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## Emigration and Brain Drain: Evidence From the Caribbean

*Prachi Mishra*



## **IMF Working Paper**

Western Hemisphere Department

### **Emigration and Brain Drain: Evidence From the Caribbean**

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#### **Abstract**

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This paper quantifies the magnitude and nature of migration flows from the Caribbean and estimates their costs and benefits. The Caribbean countries have lost 10–40 percent of their labor force due to emigration to OECD member countries. The migration rates are particularly striking for the highskilled. Many countries have lost more than 70 percent of their labor force with more than 12 years of completed schooling—among the highest emigration rates in the world. The region is also the world’s largest recipient of remittances as a percent of GDP. Remittances constituted about 13 percent of the region’s GDP in 2002. Simple welfare calculations suggest that the losses due to high-skill migration (*ceteris paribus*) outweigh the official remittances to the Caribbean region. The results suggest that there is indeed some evidence for brain drain from the Caribbean.

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## I. INTRODUCTION

While a vast theoretical and empirical literature considers the impact of immigration on destination countries, little work has been done on emigration and its impact on source countries.<sup>2</sup> This is surprising because the shares of the labor force leaving many individual source countries is considerably higher than the proportionate changes in the labor force of many receiving countries due to immigration.

In several source countries, the reduction in the labor force due to emigration to the United States is in the range of 7–27 percent. To cite a few examples, the labor force in Mexico, El Salvador, and Jamaica has been reduced by more than 10 percent due to emigration to the United States between 1970 and 2000. There are countries like Turkey and Algeria where the labor force has been reduced by about 10 percent due to emigration to Western Europe.<sup>3</sup> In comparison, immigrants constitute about 12 percent of the United State labor force (Davis and Weinstein, 2002). Immigration is considered to be a very important issue for the United States, and has attracted a great deal of attention in the literature.

Given the comparable magnitudes of emigration, it is surprising that there is little empirical research evaluating the impact on source countries. Some recent papers look at the impact of emigration on source countries.<sup>4</sup> This literature focuses mainly on large countries (like Mexico). A very important region that has eluded this literature is the Caribbean. This paper quantifies the magnitude and nature of migration flows from the Caribbean and estimates their costs and benefits.

The Caribbean region is an excellent case to study the effects of emigration as it has the highest emigration rates in the world. Docquier and Marfouk (2005) have documented the shares of the labor force in several source countries that have emigrated to Organization for Economic Co-operation and Development (OECD) member countries.<sup>5</sup> About 12 percent of the labor force in the Caribbean region has migrated to OECD member countries—much higher than Central America which ranks second at 7 percent. In terms of the absolute number of migrants, emigration from India and China, for example, is much greater, but their labor force is so large that the migrants constitute a very small proportion of the labor force.

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<sup>2</sup> See Borjas (1994, 1995) and Friedberg and Hunt (1995) for surveys of the empirical literature. The theoretical literature on international movement of factors includes, for example, Bhagwati and Hamada (1974), Rivera-Batiz (1989), and Quibria (1989).

<sup>3</sup> There is also substantial migration to the Persian Gulf region from many countries that has not been well documented. Sources: U.S. Census; OECD Migration Statistics; and World Bank, World Development Indicators.

<sup>4</sup> See Mishra (forthcoming), Hanson (2003), Hanson et al. (2002), and Desai et al. (2002).

<sup>5</sup> The OECD member countries include industrial countries and emerging markets like Mexico and Turkey. For the complete list of OECD countries in the dataset, see Docquier and Marfouk (2005), page 13.

The aggregate emigration rates, however, understate the loss of the educated population. The literature on immigration to the United States suggests that immigration has increased, by the greatest proportion, the supply of workers with 0–8 years of schooling (Borjas et al., 1997). However, there is a sharp contrast when we look at migration from the perspective of source countries. For most source countries and especially for the Caribbean, the percentage reduction in the labor force is much larger in the higher-schooling categories. A majority of Caribbean countries have lost more than 50 percent of the labor force in the tertiary education segment, and more than 30 percent in the secondary education segment (9–12 years of schooling). For example, the tertiary educated labor force (with more than 12 years of schooling) in Jamaica and Guyana has been reduced by 85 percent and 89 percent respectively, due to emigration to OECD member countries. Haiti has the lowest aggregate emigration rate (about 10 percent) in the region, but the tertiary-educated labor force has been reduced by 84 percent due to emigration to OECD member countries. In fact, almost all the Caribbean nations are among the top 20 countries in the world with the highest tertiary-educated migration rates (Docquier and Marfouk, 2005). The magnitude of these migration rates suggests that potentially emigration can have large impacts on the local labor markets and on the welfare of those who stay behind in the Caribbean countries.

