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Diaspora Externalities as a Cornerstone of the New Brain Drain Literature

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Abstract

The pace of international skilled migration has accelerated during recent decades and it has attracted considerable attention across scholars and politicians. This paper gives a general and critical idea of the brain drain issue. It provides stylized facts on the magnitude and skill composition of migration and explores the main findings on brain drain. Then it focuses on diaspora networks and on the major channels whereby they foster economic development in source countries. Some policy implications and general conclusion for future research are also given in the last part of the work.

Keywords: brain drain, migration, diaspora
JEL Codes: F2, O15, Z13

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1 Introduction

The pace of international migration from poor to rich countries has accelerated during the last decades. In particular, recent data suggest that emigration of highly skilled people from developing countries continues unabated. What will be the consequences for both the receiving and the sending countries? Developing nations have long worried about the economic impact of losing their best and brightest people and the more traditional economic literature has long maintained that this "'brain drain"' is unambiguously detrimental for those left behind. A new perspective emerged in the early 90's, showing the possibility of a "brain gain" in the "brain drain". Indeed, positive effects of skilled emigration on home countries have been exemplified, taking the form of either "incentive" (ex-ante) effects on investments in education in the sending economy or "feedback" (ex-post) effects such as remittances, return migration after additional knowledge and skills have been acquired abroad, and the creation of business and scientific networks. In particular, the importance of expatriate networks has been underlined in the most recent debate, given the successful examples of the Indian and Chinese mature diasporas.

Although the literature does account for a wide amount of anecdotal evidence about the mechanisms through which diasporas can stimulate economic development in their home countries, empirical and theoretical studies are still far from being systematic.

This work aims at providing an overview of the brain drain issue, laying particular emphasis on the resulting diaspora effects. It is organized as follows: section 2 provides stylized facts on the magnitude and skill composition of skilled migration; section 3 provides a brief literature review on the brain drain problem, section 4 focuses on the diaspora effects and section 5 gives some hints for further research.

2 Stylized facts

Until recently, despite many case studies, there has been no systematic empirical assessment of the brain-drain magnitude. For years, national authorities have stressed the need for more systematic and harmonized databases that include skill or education categories. The first systematic attempt to assess the extent and nature of skilled migration was made by Carrington

and Detriagiache (1998). They constructed estimates of emigration rates of workers at three educational levels (primary, secondary and tertiary) for 61 developing countries in 1990. These estimates were based on three main data sources: US Census data on the skill composition of immigration, OECD data on immigration per country of origin, and Barro and Lee's (2001) data on educational attainment in the source countries. Their study, however, relies on very strong assumptions and suffers from many shortcomings. First, they transpose the educational structure of US immigrants onto the OECD data. For example, migrants from Algeria to France are assumed to be distributed across education categories in the same way as migrants from Algeria to the United States. However, since US immigration policy differs from that of other countries in that it is highly selective, the resulting estimates arguably cannot be considered reliable for countries with a low emigration rate to the US. Second, they use OECD migration statistics, which report limited information on the origin of immigrants, for non-US countries. Indeed, many OECD statistics only report the origin of migrants coming from 10 or 15 countries, thus leading to an underestimation of immigration for a large number of countries for which data were aggregated into an "other countries" category; for example, migration from Africa is particularly mis-measured. Third, the OECD classifies European immigrants by citizenship. This is another source of under-reporting bias, as the number of foreign-born people is usually higher than the number of foreign citizens. Moreover, OECD statistics do not give any information on immigrants' age of entry, so a foreign individual who arrived in the host country at age 1 and then graduated there from higher-education institutions is considered to be a highly-skilled immigrant. Finally, the Carrington and Detriagiache dataset excludes all South-South migration, which can be relevant in some cases, for instance, in the case of migration to the Gulf States from Arab and Islamic countries or to South Africa from its neighboring countries. [1]

In addition, Adams (2003) used the same method to provide estimates for the year 2000 for 24 labor-exporting developing countries. Docquier and Marfouk (2006) extended this research to the years 1990 and 2000 and included almost all of the OECD countries (195 countries in 2000 and 174 in 1990) by collecting Census, Register and Survey data that report migrant educational levels and countries of birth for all OECD countries. They provide a

[1] See for example Docquier and Marfouk, 2006, Docquier and Rapoport, 2007, for further details

dataset on international migration by educational attainment that improves the previous datasets in different ways. Mainly, they address both the under-reporting problem and the problem of transposing the US immigration education structure to the rest of the OECD countries. Moreover, they expand the sample. [2] Nevertheless, they did not take into account South-South migration, even though this has been shown to be relevant in some cases. More recently, Docquier, Lowell and Marfouk (2007) updated and extended the Docquier-Marfouk dataset. They computed gender-disaggregated indicators of brain drain, and they provided emigration stocks and rates by level of schooling and gender for 195 source countries in both 1990 and 2000. Based on these new datasets, we have an overview of the trends in international migration for at least South-North migration and North-North migration, as the last dataset still does not take into account South-South migration.

We will now consider the main characteristics of skilled emigration, as they can be inferred from the use of previously-cited datasets.[3] Starting with an overview of the main observed trends, we then focus more closely on the distribution of migrants by education, quality and sector.

2.1 Overview of the trends in international migration

Considering Docquier, Lowell and Marfouk's (2007) dataset, the total size of the working-aged population born in one country and living in another one in the OECD area was around 40 million in 1990 and 57 million in 2000. With regard to skill composition, international migrants are more likely to be highly skilled than other workers. At the world level in 2000, highly-skilled immigrants represented around 35% of OECD immigrants, while only 11.1% of the world labor force had post-secondary education. Considering more specifically the case of developing countries, Docquier, Lohest and Marfouk (2007) find that in 2000, developing countries accounted for 64.5% of total immigrants and 61.6% of skilled immigrants in the OECD, which is 15 percentage points higher than in 1990. About three quarters of these immigrants live in one of the most important host countries with regard to

[2] See Docquier and Marfouk, 2006, for further details on the methodology

[3] We refer both to the Docquier-Marfouk dataset, 2006, and its updated version, Docquier, Lowell and Marfouk, 2007. We disregard trends related to data disaggregated by gender, and we focus just on one year, the 2000. For data across time, it is possible to refer to Defoort, 2008. She looks at the migration rates, considering just the six main immigration countries, during the period 1975-2000 (one observation every five years).

selective immigration policies (Australia, Canada and United States). One fifth of them live in one of the 15 member-countries of the European Union (EU15). Finally, the skilled emigration rate (on average 7.3% for developing countries) is much higher than the total average emigration rate (on average 1.5%). The highest rates of skilled emigration are observed in small and poor countries.

Docquier et al. (2007) decompose the skilled emigration rate into two components, namely, openness, as measured by the average emigration rate of the working-age population, and schooling gap, as measured by the relative education attainment of emigrants compared to natives. In doing so, they show how country size and the level of development are the key determinants to explain the intensity of the brain drain from a given country

Through a preliminary descriptive analysis, they find that the average emigration rate decreases with the country size. Therefore, small countries tend to be the most affected by the brain drain in relative terms. As it can be noticed in the table 1, the emigration rates of skilled workers in Guyana, Jamaica, Grenada and Haiti are more than 80%. In absolute terms (that is, in terms of the number of educated emigrants), the largest countries are strongly affected by the brain drain, but countries with large stocks of skilled emigrants exhibit low rates of emigration. For example, from table 1, in 2000 the main exporters of brain among developing countries, are the Philippines (1,111,075), India (1,034,373), Mexico (949,334) and China (783,369) and their emigration rates are 13.5% , 4.3% , 15.5% and 3.8 % respectively.

On the other hand, according to Docquier et al. (2007), another determinant of the skilled emigration rate is the schooling gap, which obviously decreases in national income. This explains, caeteris paribus, why poor countries suffer from brain drain. Schooling gap, moreover, depends on destination. On average, the schooling gap observed in selective immigration countries (Australia, Canada and the United States) is about twice as large as the gap observed in EU15 and the rest of the OECD, where immigration policies focus mainly on family reunification and asylum seeking. The size of the brain drain is therefore affected by the positive selection of migrants.

