THE AFRICAN BRAIN DRAIN: SCOPE AND DETERMINANTS

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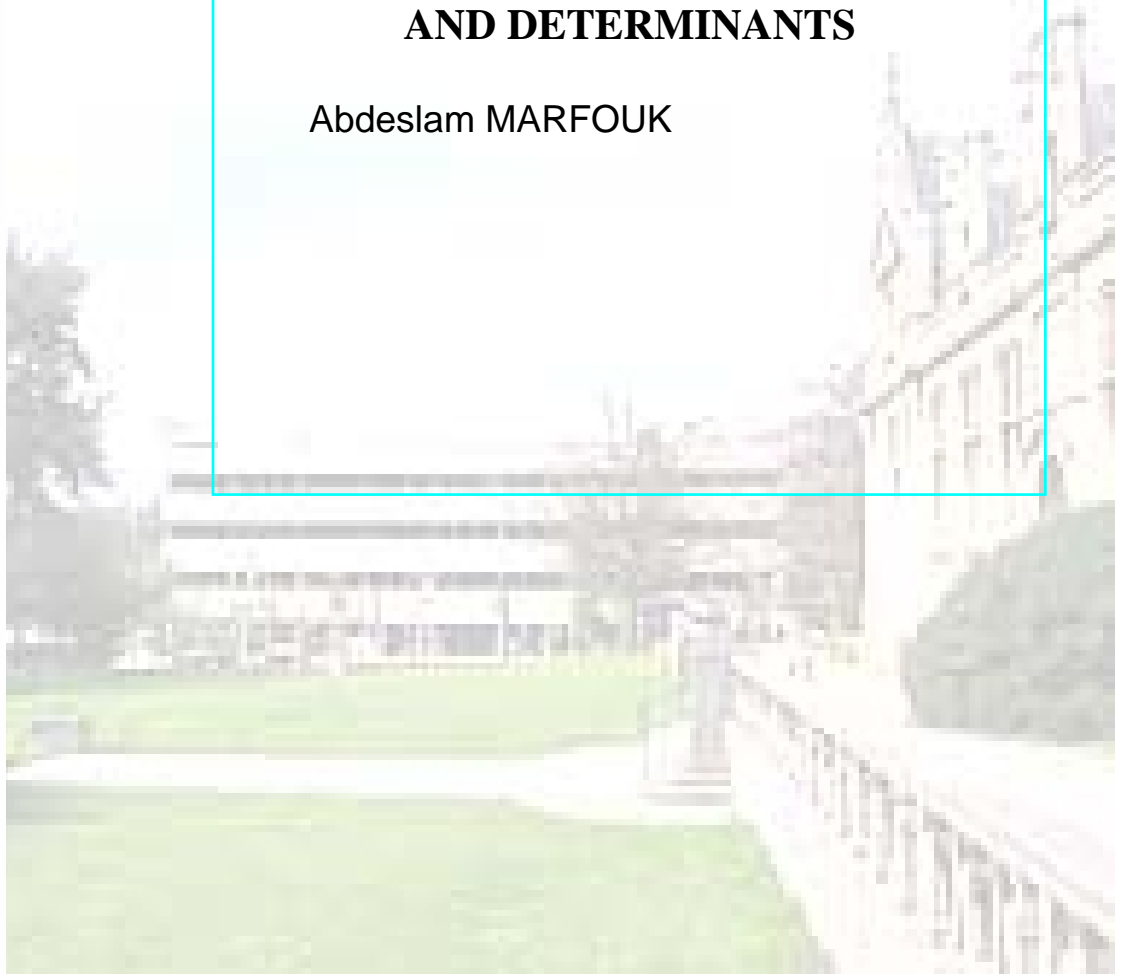
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Abstract: *This paper empirically examines the determinants of highly-skilled emigration from Africa with recent original data set on international migration. The analysis shows that 10 out of the 53 African countries have lost more than 35 per cent of the their tertiary educated labor force and countries such as Cape Verde (68 percent), Gambia (63 percent), Seychelles (56 percent), Maurice (56 percent) and Sierra Leone (53 percent) suffered from a massive brain drain. Regression models reveal that economic and non-economic considerations have a strong impact on the African brain drain. This study finds that the degree of fractionalization (ethnic, linguistic and religious) at origin countries, jobs opportunities at destination countries, selective immigration policies, wage gap, geographical distance, former colonial links, and linguistic proximity between countries of origin and destination are the main forces driving highly-skilled emigration from Africa.*

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1. Introduction

During the last decade, the number of legal immigrants in the OECD countries has increased by 17 million (or by 40 percent), from 42 million in 1990 to 59 million in 2000.[2] This rise is mostly explained by the inflow of persons from the less developed countries. Between 1990 and 2000, the number of immigrants originating from developing countries grew by 96 percent comparing to only 6 percent migrating from high-income countries. As a result, the share of the immigrants from developing countries in OECD countries has increased from 46 percent in 1990 to about 65 percent in 2000 (Table 1).

These trends contribute to the political success of "populist" anti-immigration parties and to general public hostility towards immigration in a number of Western European countries. The results of the Eurobarometer survey conducted in 2000 revealed that around 30 per cent of the respondents in countries such as Belgium and Germany are not willing to accept more immigrants. When asked if immigrants "are more involved in criminality", the proportion of positive responses ranged from 30 percent in Ireland to 81 percent in Greece, see Thalhammer and al. (2001).

More importantly, the conclusions emerging from a number of academic studies on contentious issues such as the welfare dependency of immigrants, their assimilation in the labor market and the economic costs of immigration have played a major in the negative public opinion especially towards low-skilled immigration. This also fuelled the debate on the reform of immigration policies in many OECD countries. For example, in a series of articles, Borjas (1985, 1994, and 1995) pointed out that the bad performances of the successive immigration cohorts on the US labor market are attributable to the decline in their "quality". This decline among the most recent cohorts results from a shift in the structure by country of origin. According to Borjas, recent immigrants are less skilled than earlier ones as they come from less developed countries.

Building on Borjas, several studies put forward the rise in the "quantity" and the fall in the "quality" of immigration flows to other OECD nations.[3] See among others Baker and Benjamin (1994) for Canada, Edin et al. (2000) for Sweden and Hayfron (1998) for Norway. All these studies depict a negative picture of immigration and suggest that highly-skilled immigration is "good" for receiving countries while the flows of low-skilled workers is "bad".

Beyond these considerations, it is essential to stress the fact that South-North migration increasingly consists of high-skilled persons, partly due to migration selectivity in a number receiving countries. In ten years from 1990 to 2000, the stock of immigrants from African countries residing in the OECD increased

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[2] The study focuses on persons aged 25 and over, referred to as adults.

[3] The "quality" of immigrants is closely related to the assimilation of the immigrants in the labor market and to the immigration policy. It has been an issue of intense interest among economists. Borjas (1985) and Chiswick (1978) provided controversial results on that issue.

by about 54 percent while the number of the continent's highly skilled emigrants grew by 113 percent (see Table 1). As a consequence of this large outflow of highly educated individuals a number of the African countries experienced a considerable loss of human capital.

Today, a number immigrant-receiving countries in the OECD are thinking about reforms of their immigration policies. Besides controlling the immigration volume "quantity", the selection of immigrants "quality" is an issue that has caused a rising concern in the debates on immigration. In general terms, a common point to contemporary migration policies is their selective nature. For example, the skills-based points systems in Australia, Canada and New Zealand target candidates to emigration according to their prospective "contribution to the Australian economy". In the United States emphasis is put on the selection of highly skilled workers through a system of quotas favouring candidates with academic degrees and/or specific professional skills. Recently, a number of European countries (including France, Germany, Ireland and the UK) have introduced programs aiming to attract qualified labor force. In UK the government has announced in March 2006 the introduction of a points-based immigration system similar to the skilled migration programs for entry to Australia, Canada and New Zealand. More recently, in September 2007, Franco Frattini, European Union (UE) Commissioner for Justice, Freedom, and Security, proposed the introduction of a unified "Blue Card" which aims at attracting highly-skilled migrants from outside the EU who may otherwise favor other potential destinations such as the United States, Canada, New Zealand or Australia.