The simple labor demand-supply framework suggests that changes in domestic labor supply and wages due to emigration lead to a net welfare reduction (termed an “emigration loss”) for the producers and workers who have stayed behind (Figure 1). The welfare loss occurs due to the movement of inframarginal workers (i.e., those who are paid less than their marginal product). The concept is analogous to the idea of immigration surplus that exists in the migration literature (Borjas, 1995). The concept was first given by MacDougall (1960) in the context of capital flows.

There are several other costs of high-skilled emigration. Highly-skilled workers often confer externalities to those stayed behind by affecting their productivity through transfer of know-how and also through better monitoring and motivation. If high-skilled workers confer a positive externality, then the loss due to their migration will be higher than the simple emigration loss. The *augmented emigration loss*—the emigration loss that takes into account the positive externality from the high-skilled labor force—is estimated in the paper. Another important consideration in assessing the costs of migration is the education subsidies that finance the education of the migrants. Governments in countries such as Barbados, Trinidad and Tobago, and Jamaica spend much more per capita on tertiary education than they do on primary and secondary education.

At the same time, emigration confers many benefits on source countries. One of the most important measurable “benefits” to the source countries are transfers from abroad or remittances. Most Caribbean countries rank among the top 30 countries in the world with the highest remittances as a percent of GDP. The Caribbean is the world’s largest recipient of remittances, as a share of GDP. Remittances constituted about 13 percent of the region’s GDP in 2002.

The main result in the paper is that the *total losses* due to skilled migration (which includes the “emigration loss,” externality effects, and government expenditure on educating the migrants) outweigh the recorded remittances for the Caribbean region on average, and for

almost *all* the individual Caribbean countries. The comparison of the welfare losses with remittances in this paper is subject to the caveat that the measurement of remittances is subject to data deficiencies. Most importantly, measured remittances do not include transfers through informal channels such as those carried by hand or by friends or family, or in-kind remittances of jewelry and consumer goods.<sup>6</sup>

The calculations in the paper are not sufficient to conclude one way or the other about the *overall* impact of emigration. Migration has many other costs and benefits, the measurement of which is beyond the scope of the paper. There are, for example, benefits to source countries because of the migrant networks. Migrant networks can lead to more trade and investment (Rauch and Trinidad, 2002). Emigration can also induce human capital formation in the source country by raising the expected returns from education (Beine et al., 2003). On the cost side, migration can result in a fiscal loss from the foregone tax revenue that would have accrued if the migrants had stayed behind (Desai et al., 2002). All these issues have been addressed in the literature, albeit separately.

There are broadly three strands of literature that are related to this paper. The first strand of literature consists of papers on immigration that quantify welfare effects of immigration into the United States, (Borjas (1995), Davis and Weinstein, (2002)). This paper uses techniques similar to Borjas (1995) study of immigration. In addition to the techniques used in the previous literature, this paper also includes the cost of education subsidies to the source countries in calculating the losses. The second strand of literature consists of recent papers that quantify the impact of emigration on source countries. These papers look at the impact on large source countries such as Mexico and India (Chiquiar and Hanson, (2005), Desai et al., (2002), Mishra, forthcoming)). One of the important regions that has not been included in these papers is the Caribbean. As argued above, the potential impact of emigration is likely to be large for the Caribbean countries. The third set of papers focus on migration from the Caribbean. The Caribbean countries have historically experienced large-scale migration. There are some papers that look at the history of Caribbean migration (Carlson (1994), Duay (1994)). Some papers also document the flow of remittances and discuss the potential impact (Wood and McCoy (1985), Samuel (2004), and Connell and Conway (2000)).

This paper is the first to quantify the welfare impact of skilled emigration on any source country, taking into account the external effects and the costs of education subsidies. This paper differs from the existing literature on Caribbean migration by bringing all three strands of the literature together using very detailed datasets. This paper uses a very detailed dataset compiled by Docquier and Marfouk (2005) on emigration rates, which they construct using census data from a number of OECD member countries. Since the United States is a major destination for Caribbean migrants, the emigration rate to the United States is also estimated separately, using data from the U.S. Census. Also, none of the existing papers on Caribbean migration have looked at the composition of emigration rates by skill level.