But where do skilled migrants emigrate? If we consider the six major destination countries, 51.41 % of skilled migrants emigrate to the United States, 13.45 % to Canada, 8.10 % to Australia, 6.09 % to United Kingdom, 5.04% to Germany and 3.01 % to France.[4]

[4]On the total stock of skilled migrants in 2000 in the OECD area, stock that amounts

Table 1: Ovierviews of the trends in international migration (year 2000)

All countries	Highest emigration stock	All countries	Highest emigration rates
United Kingdom	1478477	Guyana	89.24%
Philippines	1111075	Jamaica	84.58%
India	1034373	St Vincent & Gren.	84.58%
Mexico	949334	Grenada	84.25%
Germany	936523	Haiti	83.36%
China	783369	Cape Verde	82.42%
Korea	612939	Palau	80.88%
Canada	523463	Trinidad and Tobago	78.95%
Vietnam	505503	St Kitts & Nevis	78.50%
Poland	454560	Seychelles	77.23%
United States	426103	Tonga	75.57%
Italy	395233	Samoa	73.38%
Cuba	331908	Nauru	71.99%
France	310754	St Lucia	68.61%
Iran	303385	Ant and Barb	68.49%
Hong Kong	292575	Gambia, The	67.78%
Jamaica	286932	Suriname	65.76%
Japan	278272	Belize	65.52%
Taiwan	274168	Tuvalu	64.90%
Russia	270445	Dominica	63.93%
Netherlands	254734	Fiji	62.75%
Ukraine	249015	Barbados	62.64%
Colombia	233073	Malta	58.31%
Ireland	228144	Mauritius	55.83%
Pakistan	220591	Kiribati	55.75%
New Zealand	174872	Sierra Leone	49.20%
Turkey	174689	Ghana	44.64%
South Africa	173021	Liberia	44.25%
Peru	163931	Lebanon	43.77%
Romania	162904	Marshall Islands	42.78%
Greece	161670	Kenya	38.52%

Source: Docquier, Lowell and Marfouk (2009)

Table 2: Diasporas toward the OECD receiving countries

United Kingdom		**Philippines**		**India**	
USA	418794	USA	833958	USA	664406
AUS	381348	CAN	154960	CAN	153310
CAN	365420	AUS	51487	UK	123300
POL	85236	JAP	22208	AUS	55514
IRE	62946	UK	11463	NZE	7797
GER	40000	ITA	6566	GER	7075
FRA	33422	KOR	5213	FRA	3434
SPA	18060	GER	4922	SWI	2901
NET	13397	NZE	4311	JAP	2628
SWI	11346	IRE	2763	ITA	2158
ITA	7741	SPA	2420	SWE	2060
BEL	6741	NOR	1795	IRE	1854
JAP	5830	SWI	1715	NET	1825
NOR	5215	FRA	1533	NOR	1394
SWE	5020	SWE	1430	SPA	1140
TUR	2937	NET	1357	AUT	879
GRE	2525	AUT	898	BEL	844
POR	2291	GRE	616	KOR	606
DEN	2169	BEL	613	DEN	377
AUT	1854	DEN	421	MEX	252
NZE	1854	MEX	235	POR	165
MEX	1689	FIN	88	GRE	142
LUX	1268	POR	47	FIN	124
KOR	801	LUX	42	CZE	114
CZE	644	CZE	13	LUX	42
FIN	512	SLO	1	ISL	25
ISL	423	ISL	0	SLO	8
SLO	38	HUN	0	HUN	0
HUN	0	POL	0	POL	0
UK	0	TUR	0	TUR	0

Mexico		**Germany**		**China**	
USA	919139	USA	387067	USA	434547
CAN	12165	CAN	111710	CAN	144765
SPA	6200	NET	97718	AUS	74114
GER	2372	UK	64573	JAP	60266
UK	2216	SWI	60935	UK	16270
FRA	2146	AUS	38440	GER	10233
SWI	986	FRA	32281	NZE	10020
ITA	941	TUR	30864	KOR	7064
AUS	687	AUT	24629	FRA	6885
JAP	517	SPA	22440	NET	4184
SWE	460	ITA	9299	SWE	2890
NET	372	SWE	8850	SWI	2189
BEL	239	BEL	7743	SPA	1900
AUT	223	POL	7045	ITA	1640
IRE	136	DEN	4672	AUT	929
NOR	116	NZE	4056	BEL	866
NZE	111	NOR	3749	IRE	833
POR	83	IRE	3254	NOR	812
DEN	78	MEX	3160	MEX	594
GRE	53	HUN	2833	DEN	555
FIN	31	LUX	2383	FIN	444
CZE	25	GRE	2259	TUR	415
LUX	21	POR	2167	CZE	316
ISL	18	JAP	1944	POL	280
HUN	0	CZE	978	LUX	123
KOR	0	FIN	740	POR	122
MEX	0	KOR	589	GRE	92
POL	0	SLO	95	SLO	16
SLO	0	ISL	48	ISL	6
TUR	0	GER	0	HUN	0

Source: Docquier, Lowell and Marfouk (2009)

Considering the first six countries with the highest number of skilled immigrants and their 30 OECD destination countries, table 2 reveals that both for developed and for developing countries, the largest diasporas can be found in the US, followed by Canada (except for the United Kingdom, whose second destination in absolute term is Australia). For India, United Kingdom is an important destination too. Obviously, location choices depend on several factors, including historical ties, past colonial links, geographic distance (e.g., the US is the main destination choice for migrants from Mexico and Cuba), cultural and linguistic distances (e.g., for US migrants, the main destinations are Canada and the UK). Past migration flows seem to be an important determinant as well, since they help to reduce migration costs (Beine, Docquier and Ozden, 2008).

2.2 Importance of the schooling location: educated at home or abroad?

The Docquier and Marfouk dataset and its extended version consider as skilled immigrants all foreign-born workers with university or post-secondary training who are currently living in an OECD country. As Beine, Docquier and Rapoport (2007) underline, "this definition is based on the country of birth and does not account for whether education has been acquired in the home or in the host country. Depending on the objective for which the data are going to be used, such definition could appear either too inclusive or too exclusive. For example, it would seem appropriate (or even too exclusive) if one wants to measure the extent of a country's 'skilled diaspora.' Conversely, it may seem too inclusive if one wants to estimate the fiscal cost of the brain drain for the source country, in which case only people with home-country higher education should be considered as skilled emigrants".

Building on the Docquier and Marfouk dataset, Beine, Docquier and Rapoport use immigrants' age of entry for measuring where education has been acquired. They provide alternative measures of the brain drain by defining skilled immigrants as those who left their home country after age 12, 18 or 22, and they perform analyses for both 1990 and 2000. By construction, their corrected rates are lower than the ones calculated with Docquier and Marfouk's dataset, which did not take into account the age of entry. However, the country rankings by intensity of brain drain are almost the same.

to 20,250,041, according to Docquier, Lowell and Marfouk (2009) dataset

Nevertheless, the determination of the origin of acquired education is problematic with the Census-based data used by Docquier and Marfouk. The first problem is underlined by Rosenzweing (2005), who explain that "information on 'entry' year, which could be used to calculate entry age, is based on answers to an ambiguous question - in the US Census the question is 'When did you first come to stay?' Immigrants might answer this question by providing the date when they received a permanent immigrant visa, not the date when they first came to the US, at which time they might not have intended to or been able to stay". Hence, age at first entry might not signal much regarding the location of a migrant's schooling.

A second problem is linked to the fact that Census-based data provide information on the foreign-born population, but this figure includes unknown proportions of persons who are not permanent immigrants, including students. Therefore, this dataset completely ignores the fact that many tertiary-educated people, residing in both low and high income countries, acquire their tertiary schooling abroad mainly in high-income countries, which are the major sources of education for students from low-income countries. In addition, Census-based statistics can also overestimate the net loss of human capital, because they do not consider return migration among students acquiring education abroad. This is a problem worth addressing if we want to evaluate the actual magnitude of the brain drain, as the total number of international students in the world is large; the UNESCO reported that in 2005 alone, over two million students were enrolled in tertiary institutions as non-resident students. An evaluation of the effects of students studying abroad on developing countries of origin requires information on the return rates of foreign students. If no students return, then education abroad represents a net loss for the sending country. However, if all students return, the sending country gains from emigration.

Rosenzweig (2006) has argued for the importance of knowing if higher education has been acquired abroad; he has computed a rate of return to evaluate the actual effect of a brain drain on the sending country. In order to do so, he constructed a "stay rate" as the ratio of students deciding to stay in the United States, that is, "student stayers," to the total number of foreign students in the US. He used data on foreign students in the US taken from the Student and Exchange Visitor Information System (SEVIS), which provides information on current foreign-born students by country. He also used data from the US new immigrant Survey (NIS) through which it is possible to identify US student stayers, who are defined as permanent immigrants who

ever held a student visa. In table 3, we compare the proportion of skilled immigrants with US tertiary schooling with regard to both the Rosenzweing and Docquier and Marfouk (DM) datasets, controlling for age of entry. [5] The correlation between these two measures is 0.26, and the measure from DM dataset is higher for 83 countries and lower for 56 countries. Although, as explained above, immigrants' age of entry is not an adequate proxy for measuring where education has been acquired, the Rosenzweing data also have some limitations. This dataset is derived mainly from NIS data, which sampled 4% of all US adult (18+) permanent resident aliens who received their visas between April and November 2003. Even if the NIS is the only database that identifies a complete history of visits by each immigrant to the US, given its number of observations, it presents the double disadvantage of not only being incomplete but also presenting a selective sample of countries, as only those countries with sufficient number of immigrants in US are represented.

2.3 The sectoral characteristics of migrants: the importance of the medical brain drain

The available evidence suggests that skilled migration is concentrated into certain sectors. Two main sectors appear to attract a large proportion of skilled migration, namely, the health and Information Computer and Technology (ICT) sectors. The emigration of health care workers is a persistent form of brain drain. Commander et al. (2003) point out that in the 1960s and 1970s, much of the concern about brain drains referred to the emigration of doctors and nurses from developing countries. In comparison, the growth of labor mobility in the ICT sector is a more recent phenomenon. The latter phenomenon may be positive, since the ICT sector is usually characterized by agglomeration and spillover effects. Therefore, the development of associated networking effects may facilitate the adoption of new technologies in developing countries. However, a medical brain drain could be very detrimental for developing countries, as it may affect a country's health conditions.

