

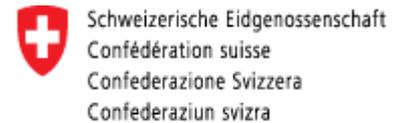
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Brain Drain, Gain, and Circulation

Zovanga L. Kone

Çağlar Özden

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Brain Drain, Gain, and Circulation*

Zovanga L. Kone, Çağlar Özden[†]

Abstract

Although total global migration as a share of world population has been relatively stable, the world is witnessing a rapid increase in the number of high-skilled migrants. After identifying interesting patterns revealed by the existing data, the paper focuses on economic impact on the sending, mostly developing, countries. The initial focus of the literature was brain drain and the potential losses of tax revenue and productivity spillovers in origin countries. More recent contributions, however, identified several channels through which high-skilled emigration might bring benefits to sending countries. Among these are brain gain (endogenous increase in human capital investment) and brain circulation and network effects (knowledge diffusion and global economic integration).

Keywords: High skilled migration, brain drain, brain gain, brain waste

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[†] Zovanga L. Kone is Researcher at the Centre on Migration, Policy and Society (COMPAS), University of Oxford and Çağlar Özden is Lead Economist, Development Research Group, World Bank. The authors may be contacted at zovanga@googlemail.com.

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1. Introduction

The total stock of immigrants¹ in the world stood at 232 million in 2013 according to United Nations estimates (United Nations 2013), representing an increase of about 30 percent from 2000. Recent World Bank estimates put that number at 250 million for 2015 (World Bank 2016). As a share of world population, however, the number of migrants only grew from 2.9 percent to 3.3 percent, as a result of rapid population growth in the world. The relative stability of global migration levels stands in sharp contrast to other indices of global economic integration. For example, world trade-to-GDP and global foreign direct investment-to-GDP ratios increased more than 300 percent over the same period. However, these low levels of population movement mask several important changes and patterns, especially for high-skilled migration flows.

The first observation is that high-skilled migration became significantly more concentrated to particular destinations. Organisation for Economic Co-operation and Development (OECD) destinations, in particular, several specific corridors leading to a handful of OECD destinations, such as the Mexico–United States corridor, now dominate the overall numbers. Conversely, the level of dispersion among origin countries has increased. In other words, global migration has become more skewed as migrants come from more countries but go to fewer destinations (for example, Czaika and de Haas 2014). Second, the number of high-skilled migrants, generally defined as people with tertiary education, increased at a much faster rate—about 75 percent between 2000 and 2010, compared with global migration or the share of the tertiary educated in the underlying population. And more than two-thirds of the tertiary educated migrants in the world chose just four English-speaking OECD countries—Australia, Canada, the United Kingdom, and the United States—as their destinations. Third, several patterns are emerging among the highly skilled migrants, such as return migration and transit migration. Modern-day, highly skilled and educated professionals do not exactly match the stereotypical migrant who leaves home right after university graduation and permanently moves to a wealthier country. Rather, their lives seem to be taking them to multiple destinations during their educational and professional careers. In short, global markets for talent seem to be integrated in more complicated ways than has been assumed.

The goal of this paper is to review the current data on global migration patterns, especially those patterns that relate to highly skilled migrants, and review the relevant academic literature on the determinants and impact of such patterns. High-skilled migration has been referred to as *brain drain* in the earlier literature, especially in papers from the 1970s. As the academic literature further explored the role of human capital in economic development, migration of highly educated people from poorer developing to wealthier developed countries came to be viewed from a rather negative perspective. Mainly associated with Bhagwati and his co-authors (for example, Bhagwati and Hamada 1974), this mostly theoretical literature focused chiefly on the welfare and public finance implications of brain drain, especially for the poor origin countries that financed the education of the highly skilled and were already suffering from low levels of human capital.

As brain drain moved from the academic to the public vocabulary and dominated the policy debate, a new academic literature began to emphasize the beneficial effects of high-skilled migration, which will

¹ The general definition of an immigrant is a person living in a country other than the one in which he or she was born. Some countries, however, use other classifications, such as country of nationality. These definitions and the corresponding numbers might show significant differences depending on the citizenship and naturalization laws of the destination countries.

be referred to here as *brain gain*. This relatively balanced view emphasizes several channels through which an origin country might benefit from the emigration of its high-skilled workers. The first channel highlights the growing incentives faced by people in origin countries to acquire human capital because of the higher probability of immigration to high-income countries (Stark, Helmenstein, and Prskawetz 1998; Mountford 1997). The second group of channels identifies how migrants help their origin countries integrate into the global economy through increased trade, foreign direct investment (FDI), and technology flows. Finally, the third channel focuses not only on the emigration of the high-skilled but their return migration back home or migration to a third country, which is referred to as *brain circulation*. In this case, migrants move with the additional human and financial capital that they acquire along the way, contributing to further economic development and growth in their new destination or back in their home countries.

The paper is organized as follows: The next section reviews the data sources and overall patterns of high-skilled migration observed today. Next, the paper discusses the main premises of the brain drain literature and whether the observed patterns fit the predictions. Then the brain gain literature and its main strands and results are introduced. The paper continues with the brain circulation literature and presents the main contributions. The paper ends with a discussion of the conclusions.

2. High-Skilled Migration Data

Before the migration data are presented, several important caveats and data challenges must be addressed. The migration statistics cited in this paper are approximate because there are no definitive data sets. Existing migration data come from destination countries because it is easier to capture people where they currently reside rather than where they came from. The main source of migration data, especially those cited in this paper, are national censuses, which are generally conducted every 10 years. Other commonly used data sources are (1) labor force or other specialized national surveys, (2) population registers, and (3) various administrative data sources such as border statistics, employment and residency permits, and naturalization records.

Numerous studies tackle how to collect and analyze global migration statistics (Özden et al. 2011; Carletto, Larrison, and Özden 2015) given the data challenges posed by various sources. Among the main data challenges are the following: First, there is no consistent definition of a migrant. Even though the United Nations defines a migrant as someone who changes his or her usual place of residence, some countries use the country of citizenship as the main identification criterion instead of the more appropriate country-of-birth criteria. This distinction can cause significant biases when comparing countries with rather different citizenship and naturalization laws (Carletto, Larrison, and Özden 2015). Second, census dates vary significantly; many countries do not include migration questions and some do not even regularly conduct censuses. This problem is especially common among low-income countries that are afflicted by fiscal problems, civil conflict, or natural disasters. Third, even if they exist, data are not released in a regular and timely manner. Fourth, in the released data sets, origin countries might be aggregated into groups, such as Latin America, which makes identification of individual corridors difficult. Finally, many variables relevant for high-skilled migration, such as education level, occupation, and sector of employment, might not be available or released.

