

**INTERNATIONAL MIGRATION
PAPERS**

46

**SOME DEVELOPMENTAL EFFECTS
OF THE INTERNATIONAL
MIGRATION OF HIGHLY SKILLED
PERSONS**

B. Lindsay Lowell

International Migration Branch

INTERNATIONAL LABOUR OFFICE GENEVA

Table of contents

Foreword	v
Executive Summary	1
1. Introduction	2
1.1. Trends in the modern brain drain.....	3
2. Demography of the brain drain	5
2.1. The analysis.....	6
2.2. Technical notes on the data.....	7
2.3. Regional differences in cumulative losses and emigrant selectivity.....	9
2.4. Countries with losses and emigrant selectivity above the regional average.....	10
2.5. Countries with the largest tertiary educated emigrant populations.....	13
2.6. Summary of the demography of the brain drain.....	13
3. Economic research on the brain drain	13
3.1. Three waves of research: No effect, negative effect, big negative effect.....	13
3.2. Brain drain and education.....	15
3.3. Optimal brain drain.....	15
3.4. Institutional effects on brain drain.....	16
3.5. Summary of the direct impacts of a brain drain.....	17
4. Feedback or offsetting effects	17
4.1. Return migration.....	18
4.2. Remittances by the highly educated.....	19
4.3. Technology / knowledge transfer.....	22
4.4. Flows of international migration and trade.....	23
4.5. Summary of feedback effects.....	23
5. Conclusions	24
References	26
Endnotes	30
Contributors	31
International Migration Papers	32
Figure 1. Flow of international migrants by skill category between source and receiving countries.....	4
Figure 2. Cumulative percentage loss of tertiary and secondary educated in OECD by source region, 1990.....	8
Figure 3. Tertiary educational selectivity of emigrant stock by source region, 1990 or nearest date.....	9
Figure 4. Cumulative percentage loss of tertiary and secondary educated for countries above source region average, 1990.....	11
Figure 5. Tertiary educational selectivity of emigrant stock for countries above source region average.....	12
Figure 6. The number of tertiary educated emigrants in the OECD or USA, 1990.....	12
Table 1. Correlations between brain drain and economic growth.....	24

Foreword

This report forms part of the series of studies conducted by the International Labour Office under the DFID-sponsored project on *“Skilled labour migration (the ‘brain drain’) from developing countries: Analysis of impact and policy issues.”*

International migration of skilled persons has assumed increased importance in recent years reflecting the impact of globalisation, revival of growth in the world economy and the explosive growth in information and communications technology. A number of developed countries have recently liberalized their policies to some extent for the admission of highly skilled workers.

The problem lies in the fact that this demand is largely met by developing countries, triggering an exodus of their skilled personnel. While some amount of mobility is obviously necessary if developing countries are to integrate into the global economy, a large outflow of skilled persons poses the threat of a ‘brain drain’, which can adversely impact local growth and development. The recent UK government (DFID) White Paper on International Development, *“Eliminating World Poverty: Making Globalisation Work for the Poor”* has rightly pointed out the need on the part of developed countries to be more sensitive to the impact of the brain drain on developing countries. It was in this context that the Department for International Development, United Kingdom, approached the ILO for carrying out research relevant to the above issues.

This paper prepared Professor Lindsay Lowell reviews the extent to which highly educated emigrants from developing countries represent an economic loss or “brain drain” based on an extensive survey of the literature. It first systematically reviews available data on international mobility. Then it examines the economic analysis of direct effects of the brain drain on economic development. In the final section, the paper considers the major favourable feedback effects generated by high skilled emigration. The study concludes that the existence of such feedback effects gives policymakers tools that they can use to address the adverse impacts of the brain drain. It also highlights the gaps in research on this issue.

ILO gratefully acknowledges the financial support of the Department for International Development, United Kingdom for undertaking this research programme.

Mr. Piyasiri Wickramasekara, Senior Migration Specialist, International Migration Branch, acted as the ILO Project Coordinator and technically backstopped all the studies. ILO is most grateful to Professor Lindsay Lowell for his valuable contribution.

Geneva, December 2001

Manolo I. Abella
Chief
International Migration Branch

Executive Summary

This paper reviews the extent to which highly (tertiary) educated emigrants from developing countries represent an economic loss or “brain drain.” (1) It systematically reviews available data on international mobility, (2) then it examines the economic analysis of direct effects of brain drain on economic development, and it (3) finishes the review by considering the major favourable feedback effects generated by high skilled emigration.

(1) The only comparative data on the demography of the brain drain are for 1990, more than a decade ago and before significant upswings and shifts in the levels of international mobility. But this is the only data available and it offers insight into the variation that occurs across regions and countries. It demonstrates that even without further investigation into all the economic factors that might offset it, the “brain drain” is a likely reality for many countries. Losses of 10 to 30 percent of the tertiary educated subpopulation are significant on the face of it. There is little doubt that blanket statements about brain drain are not warranted, but that there is equally little doubt that the problem may well be faced by many developing countries.

(2) Indeed, most of the economic literature finds that the direct impact of a brain drain is to lower economic growth: albeit, there are important caveats to this conclusion. Neoclassical models of economic development generate an expectation that brain drain has adverse effects for sending country development (Bhagwati and Hamada 1973). More recent thinking, a.k.a. endogenous growth theory, generates even greater estimated losses than the neoclassical models (Straubhaar and Wolburg 1997). Brain drain reduces the wages of the unskilled population, likely increases the wages of remaining skilled workers, and hence increases inequality. Poverty increases, the after effect of both increased inequality and slower economic growth.

Another theoretical variant finds that at some optimal level of emigration, more than none but not too much, sending countries actually benefit (Beine et al. 1999; Mountford 1997). The possibility of emigrating to higher wage countries may stimulate persons to pursue higher education in the hope of improving their expected wages abroad. This can increase the average level of education or human capital available to developing countries and spur economic development. Further, institutional factors suggest that effects need to be evaluated on a case-by-case basis.

(3) And there may any number of feedback effects generated by high skilled emigration. Return migration or “brain circulation,” in particular, can re-supply the highly educated population in the source country and, to the degree that returned migrants are more productive, boost source country productivity. Technology transfer is another important outcome of brain drain; only it implies not the return of people but the infusion of new ideas and investment in the source country by its skilled emigrants. Many claim that these transfers can be as, if not more, important than the physical return of expatriates.

Emigrant monetary remittances to their source countries are often cited as potentially important stimuli to economic growth. There is a lack of rigorous study of the behaviour and consequences of remittances by highly educated emigrants. Yet, the implication of the literature review undertaken here leads to the inference that the highly skilled may be less likely than their lesser

skilled compatriots to remit and that their remittances alone are unlikely to compensate source countries for economic losses due to a brain drain.

Yet, there may be unique characteristics of the financial behaviour of highly skilled emigrants. They are more likely to be banked and, hence, they are more likely to save and are more able to access loans. A propensity to channel monies through the formal market also mean that highly skilled emigrants are more likely to invest in instruments like remittance backed bonds, to place their savings in foreign currency accounts, or invest directly in their home country.

Ultimately, the empirical literature on the brain drain is disappointing in the sense that much of it depends upon the assumptions of theoretical, albeit mathematically sophisticated, economic models. Empirical analysis or the modelling of statistical data is relatively rare. And to cap it all, the offsetting, cumulative effects of ongoing contact, return, transfer, and investment are generally not included in the theoretical literature, much less are they well-documented or measured making any assessment difficult. In short, there is plenty of evidence that concerns with a “brain drain” are legitimate, but there is little empirical means of establishing which countries are most at risk, much less which countries are most likely to benefit.

1. Introduction

Early international interest in the causes and consequences of the brain drain resulted in debates and resolutions in the United Nations starting from about 1967. That debate focused on poorer countries’ losses when skilled professionals emigrated from developing to developed countries and/or remained after study abroad. Concern about the problem led to serious discussions about return policies for students and immigrant taxes on developed receiving countries (Glaser and Habers 1978; Bhagwati 1987).

That earlier debate dissipated during the 1980s and was rarely heard again until the latter 1990s. It is not clear that the situation changed, movement from developing to developed country continued, but other issues came to the fore. In developed countries heated debate zeroed in on low skilled immigrants, in particular a concern with too many. Still, policies tended to favour family and lower skilled immigration. Small battles were fought over the admission of medical personnel or nurses, but there was otherwise little specific attention among policymakers or academics on high skilled flows (Vasegh-Daneshvary, Schlottmann, and Herzog Jr. 1987).

In developing countries concerns did not disappear, but the discussion attenuated as emigration continued apace and other issues pushed to the fore. All the related challenges of economic development took front stage, i.e., the shift from import substitution to open markets, infrastructure development, strengthening the financial sector, institution building, and so on. In the meantime, many countries were successful in building their educational system and increasing the output of students.

But what of the brain drain? Has the problem gone away or was it even ever really a problem? This paper addresses the consequences of brain drain as follows. First, a review of the economic literature on the brain drain turns up broad agreement on the direct adverse consequences for

economic development. But sweeping generalizations are difficult to sustain when institutional factors can play out the effects of brain drain differently in each emigrant-source country. Second, the possible effects of various feedback loops from brain drain are discussed, although the quantitative value of these feedbacks are uncertain, they further demonstrate why sweeping generalizations are inadequate. Thirdly, recently produced datasets that measure the brain drain are examined. Unfortunately, these are for about 1990; however, they are the only readily available comparative data. They establish that the demography of the situation has been one that makes the potential for economic loss/gain very real.