To estimate the extent of the medical brain drain, Docquier and Barghava (2007) collected data on doctors with foreign qualification working in the 16 main OECD countries. Aggregating these data, they computed medical emigration rates for all countries during the period 1991 to 2004 on an annual

[5] The rate for the DM dataset is $\frac{BD0^{+}-BD22^{+}}{BD0^{+}}$

Table 3: Stay rate in Rosenzweig and Docquier-Marfouk data set

country	**us_school**	**DM06**	country	**us_school**	**DM06**	country	**us_school**	**DM06**
Cyprus	1.000	0.540	Hungary	0.405	0.430	Egypt	0.076	0.248
Bahamas, The	1.000	0.540	Saudi Arabia	1.000	0.424	Nepal	0.192	0.243
Kuwait	0.163	0.540	Ireland	0.234	0.411	Sri Lanka	0.093	0.242
Belize	0.000	0.540	Malaysia	0.557	0.407	Romania	0.289	0.241
Cambodia	0.233	0.540	Croatia	0.649	0.396	Malta	1.000	0.240
Austria	0.363	0.540	Macedonia	0.000	0.390	Nigeria	0.285	0.236
Portugal	0.149	0.540	Bolivia	0.356	0.390	Senegal	0.000	0.231
Laos	0.000	0.540	Indonesia	0.736	0.386	Sierra Leone	0.430	0.227
Panama	0.484	0.540	Venezuela	0.264	0.382	United Arab Emirates	1.000	0.225
Greece	0.723	0.540	Sweden	0.429	0.382	Bangladesh	0.082	0.220
El Salvador	0.593	0.540	Thailand	0.783	0.381	Algeria	0.076	0.213
China, Hong Kong	0.527	0.540	Ethiopia	0.171	0.376	Ghana	0.366	0.213
Italy	0.655	0.540	Lithuania	0.161	0.370	Qatar	0.000	0.208
Vietnam	0.278	0.540	Denmark	0.382	0.369	India	0.143	0.205
Mexico	0.417	0.540	Chile	0.527	0.368	China	0.380	0.202
Tonga	0.000	0.540	Iraq	0.194	0.367	Sudan	0.144	0.179
Barbados	0.740	0.533	Yemen	0.271	0.365	Russia	0.162	0.177
Cuba	0.097	0.523	Singapore	0.592	0.364	Estonia	0.109	0.177
Guatemala	0.382	0.513	Colombia	0.196	0.361	Botswana	1.000	0.174
Jamaica	0.370	0.511	Argentina	0.148	0.361	Kazakhstan	0.127	0.143
Lebanon	0.227	0.508	Morocco	0.167	0.360	Turkmenistan	0.000	0.140
Costa Rica	1.000	0.498	Turkey	0.392	0.359	Ukraine	0.254	0.134
Belgium	0.450	0.498	Syria	0.464	0.345	Bulgaria	0.186	0.128
Trinidad & Tobago	0.397	0.495	United Kingdom	0.185	0.342	Albania	0.031	0.114
St. Vincent & Grenadines	1.000	0.495	Australia	0.254	0.341	Moldova	0.348	0.112
Jordan	0.086	0.493	Zimbabwe	0.571	0.341	Azerbaijan	0.472	0.109
Dominican Republic	0.000	0.493	Poland	0.123	0.325	Libya	0.000	0.108
Spain	0.222	0.489	Finland	0.947	0.325	Belarus	0.216	0.105
Latvia	0.636	0.488	Switzerland	0.202	0.322	Tunisia	0.000	0.103
France	0.358	0.485	Peru	0.124	0.322	Georgia	0.037	0.093
Canada	0.255	0.475	Eritrea	0.000	0.314	Uzbekistan	0.092	0.091
Grenada	0.634	0.471	Burkina Faso	0.000	0.311	Kyrgyzstan	0.000	0.090
Haiti	0.317	0.468	Tanzania	0.369	0.310	Tajikistan	0.000	0.062
Honduras	0.293	0.466	Kenya	0.349	0.300	Gambia, The	1.000	0.046
Fiji	0.000	0.463	Paraguay	1.000	0.299	Papua New Guinea	0.000	0.043
Guyana	0.152	0.461	Philippines	0.067	0.299	Mongolia	0.123	0.026
Korea	0.351	0.460	Liberia	0.353	0.280	Togo	0.041	0.022
St. Lucia	1.000	0.460	New Zealand	0.375	0.275	Cote d'Ivoire	0.335	0.018
Ecuador	0.260	0.459	Cameroon	0.091	0.274	Congo, Democratic Republic	0.000	0.017
Nicaragua	0.228	0.457	Pakistan	0.236	0.272	Rwanda	1.000	0.013
Norway	1.000	0.449	Armenia	0.062	0.272	Burma	0.285	0.010
Uruguay	0.000	0.448	Uganda	1.000	0.270	Chad	0.000	0.002
Netherlands	0.000	0.444	Taiwan	0.480	0.268	Zambia	0.117	0.002
Israel	0.290	0.440	Brazil	0.411	0.268	Niger	0.000	0.002
Iran	0.360	0.433	South Africa	0.262	0.266	Congo, Republic	0.000	0.001
Dominica	0.416	0.433	Somalia	0.636	0.260	Benin	0.000	0.000
Japan	0.525	0.430	Iceland	0.000	0.251			

basis. They defined the medical brain drain as the proportion of physicians trained, rather than born, in their country of origin and working abroad. They show that small and low-income countries are the most affected by the medical brain drain. The health care shortages are particularly severe in Sub-Saharan Africa and in South Asia. Among the 30 most affected countries, 12 countries are from Sub-Saharan Africa (Cape Verde, Sao Tome and Principe, Liberia, Ghana, South Africa, Uganda, Somalia, Ethiopia, Zimbabwe, Malawi, Zambia, Sudan), where the number of health professionals is very low. A significant increase in emigration rates over time is also observed in Zimbabwe, Malawi, Zambia and Togo. These statistics yield a worrisome picture, above all for African countries, where health conditions are generally poor and more than 25 million people are stricken by HIV/AIDS.

The urgency of the problem is confirmed by Barghava and Docquier (2008), who find that the medical brain drain has a negative impact on the supply of healthcare staff in developing countries, which may negatively affect health, life expectancy and the growth of the concerned population. In particular, the fraction of a country's physicians who work abroad has a positive and significant impact on the number of adult deaths due to AIDS. Given the statistics on the medical brain drain, it is absolutely important to develop policies aimed at increasing the supply of health care staff in developing countries. For this purpose, Barghava (2005) has suggested subsidies from developed countries [6] and medical training for African students in foreign countries. [7]

In contrast, according to Clemens (2007), the medical brain drain does not degrade basic public health conditions. Using a new bilateral dataset collected by Clemens and Pettersson (2006), which provides estimates for the emigration rates of physicians from 53 Sub-Saharan African countries migrating to nine countries (namely, UK, US, France, Australia, Canada, Portugal, Belgium, Spain and South Africa), he found no causal connection between the large African health worker diaspora and any degradation of indicators

[6] According to Barghava (2005), "apart from voluntary restraints, developed countries recruiting staff from African countries should be required to deposit the funds with an agency such as the Global Fund that can compensate developing countries for emigrating staff and subsidize salary increases"

[7] according to Barghava, this should be encouraged even if other developing countries are better-suited than developed ones so as to avoid permanent migration of medical staff after education has been acquired abroad

of public health. [8] In his opinion, Africa's generally low staffing levels and poor public health conditions are the result of factors entirely unrelated to international movements of health professionals. He instead puts the blame on a "bad" health system in which most of the highly trained health professionals work outside the public sector, are regularly absent during their working hours and do not spend any portion of their time working in rural areas or slums, where children "die principally from lack of oral rehydration during diarrhea, lack of malaria prophylaxis, and lack of basic primary treatment for acute respiratory infections" (Clemens (2007)). While it is undeniable that the lack of any kind of modern preventive or primary health care is a major problem for Africa, we argue that medical shortages triggered by emigration of health professionals are a serious concern that needs to be taken into account. Nobody can ignore the fact that countries such as Ghana have only six doctors for each 100,000 people, whereas countries such as the United States, Britain, Canada and Australia, have more than 220 doctors per 100,000 people. [9]

2.4 The quality of skilled migrants abroad

Many case studies (Kuznetsov, 2006, Kapur and McHale, 2005) highlight that most members of diasporas were educated in the highest education institutions of their countries of origin. Considering, for example, the case of Indian immigrants to the United States in the Information Technology (IT) sector, most Indian engineers that expatriate to the US graduated from the Indian Institute of Technology (IIT), a highly selective institution. To further understand this phenomenon, we draw on Sukhatme's (1994) analysis of the IIT brain drain in Mumbai in the 1970s; according to this study, 31% of

[8] Indicators included child mortality; mortality during the first year of life per 1,000 live births (IMR); the measles vaccination rate; the diptheria/pertussis/tetanus (DPT) vaccination rate; the prevalence of acute respiratory infections (ARI) in children under age five lasting at least two weeks and requiring medical care; the fraction of those ARIs that saw a trained health professional; the percentage of deliveries attended by trained personnel; the percentage of children under age five with diarrhea requiring medical attention and lasting at least two weeks; the percentage of those diarrhea cases that received either oral rehydration therapy or increased fluids with continued feeding; the percentage of people aged 15 - 49 who are infected with HIV; and the percentage of adults with advanced HIV infection receiving antiretroviral treatment.