There is no doubt that the shift in immigration policies of the OECD countries towards selective immigration systems may intensify the African brain drain. Due to the lack of adequate data, a comprehensive analysis of the forces driving emigration of African highly skilled workers to the OECD is missing in the literature. Such analysis would provide valuable insights to policy-makers in both sending and receiving countries. From the perspective of the countries of origin, understanding the migration dynamics would help policy makers to better control and monitor their losses of highly skilled workers. For countries of destination a better understanding of the factors affecting international skilled migration would facilitate the formulation of appropriate immigration policies.

The objective of this study is to fill part of this knowledge gap. Relying on a new an original data set I focus on high-skilled emigration from Africa to OECD countries. To the best of my knowledge, this study is the first to explore the forces driving African skilled migration. The approach is also original as it explains the bilateral migration relationships between OECD countries and Africa's 53 nations. Most of the existing empirical literature focused on migration flows to a single destination country.[4] Thus, it was

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[4] Due in part to the difficulty to obtain data, these studies had been focused on a single receiving country. Two recent exceptions are Pederson et al. (2004) and Mayda (2005).

rather tentative to generalize the previous results obtained from these studies. By considering the 30 OECD countries, this study gives very general insights about the determinants of migration.

I find that the economic and non-economic considerations drive the emigration of African highly skilled workers. The estimation results reveal that geographical distance, wage gaps, former colonial links, linguistic proximity, selective immigration policies as well as economic and job opportunities in the receiving countries, fractionalization (social, ethnic, religious, and linguistic) at origin countries have a strong impact on the African brain drain.

The remainder of the paper is organized as follows. Section 2 explains why we know little about Africa international emigration and the brain drain. Section 3 describes the data sources. Section 4 focuses on African migration to the OECD member states. Sections 5 and 6 present the model and resulting empirical findings. The final section summarizes the conclusions.

2. Why do we know little about African emigration and brain drain?

Over the period 1965-2000, the number of international migrants in the world increased by about 3 million a year, from 75 million in 1965 to 175 million in 2000 (United Nations, 2002). The migration pressure to developed countries is expected to intensify in the coming years given the demand for skilled labor, the rising gap in living standards and diverging demographic trends in poor and rich countries. As a result of such large-scale mobility of people, international migration and its impacts on countries of origin and destination has emerged as a central issue in public policy debates and is stimulating the interest of the scientific community and international agencies.

Despite this growing interest, there is a large consensus that migration statistics are poor. Many scholars underlined that scarce and inadequate international migration data pose major obstacles in studying migration dynamics in developing countries. For example, Arthur (1991) stressed that the first problem that any researcher of the Third World migration encounters is the general absence of recorded data. The need for better migration data has since been strongly emphasized by international agencies and researchers. A regional conference, held in Addis Ababa in 2000, highlighted that the lack of adequate data was a major problem for monitoring the scope and impact of brain drain from Africa.[5]

It is well documented that the official statistics in countries of origin, when available, do not give a realistic picture of emigration.[6] Thus, statistics provided by immigration countries become the only

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[5] The conference was held at the initiative of the UNECA, IOM, and IDRC.

[6] For example, Wickramasekera (2002) notes that "Thailand generally reports that 125,000 to 150,000 workers leave for overseas contractual employment every year but the total stock of Thai workers overseas is estimated to be around 450,000 at present including irregular workers". Similarly, Bhorat and al. (2002) compare South African emigration data and South African registered immigration in five receiving countries

reliable sources of migration data. A few international agencies disseminate data on stocks and/or flows of international migrants. However, the information provided by these statistical sources still remain incomplete and inaccurate. For example, the United Nations Population Division provides information on the total stock of foreign-born population by country and region of residence without any detail on the country of origin and education level of the immigrants. Similarly, the Eurostat statistics record the stock of foreigners (non-citizen)[7] from the major sending countries[8] for the European member states without any information on educational levels. This situation is clearly illustrated by the IOM (2005, p. 141) who has pointed "that the exact number of migrants living in Europe is still unknown". This is partly due to the fact that, in contrast to Australia, Canada, New Zealand and the US, many European countries use nationality and not the place or country of birth as the standard criterion in their migration statistics. Consequently, it became impossible to present a full and realistic picture of the migration from a specific African country. In short, the magnitude of the continent's emigration to developed countries and consequently, the scope of the African brain drain are still unknown.

3. A new data set on skilled migration

This analysis builds on a new data set on international migration developed by Docquier and Marfouk (2006) (DM06). The data is unique in the sense that it quantifies migration stocks in OECD countries by education level and therefore allows to focus on the number of skilled migrants in particular. The following section describes the methodology used to compute absolute and relative numbers on migration by educational attainment and country of origin. First, (absolute) emigration stocks by educational attainment are computed for all the world countries. In a second step, these numbers are expressed in percentage of the total labor force born in the sending country (including migrants themselves).

Skilled migration stocks: Data on emigration can only be captured by aggregating harmonized immigration data collected in many receiving countries. Usually, detailed information about the origin and skill of immigrants can be obtained from national censuses and registers. The DM06 data set is based on such data and was collected in all OECD countries. It counts migrants as working-aged (25 and over) foreign-born individuals living in an OECD country. Considering the working-aged population (aged 25 and over) maximizes the comparability of the immigration population with data on educational attainment in the source countries. And it excludes a large number of students who temporarily emigrate to complete their education.

(Australia, Canada, New Zealand, UK and USA) and show that the immigration data was approximately 3 times higher than South African emigration records.

[7] The concept of country of birth which is time invariant allows to identify immigrant population and thus, to capture the decision to emigrate. By contrast, the criteria of citizenship which changes with naturalization underestimate the emigration.

[8] For example, among Africa's 53 countries only a limited number were identified as region of origin in the Eurostat data.

Three levels of schooling are distinguished. Low skilled workers are those with primary education, medium skilled workers have secondary education and high skilled workers tertiary education. The brain drain is defined as the migration of tertiary educated workers. In the DM06 data set, special attention is devoted to the homogeneity and the comparability of the data. This induces several methodological choices[9]:

- By restricting the receiving countries to the OECD area, the DM06 data set focuses on the South-North and North-North migration. Obviously, a brain drain is observed outside the OECD area (e.g. to the Gulf countries, South Africa, Malaysia, Hong-Kong, Singapore, Taiwan,). However, given (less detailed) census data collected from various non-OECD countries, about 90 percent of high skilled international emigrants are living OECD countries.

- To allow comparison, the number of receiving countries is the same in 1990 and 2000. Consequently, Czechoslovakia, Hungary, Korea, Poland, and Mexico are considered as receiving countries in 1990 although they were not members of the OECD.

- Migration is defined on the basis of the country of birth rather than on the concept of foreign citizenship. The concept of foreign-born allows to identify immigrant population and thus to capture the decision to emigrate. By contrast, the criteria of citizenship underestimate the emigration since the number of foreign-born is much higher than the number of foreign citizens (twice as large in countries such Netherlands or Sweden). Another reason is that the concept of country of birth is time invariant, contrary to citizenship which changes with naturalization.[10] However, in a limited number of cases, immigrants are only classified by citizenship.

Skilled migration rates: Are obtained by comparing the emigration stocks to the total number of people born in the source country and belonging to the same educational category. Calculating the brain drain as a proportion of the total educated labor force is more appropriate to evaluate the pressure imposed on local labor markets than looking at the absolute numbers of skilled emigrants. For example, the pressure exerted by 149,432 Egyptians high skilled emigrants, which is 4.6 percent of the Egypt educated total labor force, is less important than the pressure exerted by 1,525 high skilled emigrants from Gambia - 63.3 percent of national educated labor force. I will use the term "emigration rate" defined by the following equation:

(1a)
$$m_{h,d,t}^{H} = \frac{M_{h,d,t}^{H}}{N_{h,t}^{H} + M_{h,t}^{H}}$$

Where h, d, t, and H respectively represent country of origin, immigrant-receiving country, time, and the immigrant's education level. $M_{h,d,t}^{H}$ is the migrant stock from country of origin h residing in the OECD country d; $N_{h,t}^{H}$ is the resident population of the country of origin h and $M_{h,t}^{H}$ is the total number of migrants from country h.