1.1. Trends in the modern brain drain

Events during the 1990s stand to reintroduce the brain drain debate to policymakers and academics. The key event driving this change of events is ongoing increases in skilled emigration from developing countries. That flow was boosted in the 1990s by the streamlining and increase in admission numbers granted to highly skilled immigrants in the traditional receiving countries.

Among the OECD countries the United States, as shall be discussed in the second half of this paper, receives the lion's share of highly educated immigrants. It doubled the number of admission numbers for highly skilled immigrants in 1992, increasing the share of educated among new admissions (Lobo and Salvo 2000). Canada nearly doubled its overall numbers and increased to half the share of its intake immigrants are highly skilled (Iribarren 1995).

The changes stem from the governments desire to respond to public opinion and to boost their economies. More recently, traditional receiving countries, as well as European nations have scrambled to create policies that attract highly skilled workers, in particular, in the rapidly growing sector of information and communication technology. The United States has been the leader in this sector and, despite the recent "dot.com" business bust, the information and technology sector looks to continue its path breaking ways. In the past 3 years the U.S. has increased its cap on temporary skilled workers from 65,000 to 115,000 and then again to 195,000. The Canadians and Australians have further streamlined their permanent and temporary admission policies to better compete; as have the Irish, the English, the Germans, and other countries.

Not that the issue is constrained to just the developing world. During the 1990s the UK and Ireland rank high in the number of emigrants they send abroad. For a time, the UK led in the number of professionals emigrating to the United States. Further, in science and engineering over half of European students in the United States remain (Mahroum 2000). Likewise, the Canadians argue bitterly about their brain drain to the United States, taking some comfort in the fact that they replace all their personnel loss with highly skilled foreigners primarily attracted from developing countries in Asia (Akbar and Devoretz 1993).

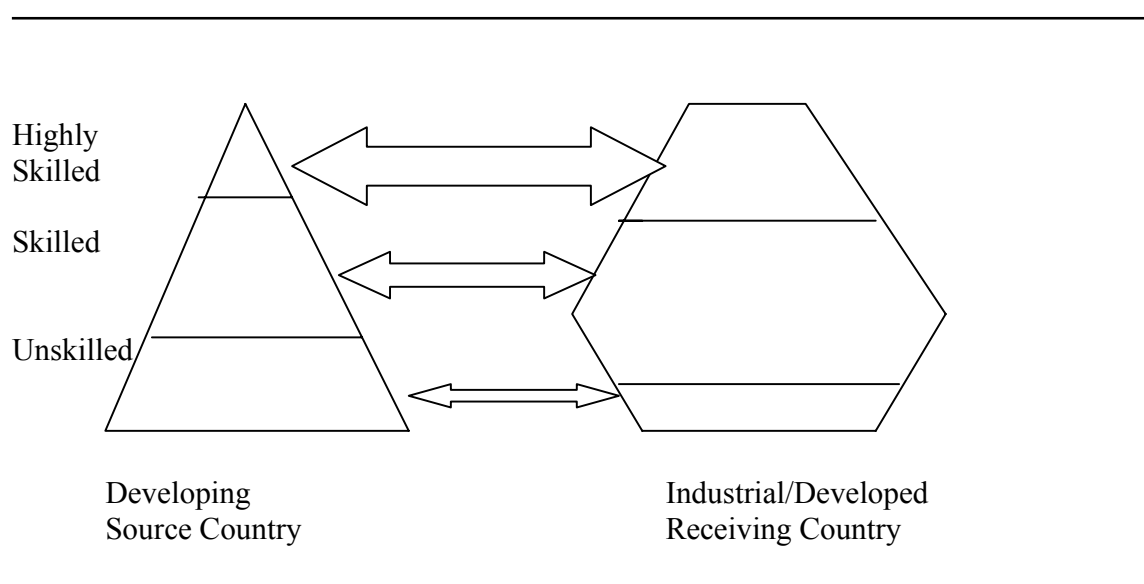
Nonetheless, competition among the developed countries is unlikely to lead to restrictive admissions. In fact, it is likely that the global economy and various national policies will combine to further the movement of highly skilled workers from developing to developed countries. This is not the place to enter into a discussion about all the various factors that experts point to in forecasting an upward trend in high skilled movements, e.g., the forces of

globalisation, expansion of labour markets, shortages of highly educated workers in the information-age economies, just-in-time demand for industries eager to get on the front of technology curves, growing bodies of foreign student bodies in all OECD countries, and so on.

While the emphasis in the discussion that follows is on the implications of brain drain for developing countries, one thing most experts agree upon: developed countries stand to benefit from the contributions of highly educated foreign workers. Having accepted the principle of opening markets to trade, and the belief that all parties win in an open regime, policymakers are likely to listen to those who urge more liberal regimes of international mobility (Chang 1997; Straubhaar 2000). In short, current events raise once more the spectre of developing countries losing their educated workforce. What damage will this incur? Are there feedback loops from high skilled emigration that return some benefits that offset and even boost emigrant-source country development?

The basic anatomy of the brain drain is simple enough to chart (see figure 1). As we shall see, the flow of highly educated persons out of developing countries may address an imbalance in supply/demand and wages, but it occurs in a situation where imbalances in the available knowledge base put developing countries at risk. The well educated are the most likely to emigrate while, at the same time, the supply of highly educated workers in the source country is significantly smaller than that of the receiving developed country. Any possible adverse effects to the receiving country, such as increased labour market competition, are proportionally less than the possible adverse effects of the brain drain to the source developing economy.

Figure 1. Flow of international migrants by skill category between source and receiving countries.



2. Demography of the Brain Drain

The first necessary condition for a “brain drain” is that a relatively large number of highly skilled persons are actually “lost” to a source country. This is a rather straightforward expectation, but cross-national statistics present very little information on the education of either source-country or emigrant populations. The demography of the phenomenon has not been concretely known since the debate began in the 1960s.

The only comparative data set on the relative movements of workers by education level was constructed in 1998 and is only for the year 1990. Carrington and Detragiache (1998; 1999) used several different data sources to construct somewhat crude, but very serviceable estimates of the brain drain, i.e., the percent of highly educated persons from a given developing country who emigrate to OECD countries. These estimates are available only for Africa, Asia and the Pacific, North, and South America. Eastern European countries can be compared using a slightly different measure of brain drain (Straubhaar and Wolburg 1998), i.e., the percent of just emigrants from a developing country who are highly educated. These estimates make it clear that, at least in terms of the likely scale of international movement; a “brain drain” may exist for several developing countries.

2.1. The analysis

The greater the relative number of highly skilled emigrants abroad, the greater the possibility that conditions are created for adverse economic consequences for the source country. But “how much” is enough to firmly create the likelihood that a “brain drain” exists?

The number of persons with advanced education is the first figure that needs to be considered. The educational distribution examined departs from a tripartite breakdown of primary, secondary, and tertiary education. Population estimates are made for the emigrant population over the age of 25 years from a given source country and it is divided into three skill groupings (Carrington and Detraigiache 1998):

- (1) primary education is defined as 0 to 8 years of schooling,
- (2) secondary education as 9 to 12 years, and
- (3) tertiary education as more than 12 years of schooling (the later referred to here as “skilled” or “highly-skilled”).

Most of the analysis here focuses on the tertiary educated population, loosely what might be considered the college educated. It turns out that primary educated persons are the least likely to emigrate, while the tertiary are the most likely to emigrate. The data on the primary educated are not shown here because the percentages available are extremely small, and because they are not of interest. Rather, while secondary educated persons are considered here, the focus throughout is on the tertiary educated.

There are two ways of measuring “how much” of a brain drain, e.g., movement of the tertiary educated outside their source country of origin:

- (1) “Cumulative loss” refers to highly educated emigrants who are not resident in their source country (region). It is measured as the percent of all tertiary educated persons from a given country who are abroad, $E_{ij} / E_{ij} + S_{ij}$ where E is the number of emigrants in the ith (tertiary) educational category from the jth country; and S is the source country non-migrant population in the ith (tertiary) educational category from the jth country.
- (2) “Educational selectivity” of the emigrant stream refers to the degree to which emigrants tend to be highly educated. This is measured as the percent of tertiary educated emigrants out of all emigrants who are abroad or $E_{ij} / 3E_{ij}$, where the denominator is the sum or total of all emigrants abroad in all educational categories. If a large share of emigrants has a tertiary education one can say that emigrants are a positively selected population. This is a different sense of the relative loss of human capital implied by the term brain drain.

These measures of what are being called here cumulative loss and educational selectivity capture different aspects of the phenomenon. Researchers have referred to both measures when conceptualising the brain drain. While the cumulative loss measure may be closest to the concept of brain drain, the measure of educational selectivity is also an indicator of the relative loss of educated persons. Using both measures the comparisons shown in the following tables are for:

- (1) world region averages for the measure of “cumulative loss” and “educational selectivity;”
- (2) countries within regions that exceed the regional average rate of loss or selectivity.

The regional averages are of interest in their own right, while singling out countries with above average rates of loss or selectivity focuses in on the upper range of brain drain possibilities. With no further information on the economic consequences of the outflow, these are the countries that one would first consider as candidates for significant brain drain effects. Most importantly, this focus helps establish a feel for the upper range of the phenomenon.

In the final table a third comparison is made of:

- (3) tertiary educated *populations* abroad (number of emigrants) for those countries within each region that account for the preponderance (75 percent) of the region’s numerical loss.

This provides another way of considering the demography of the brain drain. It establishes that the countries with relatively large losses (2 and 3 above) are not necessarily those that send the greatest number of tertiary emigrants abroad. It shows that a few countries can account for most of the numerical outflow from a region.

