828	90832	109996	54,8%	67634	19006	48628	71,9%	33705	17693	16012	47,5%
Northern Europe	64279	30592	33687	52,4%	20508	9467	11041	53,8%	12704	6479	6225	49,0%
Southern Europe	103439	49491	53947	52,2%	67532	30653	36878	54,6%	11250	5757	5493	48,8%
Western Europe	130490	62436	68054	52,2%	41574	17743	23831	57,3%	30515	16122	14394	47,2%
Oceania	17773	8665	9107	51,2%	6156	2965	3191	51,8%	4923	2706	2217	45,0%
Australia and New Zealand	14842	7170	7672	51,7%	3683	1738	1945	52,8%	4844	2653	2191	45,2%
Others Oceania	2931	1496	1435	49,0%	2473	1227	1246	50,4%	79	53	25	32,2%
Groups of interest												
OECD members	739278	355109	384169	52,0%	238790	107414	131376	55,0%	203547	105145	98401	48,3%
Large countries (>75M)	2130619	1062349	1068270	50,1%	1258734	553740	704994	56,0%	224760	125793	98967	44,0%
Sub-Saharan Africa	224826	109216	115610	51,4%	181718	83180	98538	54,2%	6427	4502	1925	29,9%
LAC countries	250823	120941	129882	51,8%	169543	80738	88805	52,4%	29653	15502	14151	47,7%
MENA countries (e)	133690	68193	65497	49,0%	90775	42064	48711	53,7%	12205	7794	4411	36,1%
Islamic countries (f)	519936	260151	259785	50,0%	393241	180297	212944	54,2%	30324	20330	9994	33,0%

(a) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(c) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(d) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(e) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(f) http://www.islamic-world.net/countries/index.htm

It comes out that the highest growth rates were observed in the poorest regions of sub-Saharan Africa, Pacific islands and Southern Asia. The level of schooling of the adult population also increased significantly in Northern Africa. The change in the intensity of the brain drain will then result from the comparison of the growth rate of skilled emigrants with skilled residents/natives. In many African countries (except in Southern and Northern Africa) and in Central America and Southern Asia, the growth rate of the stock of skilled female emigrants exceeded the growth rate of the skilled female population. The brain drain increases significantly in these regions. The opposite movement was observed in Southern and Northern Africa, or in Pacific islands.

4.2 Emigration rates by education level and gender

Tables 5.1 and 5.2 show the emigration rates of unskilled and skilled workers, as well as global emigration rates by country groups and region of origin in 1990 and 2000. The reported index gives the female/male ratio in emigration rates by education level. Our 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. Skilled emigration rates are high in small and poor countries. Small developing islands of the Caribbean (47.2 percent) and the Pacific (63.1 percent) are particularly affected.

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 emigration rates are, however, lower than men's in the less developed countries, especially in Northern and sub-Saharan Africa. On the contrary, skilled emigration rates are more pronounced among women. In 2000, the average (weighted) female/male ratio of brain drain amounted to 1.20. Huge ratios were observed in regions where women have a poor access to education such as Middle Africa (2.225), Eastern Asia (2.030), Southern Africa (1.914) and Western Africa (1.842).

Between 1990 and 2000, and despite the rise in women's level of schooling, men's and women's skilled emigration rates slightly increased. Although the gender ratio of skilled migration rates decreased at the world level and in most regions, it rose in some developing regions such as Middle and Western Africa.