Despite these challenges, great progress has been made over the past decade in collecting, compiling, and analyzing bilateral migration data. The global migrant stock stands at about 232 million people according to the United Nations estimates for 2013, about 3.3 percent of the world population (United

Nations 2013). OECD destinations account for approximately half of this stock, but their shares have been increasing over time. About two-thirds of the world’s migrants are between the ages of 15 and 64, the working-age population, which is the relevant group for the purposes of this paper. And, about 25–30 percent of this group are tertiary educated, the preferred criteria designating the highly skilled². Finally, more than 75 percent of the tertiary educated migrants in the world live in OECD destinations (Artuc et al. 2015). In short, the vast majority of high-skilled migrants reside in OECD countries where the data are more reliable, complete, and comparable. This is why almost all of the data presented in this paper come from OECD destinations.

Table 1 Top 10 Migration Corridors by Stock of Migrants (ages 15 and over), 2010

<i>Destination</i>	<i>Origin</i>	<i>Stock of immigrants</i>	<i>Share of the tertiary educated (percent)</i>
United States	Mexico	10,962,470	7.0
United States	China	1,994,830	52.6
United States	Philippines	1,705,975	55.0
United States	India	1,670,775	75.0
Germany	Turkey	1,432,000	4.8
Thailand	Myanmar	1,382,647	0.7
France	Algeria	1,320,824	18.7
Germany	Poland	1,234,000	20.4
United States	Vietnam	1,162,215	29.6
United States	El Salvador	1,135,600	9.0

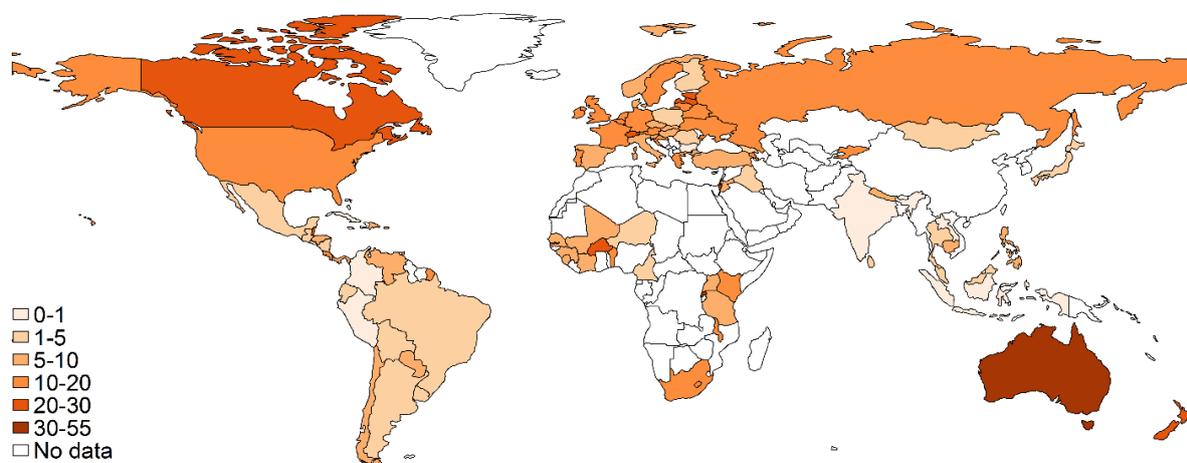
Note: Available data exclude Russia and the Persian Gulf countries, which are likely to be the destinations for some of the major corridors.

The first important observation is that tertiary educated migrants are not only concentrated in OECD countries, they also compose a significant portion of the labor force in these countries. Map 1 provides the share of immigrants among the tertiary educated working populations across the world in 2000, the latest year with relatively complete data on high-skilled migration. For example, migrants constitute more than 30 percent of the tertiary educated labor force in Australia and 25 percent in Canada. High ratios are also observed in countries like the United Kingdom, the United States, and several other OECD countries. Concentration of high-skilled migrants is further depicted in table 1. The top 10 corridors of migration accounted for more than 24 million migrants in 2010 and the majority of these corridors are very “skill-intensive,” especially those from Asian countries to the

² The literature includes studies in which “at least one year of tertiary education” is used as the criterion to distinguish high skilled. Several databases, such as the OECD’s Database on Immigrants in OECD Countries 2010, include both definitions of tertiary educated—those with university education and those with at least one year of tertiary education. While the overall patterns are similar, this distinction may lead to differences in some destination countries, like the United States. Researchers should pay close attention to these issues in their analyses.

United States. Note that this list excludes Russia and Persian Gulf countries as destinations because data were not available.

Map 1 Immigrants in the Tertiary Educated Labor Force in Destination Countries, 2000 (percent)



Source: Barro and Lee 2013.

The second important observation is the growth of migration to OECD countries, especially for high-skilled workers³. As table 2 illustrates, there were about 75 million migrants older than age 15 in OECD countries in 2000, when the comparable native population stood at 661 million people. Some 23.6 percent of the migrants and 18.2 percent of the natives are tertiary educated, indicating slightly higher human capital levels among the migrants. The 2010 data show the gap widening. The total native population grew by 8 percent while the migrant stock grew by more than 34 percent to 100 million people. Furthermore, there were almost 30 million tertiary educated migrants in 2010, implying growth of more than 70 percent. In contrast, the stock of primary educated migrants grew by only 10 percent and the stock of tertiary educated natives grew by 35 percent. While the sharp increase in the stock of migrants with tertiary education partly reflects the turning of OECD countries toward more selective migration policies, which favor high-skilled migration, these migrants themselves may find OECD destinations attractive because they provide better earning opportunities, professional advancement, assimilation, and cultural acceptance (Docquier and Rapoport 2012).