2.2. Technical notes on the data

The figures shown on the following pages are based on manipulation of the statistics generated by Carrington and Detraigiache (1998). They make estimates of the brain drain based for 61 developing countries that they estimate account for 70 percent of the total population of developing countries. Their sample includes the major countries typically thought of in discussions of brain drain, but because of data lacunae it excludes critical observations. In particular, developing countries in Eastern Europe are not included in their data.

They construct their estimates for the education level of each country's emigrant population in either the United States or the combined OECD countries (Organization for Economic Cooperation and Development). Given the peculiarity of their estimating technique, the estimates for the U.S., which accounts for 54 percent of total migration flows within the OECD, are somewhat more reliable than those for the entire OECD area.

Their method uses the educational distribution of the foreign born in the 1990 U.S. Census to proxy for the unknown educational distribution of immigrants in OECD countries. Such an indirect approach is necessary because there are no readily available data on the educational characteristics of immigrant populations in most OECD statistical sources. Clearly, for some source countries many if not most educated emigrants do not end up in the United States and the resulting estimates are unreliable. In the tables presented here, 5 countries without a sizable U.S. flow are excluded (e.g., those countries with less than one-third of their total flow to the U.S. are Bangladesh, Malaysia, Sri Lanka, Senegal, and Tunisia).

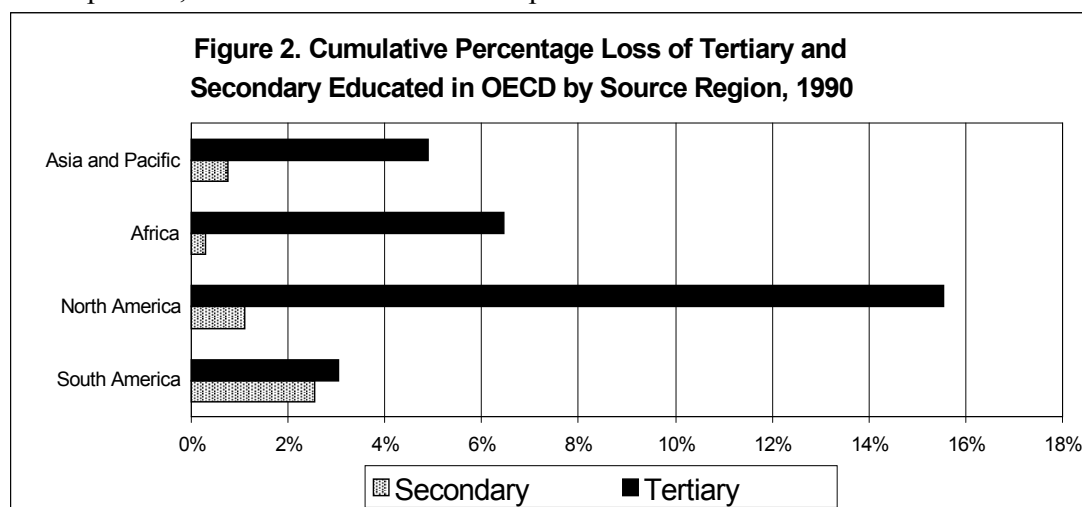
Having estimated the emigrant population in each class of education, the next step is to calculate the percent or share of emigrants out of the source country population by educational class. This is, of course, a crucial measure as it expresses the degree of relative loss that underlies the casual observation of brain drain. Here Carrington and Detraigiache (1998) present two measures, the share of primary, secondary, or tertiary emigrants measured against the (a) remaining source country populations; and the (b) share of emigrants measured against the sum of emigrant and source country populations.¹ The latter measure is most clearly interpreted as the "cumulative loss" of a given country's skilled population abroad, but it assumes that none of the emigrants are actually captured in the source country statistics (if they are they would be double counted). Rather than express these two different measures as the upper and lower bounds of a range, the discussion here takes the midpoint of the two measures as a point estimate.²

Finally, the Carrington and Detraigiache (1998) estimates are made for developing countries in Africa, Asia and the Pacific, North, and South America. Data on educational classes are not readily available for countries of the former Soviet Union and Eastern Europe, nor would the U.S. emigrant population proxy well for that regional flow. Instead, we can compare estimates taken from Straubhaar and Wolburg's (1998) analysis of Eurostat Labour Force Survey for 1992-1994. The Eurostat Survey captures tertiary education of foreign workers in the European Union, but due to data limitations the estimates shown here are restricted by Straubhaar and Wolburg to foreign populations found in Germany. Due to the unique nature of the Yugoslavian outflow (4 percent tertiary educated), that country is dropped from this analysis and not included in the weighted averages for the region. Bringing in the Eastern European estimates requires a different measure of brain drain. The Eurostat data only capture the emigrant population, so the only measure available is the percent or share of all emigrants with tertiary education.

2.3. Regional differences in cumulative losses and emigrant selectivity

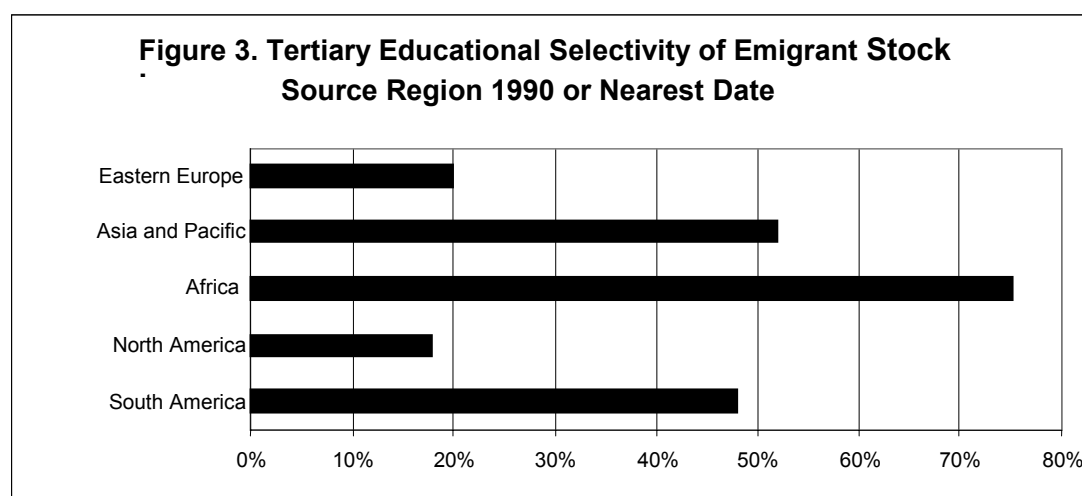
Starting with the measure of cumulative loss, or the share of skilled persons who are abroad (emigrants), figure 2 shows that there are notable differences by which region of the world the outflow originated in. It shows that population losses among the tertiary educated are substantially greater than those among the secondary educated. It also shows that the percentage loss of tertiary emigrants is greatest for North America, about 15 percent of all highly skilled

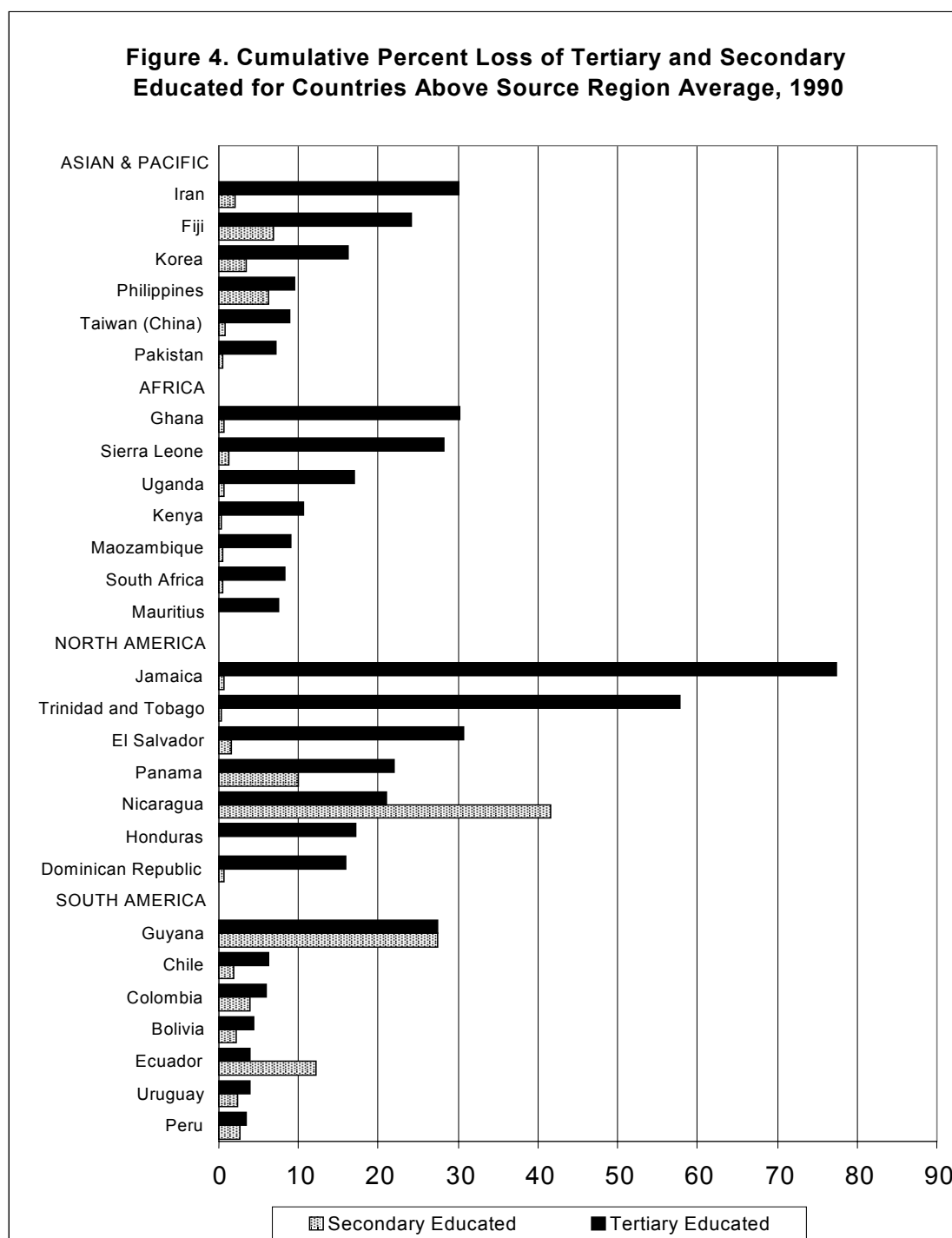
persons in this region are found in an OECD country, followed by Africa with 7 percent, Asia with 5 percent, and South America with 3 percent.