Table 5.1. Rates of emigration by education and gender in 1990

	Total migration (All education levels)				Unskilled migration (Less than secondary)				Skilled migration (post-secondary)			
	Both	Males	Females	Ratio	Both	Males	Females	Ratio	Both	Males	Females	Ratio
World	**1,6%**	**1,6%**	**1,6%**	**1,001**	**1,2%**	**1,4%**	**1,1%**	**0,833**	**5,0%**	**4,5%**	**5,7%**	**1,273**
World Bank Income Classification (a)												
High-income countries	3,0%	2,9%	3,0%	1,040	3,9%	3,9%	3,8%	0,980	4,0%	3,6%	4,4%	1,227
Upper-Middle-income countries	2,5%	2,7%	2,3%	0,845	2,7%	3,2%	2,3%	0,694	5,5%	5,5%	5,5%	1,008
Lower-Middle-income countries	1,1%	1,0%	1,1%	1,025	0,8%	0,9%	0,7%	0,735	8,1%	6,4%	11,2%	1,752
Low-income countries	0,5%	0,5%	0,5%	0,848	0,3%	0,3%	0,3%	0,886	5,5%	4,7%	7,5%	1,582
United Nations Classification (b)												
Least Developed Countries	0,7%	0,8%	0,6%	0,781	0,4%	0,5%	0,4%	0,815	11,4%	9,7%	16,1%	1,657
Landlocked Developing countries	0,7%	0,8%	0,6%	0,803	0,5%	0,5%	0,4%	0,746	5,0%	4,8%	5,3%	1,104
Small Island Developing countries	9,6%	9,0%	10,2%	1,137	5,6%	5,3%	5,9%	1,105	43,1%	38,0%	49,4%	1,302
United Nations Classification (c)												
Africa	1,2%	1,5%	1,0%	0,663	0,9%	1,1%	0,7%	0,624	11,2%	9,7%	15,6%	1,608
Eastern Africa	0,8%	0,8%	0,7%	0,864	0,4%	0,3%	0,4%	1,011	16,5%	14,6%	20,7%	1,415
Middle Africa	0,4%	0,5%	0,3%	0,657	0,2%	0,2%	0,2%	0,742	9,7%	7,9%	17,6%	2,225
Northern Africa	2,9%	3,5%	2,2%	0,630	2,6%	3,3%	1,9%	0,568	9,2%	8,3%	11,7%	1,411
Southern Africa	0,8%	0,8%	0,8%	0,984	0,2%	0,2%	0,3%	1,291	11,3%	8,8%	16,9%	1,914
Western Africa	0,7%	0,8%	0,5%	0,565	0,4%	0,5%	0,3%	0,567	11,0%	9,5%	17,4%	1,842
Americas	2,2%	2,2%	2,2%	0,998	2,5%	2,5%	2,5%	0,991	2,9%	2,6%	3,3%	1,255
Caribbean	12,8%	12,2%	13,4%	1,103	8,2%	8,0%	8,4%	1,053	44,0%	40,4%	47,8%	1,182
Central America	7,4%	8,0%	6,9%	0,854	7,3%	8,2%	6,5%	0,794	13,7%	12,0%	16,2%	1,350
South America	1,2%	1,1%	1,2%	1,114	0,5%	0,4%	0,5%	1,236	4,8%	4,5%	5,2%	1,144
North America	0,8%	0,7%	0,8%	1,176	1,9%	1,4%	2,5%	1,797	1,0%	0,8%	1,2%	1,389
Asia	0,6%	0,6%	0,6%	1,016	0,4%	0,4%	0,4%	0,849	5,2%	4,2%	7,1%	1,699
Central Asia	0,2%	0,2%	0,2%	1,043	0,3%	0,6%	0,2%	0,306	0,3%	0,3%	0,4%	1,522
Eastern Asia	0,4%	0,3%	0,4%	1,209	0,2%	0,2%	0,2%	0,945	3,7%	2,8%	5,7%	2,030
Southern Asia	0,4%	0,4%	0,4%	0,824	0,2%	0,2%	0,2%	0,853	4,4%	3,8%	6,4%	1,684
South-Eastern Asia	1,4%	1,3%	1,5%	1,156	0,6%	0,6%	0,7%	1,176	10,8%	9,4%	12,5%	1,324
Western Asia	3,3%	3,6%	3,0%	0,828	3,1%	3,6%	2,7%	0,773	8,0%	8,0%	7,9%	0,987
Europe	4,0%	4,1%	3,8%	0,943	4,9%	6,2%	4,2%	0,684	7,0%	6,7%	7,3%	1,090
Eastern Europe	1,8%	1,9%	1,8%	0,935	3,2%	6,3%	2,3%	0,368	3,6%	3,6%	3,5%	0,979
Northern Europe	6,9%	6,7%	7,1%	1,053	5,7%	5,5%	5,8%	1,053	14,4%	13,7%	15,4%	1,124
Southern Europe	7,0%	7,6%	6,3%	0,827	6,5%	7,3%	5,9%	0,807	11,5%	12,3%	10,4%	0,845
Western Europe	3,4%	3,2%	3,7%	1,158	4,1%	4,1%	4,1%	0,986	5,6%	5,0%	6,5%	1,310
Oceania	3,4%	3,3%	3,5%	1,066	2,2%	2,1%	2,2%	1,066	5,5%	4,7%	6,9%	1,457
Australia and New Zealand	3,0%	2,9%	3,0%	1,042	1,9%	1,9%	1,9%	0,990	4,3%	3,6%	5,3%	1,480
Others Oceania	6,0%	5,4%	6,6%	1,213	2,7%	2,5%	3,1%	1,252	61,2%	54,3%	71,0%	1,306
Groups of interest												
OECD members	3,4%	3,4%	3,3%	0,978	4,5%	4,8%	4,3%	0,887	4,1%	3,8%	4,5%	1,199
Large countries (>75M)	0,6%	0,6%	0,6%	1,061	0,5%	0,5%	0,4%	0,843	2,4%	2,1%	3,0%	1,418
Sub-Saharan Africa	0,7%	0,8%	0,6%	0,739	0,3%	0,4%	0,3%	0,782	12,8%	10,8%	18,7%	1,734
LAC countries	3,5%	3,6%	3,5%	0,975	2,6%	2,7%	2,5%	0,917	10,1%	9,3%	11,2%	1,211
MENA countries (e)	2,8%	3,2%	2,3%	0,704	2,1%	2,6%	1,7%	0,645	11,3%	10,9%	12,1%	1,112
Islamic countries (f)	1,5%	1,7%	1,2%	0,737	1,1%	1,4%	0,9%	0,671	8,1%	7,4%	9,6%	1,296