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<sup>6</sup> For details on issues regarding measurement of remittances, see IMF (2005).



The rest of the paper is organized as follows: Section II presents the theoretical framework for the welfare calculations, Section III discusses the data and the evidence on emigration from the Caribbean, and Section IV presents the results from the welfare calculations. Section V concludes.

## II. THEORY

The quantitative estimates of the gains and losses resulting from emigration must rest on prior conceptualization of these gains and losses. There are several costs and benefits of migration that accrue to both the recipient as well as source countries.

### A. Losses Due to Emigration: A Simple Labor-Demand Framework

The simple economic model of labor demand and supply is an important starting point to quantify the welfare implications and has been used in the literature in the context of immigration and capital flows (MacDougall (1960), Borjas (1995)). The aim here is to quantify the welfare loss due to movement of labor, everything else remaining unchanged.<sup>7</sup> Welfare is measured by GDP accruing to those who have stayed behind in the source country. Consider a single numeraire good whose production function is given as:

$$Q = F(K, L), \quad (1)$$

where  $K$  is the fixed factor assumed to be internationally immobile,  $L$  is the labor employed in production and  $Q$  is the gross domestic product. Figure 1 shows the simple model of labor demand and supply. The initial equilibrium wage is  $w_0$ . A large emigration flow of a magnitude  $M$  of workers reduces the labor force from  $(N+M)$  to  $N$ . The wage rate as a result increases from  $w_0$  to  $w_1$ . The workers who have stayed behind gain an area equal to  $w_0 w_1 ab$  (rectangle region  $A$ ), owners of the fixed factors in the economy lose an area equal to  $w_0 w_1 ac$  (rectangle region  $A$  + triangle region  $B$ ) and the country as a whole loses the triangle  $abc$  (region  $B$ ). The triangle  $abc$  (region  $B$ ) can be termed as the “*emigration loss*.” The emigration loss arises because the cost of employing the inframarginal workers who migrate is less than the value of their marginal product. The surplus on these workers is therefore lost due to emigration, which imposes a cost on those who have stayed behind.

Following Borjas (1995), the estimated welfare loss to the source countries as a percent of GDP can be expressed as:

$$\text{Emigration loss (triangle } B \text{ in Figure 1)} = (1/2)sem^2, \quad (2)$$

$$\text{Gain to the workers who have stayed behind} = sem(1 - m) \quad (3)$$

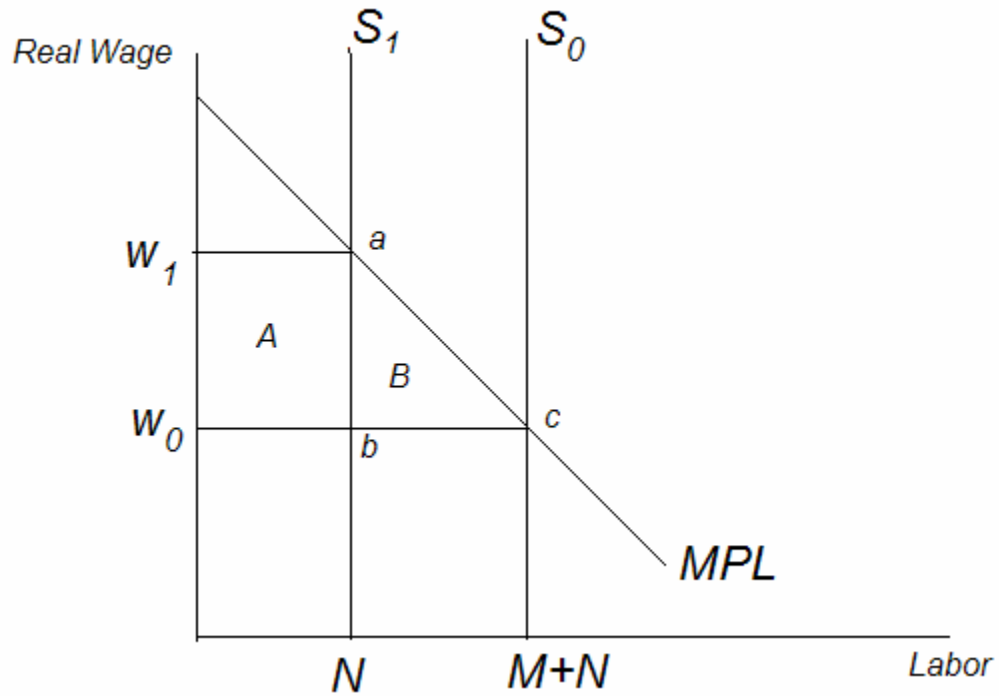
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<sup>7</sup> Davis and Weinstein (2002) simulate the welfare impact due to inflow of both labor and capital into the United States.

$$\text{Loss to the owners of the other factor} = sem(1 - \frac{1}{2}m) \quad (4)$$

where  $e$  is the magnitude of elasticity of factor price of labor (i.e., the percentage change in wage resulting from a 1 percent change in the size of the labor force),  $m$  is the fraction of the labor force that has migrated,  $s$  is the share of labor in  $GDP$ .