The relative loss of tertiary skilled persons is far greater than that of secondary schooled persons, while the loss of primary schooled persons is relatively little and essentially zero from most countries (and hence not shown). This supports the observation that emigration is selective of those who can afford it (not the poorest primary schooled), and those who stand to benefit most (the tertiary educated). Because the base population in each region is comprised of mostly less-educated persons, a small percentage outflow can translate into a large numerical flow. But clearly on percentage loss basis North American exceeds that of the other regions.

Moving to a regional comparison of educational selectivity, that is the percent of emigrants abroad with a tertiary education, figure 3 shows that Eastern European emigration appears to have been the least selective of the regions. Otherwise, the pattern of educational selectivity shows some shift in the relative “brain drain” phenomenon by region as compared to the pattern of cumulative losses. In figure 2 above Africa shows a greater cumulative loss of tertiary skilled emigrants than South America, but in figure 3 South American emigrants exhibit greater educational selectivity than African emigrants. Of course, this outcome is quite possible because the two measures capture different aspects of the flow and stock of movers.





2.4. Countries with losses and emigrant selectivity above the regional average

Figure 4 shows the leading “brain drain” countries in the Carrington and Detragiache dataset for 1990. It rank orders the countries within each region and shows only those whose share of tertiary educated emigrants abroad exceeds the regional average. For example, Iran with 30

percent of its tertiary population abroad has a loss that is 6 times greater than the regional average for Asia and the Pacific. About 30 percent of highly skilled Ghanaians and emigrants from Sierra Leone are estimated to live abroad. Surprisingly, about 77 percent of Jamaicans are estimated to live abroad.

Figure 5 next shows countries with educational selectivity of their emigrants that is greater than the regional average. Once again, this permits us to include Eastern Europe which shows that even the leading countries in this region demonstrate less emigrant selectivity than is the case for the leading countries in other regions. What is also striking, and not unanticipated, is that the countries with the greatest cumulative losses of tertiary educated persons are not necessarily those whose emigrants demonstrate the greatest selectivity. Ghana, for example, ranks as the African country with the largest cumulative loss of tertiary educated emigrants, but its emigrant outflow ranks below the regional average in terms of the share of emigrants with tertiary education (so does not appear in figure 5). At the same time, South Africa ranks above average both in terms of cumulative loss of tertiary educated emigrants and in terms of the selectivity of its emigrant stock abroad. Such countries that appear on both lists warrant special attention.

2.5. Countries with the largest tertiary educated emigrant populations

Figure 6 shows the estimated *number* of tertiary educated emigrants in the combined OECD countries. The figure shows only those countries that combined comprise about 75 percent of the entire outflow of highly skilled workers from the entire region. Four countries, Korea, India, China, and the Philippines account for three-quarters of the outflow of highly skilled persons from all of Asia and the Pacific. In Africa, just two countries account for three-quarters of that regions outflow, i.e., South Africa and Egypt.

These estimates convincingly demonstrate the numerical loss of highly skilled persons can be sizable, but the relative loss to the source country of such persons need not be as large. This is a trite observation when one considers that China has about 320,000 highly emigrants in OECD countries who, in turn, account for only about 3 percent of China's tertiary educated population. This is a case where a small percentage of cumulative loss when multiplied through a very big Chinese population generates a numerically large brain drain. In the same vein, Mexico ranks first regionally with an estimated 350,000 tertiary educated persons living abroad, but does not rank above average in terms of its cumulative loss for the North American region (about 10 percent).

Another insight that can be gleaned from this table is that, unsurprisingly, the U.S. accounts for almost all tertiary emigrants in North and South America. The U.S. gets nearly 100 percent of North America's and 80 percent of South America's outflows. The major exceptions in the American system appear to be Brazil and Jamaica whose emigrants can often be found in other OECD countries.

In contrast, high skilled emigrants from Asia and the Pacific, as well as Africa, are as likely to be found in OECD countries other than the U.S.; about half of the global emigrant population of the highly skilled from Asia or Africa. The regional domination of the United States is greatest for North and South America, while Europe and other OECD receiving countries more successfully compete for highly skilled emigrants from Asian and Africa.

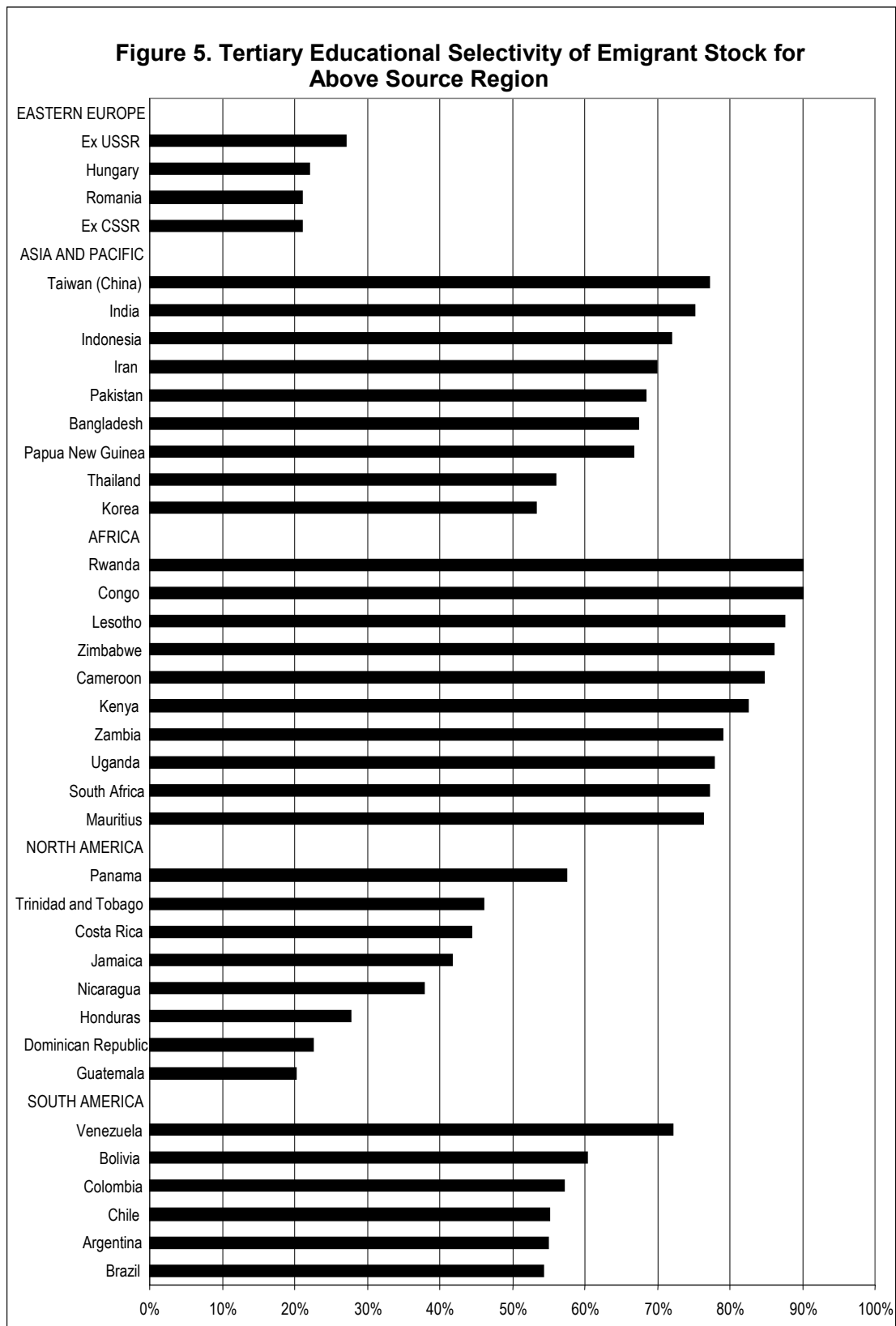
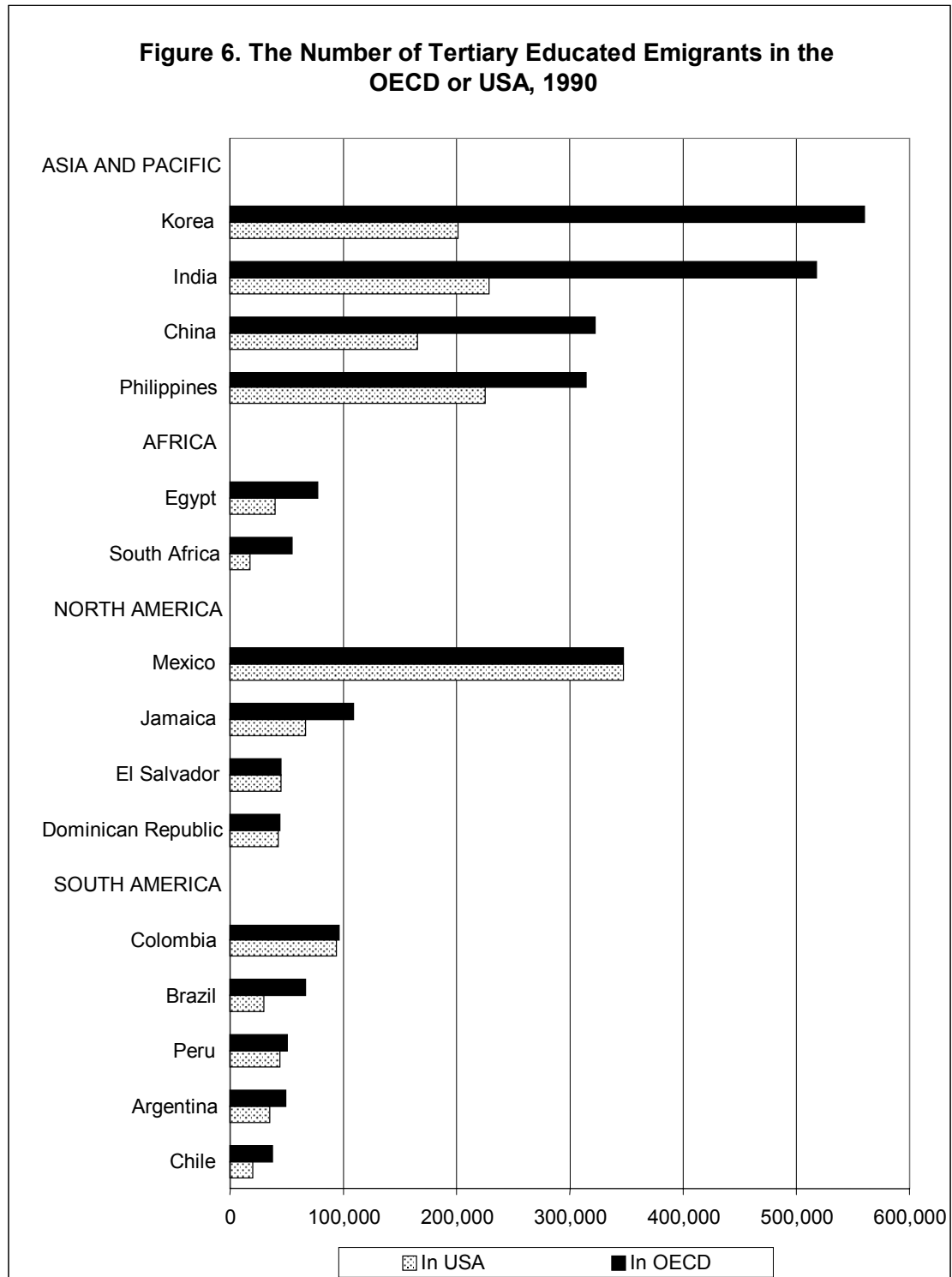