(a) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(c) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(d) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(e) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(f) http://www.islamic-world.net/countries/index.htm

Table 5.2. Rates of emigration by education and gender in 2000

	Total migration (All education levels)				Unskilled migration (Less than secondary)				Skilled migration (post-secondary)			
	Both	Males	Females	Ratio	Both	Males	Females	Ratio	Both	Males	Females	Ratio
World	**1,8%**	**1,8%**	**1,8%**	**1,011**	**1,3%**	**1,4%**	**1,2%**	**0,833**	**5,4%**	**5,0%**	**6,0%**	**1,200**
World Bank Income Classification (a)												
High-income countries	2,9%	2,8%	3,0%	1,045	3,6%	3,6%	3,5%	0,964	3,8%	3,7%	4,0%	1,068
Upper-Middle-income countries	3,5%	3,8%	3,2%	0,859	3,6%	4,4%	3,0%	0,694	6,2%	5,9%	6,5%	1,103
Lower-Middle-income countries	1,3%	1,2%	1,3%	1,077	0,9%	1,0%	0,8%	0,797	8,1%	6,5%	10,7%	1,657
Low-income countries	0,7%	0,7%	0,7%	0,920	0,3%	0,3%	0,3%	0,981	7,5%	6,3%	10,2%	1,615
United Nations Classification (b)												
Least Developed Countries	0,9%	1,0%	0,9%	0,877	0,5%	0,5%	0,5%	0,915	12,3%	10,3%	17,1%	1,666
Landlocked Developing countries	1,0%	1,0%	0,9%	0,891	0,5%	0,5%	0,5%	0,862	6,0%	5,5%	6,7%	1,220
Small Island Developing countries	11,1%	10,1%	11,9%	1,176	6,4%	6,0%	6,8%	1,121	41,0%	35,5%	47,2%	1,330
United Nations Classification (c)												
Africa	1,4%	1,6%	1,2%	0,753	0,9%	1,1%	0,7%	0,699	10,4%	9,2%	13,1%	1,427
Eastern Africa	*0,9%*	*0,9%*	*0,9%*	*0,957*	*0,3%*	*0,3%*	*0,3%*	*1,215*	*18,1%*	*15,6%*	*23,0%*	*1,481*
Middle Africa	*0,7%*	*0,7%*	*0,6%*	*0,807*	*0,3%*	*0,4%*	*0,3%*	*0,883*	*10,4%*	*7,9%*	*22,6%*	*2,863*
Northern Africa	*2,9%*	*3,4%*	*2,4%*	*0,688*	*2,6%*	*3,2%*	*2,0%*	*0,630*	*7,8%*	*7,4%*	*8,6%*	*1,160*
Southern Africa	*1,1%*	*1,2%*	*1,1%*	*0,988*	*0,3%*	*0,3%*	*0,3%*	*1,006*	*7,3%*	*7,0%*	*7,6%*	*1,085*
Western Africa	*1,0%*	*1,1%*	*0,8%*	*0,721*	*0,5%*	*0,6%*	*0,4%*	*0,682*	*13,9%*	*10,3%*	*31,7%*	*3,065*
Americas	3,3%	3,4%	3,2%	0,950	4,0%	4,3%	3,7%	0,867	3,3%	3,2%	3,4%	1,070
Caribbean	*15,5%*	*14,3%*	*16,6%*	*1,157*	*10,4%*	*9,9%*	*10,8%*	*1,093*	*43,0%*	*38,0%*	*47,9%*	*1,261*