[9] Data from Devastating Exodus of Doctors From Africa and Caribbean Is Found, New York times, 27/10/2005

IIT graduates settled abroad, while the estimated migration rate of engineers for the country as a whole was only 7.3%. Furthermore, the migration was significantly higher in those branches of engineering in which IIT entrants had the highest scholastic ranking. Other fields in India show a similarly strong selection bias in emigration. In medicine, the emigration rate for doctors in general was about 3% during the 1980s, but for graduates of the All India Institute for Medical Sciences, India's most prestigious medical training establishment, the rate was 56% between 1956 and 1980 and still 49% in the 1990s. [10] The quality of education is an important factor in explaining the performance of migrants abroad. Educational systems, in fact, are qualitatively different across countries, and this is especially true among developing and developed countries. Coulombe and Tremblay (2006) provide data to measure the skill-schooling gap observed for the foreign population with respect to the Canadian-born population in Canada. They view the skill-schooling gap as related to the differences in the quality of educational systems across countries: the higher the schooling gap, the lower the quality of the education system. [11] As presented in table 4, we can see that for poor countries, the gap is quite large. The difference in the schooling gap can translate itself into different earnings for migrants in the host country; this fact might provide an explanation as to why only very select people from the most prestigious schools can perform well abroad. Overall, this suggests that in several cases, migration mainly concerns the best engineers, physicians, scientists or other highly-skilled individuals.

[10] Khadria (1999).

[11] To calculate the schooling gap, Coulombe and Tremblay compute the mean skill level at all schooling levels from the 2003 International Adult Literacy and Skills Survey (IALSS) 2003 data, and then they convert the mean skill level of international immigrants into the equivalent years of schooling in the Canadian-born population. Finally, they compute the difference between the mean years of schooling of the international immigrants and the years of equivalent schooling in the Canadian-born population, and they adjust this difference to take into account that the skill-schooling function is a concave function of the difference between the mean years of schooling of the international immigrants and the years of equivalent schooling in the Canadian-born population. The results provide a single number in years of schooling, which is the skill-schooling gap.

Table 4: The skill-schooling gap of international immigrants by country of origin and per capita income (Y)

	Skill-schooling gap	**Per capita income**		**Skill-schooling gap**	**Per capita income**
United States	0.9	28381	Vietnam	3.2	1498
Portugal	0.9	13134	Mexico	3.2	7159
Netherlands	1.3	20965	Other countr.	3.2	
Italy	1.4	20147	China	3.3	2800
Russia	1.4	7192	Philippines	3.7	3021
United Kingdom	1.5	19543	Jamaica	4.2	3810
France	2.2	20142	El Salvador	4.2	4206
Germany	2.4	21048	Sri Lanka	4.3	3038
Hong Kong	2.4	25168	Poland	4.4	7338
Romania	2.5	4780	India	4.4	1978
Taiwan	2.8	14583	South Korea	4.9	13 767
Guyana	3.0	2651	Pakistan	5.0	1909
Iran	3.0	5302	Ukraine	6.5	4787
Lebanon	3.2	4495			

Source: Coulombe and Tremblay (2006)

3 The Brain Drain and Human Capital Formation

This section explains and summarizes both the traditional view on the implications of the brain drain for sending countries and the more recent view, which emphasizes the role of skilled migration in the formation of human capital

3.1 Controversy on Brain Drain and Human Capital accumulation

An extended debate has been taking place on the economic impact of brain drain on sending countries. Economic models in the 1960s, particularly Grubel and Scott (1966), assumed perfectly competitive markets and no public subsidy for education. With all markets clearing, wages set equal to marginal product and without externalities, there was no welfare impact on those remaining behind, thus the policy recommendation was free migration.

Later on during the 70's, a series of new models emphasized the negative

effects of skilled migration for the sending countries (for example, Bhagwati and Hamada, 1974). They assumed a complementarity between skilled and unskilled people, the departure of the skilled then reducing the productivity of the unskilled. Therefore, in those models, skilled migration can be seen as a negative externality on those left behind. In fact, as skilled workers are generally the richest taxpayers, the sending country loses a substantial source of income that can be taxed and redistributed. Moreover, sending governments lose initial education investments, because they bear the cost of human capital formation without receiving the returns, and so poor countries become poorer and rich countries become richer. This early literature is also well known for its policy conclusions. For example, Baghwati and Hamada (1974) suggested an income tax on skilled migrants; this tax would be levied by the receiving countries (i.e., the developed world) and redistributed in one form or another to the sending (i.e., developing) countries.

New endogenous growth theories have renewed the relationship between migration, education and growth. The first models in this framework continued to emphasize the detrimental effects of the brain drain on sending countries. The main idea was that since human capital accumulation is important in inducing economic growth (Lucas, 1988), the loss in human capital induced by the emigration of skilled workers would reduce productivity and income per capita, therefore restraining growth in the sending country (Miyagiwa, 1991, Haque and Kim, 1995).

A more recent literature offered a more optimistic perspective by demonstrating the possibility of "a brain drain with a brain gain" (Mountford 1997, Stark et al. 1997, 1998, Vidal 1998, Beine et al. 2001). The main insight of these studies is that on an individual level, migration prospects increase the expected return of education in poor countries and therefore foster domestic enrolment in education. When this incentive (or 'brain') effect dominates the observed emigration (or 'drain') effect, the origin country may in fact end up with more human capital. One of the main assumptions of these models is that the probability of migration is uncertain: among the many that invest in education, only a fraction actually emigrates. Those who remain in the country are endowed with higher human capital thanks to the incentive effect. Moreover it is necessary that skilled workers have a higher probability to emigrate than unskilled workers.

What empirical evidence exists for this new theory? An important step in the literature has been taken by Beine, Docquier and Rapoport (2001). They aim to estimating the growth effect of the brain drain. In a cross-

sectional study of 37 developing countries, they show that the probability of emigration has a positive impact on human capital formation in sending countries, especially for countries with a low initial GDP per capita level. In this study, they encountered data difficulties, since they had to use gross migration rates as a proxy for the brain drain due to the lack of comparative data on migration by educational attainment. In a subsequent study, Beine et al. (2003) used the Carrington and Detriagiache dataset to estimate the emigration rate for tertiary-educated people as a proxy for the brain drain. This study covers more countries, including 50 developing countries, and also uses more explanatory variables to understand the relationship between human capital, migration and growth. The results confirm their previous study.

On the contrary, Faini (2003) finds little empirical support for this so-called "revisionist" approach. Using the Carrington and Detriagiache dataset, he estimates a different specified equation relating educational achievements to a set of explanatory variables, including migration. He finds that a higher probability of migration for workers with secondary education has no visible impact on the rate of secondary school enrolment. Moreover, a higher probability of migration of workers with tertiary education has a positive and significant impact on the rate of secondary school enrolment, but a negative one on tertiary school enrolment. According to Faini, one way to interpret the results is that the most talented individuals try to migrate early, pursuing their graduated studies abroad to have better chances in the host countries. These results do not support Beine et al.'s (2003) beneficial brain drain view.

Mariani (2004) estimates different growth equations in a cross-sectional analysis of developing countries and considers both the Carrington and Detriagiache and the Docquier and Marfouk datasets on skilled migration. He finds that a brain drain can positively affect income growth only if schooling and/or income are not too unequally distributed across classes. Therefore, only countries endowed with "a numerous enough middle class" can benefit from the educational incentive derived from increased migration

In a very recent study, Beine, Docquier and Rapoport (2008) use the Docquier and Marfouk dataset and find a positive and significant impact of skilled migration prospects on gross (pre-migration) human capital levels in a cross-sectional analysis of 127 developing countries. The results also hold using the Beine et al.'s (2007) alternative brain drain estimates when controlling for where migrants acquired their skills. Positive effects are also obtained using alternative measures of a brain drain. They obtain uncertain

results when measuring human capital in terms of school enrolment rate, confirming Faini's findings Beine, Defoort and Docquier (2006) estimate a similar equation in a panel setting (specifically, six observations by country), controlling for unobserved heterogeneity and the endogeneity of the migration rate. Their results confirm a significant incentive effect on developing countries; the effect is stronger in low-income countries.

Finally, Checchi et al. (2007) empirically investigate the relationship between factor mobility (that is, foreign direct investment (FDI) and migration) and domestic human capital accumulation in developing countries. Considering both the incentive effect of migration on investment in education and the possibility that inward FDI can modify relative incentives to acquire education, possibly through the adjustment of relative returns to educational attainment, they do not find strong evidence for a beneficial effect of factor mobility on domestic human capital accumulation.

Relying on their baseline specification, Beine et al. (2008) use counterfactual simulations and equate the skilled emigration rate to the unskilled rate in order to estimate the net effect of the brain drain for each country and region. They find that the brain drain stimulates human capital accumulation among residents in some countries. It appears that the countries experiencing a positive net effect (the "winners") generally combine low levels of human capital (below 5%) and low skilled migration rates (below 20%). Alternatively, countries that do not benefit from a brain drain are typically characterized by high rates of skilled emigration and/or high enrolment rates in higher education. The brain drain seems then absolutely positive for some countries such as India and China, whereas for many Sub-Saharan African or Central American countries it raises a lot of concerns.

Thus far, controversial empirical results concern the impact of a brain drain on human capital formation. Given the quality of the data used in the analysis (they are mostly cross-sectional studies, where the results often depend on the specification chosen), the results obtained must be considered preliminary. Further analyses are required before drawing definitive conclusions.

Beyond the aforementioned incentive effect, return migration may also promote human capital formation and social and cultural changes. Returnees in fact can bring home new skills, new ideas and new technology. In the next subsection, we will investigate these effects.