Figure 1: Labor Demand-Supply Model: Welfare Impact of Emigration



### B. Measurement of External Effects

Even if the triangle emigration losses are of second order, the overall emigration loss can be substantial if emigration leads to a decline in the productivity of those who have stayed behind. Qualified doctors, engineers, researchers are not only more productive themselves but are also expected to make other workers in the economy more productive. External effects have been considered important in the immigration literature. Borjas (1995) calculates the “immigration surplus” in the presence of external effects. Borjas finds that immigration surplus increases substantially in the presence of external effects. However, unlike Borjas (1995) which looks at overall immigration rate, this paper focuses on external effects due to high-skilled emigration.

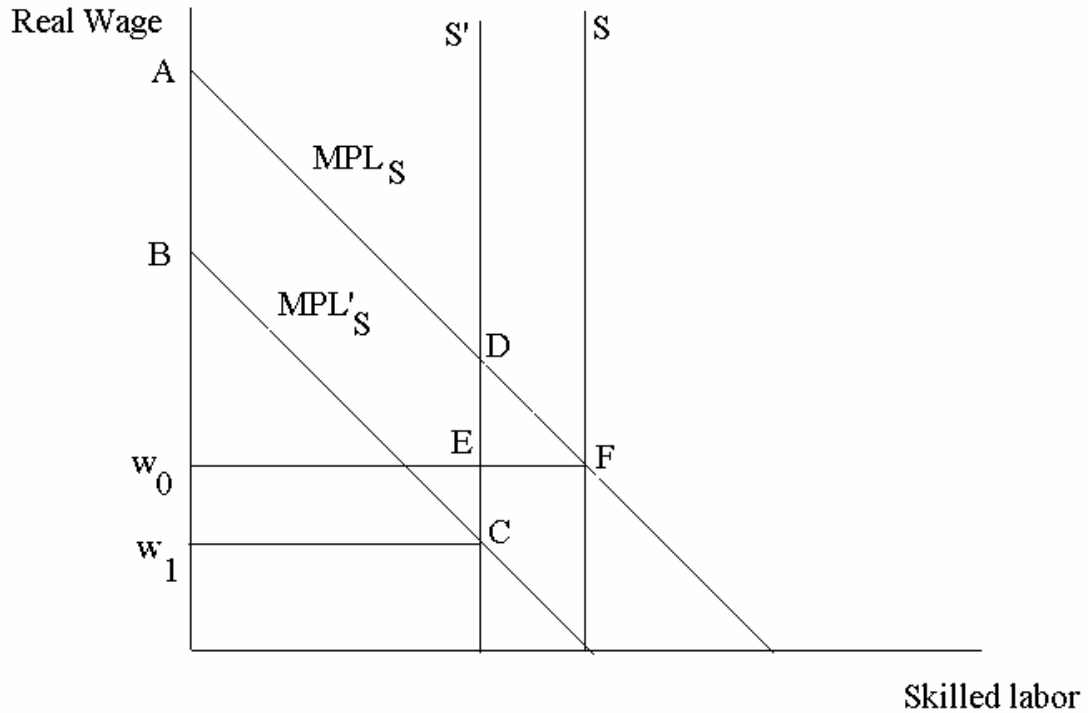
If skilled labor is complementary to the other factors, then the production function can be expressed as:

$$q = f(l_s, l_u) L_s^\gamma \quad (5)$$

where  $q$  is the representative firm's output,  $l_s$  and  $l_u$  are the skilled and unskilled labor employed by the representative firm,  $L_s$  is the aggregate stock of skilled labor employed in the economy, and  $\gamma$  is the percentage change in marginal product of skilled and unskilled labor due to a 1 percent change in the aggregate stock of skilled labor. As skilled migrants leave the economy, the marginal product of both skilled and unskilled labor decreases. With this production function that accounts for external effects, emigration not only reduces the supply of labor but also shifts the marginal product of labor curve inwards. The emigration loss is larger than that without incorporating external effects.