4. The magnitude of the African brain drain

Between 1990 and 2000, the number of immigrants in the OECD countries increased by 17 million (or 40 percent), from 42 million in 1990 to 59 million in 2000. During the same period the stock of highly skilled immigrants increased by 8 million (or 64 percent) from 12 million in 1990 to 20 million in 2000. Consequently, the share of highly skilled workers increased from 30 percent in 1990 to 35 percent in 2000. These figures provide strong evidence that emigration is more and more concerned by the movements of highly skilled persons. Table 1 provides a descriptive overview of the distribution of OECD immigrants by educational attainment, regions of origin and region destination.

The numbers for Africa are even more drastic. In ten years from 1990 to 2000, the total stock of immigrants from African countries increased by 54 percent to compare to 113 percent for the highly skilled workers (see Table 1). Thus, a number of the African countries experienced a considerable brain drain. Table 3 shows that 10 countries have lost more than 35 percent of the their tertiary educated labor force and a number of countries, such Cape Verde (68 percent), Gambia (63 percent), Seychelles (56 percent), Maurice (56 percent), Sierra Leone (53 percent) and Ghana (47 percent), suffered a massive brain drain. As Lowell (2002b) notes, while some level of skilled migration is necessary for developing nations to integrate into the global economy, a large outflow of skilled persons can be unfavorable for growth and development.

Many economists have pointed out that migrants are not randomly selected. An interesting selection indicator 'selection rate' is given by the proportion of highly skilled migrants in the total emigration stock. From the same table 1 we can see that among all immigrants, low-income countries are the most educated: the proportion of immigrants with tertiary education represents 45 percent in 2000. From the same table we can see that in every group the proportion of highly skilled among migrants (35 percent for the world average) is much higher than the proportion observed among residents (on average 11 percent). In 2000, Africa's highly skilled emigrants represented 31 percent in its total stock, to compare to a share of only 4 percent of highly educated people among the continent residents.

1986-1995 had obtained the Canadian citizenship and this proportion reached 89 percent for those who landed in Canada before 1986 (see Citizenship and immigration Canada: http://www.cic.gc.ca/).

A number of previous studies provide strong evidence that highly skilled individuals are the most mobile. The data provided in Table 1 reveals in 2000, the highly skilled migration rate (5.3 percent for the world average) was three times as high as the global migration rate (1.8 percent). Disaggregated data by group of origin confirm that the global migration rates are usually moderate, while the ones for highly skilled are much higher. For example, the Africa highly skilled emigration rate (10.4 percent) is more than 7 times as high as the average immigration rate (1.5 percent).

In 2000, Africa represented around 4.5 million of the total OECD immigrants and 1.4 million of highly skilled immigrants which corresponds to 7.6 percent of the total foreign-born population and 6.8 percent of highly skilled immigrants (respectively, 7 percent and 5.2 percent in 1990). About 75 percent of African migrants choose European Union member states (EU15) as destination. More than 50 percent of African highly skilled migrants reside in one of the three so-called "traditional immigrant-receiving countries" (Australia, Canada and the US). In contrast, the EU15 only attract 46 percent (45 percent in 1990) of the African highly skilled migrants.

Table 2 depicts the situation for Africa by countries of origin in 2000. The table shows that averaging numbers from Africa hide a huge heterogeneity within the continent. In absolute numbers, the biggest countries are obviously strongly affected by the brain. The stock of highly skilled migrants is high from South Africa (168,083), Nigeria (149,494), Egypt (149,432) and Morocco (141,168). Still, in relative terms - or proportion of national educated labor force - small countries are much more affected. The highly skilled emigration rate exceeds 55 percent in nations such as Cap Verde (68 percent), Gambia (63 percent), Mauritius (56 percent) and Seychelles (56 percent). It is worth noting that African countries with large stocks of highly skilled emigrants may exhibit low rates of emigration. This is obviously the case of Egypt (4.6 percent) and Algeria (9.4 percent), see Docquier and Marfouk (2006).

The last two columns of Table 2 give the 25 highest and lowest selection rates among emigrants. Selection rates are very low in traditional low skilled emigration countries such as Mali (11 percent), Equatorial Guinea (12 percent), Morocco (13 percent) and Algeria (14 percent). Several African countries exhibit low selection rates but a high brain drain rates. Examples are Senegal, Gambia, Morocco and Mozambique. On the other extreme, the highest selection rates are observed in countries such Nigeria (65 percent), South Africa (63 percent), Egypt (59 percent), and Liberia (58 percent). These figures reveal that contrary to the popular belief, the African migration flows to OECD member countries are not exclusively composed by low skilled workers.

Table 1- Descriptive statistics by country groups (1990-2000)

Group of origin	Emigration structure In thousands[a]			High skilled by destination In percentage			Labor force structure In thousands[a]			Emigration rates In percentage	
	Total emigrants	High skilled emigrants	Share of high skilled	In selective countries	In EU15 countries	In the rest of OECD	Total labor force	High skilled labor force	Share of high skilled	Total	High skilled
YEAR 2000											
World[d]	**59,022**	**20,403**	*35%*	**73%**	**21%**	**6%**	**3,187,233**	**360,614**	*11%*	**1,8%**	**5,3%**
By region											
Africa	4,497	1,388	*31%*	51%	46%	3%	298,112	11,896	*4%*	1,5%	10,4%
Asia	15,043	7,041	*47%*	80%	14%	6%	1,917,998	119,986	*6%*	0,8%	5,5%
Europe	21,095	6,686	*32%*	59%	30%	11%	499,479	89,387	*18%*	4,1%	7,0%
Latin America and Caribbean	13,881	3,655	*26%*	89%	8%	3%	249,408	29,507	*12%*	5,3%	11,0%
From the rest of the World[b]	4,506	1,633	*36%*	63%	23%	14%	222,236	109,838	*49%*	2,0%	1,5%
By group of interest											
High-income countries	19,206	7,547	*39%*	68%	24%	8%	666,246	200,607	*30%*	2.8%	3.6%
Developing countries[c]	38,083	12,576	*33%*	76%	19%	5%	2,520,987	160,008	*6%*	1,5%	7,3%
Low-income countries	6,544	2,948	*45%*	77%	21%	1%	898,768	36,332	*4%*	0,7%	7,5%
Lower medium-income countries	17,053	6,089	*36%*	77%	17%	6%	1,298,233	76,981	*6%*	1,3%	7,3%
Upper-medium-income countries	14,486	3,539	*24%*	75%	20%	5%	323,987	46,694	*14%*	4,3%	7,0%
Least developed countries	2,510	853	*34%*	69%	29%	2%	245,974	5,635	*2%*	1,0%	13,1%

[a] Migrants and labor force correspond to individuals aged 25 or older.

[b] The rest of the world correspond to North America, Oceania, dependent territories and migrants who did not reported their country of birth

[c] Developing countries correspond to the sum of low-income, lower medium-income, and upper medium income countries.

[d] The world is the sum of developing countries, high-income countries, dependent territories and migrants who did not reported their country of birth.

Immigrants and labor force correspond to individuals aged 25 or older.

Source: Author's calculations based on Docquier and Marfouk (2006).