³ We should note Iceland, Korea, Israel and Slovenia are excluded from these numbers: The data were not fully available for the former two countries and the latter two joined the OECD after 2000. Furthermore, Japan is excluded because certain data are unavailable.

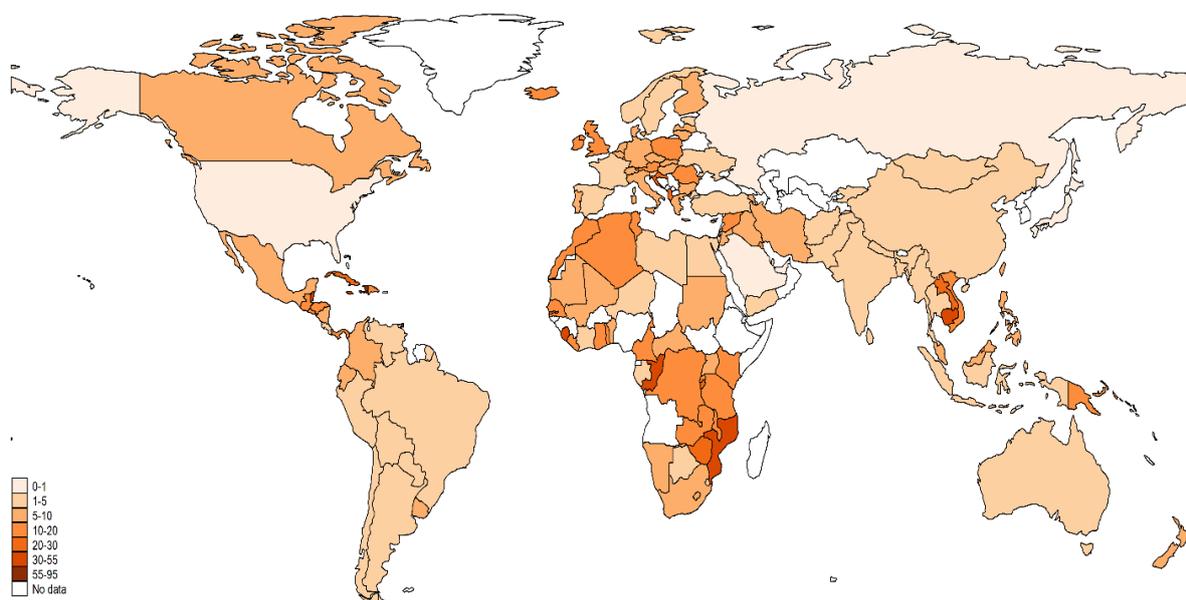
Table 2 Stock of Population Older than Age 15 in Organisation for Economic Co-operation and Development Countries

	2000		2010	
	Natives	Foreign born	Natives	Foreign born
Total stock	661,254,081	74,582,390	714,106,013	100,263,843
Primary educated (%)	40.9	41.0	35.9	33.6
Secondary educated (%)	38.2	32.8	40.4	34.8
Tertiary educated (%)	18.2	23.6	22.8	29.6
Education unknown (%)	2.7	2.6	0.9	2.0

Note: Excludes Japan, Iceland, the Republic of Korea, Israel, and Slovenia.

The third and final observation is on the origins of high-skilled migrants. Map 2 provides the emigration rate of tertiary educated people across the world for 2000. As opposed to destination countries, emigration is less concentrated and a nonnegligible share of tertiary educated people emigrate abroad from almost every country. As of 2010, nearly one out of every six countries in the world saw more than 20 percent of their high-skilled population emigrate abroad. Furthermore, emigration rates were between 10 and 20 percent for an additional one-fifth of countries. These high-emigration countries tend to be smaller and poorer countries, in Africa, the Pacific, and the Caribbean. Many of these countries are islands.

Map 2 Emigration Rate among the Tertiary Educated, 2000 (percent)

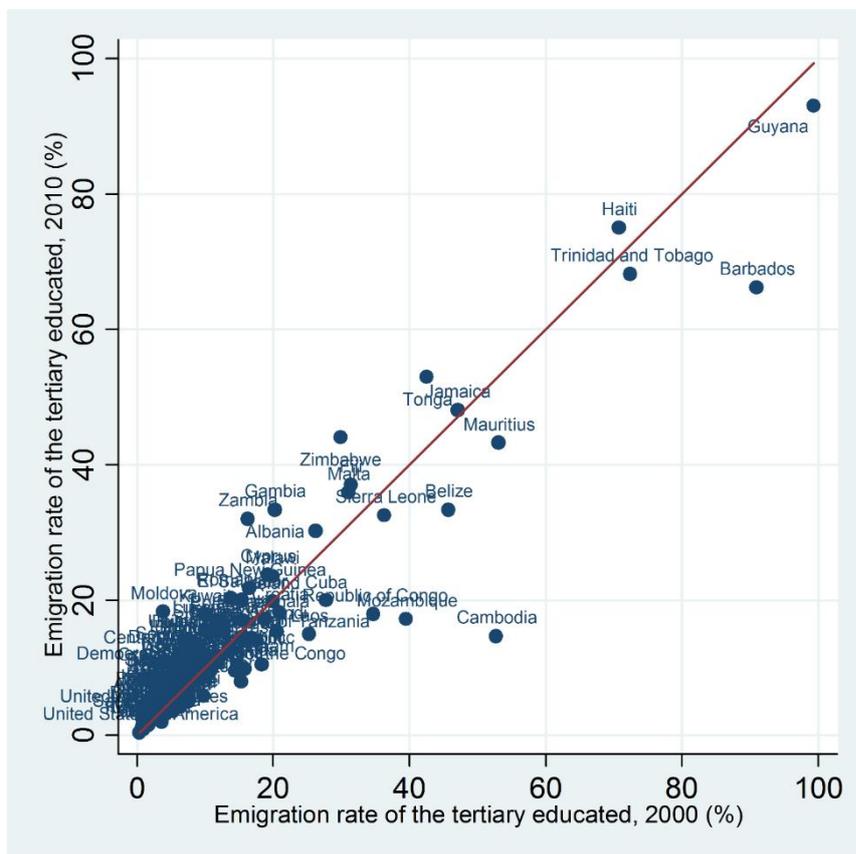


Source: Barro and Lee 2013.