Figure 2 shows the emigration loss in the presence of external effects. The welfare impact of emigration of skilled labor is analyzed, assuming that only skilled labor moves. Emigration of skilled labor reduces its supply from  $S$  to  $S'$ . The marginal product of skilled labor also shifts from  $MPL_S$  to  $MPL'_S$ . The "emigration loss" is given by area ABCD plus triangle DEF. The area ABCD has been added to the emigration loss due to the external effects of labor employment. Emigration of skilled labor would also lead to a decline in productivity of unskilled labor (which is not shown in the figure).

Figure 2. Labor Demand-Supply Model: Welfare Impact of Emigration with External Effects



First, the loss due to emigration of skilled labor is calculated without incorporating external effects, and then augmented to include external effects.

The magnitude of the loss (as a fraction of GDP) without incorporating external effects can be expressed as

$$\text{Emigration loss (triangle DEF in Figure 2)} = \frac{1}{2} s_s e_s m_s^2 \quad (6)$$

The magnitude of the loss (as a fraction of GDP) including external effects is given as:

$$\text{Emigration loss with external effects} = \frac{1}{2} s_s e_s m_s^2 + \frac{\gamma s_s m_s}{1 - \gamma} (1 - s_s m_s) + \frac{\gamma s_u m_s}{1 - \gamma} (1 - s_u m_s) \quad (7)$$

where  $s_s$  and  $s_u$  are, respectively, the skilled and unskilled labor shares of national income,  $e_s$  is the magnitude of elasticity of factor price of skilled labor i.e., percentage change in wage of skilled labor resulting from a 1 percent change in the size of the labor force, and  $m_s$  is the fraction of skilled labor force that emigrates. The second and third terms denote the external effects on skilled and unskilled labor, respectively. The expression in (7) is similar to Borjas (1995) study of immigration.

Even if the triangle emigration losses are of second order, the overall emigration loss can be substantial if the external effects are large. The magnitude of the external effects in turn depends on the assumption about the elasticities. In order to calculate the emigration loss in the presence of external effects, we require data on elasticity of factor price of skilled labor and elasticity of marginal product of labor. Both these elasticities are difficult to estimate. The calculations in the paper have been made under varying assumptions on the elasticities.

### C. Education Cost of the Skilled Migrants

An important cost that emigration imposes on source countries (and estimates of which have largely been ignored in the literature) is the public expenditure on the education of migrants. This cost is particularly high for the tertiary-educated migrants in developing countries like Barbados, Jamaica, and Trinidad and Tobago (UNESCO, 2004).

The subsidy on education is generally rationalized as reflecting the gap between private and social costs of education—that is, educated citizens confer external benefits in the economy. As emigrants do not stay in the economy, the entire subsidy on their education could be treated as a social cost. The public expenditure on education of migrants is a loss to the source country, since there is an opportunity cost to this expenditure in terms of expenditure foregone or higher than necessary tax rates. There are many other costs of emigration which have not been considered in this paper. For example, emigration can result in a fiscal loss from the foregone tax revenue that would have accrued if the migrants had stayed behind (Desai et. al, 2002).

In order to place the estimated losses due to emigration in perspective, the next section discusses the different benefits from emigration to source countries and compares the calculated losses to a quantifiable benefit from migration—that is, remittances.

#### **D. Benefits of Emigration**

The most immediate benefit from emigration is the flow of remittances or transfers by migrants to the country of origin. Latin America and the Caribbean region is the largest recipient of remittances and also has the fastest growth in its receipts. In 2003, remittance flows exceeded combined flows of foreign direct investment (FDI) and official development assistance (ODA) to the region (Terry, 2004).

Several other channels through which emigration can benefit source countries have been identified in the literature. There are possible network effects of migration. Rauch and Trinidad (2002) have estimated large impacts of the networks in trade and FDI in a cross-section of countries.<sup>8</sup> In the long run, benefits from emigration can occur also from its favorable effect on human capital formation. Emigration, if it is biased towards the high skilled, can raise their relative wages and returns to higher education, and induce human capital formation. A positive probability of emigration to a high-wage country can also raise the expected returns from human capital accumulation and thus induce skill formation (Beine et. al., 2003).