3.2 Return Migration

The return of expatriates to their home country is widely perceived as beneficial, since migrants are expected to come back with more skills and increased financial resources. Hence, the fact that they will spend the rest of their career in their origin country may have beneficial effects on that country's productivity as well as the diffusion of technology, but we need further empirical evidence to argue that skilled returnees positively affect economic development in their countries of origins.

Dos Santos and Postel-Vinay (2003) show that when an economy has a relatively inefficient research and development sector, the emigration of a limited number of skilled workers may be beneficial. Indeed, they can return with more knowledge and can contribute to the diffusion and imitation of more advanced technologies. Return migration can then have a growth-enhancing effect that in turn reduces the technological gap between the two economies. As a result, in the long run, fewer native-born workers are compelled to emigrate, and more emigrants are likely to return. In a similar paper, Dos Santos and Postel-Vinay (2004) show that a shift in immigration policy, with an increase in the share of temporary visas, may benefit countries from which educated migrants emigrate. Two effects of the proposed immigration policy are thus described: a decrease in the incentive to acquire education, which reduces the pre-migration stock of human capital in the origin country, and a higher proportion of returnees among emigrants, which increases the country's stock of knowledge, a complement of human capital. Their paper derives the theoretical conditions required for an overall positive effect to occur.

From a different perspective, Stark et al. (1997) consider return migration in a context of imperfect information. Given the possibility to emigrate and to receive higher expected returns to human capital, workers have an incentive to invest in education in order to migrate. In the destination country, migrants are paid according to the average productivity of the migrants' group. After a certain period of time, the personal abilities of migrants are revealed, and thus workers will be paid according to their individual productivities. Relatively low-skilled workers will be paid less in the second period; at this point, they may decide to return home to their origin country, which may thus benefit from their educational investments.

Returnees can also come back with financial resources and overcome their previous liquidity constraints by investing in their home country with sav-

ings accumulated abroad. For example, Ilahi's (1999) study of Pakistan, Mesnard's (2001) and Mesnard and Ravaillon's (2006) study of Tunisia, and McCormick and Wahba's (2001) study of Egypt show that savings repatriated by migrants are used for investments into small businesses.

From still another perspective, Borjas and Brastberg (1996) demonstrate that under fairly general conditions, return migration tends to exacerbate the selection bias that characterized the initial immigrant flow. That is, if migrants were initially relatively skilled, then the returnees are the least skilled of these emigrants. For example, Cohen and Haberfeld (2001) find that Israeli immigrants returning from the United States are negatively self-selected from those Israelis who emigrated in the first place.

Domestic residents who have decided to go and study abroad to acquire additional human capital are a very important class of potential returnees. But how many students eventually return? Solimano (2002) reports data from the US National Science Foundation that show that about 47% of the foreign student on temporary visas who earned doctorates in 1990 and 1991 were working in the United States in 1995. Indeed, the majority of the PhD students from India (79 %) and China (88 %) who graduated from US universities in 1990 and 1991 were still working in the US in 1995. More generally, this NSF study reports that foreign doctoral recipients in science and engineering who were working in the US after 10 to 20 years tend to remain in the US. Also, Barghava (2005) emphasizes the relation between the medical brain drain and medical training in developed countries An opposing, more optimistic view is offered by Rosenzweig (2006), who maintains that a large number of people born in low-income countries receive their higher education in high-income countries, and the vast majority of them return to their home country. Considering new data for the United States taken mainly from New Immigrant Survey (NIS), he calculates the average student stay rate weighted by the number of students per country; he calculates this average at 4.7% this figure is 2.7% for Asian countries of origin and 6.6% for students from countries outside of Asia. As Roseinzweig states, "these rates may seem low, but they are relative to the stocks of students. If, say, there are five cohorts in the population of foreign students, these rates would be multiplied by five to obtain probabilities that a student in a single entry cohort of students did not return, which would be about 20% (13.5% and 33% for Asian and non-Asian countries, respectively). The flow of students per year to the United States is about 250,000; the (NIS) estimated count of about 50,000 student stayers from a cohort of immigrants thus also suggests

a stay rate of 20%" Even if this seems like good news, these statistics must be considered with caution, as they are derived from a 4% sample of US permanent resident aliens 18 years or older who received their visas between April and November 2003. Even if the NIS is the only database with which it is possible to identify a complete history for each immigrant of visits to the US, given its limited number of observations, the dataset presents the double disadvantage of not only being incomplete but also presenting a biased sample of countries, as only those countries with a sufficient number of immigrants in US are represented.

In sum, we can say that in general, studies of return migration suggest that those who return may be those that have performed relatively poorly when abroad, while those who stay are the best and the brightest. Moreover, as discussed in Faini (2003), if the most skilled migrants are the ones who tend to remit less, then "the home country residents will be further penalized by the decline in remittances."

Of course, these observations do not necessarily hold for all countries and all migrants groups. But given these results, is it possible that the most talented immigrants can still contribute to the economy of their country of origin? Other sociological and economic studies show that some channels related to the expatriates that do not require the return migration of highly skilled individuals may be important, especially insofar as exports, investments, and scientific networks are linked to diasporas abroad. The most talented migrants are likely to make their contribution as members of the diaspora rather than through their return.

4 Diaspora Effects

Even without return migration, networks and diasporas may promote trade, investments and the circulation of information and technology in the sending country. Networks and diasporas, moreover, may be important in facilitating cultural and social changes. Obviously, diasporas encourage remittances that are often invested in schools and training resources. In the following subsections, we investigate each channel through which diasporas from abroad can enhance development in sending countries.

4.1 Brain Drain and Remittances

It has long been acknowledged that remittances can act as a counterbalance to skilled migration. According to the Global Economic Prospects of the World Bank (2006), recorded remittances in developing countries amounted rose to about US dollar 167 billion in 2005, up 73 percent from 2001. Indeed, in a lot of source countries emigrants' remit earnings account for a sizeable share of annual Gross Domestic Product and for some countries they represent one of the major sources of foreign capital, even exceeding foreign direct investments and development aid. The recent increase in remittances can be explained through the growing importance of the underlying causes, namely migration especially to rich countries, lower costs and larger networks in the global financial sector, and government policies that improve financial market access, which encourage the use of official channels (Niimi, Ozden, Schiff, 2008).

Although remittances play a very important economic role in developing countries, it is difficult to know the specific remittance-patterns of skilled migrants. Presumably, skilled migrants remit more, because they earn more. However, skilled migrants probably come from wealthy families and therefore have fewer incentives to remit.[12] Moreover, skilled migrants tend to migrate more on a permanent basis; as such, they are more likely to reunite with their close family members. As Lucas and Stark (1985) show, the flow of remittances tends to decline the longer a migrant is abroad. Therefore, remittances may tend to decline with skilled migration. Overall, it is therefore not clear as to which force dominates to shape the pattern of remittances for skilled migrants.

At an aggregate level, Faini (2006) tries to investigate the relationship between skilled migration and remittances by relying on the Docquier and Marfouk dataset. He finds that a rise of 10% of the share of skilled migrants is associated with a fall of 1 % in the GDP share of remittances. The results of his study must, however, be considered with caution, because endogeneity problems between remittances and the education level of migrants are not taken into account. In a further study, Niimi, Ozden and Schiff (2008) address this issue and again show that at a cross-country level, remittances are negatively correlated with the educational level of migrants. This does not necessarily imply that remittances from skilled migrants are negligible,

[12] One exception is that if they have a commitment to remit money back to their family in order to refund their investments in education.

as shown by Kangasniemi et al. (2007). They find that nearly half of Indian medical doctors working in the UK remit income to their home country, and these transfers represent on average 16% of remitter income. Certainly, further analysis is required to examine the robustness of these results given the limited availability of cross-country observations and the absence of data on informal remittance flows.

Another key issue refers to the motivation of remitters. Remittances can be motivated by many factors, such as altruism or self-interest (Lucas and Stark, (1985)). Some researchers believe that remittances are altruistic motivated (migrants workers wish to support their family members left behind) and they are countercyclical with domestic output (migrants send more money when their home countries experience financial crisis or natural disasters, e.g. Chami et al. (2003), Kapur and McHale (2005), Yang and Choi (2007)). Others consider remittances as motivated by self-interest plans (migrants workers could send money back home for the maintenance of existing investments) and pro-cyclical with domestic output.

What are the economic consequences of remittances? It is often argued that remittances are consumed instead of spent on productive activities that could stimulate economic growth in developing countries. Moreover, those who receive and rely on remittances may have fewer incentives to invest in their own income-generating activities. While many of these problems may exist, recent studies show that remittances generally reduce poverty and have positive effects on the redistribution of income. For example, Gustafsson and Makonnen (1993) show that if remittances to Lesotho were completely removed, households classified as poor would increase by an additional 11 to 14 %. In a more recent study, Adams (2006) finds that both internal and international remittances reduce the level, depth, and severity of poverty in Guatemala. Moreover, and contrary to other studies, he finds that most of remittances are not spent on consumption goods. Since households perceived remittance earnings as temporary and uncertain, they preferred to invest them in education, health and housing.