High-skilled emigration has increased over time for many countries. Figure 1 plots emigration rates to OECD countries for 2010 (y-axis) and for 2000 (x-axis) for all countries in the world; the red line is the 45-degree line. The high-skilled emigration rate is about 15 percent for low-income countries and least developed countries, as defined by the World Bank (Artuc et al. 2015). As mentioned, several small

poorer countries, such as Haiti, Guyana, and Jamaica, are most affected by high-skilled emigration. In fact, the average emigration rate is 40 percent for tertiary educated people born in these countries, which are small island developing states as defined by the United Nations. The final observation is that almost 70 percent of countries are above the 45-degree line, implying that high-skilled emigration has actually increased over time. Despite rapid growth in education levels and increases in access to tertiary education, a higher share of tertiary educated people are now moving abroad.

Figure 1 Change in Emigration Rate among the Tertiary Educated



Defining a High-Skilled Migrant

The discussion and data presented so far assume that high-skilled and tertiary educated are synonymous. Although an extensive labor economics literature discusses what constitutes “skills” (for example, Acemoglu and Autor 2011), education is equated to skills mostly because of data availability in the migration context. Most studies simply classify a high-skilled migrant as someone with a tertiary level education living in a country other than his or her place of birth because that is how most of the available cross-country data are compiled and disseminated (Docquier and Rapoport 2012).

Bucking these trends, Parsons et al. (2014) argue that there is discord over how statistical offices, policy makers, and academics view and classify high-skilled migrants. They contrast the common definitions used in the academic sphere with those based on occupational attainment levels and income levels—two measures prevalent in host countries and in policy circles. They show that the stock of high-skilled migrants soon becomes very small: taking the United States as an example, they illustrate that of the 12 million migrants with some tertiary education in the country, only slightly more than a million would be considered high-skilled if a combined measure based on educational

attainment, occupational attainment, and income levels were used. (See Parsons et al. [2014], for a detailed discussion on the topic.) In other words, the sets of highly-skilled migrants defined using different criteria—education, occupation, or income—overlap only slightly.

The occupational distribution in major OECD destination countries for immigrants who completed tertiary education is reported in table 3. The second and third columns of the table corroborate the discordance put forth by Parsons et al. (2014). There are significant numbers of tertiary educated immigrants in lower-skilled jobs when compared with natives, closely related to the brain waste point made by Mattoo, Neagu, and Ozden (2008) . The last column shows that very few tertiary educated natives work in occupations that would be considered “unskilled,” such as craft and related trades, plant and machine operators, and elementary occupations. In contrast, almost 15 percent of tertiary educated migrants are in these occupations (column 3). Another useful comparison is in occupations for which a tertiary education is likely be a requirement today, such as managerial, professional, and associate professional occupations. Note that a large portion of non–tertiary educated migrants and natives are employed in these occupations. The similarity in patterns among immigrants and natives further reinforces the idea in Parsons et al. (2014). As such, using alternative measures of high skilled would likely lead to a more nuanced picture than the one portrayed by focusing only on education levels.

Table 3 Occupational Distribution by Education for Those Age 15 and Older, 2010 (percent)

	Immigrants		Natives	
	Nontertiary	Tertiary	Nontertiary	Tertiary
Managers	4.9	11.1	5.6	11.2
Professionals	2.8	36.0	4.0	44.0
Technicians and associate professionals	8.3	16.9	13.9	21.8
Clerical support workers	8.0	8.6	13.2	8.6
Services and sales workers	20.7	11.0	20.3	6.9
Skilled agriculture, forestry and fishery	1.6	0.5	4.0	1.0
Craft and related trades	17.5	4.7	16.2	2.6
Plant and machine operators	10.5	3.4	9.4	1.4
Elementary occupation	24.7	6.9	11.9	1.5
Armed forces and unknown occupations	1.1	1.0	1.6	1.1

Source: OECD DIOC Dataset.

Note: Figures do not add up to 100 percent; the remaining share is those with unknown educational attainment level.

Data not available for Japan, New Zealand, and the United States. Other countries excluded are Chile, the Czech Republic, Estonia, Mexico, the Slovak Republic, and Slovenia.

Place of Birth versus Place of Education

Another potential bias in the high-skilled migration data is caused by an important data constraint on the location of education. Most macro data sets currently available do not contain information on where the migrant was educated. Many children migrate with their parents and subsequently acquire their education in the host country. Many others may have migrated for educational purposes, completing different stages of their education in different countries. They may eventually work in their birth country, last country of education, or even a third unrelated country. Such differences not only create important biases in skilled migration numbers, but will have important implications for policy design. For example, Beine, Docquier, and Rapoport (2010) compare high-skilled emigration estimates based on country of birth with those based on age at migration of age 22 or over, generally the age of graduation from university. They find that high-skilled emigration levels based on the latter measure are between 30 and 50 percent lower than those based on the former criteria in many small African and Caribbean countries.

To illustrate the importance of this distinction, we compute shares of those who entered the United States as children, that is, before age 15, among tertiary educated people within the working-age population (that is, ages 15 to 65) using data from the 2000 and 2010 U.S. censuses. These shares are

reported for emigrants from a group of sending countries in table 4. These ratios range between 7 percent and 38.7 percent depending on the sending country, with similar ratios across years. For example, close to a third of tertiary educated migrants from the United Kingdom and from Jamaica entered the United States as children and most likely completed their tertiary education there. These migrants would normally be considered high-skilled emigrants if we only looked at place-of-birth criteria. This begs the question of whether such individuals should be considered high-skilled British or Jamaican emigrants since they did not obtain their tertiary education in the origin country.

An alternative, based on an approach similar to that of Beine, Docquier, and Rapoport (2010), consists of computing the shares of those who entered the United States by age 22, that is, the standard age of completion of college education, among the tertiary educated people who are between the ages of 25 and 65. As table 5 shows, now close to two-thirds of some high-skilled emigrant groups, mostly those from Caribbean countries or islands, entered the United States by age 22. For geographically more distant and larger Asian countries, the lowest share is 22.7 percent, which is still a considerably high number.