Central America	*11,7%*	*13,0%*	*10,6%*	*0,817*	*12,1%*	*13,9%*	*10,6%*	*0,760*	*17,1%*	*15,6%*	*19,0%*	*1,217*
South America	*1,6%*	*1,6%*	*1,7%*	*1,113*	*0,7%*	*0,6%*	*0,7%*	*1,152*	*5,1%*	*4,8%*	*5,5%*	*1,151*
North America	*0,7%*	*0,7%*	*0,8%*	*1,113*	*2,2%*	*2,0%*	*2,5%*	*1,263*	*0,9%*	*0,9%*	*0,9%*	*1,054*
Asia	0,8%	0,8%	0,8%	1,073	0,4%	0,4%	0,4%	0,918	5,7%	4,7%	7,6%	1,631
Central Asia	*0,3%*	*0,3%*	*0,3%*	*1,141*	*0,3%*	*0,5%*	*0,2%*	*0,480*	*0,9%*	*0,7%*	*1,2%*	*1,757*
Eastern Asia	*0,5%*	*0,4%*	*0,5%*	*1,255*	*0,2%*	*0,2%*	*0,2%*	*0,997*	*4,1%*	*3,1%*	*6,0%*	*1,962*
Southern Asia	*0,5%*	*0,6%*	*0,5%*	*0,869*	*0,2%*	*0,2%*	*0,2%*	*0,912*	*6,0%*	*5,0%*	*8,3%*	*1,676*
South-Eastern Asia	*1,7%*	*1,5%*	*1,9%*	*1,252*	*0,7%*	*0,6%*	*0,8%*	*1,304*	*9,8%*	*8,5%*	*11,4%*	*1,343*
Western Asia	*3,5%*	*3,7%*	*3,3%*	*0,881*	*3,3%*	*3,7%*	*3,0%*	*0,806*	*7,1%*	*7,0%*	*7,1%*	*1,013*
Europe	4,1%	4,2%	4,0%	0,961	4,3%	5,1%	3,8%	0,738	7,2%	7,0%	7,5%	1,066
Eastern Europe	*2,2%*	*2,1%*	*2,2%*	*1,014*	*2,4%*	*3,6%*	*2,0%*	*0,544*	*4,5%*	*4,0%*	*4,9%*	*1,215*
Northern Europe	*6,7%*	*6,6%*	*6,8%*	*1,032*	*5,2%*	*5,0%*	*5,4%*	*1,098*	*14,0%*	*13,8%*	*14,1%*	*1,022*
Southern Europe	*6,8%*	*7,3%*	*6,2%*	*0,853*	*6,5%*	*7,2%*	*5,9%*	*0,820*	*10,9%*	*11,8%*	*10,0%*	*0,848*
Western Europe	*3,4%*	*3,2%*	*3,6%*	*1,131*	*3,3%*	*3,2%*	*3,3%*	*1,056*	*5,7%*	*5,4%*	*6,1%*	*1,138*
Oceania	4,3%	4,2%	4,3%	1,020	2,5%	2,5%	2,5%	1,020	7,1%	6,5%	8,0%	1,233
Australia and New Zealand	*3,7%*	*3,7%*	*3,6%*	*0,990*	*2,1%*	*2,2%*	*2,0%*	*0,914*	*5,7%*	*5,2%*	*6,4%*	*1,233*
Others Oceania	*7,2%*	*6,7%*	*7,7%*	*1,144*	*3,1%*	*2,9%*	*3,3%*	*1,158*	*52,3%*	*44,6%*	*63,1%*	*1,416*
Groups of interest												
OECD members	3,7%	3,7%	3,6%	0,952	5,2%	5,8%	4,8%	0,826	4,1%	4,0%	4,2%	1,053
Large countries (>75M)	0,9%	0,9%	0,9%	1,029	0,6%	0,7%	0,6%	0,796	3,0%	2,7%	3,5%	1,275
Sub-Saharan Africa	0,9%	1,0%	0,9%	0,848	0,4%	0,4%	0,3%	0,876	12,5%	10,5%	16,8%	1,601
LAC countries	5,3%	5,4%	5,1%	0,937	4,1%	4,5%	3,8%	0,852	11,0%	10,2%	12,0%	1,178
MENA countries (e)	2,8%	3,1%	2,4%	0,763	2,1%	2,5%	1,7%	0,689	9,1%	8,9%	9,6%	1,082
Islamic countries (f)	1,6%	1,8%	1,4%	0,796	1,2%	1,4%	1,0%	0,729	7,3%	6,6%	8,7%	1,325