In a presentation of various studies conducted in 12 Latin American and Caribbean countries, Acosta et al. (2007) find that remittances widely reduce both extreme and moderate poverty, with poverty lines of 1 $ and 2 $ per day, respectively, when migration is assumed to have already taken place. Effects of poverty reduction are largest in countries such as Mexico and El Salvador, where migrants come from the lower part of the income distribution. Extreme poverty falls by over 35% in both countries, and moderate

poverty falls by 15% for Mexico and 21% for El Salvador. The reduction in extreme poverty and moderate poverty for the 12 countries is, on average, 14% and 8% respectively. Similar results regarding remittances and poverty reduction in Mexico are also found in Taylor et al. (2005) and McKenzie (2006).

Remittances also affect human capital formation (Acosta et al. 2007). Surveying Filipino households, Yang and Martinez (2006) find that unanticipated increases in remittances stimulate human capital accumulation and entrepreneurship in origin households and contribute to lower levels of child labor, greater levels of schooling for children, more hours worked in self-employment and a higher rate of entry into capital-intensive enterprises. Cox-Edwards and Ureta (2003) and Hanson and Woodruff (2003) also show that migration and remittances reduce the participation of children in the labor force. The impact is greater on girls than on boys. In the adult labor market, Acosta (2007) shows that international migration and remittances reduce female participation in the labor force. This suggests that international migration and remittances induce women to work more inside the home, thereby resulting in greater intra-household specialization.

In addition, remittances can stimulate investments in physical capital, thereby alleviating credit constraints that deter investments in developing countries (see Woodruff and Zenteno (2001) for micro-enterprises in urban Mexico, Dustmann and Kirchkamp (2002) for Turkey, Acosta (2007) for El Salvador).

To summarize, the recent literature now recognizes a greater, positive role of remittances in national economies in developing countries. Indeed, remittances finance consumption as well as land and housing purchases, and they are an important source of social insurance in lower-income countries. They also provide liquidity for small enterprises, which is extremely important in the absence of well functioning credit markets, capital investments and education. Some countries have established policies to stimulate remittances. For example, India and Pakistan provide higher interest rates to attract remittances. Although they are very useful in alleviating immediate poverty, their impact on long-term development still remains unclear. There is no evidence that remittances can induce large economic transformation, the kind that is essential to alleviate structural poverty in the long-term. Some countries, for instance, try to collect money through hometown associations to support infrastructure development such as schools, health centers, but the results are mixed. Ouaked (2002) underlines that "these communities do

not necessarily have the resources to maintain what has been built through the contributions of the expatriates. These communal remittances have not yet been used significantly for direct income generation projects, although some governments are pledging to match funds earmarked for job creation activities. (pg. 159) "

4.2 Diasporas and flows of goods and capital

In the last few years, a large sociological and, more recently, economic literature has acknowledged and studied migrant networks. In particular, these networks are expected to facilitate the movement of goods and capital between migrants' host and home countries. Both the growth in size of the diasporas, especially the Chinese, Indian and Philippine diasporas in the US, Canada, the UK and Australia, as well as their growing involvement in the economies of their home countries have implications for the analysis of the globalization process and the analysis of the impact of diasporas on economic development in sending countries. The literature on international trade provides remarkable insight on the role of diasporas. More recently, the importance of the diaspora in facilitating investment and technology transfer in the origin country has been highlighted. In the subsequent paragraphs, we analyze this research. The importance of business and social networks in facilitating trade has been the focus of many recent studies, from both the theoretical (Greif, 1993; Rauch and Casella, 2003) and empirical perspectives (Gould, 1994; Rauch and Trindade, 2002; Head and Ries, 1998). Among the most important studies, Rauch and Trindade (2002) estimate a global bilateral trade model for 63 countries in 1980 and 1990, investigating whether the presence of large numbers of ethnic Chinese residents in the partner country is associated with more trade. They computed the product of ethnic Chinese population shares for each trading partner and add this variable in a gravity equation. Using this extended gravity model, they find that country pairs with higher concentrations of ethnic Chinese residents trade more with each other. In his seminal paper on US trade with 47 trading partners during 1970 - 1986, Gould (1994) also finds that the stock of immigrants increases U.S. trade. Both studies finally find that immigrant networks induce less effect on trade in more homogeneous products, for which prices can effectively convey the relevant information, than on trade in more differentiated products, for which matching the multifactor characteristics of buyers and sellers is more important. Overall, these studies provide evidence that networks are

important in overcoming informal trade barriers.

Along these same lines, Head and Ries (1998) estimate an extended gravity model of Canadian import and export patterns using panel data from 1980 to 1992 on bilateral trade with 136 trading partners. They find that a 10 % increase in the number of immigrants increases exports by 1 % and imports by 3 %. Then they examine the immigration effect on trade according to the different types and regions of the last permanent residence of immigrants. The relationship between trade and "skill-based migration" (independents) proves to be significantly greater than for family-based, refugee or business immigrants.

In addition to the above-mentioned studies, many other studies from the 1990s and 2000s explore the impact of immigration on trade (see Wagner et al., 2002, for a more detailed survey of the literature). In general we note that many studies have been implemented in the context of the United States and Canada (see Gould, 1994; Dunlevy and Hutchinson, 1999, 2001 for the United States and Head and Ries, 1998 and Wagner et al., 2002 for Canada). Additionally, there are studies on the UK (Girma and Yu, 2002), French departments (Combes et al. 2003) and on the European Union (Parsons, 2005). Some of these studies refer to intra-national trade and migration (Combes et al. across French Departments and Wagner et al. across Canadian Provinces); others refer to cross-national borders. Each work focuses on different aspects; they may try to explain, for example, only differentiated products (Gould 1994; Dunlevy and Hutchinson 1999, 2001) as opposed to all products. They may discuss immigration heterogeneity (Head and Ries, 1998) or business networks (Rauch and Trindade, 2002). All the studies find a significant relationship between trade flows and immigration, although the magnitude of the migration effect varies in across samples, groups of immigrants and products. The exports and imports elasticities range from 0.01 to 0.47. In some cases the exports elasticities are estimated to be higher that the imports elasticities (Gould 1994, Combes et al. 2003), while in others, the results are opposite (Heas and Ries 1998, Dunlevy and Hutchinson 1999, 2001). To the extent that skilled migrants participate in business networks that help reduce transaction costs between the host and home countries, skilled migration will encourage future FDI flows, which will foster activity and welfare in the sending country.

Why would diasporas be important in promoting international trade and investments? Rauch (2003) stresses two major channels through which diasporas could promote international trade and investments. First, a diaspora

creates (or substitutes for) trust in a weak international legal environment. Co-ethnic networks provide community enforcement of sanctions to deter opportunism and violations of contracts. If a party acts opportunistically, then its reputation suffers within that network. Second, the diaspora may provide market information as well as supplies matching and referral services. Co-ethnic networks can promote trade, because they are familiar with the market needs in their country of origin. They can provide to foreign investors important information that may otherwise be difficult or costly to obtain. In addition, they reduce communication barriers; migrants know the language, the culture, the values, the law and the practices of their home country. They know their compatriots' ways of thinking, and they better understand who is trustworthy with regard to potential business partners. Note that the phenomena described here seem to apply mainly to skilled migrants, as is confirmed by case studies of various sectors, including the software industry (Saxenian, 1999, 2001, 2002, Arora and Gambardella, 2004).

A few empirical studies studies have attempted to measure the magnitude of the diaspora externality in inducing investments, even if FDI can face even larger transaction costs than international trade.

In his study on the role of ethnic Chinese networks in attracting FDI, Gao (2003) considers both the population share of ethnic Chinese and the log of the absolute population of ethnic Chinese in the source country. Using a gravity model framework, Tong (2005) studies the role of ethnic Chinese in promoting bilateral investments by using the product of the numbers of ethnic Chinese in pairs of countries in 1990. In another study on Germany, Buch, Kleiner and Toubal (2006) use state-level German data to investigate whether and how migration and FDI are linked. They consider stocks of immigrants living in Germany and German-inward FDI. They find that there is more inward FDI in German states that host a large foreign population from the same country of origin. This agglomeration effect is confined to higher-income source countries. In fact, they find that the impact of same-country immigrants on FDI is positive, but not significant; in contrast, the interaction term between same-country immigrants and the source country 's GDP per capita is generally significant and positive. Since high-skilled migration is most predominant in high-income countries, they interpret this result to suggest an agglomeration effect that is driven by complementarity between inward FDI and high-skilled immigrants. However, they have not been able to test this hypothesis directly, as they lack data on the skill structure of immigrants.

Only recently, Kugler and Rapoport (2007) have combined the US Census data on immigration stocks by country of origin and education level for 1990 and 2000 with data from the US Bureau of Economic Analysis on FDI outflows by destination country and sector. They model the relationships of substitutability or complementarity between migration (by skill level) and the sectoral composition of FDI. They find that skilled migration and FDI inflows are negatively correlated contemporaneously, but past skilled migration is associated with an increase in current FDI inflows. Moreover, they find evidence of substitutability between current migration and FDI for migrants with secondary education and of complementarity between past migration and FDI for unskilled migrants.

Javorcik et al. (2006) also examined the relationship between the presence of migrants in the United States and US FDI in the migrants' countries of origin by explicitly taking into account the endogeneity problem that has been ignored in previous studies. They find that US foreign investments in a sending country are positively correlated with the presence of that country's migrants within the US country. The data further indicate that the relationship between FDI and migration is driven by the presence of migrants with a college education.