Table 4 Tertiary Educated Immigrants in the United States (ages 15–65)

<i>Birthplace</i>	2000		2010	
	Total stock	Entered United States when younger than age 15 (%)	Total stock	Entered United States when younger than age 15 (%)
India	612,627	7.2	1,147,541	7.0
Philippines	518,565	12.6	717,766	16.1
China	336,609	8.4	552,457	11.2
Mexico	293,560	27.4	525,011	29.6
United Kingdom	225,217	32.3	256,801	33.2
Brazil	54,181	13.4	100,034	15.0
<i>Neighboring countries</i>				
Jamaica	81,731	31.8	128,801	34.0
Dominican Republic	52,105	25.4	97,144	28.3
Haiti	45,523	26.3	75,473	29.1
Guyana/British Guiana	29,156	26.1	52,627	32.4

Table 5 Tertiary Educated Immigrants in the United States (ages 25–65)

<i>Birthplace</i>	2000		2010	
	Total stock	Entered United States when age 22 or younger (%)	Total stock	Entered United States when age 22 or younger (%)
India	566,484	25.8	1,098,625	24.8
Philippines	506,912	26.8	702,063	29.2
China	323,468	22.7	508,855	25.6
Mexico	272,449	49.1	501,114	48.5
United Kingdom	217,582	44.6	249,536	42.4
Brazil	51,474	26.1	95,791	28.9
<i>Neighboring countries</i>				
Jamaica	77,463	60.6	124,447	61.9
Dominican Republic	49,429	43.8	91,562	47.8
Haiti	43,976	55.2	73,338	56.3
Guyana/British Guiana	27,336	51.0	49,974	57.3

High-skilled immigrants to the United States account for a vast proportion of the overall global high-skilled emigrants from several origin countries. The countries in tables 4 and 5 comprise some the largest immigrant-sending countries to the United States. One may assume that other popular destinations, such as Australia, Canada, and the United Kingdom, exhibit similar patterns. These large gaps imply that more detailed data need to be collected on the educational and professional paths of high-skilled migrants.

3. Brain Drain

Existing data indicate the extent of high-skilled migration and its continuing growth over time. High-skilled migrants come from every corner of the world, especially from poorer, smaller, and isolated economies, and move to larger, wealthier, English-speaking OECD countries. In light of this, it is not surprising that the term “brain drain” dominates popular discourse on high-skilled migration (Gibson and McKenzie 2011a).

Ironically, the term brain drain first appeared in the British media a little over half a century ago to depict the loss of skilled labor from Britain, mainly to the United States, as noted by Clemens (2013), and Britain still remains one of the largest source countries of high-skilled emigrants. The earlier literature was mostly theoretical, as exemplified by Grubel and Scott (1966), who provide a theoretical framework with which to examine the implications of high-skilled emigration for economic outcomes in the sending countries. They conclude that, if an emigrant takes with them the value of their marginal product, welfare loss is not of concern in competitive and efficient markets. A similar paper by Berry and Soligo (1969) points out that although the sending countries lose their skilled workforce, they

would be compensated with remittances from the emigrants and knowledge transmission. More important, they argue that a sending country may gain if emigrants leave behind their assets.

The 1970s saw the emergence of a more pessimistic view, still mostly theoretical in nature, arguing that high-skilled emigration depletes poorer developing countries of their most scarce asset—human capital. The term “brain drain” was used to emphasize the importance and the “unfair” nature of the issue. Among the most prominent papers, Bhagwati and Hamada (1974) highlight the importance of social externalities from the highly skilled at a time when the role of human capital was taking a more central role in development economics. An additional concern on the effects of brain drain was motivated by public finance implications. Although the migrant-sending developing country finances the education of emigrants, the returns on these investments are reaped by the migrant-receiving, high-income countries. Furthermore, the sending country is exposed to significant losses in tax revenues from the emigration of people with relatively high earning potential. A third issue was based on the concern that high-skilled emigration would amplify existing inequality between the rich and the poor.

The theoretical conclusions from the earlier literature were later corroborated with empirical evidence showing that emigration puts upward pressure on wages, especially of the groups who are similar to the emigrants. Mishra (2007) finds that, for Mexico, emigration increased wage inequality, with the greatest increase for the higher wage earners (those with 12–15 years of schooling). There is, however, little impact on aggregate welfare. Desai et al. (2009) show that emigration leads to losses in national income as a result of forgone taxes. More specifically, the paper suggests that high-skilled emigration may cost India 2.5 percent of tax revenues annually, corresponding to 1 percent of annual national income. Desai et al. (2009) first produce counterfactual incomes for what high-skilled Indian migrants in the United States would have earned if they had stayed and worked in India. The values are then used to obtain the net fiscal contribution—both direct and indirect—of these migrants to the Indian economy. The authors compare the results with the gain to the economy from remittances and conclude that the exodus had a negative overall impact.

A different but closely related phenomenon that may amplify these losses is the occupational downgrading commonly observed among high-skilled immigrants (see Chiswick et al. 2005). This is partly visible in Table 3, which shows that the propensity of being in occupations at the bottom of the skill ladder is higher among immigrants relative to natives. The allocation of highly educated immigrants to low-skilled occupations and the resulting welfare loss has been termed “brain waste” by Mattoo, Neagu, and Özden (2008). They examine occupational attainment across different groups of immigrants in the United States and find that a considerable number of high-skilled immigrants, especially those from Latin American and Caribbean countries are actually in low-skill occupations. They find that numerous selection effects (based on distance from the destination country and likelihood of using family reunification programs to enter the United States) and quality of education in the home country (controlled by educational expenditure per capita) explain a large portion of this occupational downgrading of presumably high-skilled migrants. In other words, not all diplomas are equal, and the actual skill levels of these migrants are lower than their education and diplomas would suggest. This conclusion is closely related to the argument by Parsons et al. (2014) that education levels might not be a perfect measure of the actual human capital levels of migrants.