Table 1- Descriptive statistics by country groups (1990-2000) – Continued

Group of origin	Emigration structure In thousands[a]			High skilled by destination In percentage			Labor force structure In thousands[a]			Emigration rates In percentage	
	Total emigrants	High skilled emigrants	Share of high skilled	In selective countries	In EU15 countries	In the rest of OECD	Total labor force	High skilled labor Force	Share of high skilled	Total	High skilled
YEAR 1990											
World[d]	**41,865**	**12,467**	*30%*	**76%**	**17%**	**7%**	**2,765,661**	**2,765,661**	*9%*	**1,49%**	**0,45%**
By region											
Africa	2,911	652	*22%*	52%	45%	3%	227,338	5,842	*3%*	1,3%	10,0%
Asia	9,504	3,837	*40%*	78%	13%	9%	1,484,286	70,981	*5%*	0,6%	5,1%
Europe	18,807	4,804	*26%*	68%	21%	11%	469,899	65,354	*14%*	3,8%	6,8%
Latin America and Caribbean	6,978	1,856	*27%*	89%	7%	4%	191,303	17,105	*9%*	3,5%	9,8%
From the rest of the World[b]	3,665	1,318	*36%*	70%	18%	12%	392,835	17,105	*4%*	0,9%	7,2%
By group of interest											
High-income countries	18,165	5,613	*31%*	74%	17%	9%	586,069	139,458	*24%*	3.0%	3 .9%
Developing countries[c]	19,402	5,804	*30%*	79%	17%	4%	1,783,362	69,767	*4%*	1,1%	7,7%
Low-income countries	3,454	1,267	*37%*	77%	21%	2%	677,539	21,291	*3%*	0,5%	5,6%
Lower medium-income countries	8,740	2,883	*33%*	81%	14%	5%	938,974	34,948	*4%*	0,9%	7,6%
Upper-medium-income countries	7,208	1,654	*23%*	77%	19%	4%	166,848	13,528	*8%*	4,1%	10,9%
Least developed countries	1,384	373	*27%*	70%	29%	1%	185,034	3,092	*2%*	0,7%	10,8%

[a] *Migrants and labor force correspond to individuals aged 25 or older.*
[b] *The rest of the world correspond to North America, Oceania, dependent territories and emigrants who did not reported their country of birth*
[c] *Developing countries correspond to the sum of low-income, lower medium-income, and upper medium income countries.*
[d] *The world is the sum of developing countries, high-income countries, dependent territories and emigrants who did not reported their country of birth.*
Immigrants and labor force correspond to individuals aged 25 or older.
Source: Author's calculations based on Docquier and Marfouk (2006).

Table 2 - Emigration from Africa to OECD countries by countries of origin, the top-25 ranked in decreasing order, 2000

Country of origin	Total immigrants stock	Country of origin	High skilled immigrants stock	Country of origin	Total emigration rate	Country of origin	High skilled emigration Rate	Country of origin	High selection rate	Country of Origin	Low selection rate
Morocco	1,095,166	South Africa	168,083	Cape Verde	25.1%	Cape Verde	67.5%	Nigeria	65%	Congo, Rep.	40%
Algeria	607,824	Nigeria	149,494	Seychelles	19.5%	Gambia, The	63.3%	South Africa	63%	Togo	40%
South Africa	268,675	Egypt	149,432	Mauritius	10.7%	Mauritius	56.2%	Egypt	59%	Djibouti	38%
Tunisia	264,135	Morocco	141,168	Morocco	7.6%	Seychelles	55.9%	Liberia	58%	Seychelles	37%
Egypt	253,861	Algeria	85,537	Sao Tome	5.6%	Sierra Leone	52.5%	Swaziland	56%	Congo, Dem.	37%
Nigeria	229,928	Kenya	77,516	Tunisia	5.4%	Ghana	46.9%	Zimbabwe	55%	Botswana	34%
Kenya	172,918	Ghana	71,309	Equatorial Guinea	4.5%	Mozambique	45.1%	Libya	54%	Cote d'Ivoire	31%
Ghana	161,800	Ethiopia	51,392	Algeria	4.5%	Liberia	45.0%	Gabon	53%	Burkina Faso	30%
Angola	120,779	Tunisia	39,350	Comoros	3.8%	Kenya	38.4%	Benin	53%	Mauritius	29%
Ethiopia	105,632	Uganda	34,970	Liberia	3.5%	Uganda	35.6%	Sudan	52%	Somalia	28%
Somalia	99,069	Congo, Dem.	33,085	Somalia	3.3%	Eritrea	34.0%	Tanzania	51%	Guinea	26%
Senegal	94,001	Zimbabwe	32,676	Gambia, The	3.3%	Angola	32.9%	Namibia	51%	Mauritania	22%
Congo, Dem.	90,286	Tanzania	32,255	Congo, Rep.	3.0%	Somalia	32.6%	Burundi	51%	Gambia, The	20%
Mauritius	79,850	Somalia	27,916	Angola	2.8%	Rwanda	26.0%	Sierra Leone	50%	Sao Tome	18%
Uganda	75,736	Mauritius	23,043	Senegal	2.8%	Guinea-Bissau	24.4%	Lesotho	50%	Mozambique	18%
Tanzania	62,886	Cameroon	21,822	Eritrea	2.5%	Congo, Rep.	22.2%	Cameroon	50%	Angola	17%
Mozambique	60,340	Liberia	20,842	Guinea-Bissau	2.2%	Sao Tome	22.0%	Niger	49%	Senegal	17%
Zimbabwe	59,368	Angola	20,449	Ghana	2.2%	Comoros	21.2%	Ethiopia	49%	Cape Verde	15%
Cape Verde	53,649	Sudan	18,789	Sierra Leone	2.1%	Togo	18.7%	Zambia	48%	Tunisia	15%
Cameroon	44,071	Sierra Leone	18,010	Kenya	1.6%	Malawi	18.7%	Rwanda	48%	Guinea-Bissau	14%
Cote d'Ivoire	39,359	Senegal	15,729	Zimbabwe	1.4%	Senegal	17.7%	Chad	48%	Algeria	14%
Congo, Rep.	36,231	Congo, Rep.	14,672	South Africa	1.3%	Cameroon	17.2%	Uganda	46%	Comoros	13%
Sudan	36,127	Zambia	13,739	Togo	1.2%	Morocco	16.9%	Kenya	45%	Morocco	13%
Sierra Leone	35,763	Eritrea	13,144	Mauritania	1.2%	Zambia	16.8%	Ghana	44%	Equatorial Guinea	12%
Liberia	35,638	Cote d'Ivoire	12,088	Uganda	1.1%	Mali	15.0%	Madagascar	43%	Mali	11%

Note: emigrants correspond to individuals aged 25 or older.
Source: Author's calculations based on Docquier and Marfouk (2006).

5. Theoretical foundations and the empirical model

The purpose of the analysis is to evaluate the determinants of emigration rates. The theoretical foundation of this empirical studies can be found is the extended Roy's model (1951), presented in Borjas (1987) and more recently by Mayda (2005). Individuals born in the sending country compare gains in income they expect from emigration to the costs of international migration, including psychological and monetary components. Staying in the home country h, they obtain an income offer equal to:

$$(1) \qquad y_h^i = \alpha_h + \sum_{n=1}^{N} \alpha_h^n X_h^n + \alpha_h^H H^i + \sum_{m=2}^{M} \alpha_h^m X_m^i + \varepsilon_h^i$$

where X_h^n is a set of variables related to the host country (technological level, institutional factors, social expenditure, etc.), H^i is the individual's level of schooling, X_m^i is a set of variables related to individual i other than human capital (such as linguistic ability, physical and human talents not captured by schooling, etc.), ε_h^i is a iid process with zero mean and variance σ_h^2, α_h^x are parameters associated with the determinant x.

Migrating to a destination country d, their income becomes:

$$(2) \qquad y_d^i = \alpha_d + \sum_{n=1}^{N} \alpha_d^n X_d^n + \alpha_d^H H^i + \sum_{m=2}^{M} \alpha_d^m X_m^i + \varepsilon_d^i$$

Where X_d^k is a set of variables related to the destination country, ε_h^i is an iid process with zero mean and variance σ_d^2, α_d^x are parameters associated with the determinant x.

Finally, the global cost of moving from h to d is endogenous and can be written as

$$(3) \qquad c_{hd}^i = \alpha_c + \sum_{k=1}^{K} \alpha_c^k X_{hd}^k + \alpha_c^H H^i + \sum_{m=2}^{M} \alpha_c^m X_m^i + \varepsilon_c^i$$

Where X_{hd}^k is a set of variables measuring the relationships between countries h and d (such as distance, colonial links, linguistic proximity, etc.), ε_c^i is again an iid process with zero mean and variance σ_c^2, α_c^x are parameters associated with the determinant x.