(a) http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

(b) http://www.un.org/special-rep/ohrlls/ldc/list.htm; http://www.un.org/special-rep/ohrlls/lldc/list.htm; http://www.un.org/special-rep/ohrlls/sid/list.htm

(c) http://unstats.un.org/unsd/methods/m49/m49regin.htm

(d) LAC = Central America + South America + The Caribbean; Sub-Saharan Africa = Africa - Northern Africa

(e) http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/MENAEXT/0,,menuPK:247606~pagePK:146732~piPK:146828~theSitePK:256299,00.html

(f) http://www.islamic-world.net/countries/index.htm

Table 6 depicts the situation of the 30 most affected countries in 2000 regarding skilled migration rates. The right panel is based on the full sample. 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. On the right panel, we eliminate small countries and focus on countries with more 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 brain drain exceed 30 percent in nine countries, including five sub-Saharan African ones.

Regarding gender disparities, Figure 4.1 and 4.2 compares stock and rates of skilled migration by gender. Figure 4.1 shows that the correlation in stocks is extremely high (97 percent). On average, the number of skilled female migrants is lower than the number of skilled men. Figure 4.2 reveals that the correlation is lower in rates (88 percent); women's rate is on average 17 percent above men's. However, the female/male ratio in emigration rates varies strongly across countries. As shown on Table 7, it ranges from 0.522 in Bhutan to 4.378 in Nigeria. Countries where women are disproportionately affected are Nigeria, Cameroon, Sao Tome and Principe, the Democratic Republic of Congo, Angola and Guinea. On the other hand, men are over-represented in Bhutan, Lesotho, Cambodia, Saudi Arabia, Jordan and Botswana. This gender gap in skilled emigration rate is strongly correlated with the gender gap in educational attainment of residents. It is especially strong in countries where women have little access to education. A simple regression of the log of the female/male ratio in skilled 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 zero. Hence, equating men and women's educational attainment would strongly reduce the gender gap in skilled migration. It is also worth noticing that the correlation between the gender gap in 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.