### **III. DATA AND EVIDENCE**

#### **A. Measurement of Emigration Rates**

It is difficult to quantify the magnitude of emigration because source countries, in general, do not record information on those who leave. Emigration is measured by obtaining information on the migrants from censuses in recipient countries (see for example, Mishra (forthcoming), Docquier and Marfouk (2005), and Carrington and Detragiache (1998)).

Two sources of data have been used in the paper—(i) emigration rates to OECD member countries from Docquier and Marfouk (2005), who estimate the aggregate migration rates for a number of source countries in the world; and (ii) emigration rates to the United States using the data on migrants from the U.S. Census.

Emigrants to most OECD member countries are defined by their country of birth. For example, an emigrant from source country  $j$  residing in the United States is defined as a

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<sup>8</sup> Davis and Weinstein (2002) look at terms of trade effects of immigration into the United States. If migration from the Caribbean results in relatively higher reduction in factor supplies and output in the export sector, thereby reducing the supply of exports on the world market, then this can result in a terms of trade gain for the region. For the terms of trade gain to be significant in magnitude for individual countries, they should be large in an economic sense i.e., their demand and supplies should affect world prices. To the extent that Caribbean countries lack market power, we can assume this effect to be of a small magnitude for these individual countries.

person whom the U.S. Census counts as being born in country  $j$ . The migrants include naturalized citizens, temporary and permanent residents, as well as unauthorized migrants. Migrants to the United States also include asylum seekers who sought refuge from political turmoil, oppression and totalitarian governments.<sup>9</sup> The only exceptions are Germany, Greece, Italy, Japan, and Korea, where an emigrant is defined by citizenship.

About 95 percent of the Caribbean migrants enumerated in the 2000 U.S. Census arrived between 1965 and 2000. Detailed information on the year of immigration is not available for migrants to other OECD member countries. However, since the United States is the major destination for migrants from the Caribbean, one can argue that the biggest proportion of migrants to OECD member countries migrated between 1965 and 2000.

The emigration *rate* to OECD member countries is defined as the fraction of labor force having migrated to OECD member countries. It is expressed as

$$m_t^j = \frac{M_t^j}{M_t^j + N_t^j}, \quad (8)$$

where  $M_t^j$  is the number of migrants from country  $j$  counted in the receiving country's census at time  $t$  and  $N_t^j$  is the labor force in source country  $j$  at time  $t$ .

Emigration rate from country  $j$  in schooling category  $S$  is defined as

$$m_{t,s}^j = \frac{M_{t,s}^j}{M_{t,s}^j + N_{t,s}^j}, \quad (9)$$

where  $M_{t,s}^j$  is the number of migrants from source country  $j$  with schooling  $S$  who are recorded in the OECD censuses at time  $t$ , and  $N_{t,s}^j$  is the labor force in source country  $j$  with schooling  $S$ .

## B. Magnitude of Emigration from the Caribbean

Migration has been described as “*embedded in the Caribbean psyche*” and is a fact of life in the region (Reyes and Stubbs, 2004). Every year a large number of Caribbean nationals emigrate to other countries for work, education, or for other reasons. About 12 percent of the labor force from the Caribbean region has migrated to OECD member countries over the period 1965–2000. As Figure 3 shows, the Caribbean region has the highest rates of

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<sup>9</sup> The Caribbean is also one of the largest sources of illegal aliens with the Dominican Republic, Haiti, and Jamaica ranking only behind Mexico (Carlson, 1994).

migration into OECD member countries. The second-highest source of emigrants is Central America, which has lost about 7 percent of its labor force due to emigration to OECD member countries.

The figures for the individual Caribbean countries are even more striking. The average of 12 percent for the Caribbean as a whole is largely due to the low migration rates of five countries—Haiti, Dominican Republic, The Bahamas, St. Lucia, and Trinidad and Tobago. As Figure 4 shows, the majority of the other Caribbean countries have lost more than a quarter of their labor force due to emigration to OECD member countries.<sup>10</sup>