Emigration is optimal if $y_d^i - y_h^i - c_{hd}^i > 0$. This happens with a probability

$$P\left\{(\alpha_h - \alpha_d - \alpha_c) + (\alpha_h^H - \alpha_d^H - \alpha_d^H)H^i + \sum_{m=2}^{M}(\alpha_h^m X_m^i - \alpha_d^m X_m^i - \alpha_c^m X_m^i)\right.$$

$$\left. + \sum_{n=1}^{N}(\alpha_h^n X_h^n - \alpha_d^n X_d^n) - \sum_{k=1}^{K}\alpha_c^k X_{hd}^k + (\varepsilon_h^i - \varepsilon_d^i - \varepsilon_c^i) > 0\right\}$$

Or equivalently:

(4) $$P\left[v_{hd}^i > -ZS_{hd}^i\right]$$

With

$$ZS_{hd}^i \equiv (\alpha_h - \alpha_d - \alpha_c) + (\alpha_h^H - \alpha_d^H - \alpha_d^H)H^i + \sum_{m=2}^{M}(\alpha_h^m X_m^i - \alpha_d^m X_m^i - \alpha_c^m X_m^i)$$

$$ + \sum_{n=1}^{N}(\alpha_h^n X_h^n - \alpha_d^n X_d^n) - \sum_{k=1}^{K}\alpha_c^k X_{hd}^k$$

$$v_{hd}^i \equiv \varepsilon_h^i - \varepsilon_d^i - \varepsilon_c^i$$

The value of Z_{hd}^i depends on all the characteristics of individuals, the sending and receiving countries; the error term v_{hd}^i is assumed to follow a normal distribution of zero mean and a variance equal to $\sigma_v^2 = \sigma_h^2 + \sigma_d^2 + \sigma_c^2 - 2\rho_{hd} - 2\rho_{hc} + 2\rho_{dc}$ (where ρ_{xy} is the correlation between x and y)

Denoted by the cumulative distribution function of the standard normal, the probability that agent i wants to migrate is given by

(5) $$PS_{hd}^i = 1 - \Phi\left(\frac{-ZS_{hd}^i}{\sigma_v}\right)$$

This probability captures the self-selection process of migrants. In a second step, candidates to emigration face a probability to be accepted in the receiving country. This probability depends on the immigration policy of the receiving country, size of emigration and the selection process as well as on individual characteristics (H^i and X_m^i) and country ties (X_{hd}^k). Let's write the individual score in the selection process as

(6) $$s_{hd}^i = \alpha_s + \sum_{k=1}^{K}\alpha_s^k X_{hd}^k + \alpha_s^H H^i + \sum_{m=2}^{M}\alpha_s^m X_m^i + \varepsilon_s^i$$

With $\varepsilon_s^i \rightarrow N(0, \sigma_s)$, and assume that emigration occurs if $s_{hd}^i > 0$. The probability that agent I can be accepted in country d is given by

$$(7) \qquad PO_{hd}^i = 1 - \Phi\left(\frac{-ZO_{hd}^i}{\sigma_s}\right)$$

With $ZO_{hd}^i \equiv \alpha_s + \sum_{k=1}^{K} \alpha_s^k X_{hd}^k + \alpha_s^H H^i + \sum_{m=2}^{M} \alpha_s^m X_m^i$. This probability captures the out-selection process facing all the candidates to migration. The probability of effective migration combines the self-selection and the out-selection processes. It amounts to the conditional probability:

$$(8) \qquad PE_{hd}^i = P\left[\varepsilon_s^i > -ZO_{hd}^i \middle| v_{hd}^i > -ZS_{hd}^i\right]$$

If v_{hd}^i and ε_s^i are not correlated, we simply have

$$(8') \qquad PE_{hd}^i = \left[1 - \Phi\left(-ZS_{hd}^i / \sigma_v\right)\right] \times \left[1 - \Phi\left(-ZO_{hd}^i / \sigma_s\right)\right]$$

Otherwise, the expression is more complex and depends on the correlation between the error terms. In any case, in our regressions, we will explain the macroeconomic bilateral emigration rates from each country h to each country d using a set of variables reflecting individual average characteristics, home country and destination-country characteristics as well as indicators of proximity between each pair of countries.

5.1. Living standards and liquidity constraints

Neoclassical migration theory predicts that differences in terms of living standards between receiving and sending nations drive international migration (i.e. when the gap in living standards increases the emigration rates goes up and vice versa). Building on the World Bank (2005) development indicators, we used the annual gross national income (GNI) per capita, adjusted for purchasing power parity (PPP). For example, this yields a GNI per capita of 29,580 $, for high-income countries, i.e. 14 times higher than the 2,110 $ for low-income countries. For Malawi, the 2003 GNI is estimated at 590 $, compared to 27,690 $ for the United Kingdom. Even using PPP, these figures reveal huge disparities between developed and developed countries.

Against this background, it cannot be denied that these stark differences in per capita income are one of the main forces driving South-North migration. However, despite large inequalities in terms of living standards, the migration from less developed countries to developed nations is relatively small. There is a fair amount of evidence and stylized facts suggesting that the majority of migrants do not actually moved

from the lowest income to the highest income countries. Why do less developed regions, in contrast to neoclassical predictions, experience low emigration rates despite such strong incentives?

Although the relationship between migration and development is a central question, only a few empirical studies until now have paid attention to this issue. Faini and Venturini (1993), focusing on migration from Southern to Northern Europe, found that migration increases with the country-of-origin per capita income and decrease with per capita income squared. Schiff (1996) stressed that liquidity constraints play an important role in the probability of individuals to emigrate: the effect is likely to be more pronounced at low-income levels. Similar conclusions are reached by Vogler and Rotte (2000), who also found that constraints on financial resources explain why poor countries send few emigrants and experience low emigration rates. These works support the existence of an inverted-U shaped relationship between migration and economic development. In brief, economic development stimulates migration at low levels of income by relaxing the liquidity constraint. At a higher level, after development has taken place, the migration pressure tends to decline and the relationship becomes downward sloping.

This relationship explains why at the global level middle-income countries experience the highest emigration rates and why high-income and low-income countries exhibit the lowest rates. DM06 reveals that low income countries (Chad, Niger, Mali, etc.) and high income countries (such Brunei, Saudi Arabia, and Qatar) are among the countries with the lowest emigration rates while middle income countries (Lebanon, Turkey, Morocco, Suriname, Guyana, etc.) exhibit high emigration rates.

In this study, I used (GNI_d / GNI_h) the Gross National Income per capita ratio, PPP adjusted, as a proxy for the difference in living standards between the countries of origin and destination, to capture the incentive to emigrate. The inclusion of the levels of GNI per capita (GNI_h) and of the GNI squared (GNI_h^2) allows us to test for the inverted-U relationship capturing liquidity constraints. Using the World Development Indicators, I compute the average levels over the period 1975-2000.

5.2. Geographical distance

Most migration studies emphasize that geographical proximity is an important factor of migration. Migration involves monetary costs due to expenses in travel costs and initial expenditures (for visas, settlement in the country of destination, etc.). Moving also induces non-monetary or "psychological" costs, e.g. resulting from the break of social ties (separation from friends and family). Some moving costs are independent of the distance, e.g. initial expenditures such as visa, etc. However, many components of migration costs are closely related to distance. Transportation costs and information costs are positively correlated with distance. Psychological costs may also increase with distance since proximity increases

opportunities for temporary return and visits. From a brief inspection of the data provided in Table 3, we can see that an increase in distance results in a lower emigration rate to the United States.

Table 3 – Emigration rates to the United States by countries of origin in 2000

distance	Average (unweighted) high skilled emigration rates, in percent
All distances	11.2
Less than 3,000	51.6
From 3,000 to 4,000	37.0
From 4,001 to 5,000	22.8
From 5,000 to 6,000	7.5
More than 6,000	6.4

Source: Auhor's calculations based on Docquier and Marfouk (2006).

The unweighted average emigration rate for countries located at less than 3,000 kilometers from the US is more than twice as large as the rate observed for countries located between 4,001 and 5,000 kilometers, 7 times as large as the rate observed for countries located between 5,001 and 6,000 kilometers, and 8 times as large as the rate observed for countries located at more than 6,000 kilometers. Bogue and Thompson (1949) argue that distance is one of the principal factors affecting the number and the characteristics of migrants and Schwartz (1973) claims that distance should have a greater impact on low-skill emigrants than on high skilled emigrants. We used the log of the number of kilometers between countries of origin and destination ($\ln dist_{h,d}$), as a proxy for monetary and no monetary migration costs. We expect that with higher distance, the volume of migration decreases.