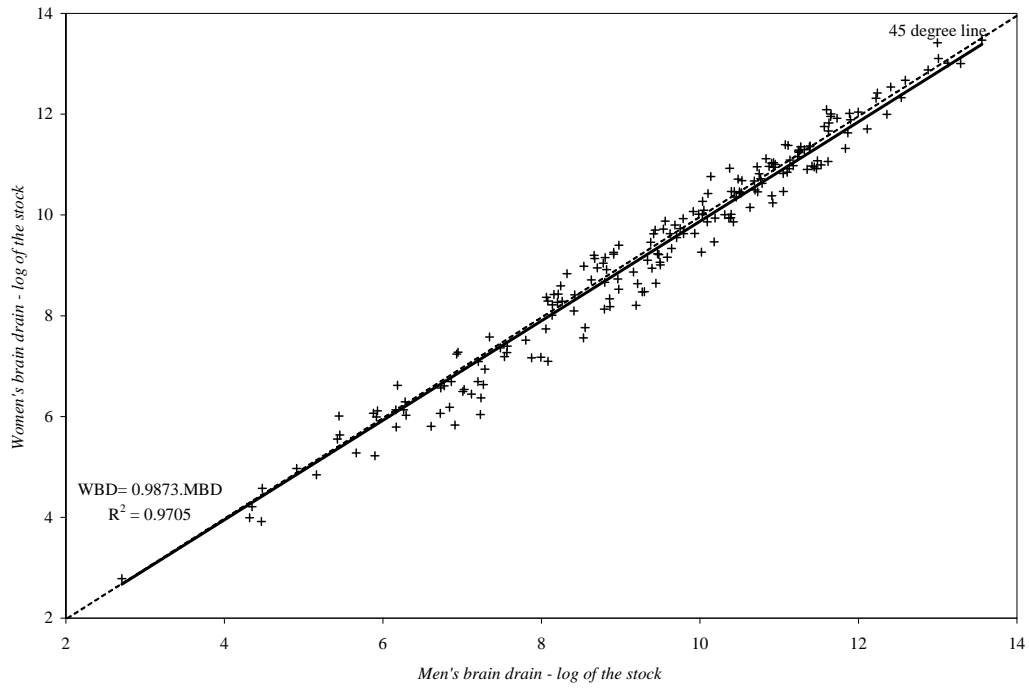**Figure 4.1. Women's and men's brain drain in 2000 - Stocks**

WBD= 0.9873.MBD
$R^2 = 0.9705$

Women's brain drain - log of the stock (y-axis)

Men's brain drain - log of the stock (x-axis)

45 degree line

Figure 4.2. Women's and men's brain drain in 2000 - Rates

WBD = 1.1783.MBD
$R^2 = 0.88$

45 degree line

Women's brain drain in % (y-axis)

Men's brain drain in % (x-axis)
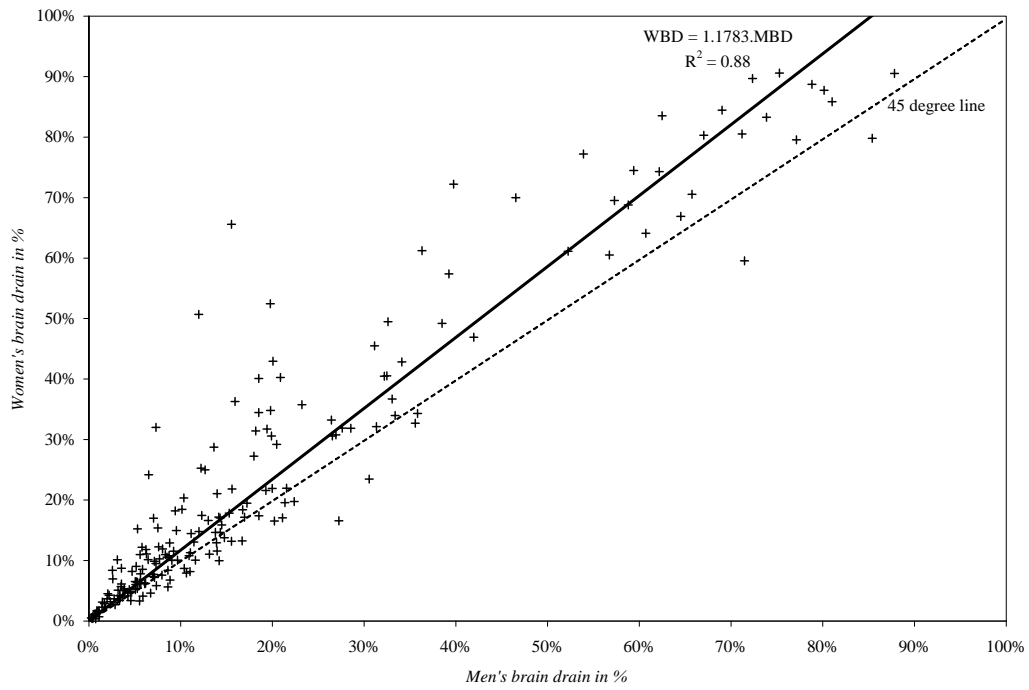
Table 6. Top-30 skilled emigration rates in 2000