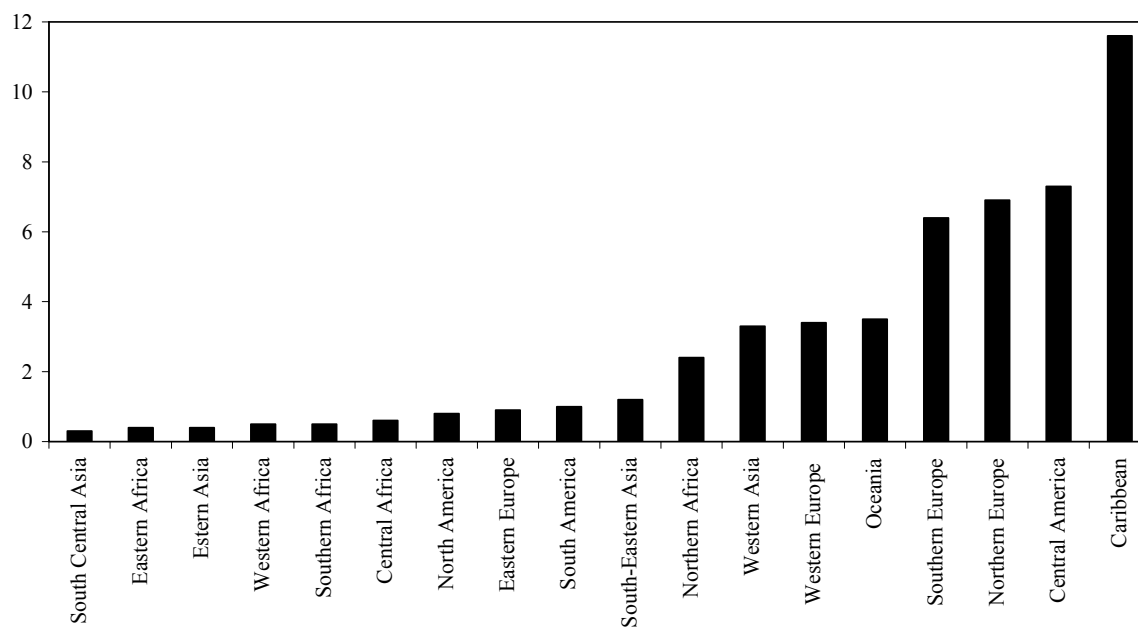
The most important destination for migrants from the Caribbean is the United States. Figure 5 shows the fraction of the total number of migrants whose destination is the United States. The fraction ranges from about 60 percent to 90 percent. More than three-fourths of the migrants from The Bahamas, Belize, Dominican Republic, and Haiti reside in the United States. Geographical proximity (i.e., low migration cost), higher wage differentials (relative to other destinations) and immigration laws in the United States, are the most likely reasons for such a bias. The U.S. Immigration and Nationality Act of 1965 changed the basis of entry into the United States from country quotas to family-based reunification. This led to a drastic change in the composition of migrants from developed to developing countries.

The migration rates by schooling are even more striking—70 percent of the tertiary-educated labor force has migrated from the Caribbean to OECD member countries. Table 1 shows the breakdown of emigrants from the Caribbean by their skill (education groups). The figures in the secondary and tertiary schooling categories are striking. Guyana, Grenada, Jamaica, and St. Vincent and the Grenadines have the highest tertiary emigration rates in the region followed by Haiti, Trinidad and Tobago, and St. Kitts and Nevis. In fact, as Figure 6 shows, most Caribbean countries rank in the top 20 in the world in terms of skilled emigration rates (skilled are defined as those with 12 or more years of schooling). Table 2 shows the emigration rates to the United States, by skill categories. About 60 percent of the tertiary educated labor force has migrated from the Caribbean to the United States. The rankings are similar to the emigration rates to OECD member countries in Table 1, with Guyana, Haiti, Jamaica and Grenada having the highest tertiary emigration rates to the United States.