5.3. Colonial, linguistic and historical links

For historical reasons, migration primarily occurs between former colonies and their past dominant state. This is clearly illustrated in Table 4. There is no doubt that former colonial ties explain the large concentration of migrants from Mozambique (87 percent), Angola (80 percent), and Sao Tome (85 percent) in Portugal and those from Comoros (97 percent) and Madagascar (79 percent) in France.

Table 4 - Proportion of the colonizer in the emigration stock of the former colony in 2000

Country of origin	Proportion of the total OECD emigrants stock	Country of residence
Comoros	97.4	France
Madagascar	79.3	France
Malawi	81.1	UK
Kenya	66.4	UK
Mozambique	87.0	Portugal
Angola	80.0	Portugal
Congo, Democratic Republic	44.7	Belgium

Source: Auhor's calculations based on Docquier and Marfouk (2006).

Apart from colonial links, a common language between the countries of origin and destination plays an important role in the orientation of the migration flows. Migrants from French-speaking countries mainly choose France as destination while English-speaking countries choose the US, the UK or Australia. Conversely, proficiency of the destination's official language is a central element of immigration policies in a number of the OECD countries. For example, under the points systems employed in Australia, Canada, and New-Zealand skilled worker applicants are awarded points based on their level of education, age, and other criteria, including language skills. The Canadian immigration system attributes a maximum of 24 points to applications who are proficient in Canada's official languages yields, almost as many points as can be earned for possessing a PhD or Master degree with at least 17 years of full-time study (25 points).

Linguistic proximity and former colonial ties are important forces driving South-North migration. They play a crucial role in migrants' location decision by affecting the transferability of skill, access to information about the destination, and the magnitude of migration costs. Several scholars have argued that common language increases the expected returns to migration and thus facilitates migration decisions. The literature on labor market assimilation suggests that migrants receive a substantial wage premium for their language skills. Chiswick and Miller (1992) found a positive correlation between the language skill and the earning of migrants. Funkhouser and Ramos (1993) argued that the skills accumulated prior to migration are not equally transferable to all the potential countries of destination. Recent studies concentrating on Canada reached the same conclusions. For example, DeVoretz et al. (2000) found that proficiency in Canada's official languages has a positive effect on immigrants' earnings and employment opportunities. Hiebert (2002) underlines that the education of the immigrants and their proficiency in the official language are complements in the Canadian labor market.

From the conclusions of these studies, it is clear that the proficiency in official languages of the destination country increase migration probability, particularly for qualified workers. In this context, it is not surprising to note that the majority of the emigrants from Portuguese-speaking countries (such as Angola and Mozambique) choose Portugal as a destination country. Similarly, the migrants from French-speaking countries (such Algeria, Senegal) tend to move mainly to France. In order to capture the past colonial ties and linguistic proximity I used a dummy variable ($col_{h,d}$) which is equal to 1 if the countries of origin and destination share a past colonial tie and to 0 otherwise[11]. I consider if there is a past colonial link between countries i and j then they share a common language.

5.4. Demographic structure at origin

The increase of the population and particularly large young cohorts in sending countries are a potential factor that drives South-North migration. Census data indicate that migrants are in general young persons. For example, the 15-29 age group represents over 36 percent of the immigrants admitted to the United States during the fiscal the period 1986-2000. Following previous studies such as Clark et al. (2002), Hatton and Williamson (2002) and Mayda (2005), we control for the proportion of persons aged 15-29 ($POP15-29_h$). This variable captures the demographic pressure. Data are taken from the United Nations demographic database. We used the average of 1970-2000.

5.5. Religious, ethnic and linguistic fractionalization at origin

Many conflicts in developing countries are related to religious and ethnic differences (for example, the Hutu-Tutsi violent conflicts in Burundi and Rwanda, the religious conflicts in Nigeria). While a large number of international migrants leave their homelands (voluntary migration) for better opportunities in developed counties, other people are driven by ethnic and religious discrimination. Their quest for safety forces them to emigrate. According to UNHCR statistics, the world accounts around 9 million refugees, among them 2.6 million reside in Europe and Northern America. As argued by Mauro (1995) and la Porta et al. (1999), ethnic and religious heterogeneity, which are associated to lateness tensions and bad quality of institutions, may affect positively emigration flows.

It is important to note that fractionalization and political instability are likely to be linked. Several scholars provided strong evidence that religious, ethnic and linguistic fractionalization increase the risk of interstate armed conflicts, see for example Reynal-Querol (2002). We introduced ethnic, religious and linguistic fractionalization at origin. These indicators capture the probability that two randomly selected individuals belong to different groups. I used the data from Alesina et al. (2003). In order to capture the social fractionalization (FRA_h) I calculated a composite indicator as follow:

$FRA_d = Relig \ x \ Eth \ x \ Lang + Max \ (Relig, \ Eth, \ Lang)$

Where *Relig, Eth* and *Lang* correspond to religious, ethnic and linguistic fractionalization respectively. By adding the maximum of the different fractionalization indexes I avoid considering a country as homogenous (a value of 0) if one component is equal to zero. The impact of this variable on the emigration rate is expected to be positive.

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[11] Our source of information is the CIA world factbook. We have introduced a couple of corrections. For example, we have added a colonial link between Morocco and Spain.

5.6. Welfare magnet and unemployment

There is a large debate in the migration literature on the welfare impact on immigrants' decisions. See, for example, Borjas and Trejo (1991), Borjas (1999), Khoo (1994). In Borjas' terms (1999), the role of welfare programs in migrant's location choices has been referred to as the "welfare magnet" theory. We included the variable SOC_d which measures the total social expenditures in percent of GDP. We expect that this variable will positively affect the emigration rates.

5.7. Economic and job opportunities

The next variable, UN_d, the receiving country's unemployment rate, captures job opportunities for migrants. We used the OECD statistics[12] and computed the average rates for the period 1980-2000.

The log of the population at destination ($\ln POP_d$) captures the immigration capacity of receiving countries. It also captures the size of the market and economic opportunities at destination. The data is sourced from the United Nations; we used the average of 1970-2000. The migration size varies to a large extent between the OECD receiving countries. The proportion of immigrants in the population varies from less than 1 percent for South Korea, and Mexico to more than 25 percent in Australia, Luxemburg, and Switzerland.

5.8. Returns to education "skill premium"

An important strand of migration literature initiated by Borjas (1987) has analyzed the relation between the income distribution in the source and host countries and the abilities of the migrants. Borjas'self-selection model predicts that in countries of origin with lower income inequalities compared to the country of destination, there will be a positive self-selection of migrants (i.e. individuals with higher abilities will have a greater incentive to migrate). In contrast, larger income dispersion in source countries compared to destination countries will lead to negative self-selection of migrants (persons with lower abilities will be particularly attracted). To test for the migrant's self-selection hypothesis with regard to the education level I consider the log of the Gini-index on inequality, $\ln(Gini_d / Gini_h)$, provided by the World Bank's World Development Report, as a proxy of difference in terms of returns to education – the 'skill premium' - between countries of origin and destination. We expect that an increase of the returns to education in countries of destination relative to the countries of origin will have a positive impact on the emigration rate of highly skilled persons.

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[12] The data are available at: http://www.oecd.org/dataoecd/56/37/31613113.xls.

5.9. Small African countries suffer huge brain drain

As expected, the main emigration countries in terms of absolute number of emigrants are the ones with the largest populations (Morocco, Nigeria, Kenya, etc.) whilst the smallest countries yields the least absolute number of emigrants. However, geography also plays an important influence on emigration. In fact, the DM06 data set reveals that small island nations, such as Cape Verde, Seychelles, Mauritius and Guinea-Bissau, tend to exhibit the highest emigration rate while landlocked countries, such as Lesotho, Botswana , Chad , Central Africa Republic and Burundi have substantially lower emigration rates. In 2000, the unweighted average highly skilled emigration rate for small islands African states was 41% while it was only 11% for landlocked countries. I introduced in the model two dummy variables for islands and landlocked nations to capture that islands (landlocked countries) are in general more affected (less affected) by the brain drain.