Figure 6. The Number of Tertiary Educated Emigrants in the OECD or USA, 1990



The largest numbers of skilled persons outside of their region are from Asia. They comprise about half of all tertiary educated immigrants in the U.S. and about two-thirds of those in the OCED. The next largest emigrant populations are from North America, then South America, followed in distant third place by highly skilled emigrants from Africa.

2.6. Summary of the demography of the brain drain

We have examined the only available data that measures the brain drain for a large sample of countries. Unfortunately, the data refer to 1990, more than a decade ago and before significant upswings and shifts in the levels of international mobility. But this is the only data available and it offers insight into the variation that occurs across regions and countries. It goes some way toward giving the reader a seat-of-the-pants feel for the extent of brain drain and the potential scope for adverse effects.

Most importantly, the estimates demonstrate that even without further investigation into all the economic factors that might offset it, the “brain drain” is a likely reality for many countries. Losses of 10 to 30 percent of the tertiary educated subpopulation are significant on the face of it. While the upheavals experienced by Iran or El Salvador may readily explain losses of such magnitude, in other instances, such as Korea or Ghana, other factors must be contributing to the outflows. There is little doubt that blanket statements about brain drain are not warranted, but that there is equally little doubt that the problem may well be faced by many developing countries.

3. Economic Research on the Brain Drain

Most of the work by economists on the brain drain has departed from theoretical assumptions about the factors that drive national economic development. As we shall see, there is general consensus that the emigration of highly educated persons will result in a slowing of economic growth for the source country (and a boost for the receiving country). Yet, the literature suggests that source countries can effectively respond with appropriate educational policies and even that an optimal level of brain drain is possible.

3.1. Three waves of research: No effect, negative effect, big negative effect

The economic literature on the Brain Drain has gone through at least three major iterations: a neoclassical set of models that found little adverse global effect, an extension of the basic models that finds adverse effect at least for the emigration source countries, and a decade-old “new growth” theory that finds more significant adverse effects. To a large extent the first two waves fall into the same general theoretical camp, but they make different assumptions about the functioning of the economies involved. New growth theory holds that the cumulative effects of human capital on national development are much greater than those assumed by earlier theorists.

Initial models assumed perfect competition, perfect information, and full wage flexibility. The conclusion was that small amounts of highly skilled emigration would leave the economic welfare of the remaining population unaffected (Johnson 1967; Grubel and Scott 1966). After

all, if the highly skilled emigrant removed only their personal marginal product, then the remaining population would be essentially unaffected by a reduction in the skilled labour force. At the same time, the worker by maximizing their income increases global income. Further extensions of this line of work conclude that as long as capital is internationally mobile it will equalize returns to changes in factor proportions (Berry and Soligo 1969).

A body of work quickly evolved in response to these early studies contesting their conclusions. At that time, Bhagwati (1987) identified two camps of thought about the brain drain, e.g., that of “benign neglect” and “malign neglect.” The former analysts look for how all parties to an economic transaction gain. They argue that emigrants are rational actors seeking the best working situation that they can and that they earn more by doing so. In fact, if they remain they often face unemployment or, at least, underemployment with corresponding lower earnings and productivity than possible. So their emigration serves as a “vent-for surplus” and ultimately raises global incomes and welfare. If they had remained in the source country there would have been a misallocation of skills. But the “malign neglect” camp might point out that because developed economies cannot absorb all possible highly-skilled emigrants, the resulting over stimulus of a source country supply of highly skilled workers may actually increase rates of underemployment in source countries. There is no easy resolution of these overly simple competing possibilities.³

The modifications of the original neoclassical models suggested that differing assumptions would, indeed, generate economic losses, at least for the country sending the emigrants. Loss of welfare for the remaining population can occur if there are externalities due to a loss of scarce skills. For large (finite) rates of emigration the models could be shown to generate losses for the remaining population. If the social marginal product of a highly skilled emigrant is greater than their own personal marginal product, then the remaining population loses out (think medical doctors or renowned researchers). And, finally, source governments lose both their initial educational investment in the highly skilled emigrant, as well as their downstream taxes (Bhagwati and Hamada 1973:103).

Since the mid-1980s “new growth” or “endogenous growth” theories highlight the cumulative value of human capital in economic development. Yes, the value of human capital has been known for a long time, but this change in perspective stresses that the average level of human capital in a society has positive effects on productivity of an individual worker above and beyond their own personal endowment of human capital. The greater a country’s average level of education, the greater its economic growth (Lee and Barro 1993; Barro and Sala-I-Martin 1995). More skilled workers permit countries to lower their production costs and be more competitive. Indeed, one study of 111 countries 1960 to 1990 found that a one-year increase in the average education of a nation’s workforce increases the output per worker by between 5 and 15 percent (see ILO 1998; Topel 1998).⁴

One way in which this works is through so-called externalities or consequences of the application of human capital to production (Straubhaar 2000). The skills of an individual are bound up in that person and when they move they, in a sense, simply redistribute the skilled labour that employers choose from. However, the knowledge that is produced by skilled individuals, say in R&D activities, can be protected through patents and can be generally applied by others. It is a fact of knowledge creation that it appears to be geographically concentrated say in advanced economies or local areas like California’s Silicon Valley.

Thus, receiving countries in particular benefit from increased knowledge gained from highly skilled immigrants. In the process, permanent emigration of the highly skilled creates a core-periphery phenomenon. Underdeveloped countries lose knowledge and income growth to core countries that, in turn, gain an ever-larger stock of skilled workers and knowledge.⁵ Capital investment and productivity can decline in the source country while incentives increase for emigration to the advanced economy.⁶ A vicious cycle can result.

3.2. Brain drain and education

One danger in tax-supported education in source countries is that it may accelerate high skilled emigration. Highly skilled domestic workers will choose to emigrate to earn more abroad and, in the process, if they are among the more able, their replacement workers may be less productive. Increasing the number of tertiary educated domestic workers leaves governments open to the possibility that they lose ever more of their investment in education (Bhagwati 1976).