Finally, Docquier and Lodigiani (2009) rely on original data at an aggregate level and find evidence of network externalities by using a dynamic empirical model of FDI-funded capital accumulation. Their analysis confirms that business networks are mostly driven by skilled migration. In a cross-sectional model focusing on 114 countries during 1990 - 2000, the elasticity of the FDI-funded capital growth rate to skilled migration is around 2%. They provide a panel extension with 83 countries and four periods, which confirms the existence of business network externalities. The elasticity of the capital growth rate to the stock of skilled emigrants is between 2 and 3%. Hence, skilled migration may favor trade and FDI between the home and host countries. Two main channels can be identified. First, the diaspora creates or (substitutes for) trust in a weak international legal environment. Second, the diaspora may provide market information, supplies matching and referral services. Assuming that the first channel is more important for investments destined to countries with weak institutions, Tong (2005) has tried to identify which is the most important mechanism in promoting FDI. She divided the bilateral FDI into two groups based on the level of bureaucratic quality in host countries. She finds that even if the community enforcement of sanctions is important for FDI into countries with weak institutions, the most

important role of ethnic Chinese networks is providing crucial information to investors. This fact is particularly interesting if we think about the possible relationship between network effects, FDI and growth.

According to Rauch (2003), the "information" channel seems to be very important, since its impact is less likely to decrease over time. Moreover, if the diaspora promotes trade and investments in such a way, migrants are more likely to promote the types of international trade and FDI that stimulate economic growth. Of course, the connection between trade, FDI and growth does not simply result from increments in foreign exchange, but rather it is significantly related to knowledge generation, imitation and diffusion processes.

Table 5: Studies on trade and migration: Elasticity comparison

Authors	Sample and period	Focus of the study	Export Elastic.*	Import Elastic.*
Gould (1994)	U.S. & 47 partners, 1970-86	Differentiated products	0.02	0.01
Head & Ries (1998)	Canada & 136 partners, 1980-92	Canadian immigration policy – i.e. immigrant heterogeneity	0.10	0.31
Dunlevy & Hutchinson (1999, 2001)	U.S. & 17 partners, 1870-1910	Differentiated products	0.08	0.29
Girma & Yu (2002)	UK & 48 partners, 1981-93	Individual vs. nonindividual effects	0.16	0.10
Combes & al. (2002)	95 French Departments, 1993	Intra- i.e. separate departments	0.25	0.14
Rauch & Trindade (2002)***	63 countries, 1980, 1990	Business networks, differentiated and homogenous products	0.47	0.47
Wagner, Head & Ries (2002)**	5 Canadian provinces, & 160 partners, 1992-95	Common Language and random encounter specification	0.16	0.41
Parsons (2005)	EU-15 & 15 EU-expansion countries,1994-2001	First time gravity model applied to EU	0.12	0.14

Notes: *Trade elasticities with respect to immigration. **Estimation without fixed effects. *** Estimation with differentiated products.

Source: Parsons (2005)

Table 6: Studies on FDI and migration

Authors	Sample and period	Focus of the study	Inward FDI Est. Coeff.
Gao (2003)	China & 68 FDI source countries, 1984-1997 log cumulative inward FDI, 1990 ethnic Chinese pop. share	Cross sectional gravity equation	3.7 or higher
Tong (2005)	70 countries, 1990	cross-sectional gravity equation total FDI stock from country i to country j, product of the numbers of ethnic Chinese in country i and j	0.38
Buch & al. (2006)	Germany & 80 partners, 1991-2002	Immigrants in Germany & inward FDI Tobit fixed effects panel regressions	$0.78e^{-02}$ (Same-country mig.*GDPpc)
Kugler & Rapoport (2007)	US FDI, & 55 migrants' origin countries, years 1990-2000	both stocks and flows of migrants at different educational level	0.2 (unskill.) 0.4 (skill.) (stocks)
Docquier & Lodigiani (2009)	114 countries, 1990-200 83 countries, 1980-2000	Aggregate studies, cross- sectional panel elasticities, migrants by educational attainment	0.02-0.03
Javorcik & al. (2006)	US FDI, & 56 migrants' origin countries, years 1990-2000	(stock of) migrants by educational attainment	0.3 (tot.) 0.4 (skill.)

4.3 Diasporas and flows of ideas

The importance of the skilled migrant diaspora in creating technology and knowledge transfer is related not only to the presence of trade and FDI. Indeed, a recent body of literature has suggested that more or less informal networks can be important in conveying knowledge and technology from the developed to the less developed world (Meyer and Brown 1999, Meyer 2001).

To better explain expatriate knowledge networks, Meyer and Brown (1999) identify various types of possible networks: student/scholarly networks; local associations of skilled expatriates; expert pool assistance through the United Nations Development Programme (UNDP)'s Transfer of Knowledge Through Expatriate Nationals (TOKTEN) program; and intellectual/scientific diaspora networks. Among the latter, a distinction is made between those networks that do not yet have stable or precise features and those that are more established and organized. Overall, five possible network categories are identified.

The first category encourages the sharing of information among scholars. Student/scholarly networks often facilitate studies abroad and/or reintegration into the highly-qualified labor market afterward. This kind of network may be very important in facilitating knowledge transfer among countries. As Lowell and Gerova (2004) argue, there is a strong positive correlation between the number of foreign scholars with a US PhD and the extent to which scientific articles authored in sending countries include a US author. That means that if scholarly networks helps link highly-skilled migrants to their home country, diaspora networks can stimulate collaboration and the exchange of knowledge.

The second type of networks, local associations of skilled expatriates, are groups of highly-skilled professionals who meet regularly both professionally and socially. Among these associations, for example, the SIPA (Silicon Valley Indian Professionals Association) has played an important role in the development of cooperation and exchange among highly-skilled expatriate Indians as well as between the US and India in high-technology areas.

The third type, the TOKTEN programme of the UNDP, aims at encouraging the expertise of highly-skilled expatriates to undertake short-term consultancies in their countries of origin for short periods of time. TOKTEN has proven to be a practical and effective scheme for transferring advanced knowledge and skills in cost-effective ways in countries such as Lebanon, Palestine, and Pakistan. Host institutions benefit from the expertise brought by TOK-

TEN volunteers at low or no cost to the origin countries, often resulting in speedy implementation. Meanwhile, consultants derive satisfaction from knowing they have played a part in the development of their countries. Finally and more generally, there are intellectual/scientific diaspora networks, both developed with precise features and developing classified as such, because they share certain characteristics with intellectual/scientific diaspora networks, but not yet well established and organized.

To understand the possible impact of knowledge networks, Lowell and Gerova (2004) update Meyer and Brown's (1999) list and find 20 organizations in addition to the 41 web-based diaspora networks described by Meyer and Brown. Lowell and Gerova (2004) argue that making a clear distinction among these categories is quite difficult; nevertheless, "whatever their scope and profile, the sheer number and diversity of diaspora groups seemingly attests to their increasing importance as nodes of activity connected to their homeland." (pag. 24)

If the literature provides much anecdotal evidence on knowledge diffusion and brain circulation, very few studies directly address this question either theoretically or empirically.

In fact, only very recently, Kerr (2005) uses data on international patent circulation and finds that a large ethnic research community in the US promotes technology diffusion to less advanced countries of the same ethnicity. Along the same lines, Agrawal, Kapur, and McHale (2008) use patent citation data for Indian inventors to show that both spatial and social proximity increase the probability of knowledge flows between individuals, even if the co-location effect is larger on average than the diaspora effect. Kuhn and McAusland (2006), alternatively, develop a theoretical model for beneficial brain drain based on a positive externality due to the relatively greater level of knowledge creation of skilled workers who move to an environment in which higher-quality knowledge goods are produced. Migrants, in fact, may produce products of greater value to their origin-country consumers than the products they would have produced at home. The beneficial brain drain is even more likely to be observed in the context of weak sending country intellectual property rights.

Finally, Lodigiani (2008) shows that the skilled diaspora stimulates productivity growth through technology diffusion and adoption if the sending country is far from the technological frontier. The basic idea is that the skilled diaspora facilitates adoption of foreign technologies in the home country, thereby contributing to its economic growth. Given that adoption is more

productive in countries that are far from the technological frontier, a brain drain has more positive effect on these lagging economies.

4.4 Other Diaspora Effects

The hypothesis that migration may generate positive externalities on the sending country is not only true for technology adoption but for other areas as well. For example, migrants to relatively democratic societies may have a positive impact on social, economic, and political institutions in their home countries. As such, they might transmit new ideas and behaviors prevailing in the destination countries. In particular, they may affect views on family structure and, consequently, the fertility rate in their origin countries.

As far as these effects are concerned, few studies have examined the impact of skilled migration on governance, corruption, rent-seeking and ethnic discrimination. Using a political economy model of ethnic discrimination, Docquier and Rapoport (2003) assume a rent-extraction basis for discrimination; they model discrimination as a financial penalty levied on each educated minority member and equally redistributed among the majority. Therefore, two sources of ethnic inequality emerge in the model. Discrimination decreases the return on human capital for the minority group; this, in turn, reduces the number of minority members who invest in education. Focusing on the impact of migration prospects on the optimal tax rate from the majority's perspective, they find that under free international mobility, migration prospects promote investments in education among the minority members and ethnic inequality decreases. Moreover, the equilibrium discrimination rate is such that the minority member with the highest ability is indifferent as to whether emigrate or not. Therefore, no migration flows are observed at equilibrium. On the contrary, under high immigration restrictions, ethnic discrimination increases and migration flows are observed.