5.10. Immigration policy

Immigration policies also significantly affect both the size and the "quality" (skill composition) of migrants. While European countries did not select their immigrants, the existence of selective programs, such as point-systems in Canada, Australia and New Zealand, as well as the H-1B visas in the United States, encourages the immigration of skilled workers while discouraging low-skilled immigration. Despite the importance of immigration policy, most of the previous empirical studies ignored the role of these variables as a determinant of migration flows, perhaps due to the difficulty of capturing these effects. Here, two dummy variables grouping countries with "similar" immigration policies are included. The first dummy $Ipol_{UE15}$ is equal to 1 if the immigrants-receiving country is one of the 15 member countries of the European Union. The second $Ipol_{sel}$ is equal to 1 in countries where significant selective programs existed, i.e. in Australia, Canada, New Zealand and the USA. As the latter countries exhibit high immigration rates, we expect that $Ipol_{sel}$ will have a positive effect on highly skilled workers' migration. By contrast, $Ipol_{UE15}$ is expected to exert a positive impact a negative or no effect (neutral). Because of the potential implications of our results, it is important to stress the limit of this indicator. In this context, the impact of this variable must be interpreted with extreme caution since the dummies can also capture regional specific effects unrelated to migration policies.

6. Empirical results

Our dependent variable corresponds to the emigration rates given by (1a). As the emigration rate is based on emigration stocks and thus refers to past and recent migration decisions, we used long-run averages for all explanatory time-varying variables. Among the determinants, we include a set of economic and non-economic factors described in section 5. Our equation can be written as follows:

$$(9) \quad
\begin{aligned}
m_{h,d}^{H} = {} & \beta_0 + \beta_1 \ln(GNI_d / GNI_h) + \beta_2 GNI_h + \beta_3 GNI_h^2 + \beta_4 \ln dist_{h,d} + \beta_5 col_{h,d} + \\
& \beta_6 \ln POP_d + \beta_7 UN_d + \beta_8 SOC_d + \beta_9 POP_{15-29_h} + \beta_{10} FRA_h + \beta_{11} \ln(Gini_d / Gini_h) + \\
& \beta_{12} Ipol_{UE15} + \beta_{13} Ipol_{sel} + \beta_{14} Islands_h + \beta_{15} Landlockeds_h + \varepsilon_{h,d}
\end{aligned}$$

Due to unavailability of information on Gini-index as a proxy for the skill premium 'returns to education', two receiving countries had to be excluded (the Czech and Slovak republics). Thus, emigration rates to 28 OECD receiving countries in 2000 and 53 African sending countries, i.e. for 1,484 observations, were included. A small number of countries of origin have been excluded due to unavailability of information on the independent variables.

One of the common characteristics between international migration, foreign direct investment, trade, and international aid is that many bilateral flows are equal to zero. Some of these null observations correspond to true zero flows, while others correspond to unreported information[13]. In this dataset the emigration rates are equal to zero in a large number of cases (about 36 percent of censored values). Most empirical models of international migration have been estimated by standard OLS or IV methods by considering only positive values. However, ignoring censored values would lead to a serious sample selection bias. To account for this problem, I used the Tobit model. As the Tobit estimates measure the impact of an explanatory variable on the latent dependent variable, the interpretation is made clearer by computing their marginal effect, see MacDonald and Moffit (1980). For the continuous explanatory variables, these marginal effects are used to calculate elasticities at the sample means. For the discrete variables, the marginal effects are used to calculate percentage changes in the dependent variable when the variable shifts from zero to one.

Table 5 reports the results of the best specifications based on the most significant effects when multicollinearity problems are eliminated. The first column presents the benchmark model in which I introduced as explanatory variable a composite indicator capturing countries of origin's social fractionalization (ethnic, linguistic and religious). The other columns report the estimations of alternative

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[13] Mayda (2005, p.11) in a study analyzing the determinants of migration flows to the OECD countries notes: "The data set includes zero flows in correspondence of some country pairs (immigrants inflows from Italy to the United States, from example)".

specifications in which different dimensions of fractionalization are considered separately. Table 6 reports the elasticity estimates at the sample mean for the different models.

Table 5 - Tobit regressions, the benchmark model
Dependent variable = highly skilled workers' emigration rates (in percent)

	Benchmark model	Variant 1	Variant 2	Variant 3
Country of origin/destination variables				
GNI, PPP adjusted, per capita "destination/origin" in log	1.854***	1.865***	1.691***	1.886***
	(4.29)	(4.31)	(4.37)	(4.35)
Geographic distance (origin-destination), in thousand kilometers, in log	-1.516***	-1.324***	-0.838***	-1.491***
	(4.53)	(4.12)	(2.96)	(4.31)
Former colonial ties and linguistic proximity "destination/origin"	10.289***	10.305***	10.056***	10.265***
	(16.41)	(16.43)	(17.88)	(16.34)
Skill premium (Gini-index): destination/origin	1.975***	1.969***	1.408***	1.801***
	(3.90)	(3.88)	(3.03)	(3.59)
Country of origin variables				
GNI, PPP adjusted (origin), in thousand	1.556***	1.519***	1.288***	1.323***
	(3.25)	(3.18)	(3.02)	(2.84)
GNI, PPP adjusted, (origin), in thousand, squared	-0.112**	-0.101**	-0.088**	-0.083*
	(2.27)	(2.10)	(2.03)	(1.76)
Population 15-29 (origin), in percent of the total population	12.456	10.959	8.581	8.063
	(1.02)	(0.90)	(0.80)	(0.67)
Social fractionalization: linguistic, religious, ethnic (origin)	1.214***	-	-	-
	(2.91)			
Ethnic fractionalization (origin)	-	1.835***	-	-
		(2.64)		
Linguistic fractionalization (origin)	-	-	1.585***	-
			(3.23)	
Religious fractionalization (origin)	-	-	-	1.190**
				(2.03)
Small islands (origin)	1.933***	1.919***	0.971**	1.755***
	(4.00)	(3.96)	(2.04)	(3.68)
Landlocked (origin)	-0.653**	-0.494	-0.792***	-0.873***
	(2.24)	(1.59)	(3.03)	(3.03)
Country of destination variables				
Population (destination), in log	0.992***	0.988***	0.837***	0.994***
	(9.84)	(9.80)	(9.28)	(9.83)
Unemployment rate (destination), in percent	-0.165***	-1.588***	-0.118***	-0.162***
	(3.67)	(3.54)	(2.94)	(3.58)
Public social expenditures, (destination), in percent of GDP	0.191***	0.192***	0.165***	0.188***
	(5.74)	(5.78)	(5.51)	(5.66)
Immigration policy (EU15)	-0.386	-0.362	-0.347	-0.383
	(0.99)	(0.92)	(0.99)	(0.98)
Immigration policy (CAN, AUS, NEZ, USA)	4.735***	4.629***	3.834***	4.693***
	(9.86)	(9.72)	(9.03)	(9.72)
Constant	-19.990***	-21.254***	-20.294***	-17.952***
	(3.84)	(4.03)	(4.33)	(3.45)
Log-likelihood	-2471	-2472	-2261	-2474
Number of uncensored observations	818	818	783	818
Number of censored observations	470	470	449	470
Number of observations	1288	1288	1232	1288

Note: Numbers in brackets are the absolute values of the t-ratios; *** significant at 1%; ** significant at 5%. * significant at 10%.