	Skilled migration (all countries)					Skilled migration (excluding small countries)			
Country	Both	Men	Women	F/M	Country	Both	Men	Women	F/M
Guyana	89,2%	87,8%	90,5%	1,031	Haiti	83,4%	81,0%	85,8%	1,059
Jamaica	84,7%	80,2%	87,7%	1,095	Sierra Leone	49,2%	39,8%	72,2%	1,817
Saint Vincent and the Grenadine	84,6%	78,8%	88,7%	1,126	Ghana	44,6%	39,3%	57,4%	1,462
Grenada	84,3%	75,3%	90,6%	1,203	Kenya	38,5%	32,6%	49,5%	1,518
Haiti	83,4%	81,0%	85,8%	1,059	Laos	37,2%	34,1%	42,8%	1,255
Cape Verde	82,4%	85,4%	79,8%	0,934	Uganda	36,0%	31,1%	45,5%	1,461
Palau	80,9%	72,4%	89,7%	1,239	Somalia	34,5%	33,1%	36,7%	1,110
Trinidad and Tobago	78,9%	73,9%	83,3%	1,127	El Salvador	31,7%	31,3%	32,2%	1,026
Saint Kitts and Nevis	78,5%	77,1%	79,6%	1,032	Nicaragua	30,2%	28,6%	31,9%	1,116
Seychelles	77,2%	69,0%	84,4%	1,223	China, Hong Kong SAR	29,6%	27,6%	31,9%	1,154
Tonga	75,6%	71,2%	80,5%	1,131	Cuba	28,8%	26,9%	30,8%	1,144
Samoa	73,4%	67,0%	80,3%	1,198	Sri Lanka	28,2%	26,5%	30,6%	1,153
Nauru	72,0%	62,5%	83,5%	1,337	Papua New Guinea	27,8%	20,1%	43,0%	2,141
Saint Lucia	68,6%	62,2%	74,3%	1,195	Vietnam	26,9%	30,5%	23,5%	0,769
Antigua and Barbuda	68,5%	65,7%	70,6%	1,073	Rwanda	26,3%	20,9%	40,3%	1,929
Gambia, The	67,8%	71,5%	59,5%	0,833	Honduras	24,8%	19,4%	31,7%	1,635
Suriname	65,8%	64,5%	66,9%	1,037	Croatia	24,6%	20,5%	29,2%	1,427
Belize	65,5%	53,9%	77,2%	1,432	Guatemala	23,9%	19,9%	30,6%	1,537
Tuvalu	64,9%	59,4%	74,5%	1,254	Afghanistan	22,6%	18,5%	34,5%	1,863
Dominica	63,9%	58,8%	68,8%	1,170	Mozambique	22,5%	18,2%	31,4%	1,727
Fiji	62,8%	57,3%	69,5%	1,213	Dominican Republic	22,4%	18,0%	27,2%	1,515
Barbados	62,6%	60,7%	64,1%	1,056	Cambodia	21,4%	27,3%	16,6%	0,608
Malta	58,3%	56,7%	60,5%	1,066	Malawi	20,9%	15,9%	36,3%	2,281
Mauritius	55,8%	52,2%	61,1%	1,170	Portugal	18,9%	21,1%	17,1%	0,809
Kiribati	55,7%	46,5%	70,0%	1,504	Morocco	18,0%	17,2%	19,5%	1,130
Sierra Leone	49,2%	39,8%	72,2%	1,817	Cameroon	17,1%	12,0%	50,7%	4,231
Ghana	44,6%	39,3%	57,4%	1,462	Senegal	17,1%	15,6%	21,8%	1,401
Liberia	44,3%	36,3%	61,2%	1,686	United Kingdom	17,1%	17,0%	17,2%	1,012
Lebanon	43,8%	42,0%	46,9%	1,118	Zambia	16,4%	14,0%	21,0%	1,506
Marshall Islands	42,8%	38,5%	49,2%	1,279	Togo	16,3%	13,6%	28,7%	2,110