One endogenous growth model looks at the decision to pursue education under conditions where it is possible to get higher wages in foreign labour markets with intermediate assimilation costs (Haque and Kim 1995). The results show that human capital flight reduces the average level of human capital and the growth rate, and level of, per capita income. In exploring policy responses, the model shows that educational subsidies for tertiary education prepares more domestic workers to be competitive abroad and can increase high skilled emigration. In an open economy the educated are more likely to emigrate; therefore, policy should focus education on primary and secondary education.

Another endogenous growth model also finds adverse effects of brain drain and advocates an educational response (Wong and Yip 1999). If human capital accumulation rates are already low, brain drain reduces the discounted lifetime income or utility of those who remain. Simply put, brain drain reduces the wages of the unskilled, as well as GDP growth, although it increases the wages of the high skilled who remain. The model indicates, however, that government expenditures on education can offset these effects. In particular, it is recommended that increasing the ratio of source country educators to students will lead to an increase in skilled wages and a reduction in unskilled wages, while reaching a balanced growth path.

Yet another economic analysis finds that development is mostly affected by secondary education and more, not primary education (Hague and Aziz 1999). And as the public sector employs much of the stock of higher educated domestic workers in developing countries, the competitiveness of public sector jobs is an important factor in retaining highly skilled workers. The already low level of public sector education has dropped in Africa over the past three decades, due to compressed government wages and human capital flight. Much of this is the result of “1st generation” public sector reform. Government funded education and increases in public sector wages are needed to stem the brain drain.

3.3. Optimal brain drain

More recently a few economists have advanced theoretical models to support the notion that—given levels of skilled emigration that are not too large—a brain drain can generate positive

outcomes for source countries. The general notion is that the higher earnings available abroad can serve to stimulate domestic workers to acquire more education in expectation of emigrating.

An initial study along these lines compared a hypothetical situation where a source economy was closed to emigration with one where emigration was possible (Stark, Helmenstein, and Prskawtz 1997). The exercise indicates that greater opportunities abroad create incentives whereby the source country can end up with a higher average level of human capital per worker.

If no emigration were possible, then domestic workers are not as likely to pursue higher education. The possibility of emigration affects the structure of incentives: higher returns to skills in the foreign country influence decisions about skill acquisition at home (Chau and Stark 1998). The opportunity to migrate abroad and earn more can stimulate individuals to pursue higher education in their home country (Beine et al. 1999; Mountford 1997).

If emigration is possible, albeit not for everyone, then it may spur individuals to pursue education in the hope of emigrating and to increase their expected earnings. One economic model of the effects of emigration on productivity suggests, even when average productivity is a function of past levels of human capital, that at some level of skilled emigration the share of skilled remaining in the source country increases (Mountford 1997). As the incentives to pursue education in the source country are enhanced, average human capital is increased and, therefore, overall source country growth can be stimulated.

Along these lines of thought is the notion that there may be an optimal level of emigration or a “beneficial brain drain.” Closure to emigration generates fewer stimuli to pursue education, but an excessive level of skilled emigration may deplete the stock of skilled workers faster than it can be regenerated. In these economic models there is a “right” level of highly skilled emigration that triggers favourable outcomes. Empirical analysis offers some support for these theoretical expectations (Beine et al. 1999). This is a promising line of thought because if there is an optimal level of emigration that stimulates the pursuit of higher education in source countries, and spurs economic growth, then governments should choose to take advantage of emigration.

3.4. Institutional effects on brain drain

Many modifications are made to the interplay of various economic factors that economists introduce into their models of brain drain. However, and despite heroic efforts to introduce “real world” considerations into the models, the complexity of the real world is bypassed in critical ways. Bhagwati’s (1976) analysis notes that labour market conditions (wage rigidities, emulation effects, etc.) make brain drain a factor only for given countries and/or occupations. Institutional conditions in one country may foster the “optimal” response of inducing domestic students in one country to pursue higher education with an eye to emigrating abroad. In another country, educational opportunities may be too limited to permit even the most ambitious of would-be emigrants to attain the minimal education to make them a viable job candidate (or graduate student) in a developed country.

3.5. Summary of the direct impacts of a brain drain

The earliest literature on the brain drain found little reason for concern: global welfare is raised by the rational choice of highly skilled emigrants to seek improved incomes abroad (Johnson 1967; Berry and Soligo 1969). However, subsequent work recast the assumptions of the first analysts and agreed that neoclassical models of economic development generated an expectation that brain drain has adverse effects for sending country development (Bhagwati and Hamada 1973). In particular, brain drain slows economic (GDP) growth and adversely affects those who remain, in particular low skilled workers. As a consequence poverty and inequality are likely to increase.

More recent versions of economic theory, a.k.a. new or endogenous growth theory, also typically generate expectations that high skilled emigration reduces the growth rate of sending countries (Hague and Aziz 1999; Wong and Yip 1999). Reductions in the average level of human capital have been shown to slow economic development; these models generate even greater estimated losses than the neoclassical models (Straubhaar and Wolburg 1997). Brain drain unambiguously reduces economic growth. Further, it reduces the wages of the unskilled population, likely increases the wages of remaining skilled workers, and hence increases inequality. By extension there is a double whammy on poverty, the after effect of both increased inequality and slower economic growth.

At the same time, another theoretical variant finds that at some optimal level of emigration, more than none but not too much, sending countries actually benefit (Beine et al. 1999; Mountford 1997). The possibility of emigrating to higher wage countries may stimulate persons to pursue higher education in the hope of improving their expected wages abroad. This can increase the average level of education or human capital available to developing countries and spur economic development.

Even more problematic to sweeping statements about brain drain, it seems clear that true long-term detrimental effects are unique to particular countries where the situation abets the fundamental problems that led to the brain drain in the first place. Absolute or percentage loss of highly skilled emigrants may be key, but so too may be the relative quality or productivity of those who emigrate and remain abroad (Hamada and Bhagwati 1987). Whether or not there are significant adverse effects may depend on the degree to which source country wages are flexible, and this may even vary by occupational categories. In short, institutional factors mean that the direct effect of brain drain needs to be evaluated on a case-by-case basis and it should consider several aspects of the phenomenon.

4. Feedback or Offsetting Effects

Of course, there may be economic offsets that redress the effects of brain drain. Technology transfers from host to the source country can stimulate host country growth; these are likely increased by sustained contact or return. Contact can foster changes in thinking. Return brings that possibility, along with the often times increased productivity of the returnee, e.g., skill improvements from employment abroad. There are also remittances and foreign investment generated by high-earning emigrants abroad.

4.1. Return migration

There is the possibility that temporary emigration may be the best of all in an “optimal brain drain” world. Domestic workers may pursue higher education in the hopes of going abroad if the emigration is possible. And if they return they can increase source country average productivity, especially if the worker returns after gaining experience and skills in a more advanced economy (Mountford 1997). This is a standard observation, but one that is rarely substantiated with empirical data.

Many observers believe that rates of return are high enough to warrant dispensing with the term brain drain all together; they prefer the term “brain circulation” or “professional transience” (Johnson and Regets 1998; Appelyard 1991). Research on U.S. foreign doctoral students in science and technology fields indicates that about half intend to stay in the United States, so about half leave. In 1995, five years after graduation 47 percent were still working in the United States on average. This varied widely from about 11 percent of Koreans remaining five years after graduation, to 30 percent for Mexicans, 59 percent of the English, to 79 percent of Indians, and 88 percent of Chinese (Johnson and Regets 1998). It is also estimated that about half of those admitted under the U.S. temporary high skilled program to meet shortages in high end occupations ultimately remain in the United States as permanent residents (Lowell 2000).

Nonetheless, its not clear why “about half” is considered a reasonable threshold to claim a lively rate of return circulation, and the wide variation on a per country basis makes the blanket claim a bit suspect. Furthermore, and especially given country variation in return rates, the nature of who returns raises the question of a double selectivity in international mobility. Researchers agree that migrants generally, and international migrants in particular, are “selected” in the sense that they are more able than the population that remains in source countries. This can be seen in that the poorest rarely emigrate or, as shown in this paper, the better (tertiary) educated are over represented among international migrants.

But once having emigrated, who returns to their country of origin? One line of thought is that return migrants will in fact be “selected” to be among the more able of the emigrant populations. Especially in developing countries where inequality is great, the best qualified return migrants stand to command the greatest income. Lesser qualified emigrants may choose to stay abroad in the developed receiving country because the wage differential for returning is not as great as that for their more able countrymen. This implies that the initial brain drain is somewhat mitigated through the selection of the most able return migrants.

But what if the best emigrants are the least likely to return? One economic model addresses this issue looks at the choice to emigrate and to return (Lien 1987). It assumes that the quality of a university should signal employers about the quality of workers who graduate from it. But source country employers do not know how to evaluate the quality of their nation’s emigrants. Therefore, returnees may be paid less than their full value and the highest ability emigrants face the steepest wage penalties and would be least likely to return. This model suggests that return migrants may not be of as high a quality as those who remain abroad. This type of “creaming” of the best who stay abroad means that effect of return migration is attenuated.

Nevertheless, some economists argue that return migration may be more effective in boosting development and wages than foreign assistance, at least when core economy experts run development programs at the expense of the employment of local workers. The degree to which this is the case depends upon the relative growth of core versus periphery economies, but generally “emigrant consultant advice” is a poorer response than policies of repatriation (Haque and Kahn 1997). Highly paid emigrant workers in source countries distort the wage structure and create incentives for emigration of local skilled workers. For example, there are now 100,000 foreign consultants in Africa who it is claimed distort local wages (Haque and Aziz 1999). The model indicates that employing developing country nationals (or returnees) at a higher wage would induce return migration, increase the *permanent* skill level of the source country, and increase source country growth.