An important argument is that the negative effects of brain drain may go beyond income losses. Certain skill groups, such as teachers, doctors, or scientists, generate certain social externalities, and

the earlier literature emphasized the loss of such spillovers with brain drain, even though there was scant empirical analysis of the issue. Bhargava, Docquier, and Yasser Moullan (2011) analyze the emigration of doctors from Africa and argue that a reduction in this high level of migration may generate improvements in a number of health outcomes, but only if accompanied by adequate supporting facilities and other inputs. Conversely, Clemens (2007), using cross-section data on 53 African countries, finds very little evidence that emigration of medical doctors affects health outcomes. The outcomes looked at include child mortality, infant mortality under age one, and vaccination rates and respiratory infections among those younger than age five. Counterintuitively, the paper suggests that emigration of health professional may lead to an increase in enrollment for such professions in the sending countries. They find a correlation of 70 percent between per capita emigration and per capita medical professionals, but this relationship disappears after controlling for GDP levels. Furthermore, the capacity of medical schools in many African countries is quite limited, and the increased demand for medical education is unlikely to be met in the short run. Finally, an analysis by the World Health Organization indicates that the share of emigrant medical professionals accounts for a low proportion of the current shortages experienced in parts of Africa and Asia (WHO 2006). Even if all these migrant professionals in OECD countries were to return, additional policy measures would be needed to close the remaining shortages.

4. Brain Gain

As Harry Johnson (1965, 299) noted, brain drain “is obviously a loaded phrase, involving implicit definitions of economic and social welfare, and implicit assertions about facts. This is because the term ‘drain’ conveys a strong implication of serious loss.” Taking Johnson’s statement to heart, a new literature emerged in the 1990s to challenge the assertions of the brain drain literature of the previous two decades and show how high-skilled migration might generate welfare gains for the sending countries and the people left behind. This is the “brain gain” effect.

The implications of brain gain are almost the opposite of those of brain drain. While the literature on brain drain argues that emigration deprives a country of its human capital, literature on brain gain postulates that the departure of high-skilled migrants may lead to an increase in the human capital level of a sending country. Among the most prominent contributors, Oded Stark and Edward Mountford built series of models explaining the potential mechanisms that would underpin this process. Stark, Helmenstein, and Prskawetz (1997) explain these mechanisms using differences in wages across countries and asymmetry of information between emigrants and employers in the host country. Wage differences induce individuals to accumulate more education with the aim of migrating. Once in the host country, however, all emigrants initially receive the same wage because employers cannot at first decipher the true skill level of the migrant, therefore paying both skilled and unskilled immigrants the same wage until their types are revealed. Lower wages induce return immigration among low-skilled migrants who would not have invested in education in the absence of migration prospects, thereby increasing the average human capital level in the sending country. Mountford (1997) reaches a similar conclusion using a different mechanism. For simplicity, only highly educated people are assumed to be allowed to migrate, but the probability of emigration is less than one. Under a high enough likelihood of migration, individuals will invest and acquire human capital because the expected higher income abroad will compensate for the cost of education. But emigration is realized only for a fraction of these newly educated people and some of them will have to stay home. As a result, the final human capital stock of the country will be higher than it would have been if there were no migration prospects. In other words, increased prospects for migrant doctors in the United States

might induce more people to pay the costs of going to medical school in Africa. If the potential gains are high, the cost of education low, and the probability of migration is within a range, then we might end up with more doctors in equilibrium in origin countries.

In an interesting paper, Clemens and Chand (2008) look at the response of Indo-Fijians to a 1987 coup in Fiji. As a result of the coup, employment prospects of Indo-Fijians drastically declined, especially relative to ethnic Fijians. This situation resulted in increased incentives for Indo-Fijians to acquire education to be able to migrate abroad. More specifically, the authors find significant increases in Form 7 and bachelor's degrees among Indo-Fijians, but there is no comparable impact on ethnic Fijians.

Beine, Docquier, and Rapoport's (2001) arguments are based on similar mechanisms, but their theory includes potential net costs unless the externalities associated with high-skilled emigration are sufficiently large to offset these costs. Their main contribution is to bring the data to the theory. They use emigration rates to OECD countries from 37 developing countries to provide empirical support for this mechanism. An adverse consequence of the mechanism is that prospective emigrants would make educational choices more in line with the destination country's demand rather than local demand, which would then reduce the benefits to the sending countries. Extending their earlier work, Beine, Docquier, and Rapoport (2008) use emigration rates to OECD countries from 127 countries to empirically separate winning and losing sending countries. While sending countries with low levels of skilled labor and low emigration rates stand to gain, those with emigration rates of 20 percent (or higher) , or a share of skilled labor of over 5 percent—or both—are negatively affected. They find a long-run elasticity of about 25 percent between high-skill emigration and the stock of human capital.

Skilled emigration also generates positive externalities through remittances, which are partly used to finance education. Using household data from 11 major migrant destinations, Bollard et al. (2011) find a strong positive correlation between education and levels of remittances; educated migrants remit up to \$300 more annually than their less educated counterparts. Yang (2008) provides empirical evidence on the link between remittances and investment in human capital. The paper exploits an exogenous shock to the exchange rate of the peso against various currencies of migrant-receiving countries in 1997 to show that households that received positive income shocks, via remittances, experienced more investment in human capital of children. Docquier and Machado (2015) posit that we should expect remittances to be a "sustainable source of funding for low-income countries" in this century, suggesting that this positive externality from emigration is likely to continue.

Other benefits from high-skill emigration include the diffusion of knowledge and attracting FDI to the sending countries (see Kerr 2008; Mountford and Rapoport 2011). Therefore, a more holistic view of high-skilled emigration implies that the already-small negative effect of emigration may be lower than currently believed. It would also suggest that emigration can benefit both the sending and the receiving country. Saxenian (2005) termed this phenomenon "brain circulation."

These case studies, theoretical models, and empirical analyses are based on two critical assumptions. First, migration has to be restricted via policy tools, and some people will not be able to migrate even if they would like to. So the brain gain effect a la Stark or Mountford can only appear because some of the potential emigrants are forced to stay behind. Second, the supply of education has to be elastic so that the educational system can easily meet the increased demand from potential migrants. For example, although the private nursing schools in the Philippines could expand capacity in the face of

increased demand, this is unlikely to be the case for publicly funded medical schools in Sub-Saharan Africa.

Another potential channel of brain gain is how people change their fields of study or occupations when there is a prospect of migration. In a series of surveys of the top high school students in Ghana, Tonga, and Papua New Guinea, Gibson and McKenzie (2011b) found that most students changed their field of study or how much they studied because of potential migration opportunities. They took more foreign language classes and prepared for certain entrance exams. Even the surveyed high school teachers said they covered subjects, such as American history, that were more appropriate for destination countries and they would not have included these in the curriculum in the absence of migration prospects.