Table 7. Ratio of women to men in skilled migration (year 2000)

	Country	Stock ratio	Country	Rate ratio
Highest ratio Top-20	Finland	1,873	Nigeria	4,376
	Andorra	1,758	Cameroon	4,231
	Thailand	1,735	Sao Tome and Principe	4,224
	Grenada	1,707	Congo, Dem. Rep. of the	3,711
	Bahamas, The	1,667	Guinea	3,273
	Jamaica	1,636	Angola	3,269
	Georgia	1,589	Burundi	2,874
	Saint Vincent and the Grenadines	1,562	China	2,682
	Turkmenistan	1,544	Guinea-Bissau	2,651
	Estonia	1,527	Bangladesh	2,462
	Philippines	1,518	Benin	2,409
	Antigua and Barbuda	1,423	Malawi	2,281
	Belize	1,422	Burkina Faso	2,186
	Japan	1,418	Solomon Islands	2,167
	Kazakhstan	1,412	Thailand	2,152
	Seychelles	1,392	Papua New Guinea	2,141
	Panama	1,383	Madagascar	2,111
	Dominican Republic	1,376	Togo	2,110
	Barbados	1,376	Mali	2,069
	Tajikistan	1,362	Mauritania	2,047
Lowest ratio Bottom-20	Nepal	0,515	Bulgaria	0,839
	Burkina Faso	0,511	Gambia, The	0,833
	Djibouti	0,508	Hungary	0,830
	Bangladesh	0,507	Liechtenstein	0,817
	Saudi Arabia	0,503	Portugal	0,809
	Mali	0,493	Sudan	0,798
	Tunisia	0,490	San Marino	0,793
	Jordan	0,470	Vietnam	0,769
	Togo	0,456	Israel	0,766
	Congo, Rep. of the	0,451	Uruguay	0,745
	Sudan	0,450	Italy	0,742
	Niger	0,449	Burma (Myanmar)	0,739
	Benin	0,443	Greece	0,703
	Senegal	0,441	Botswana	0,699
	Central African Republic	0,421	Yemen	0,685
	Yemen	0,378	Jordan	0,653
	Gambia, The	0,372	Saudi Arabia	0,639
	Cote d'Ivoire	0,372	Cambodia	0,608
	Chad	0,340	Lesotho	0,602
	Mauritania	0,304	Bhutan	0,516

5 Conclusion

In this paper, 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 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 recent feminization of the brain drain. We provide emigration stocks and rates for 195 countries in 1990 and 2000. Although our data set deserves some extensions (e.g. adding points in time and accounting for migration to non OECD destination countries), it can reasonably be used to capture the recent trend in women's brain drain, as well as to analyze its causes and consequences for developing countries.

Our gross data reveal that the share of women in the 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 skilled women emigrants were always bigger than the growth rates obtained for unskilled women or skilled men. This evolution particularly occurs in the least developed countries. This feminization of the South-North brain drain mostly 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 women skilled 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 brain drain is 17 percent above men's. This gender gap in skilled emigration rate is strongly correlated with the gender gap in the educational attainment of adult populations, reflecting unequal access to education in many source countries. Equating men and women's educational attainment at origin would almost strongly reduce the gender gap in skilled migration.

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