4.2. Remittances by the highly educated

Highly skilled or not, most international migrants send money home to their family. There is a sizable literature on the impact of remittances but some ambiguity about whether or not remittances boost economic development. Beyond this literature, a few research efforts suggest that banking on the developmental impact of the remittances of just the highly skilled may not be wise. Yet, where remittances by the highly skilled may not be a general panacea, they may have specific value for developments in investment and banking.

Critical evaluations of remittances and development. There is a long-standing tendency to dismiss the value of remittances because the bulk of research demonstrates that they tend not to be spent on productive investments. Most remittances are spent either on basics like food or medicine, or on consumption goods such as televisions or clothing. While basic expenditures may help poor households, the purchase of consumption goods, it has been argued, stimulates imports and not domestic manufacturing. Critics charge that the manner in which remittances are spent does little to boost domestic production, employment, or exports.

Putting aside the issue of how remittances are spent, it is possible that they distort pricing mechanisms and may lead to inequality or uncertainty (Chami and Fisher 2000). Remittances to family members have typically been viewed as insuring the source country household against risk. However, in an equilibrium market, aggregate transfers affect the distribution of wages. As a result, remittances can increase the volatility of wages and “exceed the socially optimum level of transfers.” Research on rural villages that receive remittances has found that household inequality can be increased and that incentives to emigrate are enhanced.

On the other hand, more recent empirical literature finds that remittances have “multiplier effects” that work to increase national income. Someone has to provide food and televisions and, hence, increased money in the domestic economy stimulates local agricultural production and retail activity. Remittances introduce more money into the economy and jobs are created. These multiplier effects have been found to be quite substantial (Taylor and Adleman 1995).

The implications of this seem straightforward; more remittances should benefit the development process. But consider how the rural versus urban destination of remittances affects the consequences of remittances of the highly skilled. The remittance GDP multipliers are greatest when remittances flow into rural areas, not the likely origins of the most skilled emigrants. It is

more reasonable to assume that highly skilled emigrants originate in urban areas and that their remittances are sent back to family members in urban areas. Given this it seems likely that, even though the remittance multiplier is substantial, each remittance dollar from an unskilled emigrant yields a greater developmental multiplier than a remittance dollar from a highly skilled emigrant (Verhaal 2001).

What if highly skilled emigrants are not as likely to remit as lesser skilled emigrants in the first place? Unfortunately, there is very little study of the propensity of skilled emigrants to remit. In the context of a multivariate statistical analysis, an analysis of Latino remitting behaviour hypothesizes that characteristics that help a worker acculturate in the United States will reduce the likelihood of remitting (DeSipio 2000). In particular, more educated persons, those in skilled occupations, and those who speak English well, etc., should be less likely to remit. These hypotheses were supported in three different data sets and for six different Latino populations in the mid-1990s.

Each year of education reduces the likelihood that a Latino worker remitted by somewhere between 5 and 7 percent (DeSipio 2000).⁷ Indicators of acculturation including time in the United States, naturalization, political focus, etc., also significantly reduce the likelihood that a worker will remit. While it is reasonable to expect that more educated workers will earn more, and in turn would be more likely to remit, the regression analysis does not bear this out. Further, a multivariate analysis of Mexican household behaviour likewise found that the household head's education had no impact on the total dollar amount remitted (Taylor 2000).

In short, education tends to reduce the likelihood that a worker remits. This may bear out the hypothesis that highly educated emigrants are more acculturated into the host society and, hence, less committed to ongoing connections to the source country. It may also be that highly educated emigrants choose to move for more individualistic reasons than lesser skilled emigrants whose choices are more enmeshed in family and social networks. Low skilled workers may remit to honour obligations incurred through the social networks that prompted/supported their emigration in the first place. The families of highly educated workers may be less needy. And having independently financed their move in the expectations of higher wages, the highly educated worker may be more likely to keep their earnings. Either explanation fits well with casual consideration of the facts.

The upshot of this line of thought is that remittances, at least those of the highly skilled, may not be great enough to offset the economic development losses due to their loss. To date observers and researchers alike have failed to systematically distinguish between the massive international flow of remittances generally and the portion of the flow attributable just to the highly skilled. Playing this line of inquiry out suggests that high-skilled remitters do not generate uniquely high cash flows; just the opposite may be the case. While the multiplier effects of remittances may more than compensate for the loss of low-skilled workers, it may not compensate for the loss of the highly skilled.

One key study of the brain drain asks if the total flow of remittances, the combined contributions of low- and high-skilled emigrants, offsets in particular the economic effects of a brain drain. That empirical analysis compares neoclassical and endogenous growth models using data for the emigration of Eastern Europeans to Germany in the early 1990s (Straubhaar and Wolburg 1998).

Data from the Eurostat Labour Force Survey indicate that a fairly high share of the outflow was indeed fairly skilled. Both a neoclassical and an endogenous growth model find that the loss of human capital adversely affects GDP in the Eastern European source countries. However, the statistical results indicate that total emigrant remittances do not offset the economic development loss caused by the brain drain.

Possible special characteristics of high-skilled remitters. At the same time, the story may not be quite that simple. In the absence of hard data to the contrary, and with suggestive data to hand, we can propose avenues through which the remittances of the highly skilled favourably impact source country development.

In the first place, whether or not remittances return to rural or urban areas, recent economic thinking on their multiplier effect indicates positive increases in GDP. And the Eastern European study reviewed above only considers the monetary offset of remittances against estimates of monetary losses due to brain drain. If a multiplier were incorporated into the model it is conceivable that the measured growth from remittances would more nearly offset the losses due to brain drain. The economic development impact of urban, high-skilled worker remittances may not be as great as that of rural, low-skilled worker remittances, but the combined multiplier is positive and significant.

Secondly, there may be unique attributes of the remitting behaviour of highly skilled emigrants. One thing is certain, highly skilled emigrants earn more than their low-skilled compatriots and the empirical data show that the likelihood of remitting, and the amount remitted, increase with emigrants' earnings (DeSipio 2000; Taylor 2000). So while relatively fewer highly skilled emigrants remit, when they do remit they may well remit larger amounts.⁸ Larger sums of money permit a wider range of expenditures at home and a greater level of expenditure on the goods that generate multiplier effects throughout the economy.

A wider range of expenditures can translate into the more productive uses of remittances. This may happen in a few ways. After spending on foodstuffs, medical care, and other household basics, there may be more money left over to place in savings or in investments. As for savings, we do not know the savings propensity of highly-skilled emigrants, but among Latinos we know that only about 2 percent of remittances ends up in savings (DeSipio 2000). At the same time, out of U.S. savings later transferred to Mexico about half is put into investments or used to pay down debt.

Compared with the large share of "unbanked" low-skilled emigrants, and especially that of their families in the source country, the highly educated are likely to use banks and are; therefore, more likely to place their earnings in savings. This is likely to be true both of emigrants while in the host country, as well as for their families in the home country.⁹ Thus, the remittances of the highly skilled may flow through the formal banking sector and be associated with higher rates of savings and interest income. Credit ratings and access to loans become possible. Foreign currency accounts in source countries, that permit emigrants to bank in more stable U.S. dollars or whatever currency they are paid in abroad, are another likely formal avenue for savings that are attractive for highly skilled emigrants (Puris and Rizema 1999).

Further, highly skilled workers may be more likely to invest in their home country. While not technically remittances *per se*, one special example should be noted here; an investment that expresses some of the same motivations that drive remittances. For example, the Indian government spends time in the United States and elsewhere urging its professional emigrants to invest in Indian remittance-backed bonds. These bonds are marketed by Indian banks and they are capitalized on the future flow of remittance monies back to India. Such investment vehicles tend to be solely the preserve of highly skilled emigrants.

4.3. Technology / knowledge transfer

People move because they desire to exploit their best opportunities. Yet, having moved abroad they retain connections and networks back to their home country. Especially when these networks are fostered, they can yield a flow back of knowledge and new technologies that can boost migrant source country growth. “Technology transfer” is a little studied outcome of high skilled mobility, but one that theoretically can yield significant economic benefits (Bhagwati 1977).

Much of this happens because there is a natural proclivity for emigrants to maintain ties through human networks that return emigrants’ non-physical knowledge and investments to their source country. Whether emigrants are permanent or a short-to-medium term temporary loss, their backward linkages to their source country create opportunities to increase the available knowledge and technologies to boost productivity.

In many cases, especially in developing countries, expatriates themselves organize networks that stimulate return flows of knowledge and lead to collaborative ventures between home-country academics and expatriate researchers (Kaplan 1997). The Internet has played a key role in this regard and 41 new e-based expatriate networks were founded during the 1990s in a variety of receiving nations. Apparently, most were founded during autonomously, they began spontaneously and independently of each other (Brown 2000).

The degree to which these diaspora networks of expatriates boost economic growth, no quantitative or comparative research exists. Still, human resource development is one of the keys to economic development and policies that strengthen educational institutions will have a beneficial long-term impact. Certainly, research indicates that cooperation in academic and research settings improves the conditions for economic growth in developing economies (Smallwood and Maliyamkono 1996). Many observers presume that knowledge or technology transfers are a primary way for developing countries to benefit from high skilled emigrants (Teferra 2000).