The literature on brain drain pays very little attention to the educational and professional career trajectory of emigrants because it is often assumed that emigrants complete their education at home before moving. Although certainly the case for a large proportion of emigrants, a considerable share move as children with their parents or attend tertiary education in countries other than their place of birth. It is important to account for this fact because a key argument among those who provide support for the negative impact of brain drain is that sending countries finance the education of emigrants but the receiving countries reap the benefits. Docquier and Rapoport (2012) show that defining a skilled emigrant as someone who emigrated at the age of 22 or older, as opposed to just being foreign-born, reduces the share of these emigrants. This decline is close to 50 percent for Cambodia and Mexico, for example. Additionally, since the colonial era, it has been common practice for developing countries to send students to developed countries to acquire human capital and return to their home countries to serve. Many developed countries also finance the education of students from overseas via scholarships; examples of these include the Fulbright scholarship and the Commonwealth scholarship

Finally, international migration can lead to higher human capital levels even in the absence of an endogenous effect on incentives to acquire education. One channel is through remittances sent back home, which alleviate liquidity constraints that prevent people from paying for education, especially for their children. Another channel is through return migration after acquiring human capital abroad. These issues are explored further in the next section. Gibson and Mackenzie (2011b) find that a significant portion of the top high school students they interviewed in Ghana, Tonga, and Papua New Guinea actually returned home after obtaining advanced degrees abroad. These returning high-skilled migrants become a key conduit of knowledge transfer to their home countries.

5. Brain Circulation and Networks

In the past five decades, globalization has been accompanied by lower transportation and communication costs, making the movement of people and ideas much easier. Associated with the global competition for talent, skilled migrants now find it much easier, in comparison to their unskilled counterparts, to move from one country to another. This section highlights several other channels through which mobility of highly skilled professionals might generate benefits, especially for their home countries. These gains can best be explained by this quote from former Prime Minister Manmohan Singh of India: “Today we in India are experiencing the benefits of the reverse flow of income, investment and expertise from the global Indian diaspora. The problem of ‘brain drain’ has been converted into the opportunity of ‘brain gain’” (Government of India 2010).

The first channel through which benefits may be realized, diffusion of knowledge, is frequently repeated in policy circles and the academic literature. As Saxenian (2005, 35) notes, "By 2000, over one-third of Silicon Valley's high-skilled workers were foreign-born.... These engineers and entrepreneurs, aided by the lowered transaction costs associated with digitization, are transforming technical and institutional know-how between distant regional economies faster and more flexibly than most corporations." Kerr (2008) finds evidence of transfer of knowledge between ethnic emigrant groups in the United States and their home countries, in particular among those of Chinese origin. This diffusion of knowledge is found to affect productivity in high-tech manufacturing sectors. Agrawal et al. (2011) provide empirical evidence in support of the contribution India's diaspora to the development of some of the most important inventions in India. A possible explanation for this phenomenon is that the selection mechanism put forth by Borjas (1987) applies to migrants regardless of whether they currently reside in their country of birth. They are attracted by differential returns to skills and amenities across countries. This nevertheless further contributes to the positive externalities generated by skilled emigration. As these skilled migrants diffuse the know-how they acquire in their respective host countries to the home country, sending countries become beneficiaries as they gain the best know-how available in other parts of the world.

Closely related to knowledge diffusion is the positive externality of trade stimulated by emigration. The literature on this topic was kick-started following Gould's seminal 1994 paper. Gould (1994) posits that movement of people between countries affects movement of goods between them via two channels. First, migrants would lead a destination country to increase imports of goods from migrant sending countries because of increasing demand for specific goods migrants are used to consuming at home. Second, they would facilitate trade between the receiving country and the sending country by lowering transactions costs. The empirical analysis suggests diminishing effects arising from the first channel and nuanced evidence for the second channel; skilled emigrants potentially create industries that may substitute for the trade of certain goods between the sending country and the receiving country. Literature providing an empirical link between emigration and trade includes Rauch and Trindade (2002), who suggest that Chinese networks positively affect bilateral trade in differentiated products between China and countries around the world more than they do for homogeneous products. Felbermayr and Jung (2009) find an elasticity of 0.11 between bilateral stocks of emigrants and bilateral trade, but there is no evidence that the effects differ across educational groups. Migration of the high skilled affect FDI flows as well. At the cross-country level, Kugler and Rapoport (2007) and Javorcik et. al. (2011) find a positive relationship between the number of skilled emigrants a country has in the United States and the level of FDI from the United States to that country.

In addition, a proportion of emigrants return to their home countries, bringing with them the knowledge and experience they acquired abroad. As mentioned, many developing countries send citizens abroad for educational study in advanced countries with the aim of acquiring knowledge for the management of their institutions. These practices continue today. For others, migration may just be a phase in the individual's life-cycle to accumulate capital and savings, either for pure leisure or to smooth income or alleviate credit constraints (Dustmann and Kirchkamp 2002). In such cases, temporary migration still benefits the sending country because the migrant would remit while away, and upon return, their savings accumulated abroad can be invested in growth-enhancing economic activities. Looking at Turkish migrants returning from time in Germany and interviewed in the 1980s, Dustmann and Kirchkamp (2002) find that about 50 percent became entrepreneurs. The capital used for starting their economic activity came from savings and capital acquired while in Germany. A similar

study on return migrants to Albania by Piracha and Vadean (2010) shows that they were more likely to start a business in comparison with their nonmigrant counterparts. Funds accumulated abroad are found to be a significant determinant. Wahba (2015) provides empirical evidence on the wage premium to returnees to Egypt after temporary migration. Using the Egyptian Labor Market Panel Survey, she finds that return migrants earn about 25 percent more than their nonmigrant counterparts (accounting for selection into migration, this share drops to 16 percent), indicating the value of the human capital acquired abroad. Finally, Docquier et al. (2016) provide an interesting analysis of how immigrants in high-income OECD countries contribute to the spread of democracy in their home countries, and Spilimbergo (2009) shows the same relationship with foreign education.