Table 6 - Marginal effects (computed at the mean values), benchmark model
Dependent variable = highly skilled workers' emigration rate (in percent)

	Benchmark model	Variant 1	Variant 2	Variant 3
Country of origin/destination variables				
GNI, PPP adjusted, per capita "destination/origin" in log	0.647***	0.651***	0.672***	0.657***
	(4.27)	(4.29)	(4.34)	(4.33)
Geographic distance (origin-destination), in thousand kilometers, in log	-0.529***	-0.462***	-0.333***	-0.519***
	(4.50)	(4.10)	(2.95)	(4.29)
Former colonial ties and linguistic proximity "destination/origin"	8.086***	8.102***	8.114***	8.059***
	(13.24)	(13.26)	(14.72)	(13.17)
Skill premium (Gini-index): destination/origin	0.644***	0.642***	0.517***	0.586***
	(3.89)	(3.87)	(3.03)	(3.58)
Country of origin variables				
GNI, PPP adjusted (origin), in thousand	0.952***	0.929***	0.886***	0.807***
	(4.50)	(3.17)	(3.01)	(2.83)
GNI, PPP adjusted, (origin), in thousand, squared	-0.221**	-0.200**	-0.196**	-0.164*
	(2.27)	(2.09)	(2.03)	(1.76)
Population 15-29 (origin), in percent of the total population	1.155	1.016	0.905	0.746
	(1.02)	(0.90)	(0.80)	(0.67)
Social fractionalization: linguistic, religious, ethnic (origin)	1.324***	-	-	-
	(2.90)			
Ethnic fractionalization (origin)	-	0.404***	-	-
		(2.64)		
Linguistic fractionalization (origin)	-	-	0.399***	-
			(3.21)	
Religious fractionalization (origin)	-	-	-	0.206**
				(2.03)
Small islands (origin)	0.966***	0.959***	0.457*	0.864***
	(3.43)	(3.40)	(1.85)	(3.19)
Landlocked (origin)	-0.266***	-0.203	-0.322***	-0.353***
	(2.30)	(1.62)	(3.15)	(3.14)
Country of destination variables				
Population (destination), in log	0.346***	0.345***	0.332***	0.346***
	(9.60)	(9.57)	(9.07)	(9.59)
Unemployment rate (destination), in percent	-0.408***	-0.392***	-0.331***	-0.398***
	(3.66)	(3.53)	(2.94)	(3.57)
Public social expenditures, (destination), in percent of GDP	1.324***	1.334***	1.300***	1.304***
	(5.71)	(5.75)	(5.48)	(5.63)
Immigration policy (EU15)	-0.162	-0.152	-0.147	-0.161
	(0.92)	(0.92)	(0.99)	(0.97)
Immigration policy (CAN, AUS, NEZ, USA)	2.768***	2.691***	2.208***	2.736***
	(7.91)	(7.82)	(7.31)	(7.81)
Log-likelihood	-2471	-2472	-2261	-2474
Number of uncensored observations	818	818	783	818
Number of censored observations	470	470	449	470
Number of observations	1288	1288	1232	1288

*Note: Numbers in brackets are the absolute values of the t-ratios; *** significant at 1%; ** significant at 5%. * significant at 10%.*

As expected, the income differential has a positive effect on African highly skilled migration to OECD member states. Relying on the benchmark model estimation results, a ten percent increase in living standards (Gross national income per capita, PPP adjusted) between the OECD member states and the African countries leads to an increase of the continent's highly skilled emigration rate by 6 percent (column 1 Table 6). However, the gross national income per capita at origin unambiguously impacts on emigration rates (the linear term is positive while the squared term is negative). This supports the predictions of Schiff (1996), Faini and Venturini (1993), Vogler and Rotte (2000), and Hatton and Williamson (2001) who argued that the relationship between income per capita and emigration rate can be depicted by an inverted U-shaped function.

Our results show that the effect of distance "a proxy of monetary and non-monetary migration costs" is negative. As reported under the marginal effect in Table 6 (column 1), a ten percent increase in distance leads to a decrease of the highly skilled people's emigration rate by 5 percent.

Unsurprisingly, past colonial links and linguistic proximity between African countries and the OECD member states appeared to be important forces driving African highly skilled emigration. The explanation is that the skills acquired prior to migration are more transferable to destination countries sharing the same language. This result supports Funkhouser and Ramos' (1993) argument that skills acquired prior to migration are not equally transferable to all potential host countries and the fact that education of the immigrants and their proficiency in the official language of the host country are complements in the labor market, Hiebert (2002) and Chiswick and Miller (2002). Mayda (2005) found that sharing a common language was not always a significant effect while Pederson et al. (2004) found a positive effect on migration flows. Analysing the determinants of migration flows into the OECD member states, Mayda (2005) found the former colonial ties has no effect on emigration rates. Pederson et al. (2004) found a significant relationship.

Our results also reveal that highly skilled emigration rates are inversely related to the unemployment rate at destination. A one percentage point increase in the unemployment rate of destination countries induces a decrease in highly skilled emigration by 0.4 percent.

We found that the size of the population in the receiving country is a proxy for the immigration capacity and economic opportunity at destination. A ten percent increase in the destination country population (in logs) generates a 3 percent rise in skilled migration rate.

The social welfare programs in receiving countries positively affect the migration rate of highly skilled persons from Africa. A one percentage point increase in public social expenditure as a percentage of GDP at destination induces an increase in highly skilled migration by 1.3 percent.

I obtain a positive and significant effect of country of origin fractionalization (social, religious, ethnic and, linguistic and religious), proxy of lateness tensions and bad quality of institutions, on the African brain drain.

Differences in terms of the skill premium 'returns to education' between countries of destination and origin also have an important impact on highly skilled migration from Africa. The result suggests that higher returns to education in the receiving countries relative to countries of origin increase the Africa brain drain.

The immigration policies of the four traditional immigration nations (Australia, Canada, New Zealand, and the United States) encourage highly skilled workers to emigrate. In contrast, the European Union countries' immigration policies have no effect (neutral). These results suggest that the shift of the immigration policies of the OECD countries towards more selective systems that are more liberal for highly skilled and very restrictive for low skilled workers would intensify the African brain drain. Finally, this estimations show that the effect of the population increase in the young cohort at origin is not statistically significant.

7. Conclusions

There is strong evidence indicating that economies that are better endowed with human capital grow more rapidly. Despite the role of human capital as a source of economic growth and development, many African countries continue to experience high illiteracy rates and low education attainment. While, this deficit indicates for Africa primary and secondary education remain important a large number of the continent nations face a substantial skilled emigration to developed countries. As a consequence of this large outflow of highly educated population, a number of African countries experienced a high brain drain. Our analysis revealed that 10 of Africa's 53 countries have lost more than 35 per cent of their tertiary educated labor force due to emigration to OECD member states. Especially countries such as Cape Verde, Gambia, Seychelles, Maurice, Sierra Leone and Mozambique suffered a massive brain drain. This large outflow of highly skilled persons can have very unfavorable effects for African growth and development prospects.

Today, a number of OECD immigrant receiving countries are thinking about reforms of their immigration policies. Apart from controlling the immigration volume, the selection of immigrants is an issue that has caused rising concern in the debates on immigration. There is no doubt that the shift of the immigration

policies of the OECD countries towards increasingly selective systems would intensify the African brain drain. In this context, a comprehensive analysis of the forces driving Africa's highly skilled migration would help policy makers in sending countries to better control and monitor their losses in highly skilled workers.

Relying on a unique bilateral data set on international migration by educational attainment, this study analyzed the determinants of the African brain drain. I found that the wage gap between countries of origin and destination, former colonial links and linguistic proximity, economic opportunities in destination countries, and selective immigration policies in OECD receiving countries are all significant determinants of African emigration. These findings suggest that the African brain drain results from multiple possible causes, many of which cannot be directly affected by policy makers (such as geographical specificities, proximity between countries of origin). However, one important determinant of highly skilled emigration from Africa can in fact be influenced by public policy: the creation of economic opportunities specifically for highly skilled workers in the home countries. Policies that target the development of such opportunities could play a significant role in reducing the African brain drain.

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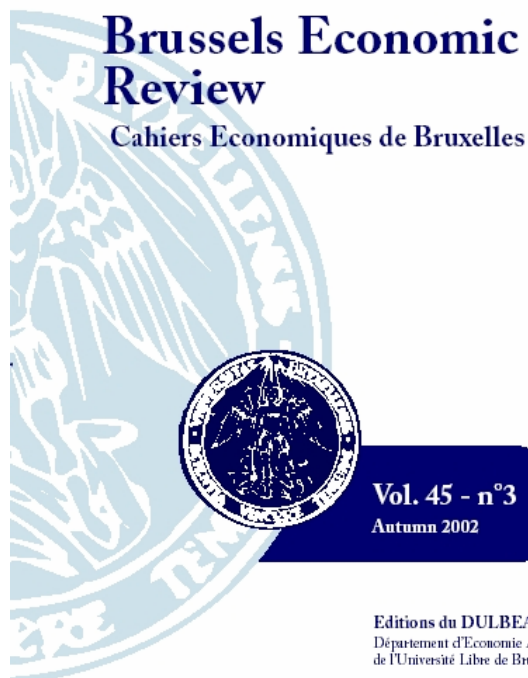
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