Extending the corruption model of Murphy, Shleifer and Vishny (1991), Mariani (2006) finds that brain drain can reduce corruption in the origin country and induce more students to opt for productive fields of study. In his model, individuals have two career possibilities: they can either engage in rent-seeking or in productive activities. If individuals opt for the second option, they may have the possibility of emigrating to a rent-free foreign country. Hence, the probability of migration reduces the relative return of rent-seeking, and decreases the fraction of skilled workers who engage in unproductive careers. Mariani provides some stylized facts that confirm his

findings. Across countries, the skilled migration rate is positively correlated with the fraction of educated people who specialize in productive studies, as measured by the proportion of students in science and engineering. Alternatively, the skilled emigration rate is negatively correlated with the fraction of students who specialize in parasitic activities, as measured by the proportion of students enrolled in law, theology and religion studies. Evidently, the casual relationship between migration and corruption must be tested, but regardless, this paper offers a new channel through which skilled migration can be beneficial for the home country.

Li and McHale (2006) take a further step in the same direction; they investigate the impact of brain drain on the sending country's institutional development. To implement their study, they first consider a general theoretical framework based on Albert Hirschman 's "exit and voice" model (1970), which helps them to clarify the main channels through which skilled migration may impact institutional development. On the one hand, for instance, skilled migrants may serve as a powerful lobbying voice from abroad. On the other hand, migration can have a negative impact on institutional development if migrants exit and remain silent abroad, in this way their exit can simply mean the absence of the positive impact of domestic human capital on institutions. Estimating the model in a cross-section environment and controlling for domestic human capital, GDP per capita and some other political and cultural factors, they find that: 1) domestic human capital has a positive effect on home country's political and economic institutions; 2) skilled migration has a positive impact on home country's political institutions but a negative impact on economic institutions; and 3) the net institutional effect of moving a portion of skilled people abroad has no significant impact on home country's political institutions, but it does have an overall negative effect on economics institutions.
Alternatively, Spilimbergo (2009) uses a panel dataset on foreign students starting from 1950 to show that foreign-educated individuals promote democracy in their home country, if the foreign education is acquired in democratic countries. This issue is worth of much further investigation.

Migrants may not only have a positive impact on economic and political institutions in their home countries, but they may influence other areas as well by transmitting new values and ideas. In this regard, Fargues (2007) investigates the relationship between migration and the birth rate in the origin country. According to him, migrants are likely to assimilate ideas and behaviors prevailing in the destination countries and transmit them to their

countries of origin. Therefore if people emigrate to a low birth-rate country, they may contribute to the reduction of birth rates in their source countries by affecting views on family structure in their origin countries. On the other hand, the hypothesis suggests that migration to high birth-rate countries induces an increase in the birth rate. Fargues presents empirical evidence in favor of his hypotheses for three source countries: Morocco, Turkey (from which most people migrate to Western Europe) and Egypt (from which most people migrate to the oil-rich Persian Gulf countries). In support of his idea, he finds a strong negative relationship between migration and birth rates among residents for Morocco and Turkey and of a positive relationship for Egypt. More recently, Beine, Docquier and Schiff (2009) use a conceptual framework similar to Spilimbergo (2009), examine the relationship between international migration and source country fertility. Using original and detailed data on migration, they provide evidence that South-North migration can lead to a reduction in fertility rates in the South, thus contributing to a reduction in home country population pressure.

5 The Need for a New Research Agenda

In this paper, we have presented an overview of the main issues concerning the so-called brain drain phenomenon. In the past, the brain drain was seen as one of the biggest problems for developing countries. In recent years, scholars have highlighted how it can induce some incentives and thus certain positive feedback effects for the source country. In particular, the diaspora seems to play an increasingly important role in the globalized world.

Diasporas may act as "bridges" between the destination and the source countries, and they can stimulate trade, investments and the transfer of technology. The hypothesis that migration may generate positive externalities on the source country may be true not only with regard to trade, investments and technology diffusion but also for other areas as well. In particular, migrants to more democratic societies may have a positive impact on the social, economic, and political institutions in their home countries. Moreover, they might transmit new ideas and behaviors prevailing in the destination countries, and as such, they may influence, for example, views on family structure in their origin countries and, consequently, the fertility rate in those countries. Although much work has investigated whether expatriate networks can induce trade, other issues remain almost entirely unexplored. Neverthe-

less, the literature does show that the diaspora may be important for the development of migrants' origin countries.

As far as technological transfer is concerned, India and China are examples of successful diasporas. On one hand, the very important role of the Indian Diaspora in the Indian IT sector has been widely discussed (Saxenien 1999). The sizable growth of the software sector, in fact, was possible thanks both to policies governing higher education in India and to the Indian executives living in the US who instilled in US-based companies the confidence to outsource in India. The Indian diaspora was also important helping Indian firms to meet US quality and delivery requirements. On the other hand, the large size and the high-skill composition of the Chinese diaspora abroad has played a critical role in the knowledge exchange process thanks to the activities of the formal and informal overseas Chinese professional (OCP) associations and to the proactive role of the Chinese government in exploiting the benefits of the Chinese diaspora.

Based on this literature overview, we wonder, what are the general conditions for a successful diaspora. Answering this question is a quite difficult task, because every case has its own features. However, it seems that there are some "potential" factors that are preconditions of a successful diaspora. First of all, the home country size seems to be an important factor. Large countries have larger diasporas and, therefore, larger networks. Intuitively, the benefit of networks increases with network size, and therefore, large countries are more likely to benefit from their diaspora. But network size is just one factor. Other conditions that contribute to the success of the diaspora include the concentration of the diaspora in the destination country [13], its educational level, skill set and income, political selection biases at origin [14], the activities in which the diaspora is engaged [15], and the developing gap between the host and destination countries. This gap may emerge in the technology sector, but it can also be seen with respect to ideas or values such as democracy, equal opportunity for men and women, and other modern democratic ideas.

[13]The more the diaspora is concentrated, the more likely is the formation of a "critical mass" of migrants

[14]The best and the brightest are more likely to emigrate and attain tertiary education abroad

[15]Distinctions may include skilled versus non-skilled labor; tradable sector versus non-tradable; new industries versus mature industries can be important factors for technology transfer for example (Kapur 2001)

Broadly speaking, home countries have much to gain from their diasporas, but analyzing skilled migration as beneficial is a difficult and complex task. In some cases, flows are verifiably beneficial. India and China are examples of beneficial diasporas; however, note that not only do these countries provide the greatest number of skilled migration, but they furthermore are so big that the depletion of human capital in the origin country is very low. Moreover, we must also consider that the positive impact is related to specific sectors of the economy in which migrants engage. Countries need human capital to innovate and imitate, implement programs and create new institutions. Very poor countries with a very high emigration rate cannot benefit from skilled migration. For example, the medical brain drain has been detrimental for Sub-Saharan Africa. Therefore, a certain level of development is a prerequisite for a country to reap the beneficial effects of migration. Diasporas in fact can facilitate development but cannot by themselves fundamentally change the prospects of a country. Nevertheless, under certain conditions, we believe that scientific and business networks are very important for economic and institutional long-term development, much more so than remittances regardless of how greatly they contribute to poverty alleviation and inequality reduction.

However, it is very difficult to parse out the dominant and minor mechanisms at work and to assess the global impact of the brain drain on developing countries. Thanks to new, integrated datasets on migration stocks and migration rates by educational attainment, many elasticities have been estimated in the recent literature in order to better analyze several direct and feedback effects caused by skilled migration. However, much work remains in order to understand the importance of these mechanisms.

In a very recent study, Docquier et al. (2008) combine the major results within the empirical and theoretical literature in a unified, general equilibrium model of the world economy in order to make the first global evaluation of the brain drain's impact on economic activity, income, and inequality in source and destination regions. They also disentangle the relative impact of each specific mechanism, and they conduct robustness checks on key assumptions. In general, they find that the empirically observed diaspora externality on FDI inflows may contribute greatly to domestic production in the developing countries. Hence, when this effect is ignored, the negative impacts of a brain drain may be overestimated. However, the positive effect is dominated by a loss of labor force in regions in which skilled emigration rates are high and/or population aging is acute. Similarly, the incentive effect on

human capital formation helps alleviate the negative impact of a loss in the skilled labor force on GDP per capita, as it prevents huge drops in the level of human capital. In addition, remittances are important in subsidizing the income of those left behind.

Given the complexity of a phenomenon such as migration in general and skilled migration in particular, a multi-level methodological approach is needed in order to fully account for its complexity. In particular, to understand the different contextual dynamics that characterize the impact of skilled migration on origin country development, a match between detailed and aggregate countries level analysis is needed. Aggregate studies that allow for cross-country comparisons, in fact, are very important in providing an overall picture, but they give limited insight into the causes and consequences of migration in individual countries. Thus, more micro studies are needed to fill this gap and go beyond the current findings in the literature. Furthermore, qualitative and quantitative approaches should complement each other; descriptive case studies are necessary to clarify the many theoretical mechanisms that are difficult to clarify many theoretical mechanisms that are difficult to be introduced in a more analytical and detailed contest.

In order to draw more general conclusions about skilled migration, broad and heterogeneous research methods are needed. Only this way will it be possible to evaluate the impact of skilled migration in different domestic contexts; as such, policies can be better crafted to minimize the negative impacts of a brain drain and maximize its positive effects.

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