While we hear stories of business executives and football stars moving to different countries as new professional opportunities appear, evidence of mobility for nonsuperstars is scant. Using the American census covering the period 2000–12, Artuc and Özden (forthcoming) find that at least 13 percent of recent tertiary educated migrants had resided in a country other than their birthplace a year before—the corresponding share was about 6 percent among those who did not complete college education. In other words, one of every seven high-skilled migrants is a *transit* migrant and comes to the United States via a third country. Artuc and Özden (forthcoming) model the decision of agents to migrate or remain in their current location as dynamic, whereby choosing to move to another country is repeated every period, with bilateral moving costs between each pair of countries comprising a stochastic component. For each potential destination, the agent weighs the associated utility to be gained against the mobility cost. Using U.S. census data, they compute the distribution of the last place of residence of tertiary educated migrants with less than a year of stay in the United States. The results are reported in Table 6. Just five countries—Australia, Canada, Germany, Japan, and the United Kingdom—account for almost two-fifth of these transit migrants. And even more startling, the United Kingdom and Canada alone hosted more than a quarter of the high-skilled emigrants (and about 16 percent of the low-skilled) a year before they entered the United States. We also see that Brazil, China, and India, three of the major emerging economies, account for about 9 percent.

Table 6 Migrants Who Arrived in the United States between 2001 and 2010 and Were in the United States for at Most a Year (age 18–65)

<i>Residence last year</i>	<i>Education</i>		<i>Residence last year</i>	<i>Education</i>	
	<i>Tertiary</i>	<i>Nontertiary</i>		<i>Tertiary</i>	<i>Nontertiary</i>
United Kingdom	13.46	7.21	El Salvador	0.22	1.05
Canada	12.21	9.11	Poland	0.21	0.35
Germany	5.52	4.82	Jamaica	0.02	0.30
Japan	3.71	2.75	Cuba	-	0.14
Australia	3.39	2.59	Asia, not classified	7.21	5.78
Brazil	3.23	1.57	Other Western Asia	4.81	6.34
India	3.05	4.15	Other Western Europe	3.85	2.72
France	3.00	1.95	Southern Europe	3.54	2.92
China	2.79	2.74	Other South East Asia	3.47	1.60
Mexico	2.22	4.86	South America, not classified	2.81	4.49
Italy	1.69	1.63	Other Eastern Europe	1.94	1.14
Taiwan Province of China	1.31	0.84	Northern Europe	1.82	2.00
Ukraine	1.11	0.54	Other Caribbean	1.82	1.68
Korea	1.03	1.53	South Africa	1.77	4.02
Philippines	0.67	0.70	Israel/Palestine	1.76	2.49
Colombia	0.66	1.03	Former Soviet Union	0.99	3.45
Vietnam	0.61	0.50	Pacific Islands	0.86	1.85
Other U.S. Possessions	0.61	0.79	Central America, not classified	0.50	1.48
Puerto Rico	0.57	2.79	Northern Africa	0.48	0.43
Dominican Republic	0.30	0.29	Eastern Africa	0.29	2.06
Guatemala	0.23	0.20	Western Africa	0.28	1.13

6. Conclusion

The emigration of high-skilled people from developing countries came to prominence in the academic literature about 50 years ago and has been at the forefront of the migration literature ever since. Recent empirical contributions answered many questions posed by the earlier theoretical papers and have led to a lively debate. To date, there is no strong evidence that the implications of high-skilled migration for the origin countries are negative. The existing empirical evidence indicates these negative effects are generally quite small.

The data indicate that high-skilled migration, especially from developing to developed countries, is increasing faster than overall migration levels and the number of highly educated people in the

sending countries. Taking advantage of agglomeration spillovers and relatively more relaxed policy measures, high-skilled migrants are concentrated in a few high-income, English-speaking OECD countries. Among the emerging issues are that high-skilled emigration is more nuanced than had been thought and can only be assessed using higher-quality and more detailed data. The prevalent definitions based on education or country of birth are likely to over-estimate high-skilled emigration rates and the subsequent costs to sending countries. For example, an increasing number of individuals move either as children or as students to their destination countries, making the place-of-birth definition meaningless. It also renders questionable the key argument that sending countries incur the cost of their education and receiving countries reap the benefit.

The gains from high-skilled emigration can be substantial if the right institutions are in place. These gains include large sums of remittances to the sending countries, knowledge diffusion, and increases in FDI and trade. These benefits can continue with the offspring of emigrants born in the host country because diasporas continue to engage with their home countries for many generations. There are numerous examples of second- and third-generation attachment to their parents' birth countries. Many countries, such as Ireland, implement specific policies to stay engaged with and benefit from their diasporas (Dickerson and Ozden 2017).

Despite the evidence, high-skilled immigration flows are controlled by many restrictive policies. Examples include the point-based systems in Australia and the United Kingdom and the H1B visa in the United States. The scarce literature examining the role of host countries' immigration policies on the skill composition of their immigrants, provides mixed findings. While some studies have suggested that skills-based selective immigration policies raise the skill composition of immigrants (see Green and Green 1995; Aydemir 2011; Czaika and Parsons 2017), others conclude these policies may not necessarily lead to much increase in the skill level of immigrants (Duleep and Regets 1996; Antecol, Cobb-Clark, and Trejo 2003), but instead will alter the origin countries (see Borjas 1993) or that geographical proximity plays a more important role (Jasso and Rosenzweig 2009). Docquier and Machado (2015), on the other hand, postulate that liberalizing skilled migration, that is, getting rid of entry visas, would lead to an increase in human capital (measured by the share of tertiary educated in the labor force) in EU15 countries by up to 10.2 percent and by up to 6.2 percent in the United States. Wages in EU15 countries could increase by up to 12 percent, depending on the policy pursued by other developed countries. These benefits to developed countries would, however, occur at a cost for developing countries because their losses would outweigh their gains; they could experience a drop in income of up to 2.5 percent. Therefore, policies would be required for fair redistribution of the gains.

Instead of removing these barriers, many OECD destination countries are actually leaning toward more restrictive immigration policies for all migrants, regardless of their economic and legal status. The restrictions imposed by the United Kingdom on foreign students are an extreme example of this pattern. Liberalizing immigration policies is likely to generate more competition for talent. A number of countries are starting to institute programs to encourage their diasporas to return home (see Del Carpio et al. 2016). As mentioned, migrants would bring with them know-how along with acquired customs and savings accumulated abroad. This could be particularly beneficial to both sending and receiving countries.

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