Otherwise, concerns have been raised about private sector technology transfer. In principle, multinational corporation (MNCs) established in developing countries could be a significant means by which knowledge is transferred. However, neither MNCs nor broader development projects readily generate value added or interject gains in technology to the local economy. Either information is kept proprietary, or gains are transferred first to the MNC’s host country (e.g., developed economies), or local workers are not hired such that the domestic labour force experiences little net improvement (Findlay 1987; Salt and Findlay 1989). Clearly, technology

transfer outside of academic markets or expatriate networks requires active corporate or government policies.

4.4. Flows of international migration and trade

Emigrants may stimulate trade with their country of origin. Clearly, as long as they retain preferences for the goods they grew up with they are likely to import items they know. One Canadian study found, over the 1980s, that a 10 percent increase in the number of immigrants from a given country was associated with a 1 percent increase in exports to and a 3 percent increase in imports from that country (Head and Ries 1998). While not finding a correlation between immigration and year-to-year changes in exports or imports, research by the OECD on immigrants in three key receiving nations and their leading source countries found a long-term increase in exports and imports between them over the 1980s (Stalker 2000).

4.5. Summary of feedback effects

There may be any number of offsetting effects on the direct effects of the brain drain. Return migration, in particular, can re-supply the highly educated population in the source country and, to the degree that returned migrants are more productive, they further boost source country productivity. Technology transfer is another important outcome of brain drain; only it implies not the return of people but the infusion of new ideas and investment in the source country by its skilled emigrants. Many claim that these transfers can be as, if not more, important than the physical return of expatriates.

Otherwise, research indicates that international migration flows are associated with increases in international trade (exports and imports) between a developing country and the industrial country that receives their emigrants. Its not certain that highly educated immigrants are more important in this regard than lesser skilled emigrants, but in principle it makes sense that this might be the case. A careful study of the flow of highly skilled persons between major cities around the globe suggests that those international flows are closely linked with links of history and trade between migrant source and receiving countries.

Emigrant monetary remittances to their source countries are often cited as potentially important stimuli to economic growth. But while remittances may offset the adverse effects of a brain drain, they do not change the underlying and ongoing effects themselves (Hague and Kim 1995). There is a lack of rigorous study of the behaviour and consequences of remittances by highly educated emigrants. Yet, the implication of the literature review undertaken here suggests that the highly skilled do not make unique contributions to remittances that mitigate brain drain effects. It can be inferred that the highly skilled may be less likely than their lesser skilled compatriots to remit and that total remittances are unlikely to compensate source countries for economic losses due to a brain drain.

Yet, there may unique characteristics of the financial behaviour of highly skilled emigrants. They are more likely to be banked and, hence, there are more likely to save and there are more able to access loans. Such behaviour generates greater resources and, to the degree that the same characteristics typify the families whom they remit to, the effect of high skilled remittances may be significant. The propensity to channel monies through the formal market also mean that

highly skilled emigrants are more likely to invest in instruments like remittance backed bonds, to place their savings in foreign currency accounts, or invest directly in their home country.

5. Conclusions

Ultimately, the empirical literature on the brain drain is disappointing in the sense that much of it depends upon the assumptions of theoretical, albeit mathematically sophisticated, economic models. Empirical analysis or the modelling of statistical data is relatively rare. And to cap it all, the offsetting, cumulative effects of ongoing contact, return, transfer, and investment are generally not included in the theoretical literature, much less are they well-documented or measured making any assessment difficult.

At the least, it can be concluded that the direct impact of significant outflows of highly educated persons (sic brain drain) is to reduce economic growth in the source country. Table 1 shows the Pearson correlations for the relationship between the measures of brain drain in 1990 reviewed above, i.e., the cumulative percentage loss to a country of its tertiary educated population, and tertiary selectivity or share of emigrant outflow. These measures are negatively associated with the prior decade's change (1980-1990) in per capita income for the 56 countries in the dataset.¹⁰ Admittedly, these measures are problematic in that they are likely to contain a fair amount of error and, as important, they are measured only in the cross section and there is no control for confounding effects. But the sign is clear: tertiary and secondary losses reduce economic growth as hypothesized and, surprisingly, losses of primary educated persons are associated with increased growth.

Table 1. Correlations between brain drain and economic growth

	Change in GDP per capita 1980 to 1990
Cumulative Loss:	
Tertiary Loss	-0.13
Secondary Loss	-0.20
Primary Loss	0.04
Emigrant Selectivity:	
Tertiary Selectivity	-0.03
Secondary Selectivity	-0.12
Primary Selectivity	0.22

The analysis becomes more problematic if one considers the many feedback effects generated by high skilled emigration. Economists prefer to look at multi-generation outcomes whereby source countries benefit from skilled emigration because it induces the remaining native population to pursue higher education. These types of models tend to generate positive economic growth downstream after an initial "brain drain" and suggest that there exist "optimal" rates of brain

drain. Yet, most models do not include a range of fuller possible and less direct feedback effects: return of expatriates with enhanced knowledge, return of the knowledge of expatriates (technology transfer but no bodies), remittance flows by emigrants abroad, investment by emigrants abroad, or the stimulation of trade.

Clearly, there is a balancing act. A brain drain is only a brain drain if significant human resources are irretrievably lost, and if those resources could have profitably been used in the migrant source country, and to the degree to which feedback effects are strong enough to offset the initial loss. Whatever the average results for a comparative dataset of countries, certainly these determinations must be made on a regional and even country-by-country basis.

Consider the data analysed in this paper. Just five countries fit all three ways of gauging the extent of brain, e.g., above average rates of cumulative loss of tertiary educated persons, above average rates of tertiary educational selectivity in emigrant outflows, and a dominant share of a region's numerical outflow of tertiary educated persons: Korea, South Africa, Dominican Republic, Columbia, and Chile. Korea would appear to have clearly benefited over the long run from its highly skilled emigrant population, although recent increases suggest ongoing evaluation. South Africa has serious concerns about its outflow, many of which appear legitimate, but alternative policies are being considered to recruit from abroad and the longer-term outcome is unsure. At the least, South Africa's economy faces other significant challenges. That can certainly be said of Columbia, as well as the Dominican Republic, or Chile.

As a final consideration, the existence of feedback effects gives policymakers tools that they can use to address the adverse impacts of brain drain. The literature implies general tools at their disposal, e.g., immigration policies that simultaneously facilitate international movement while encouraging return, as well as more general economic and educational aid projects that boost economic development. Otherwise, the implications of this review are that policies may need to be tailored on a region-by-region, or country-by-country basis. Relatively low cost policies may yield significant results, e.g., projects that enhance knowledge transfer to developing countries using Internet technologies for information exchange and job listings. Cooperative educational ventures are another possibility. But casual dismissal of brain drain realities is not in order. Policymakers in both source and receiving countries should examine the balance sheet implementing policies that ensure that feedback effects net a positive return to both parties over the longer run.

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Endnotes

¹ This tripartite breakdown is chosen to correspond with estimates by Barro and Lee (1993) of the size of the source country subpopulation in each of the three levels of education.

² For the 5 countries dropped from the data shown here the ratio of tertiary emigrants to the subpopulation of tertiary educated persons in the source country exceeded 100. This likely reflects the fact that the flow to the U.S. from these countries is more skilled than that to the OECD generally; hence, using the U.S. tertiary share as a proxy overestimates the OECD emigrant total. For the remaining countries the difference is small between the “low” and “high” estimate (e.g., when the denominator is OECD plus source country versus just the source country).

Therefore, I prefer to present the median to simplify the discussion (the only exception is Jamaica where the “low” estimate is used), while acknowledging that the estimates use proxy information and are have an unknown degree of error.

³ Here, Bhagwati (1987) is referring to numerically restrictive immigrant admission policies in developed countries of which he is critical.

⁴ Of course, international mobility of labor may also speed the rate of convergence of per capita incomes globally (Baro and Sala-I-Martin 1995).

⁵ The core-periphery observation can also be made about rural to urban area differences within developed or industrially advanced countries.

⁶ From this vantage, the flight of human capital is somewhat analogous to the loss of physical capital in response to perceptions of domestic versus foreign investments. Capital flight can lower domestic growth (Khan and Haque 1985).

⁷ Given average levels of education of between 8 to 10 years in these populations, this suggests that college educated emigrants are 30 to 56 percent less likely to remit any amount of money than otherwise similar low-skilled emigrants. At the same time, the Latino populations vary in their propensity to remit, between 60 to 70 percent of individuals report remitting (DeSipio 2000). Thus, compared to emigrants with the same years in the United States, English ability, earnings, etc., only about 5 to 40 percent of the college educated would remit at all.

⁸ Note, however, that DeSipio’s (2000) found that the greatest likelihood of remitting was for the “middle” income grouping and there is a steep fall in the likelihood of remitting among both low and high income groups. This does not negate the logic presented here, but it lessens the possibility of markedly larger remittance amounts from the highly educated in Latino populations.

⁹ Note that it is estimated that 70 percent of Mexicans are “unbanked,” e.g., they deal solely in a cash economy. Those who use banks are overwhelmingly the highly skilled and urban populations. Efforts to bring the low skilled into the banking sector, drawing in part on the flow of remittances, focus on “micro-financial” institutions (ILO 2001).

¹⁰ The Eastern European countries are not included here.

Contributors
(contact details)

B. Lindsay Lowell
Director of Research
Institute for the Study of International Migration
Georgetown University, Box 579400
Washington, D.C. 20057-9400
lowellb@georgetown.edu

Current Address

B. Lindsay Lowell
Director of Research
Pew Hispanic Center
1919 M Street, NW Suite 460
Washington, DC 20036
(202) 292-3302, -3300; fax: 785-8282
lowellb@pewhispanic.org
www.pewhispanic.org

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