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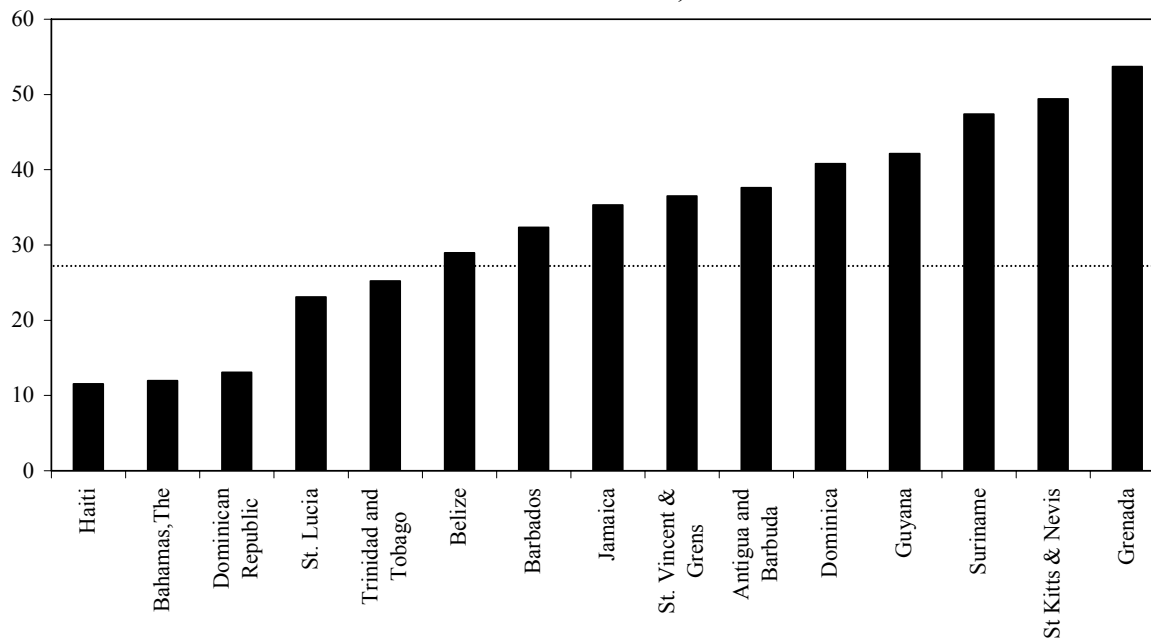
<sup>10</sup> There is anecdotal evidence of a reasonable amount of intra-Caribbean migration, but it has not been systematically documented.

Figure 3. Percent of Labor Force that Has Migrated to OECD Member Countries:  
Caribbean vs. the Rest of the World, 1965–2000



Source: Docquier and Marfouq (2004).

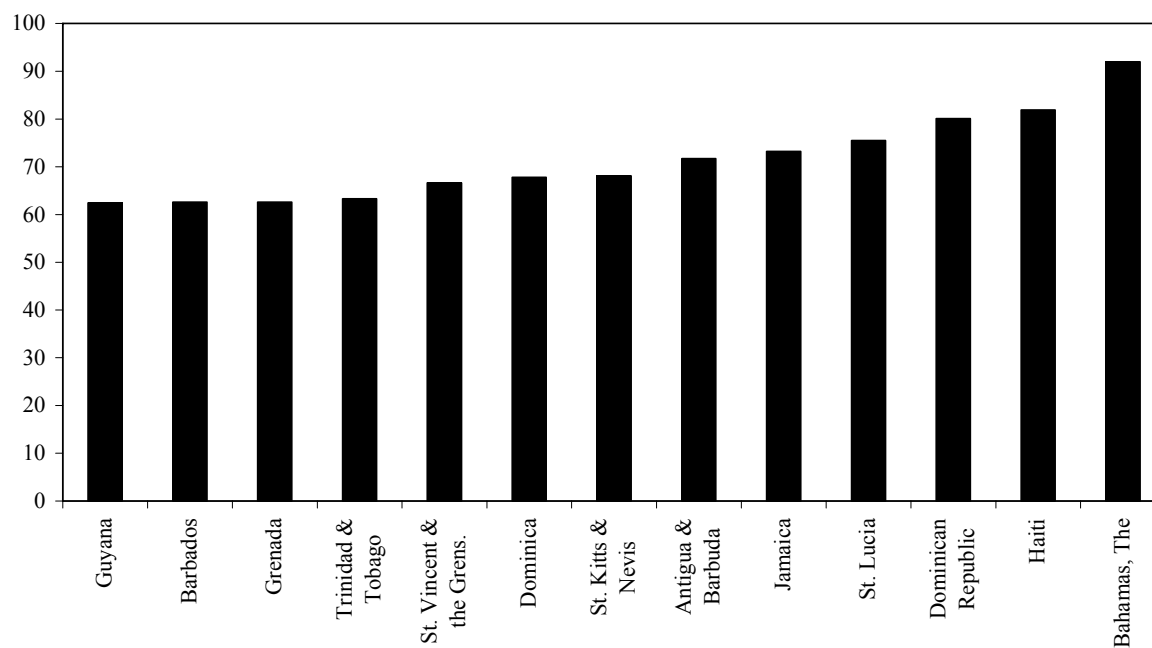
Figure 4. Percent of Labor Force that Has Migrated from the Caribbean Countries  
to OECD Member Countries, 1965–2000



Source: Docquier and Marfouq (2005).



Figure 5. Percent of Total Number of Migrants from the Caribbean Countries to the United States, 1965–2000



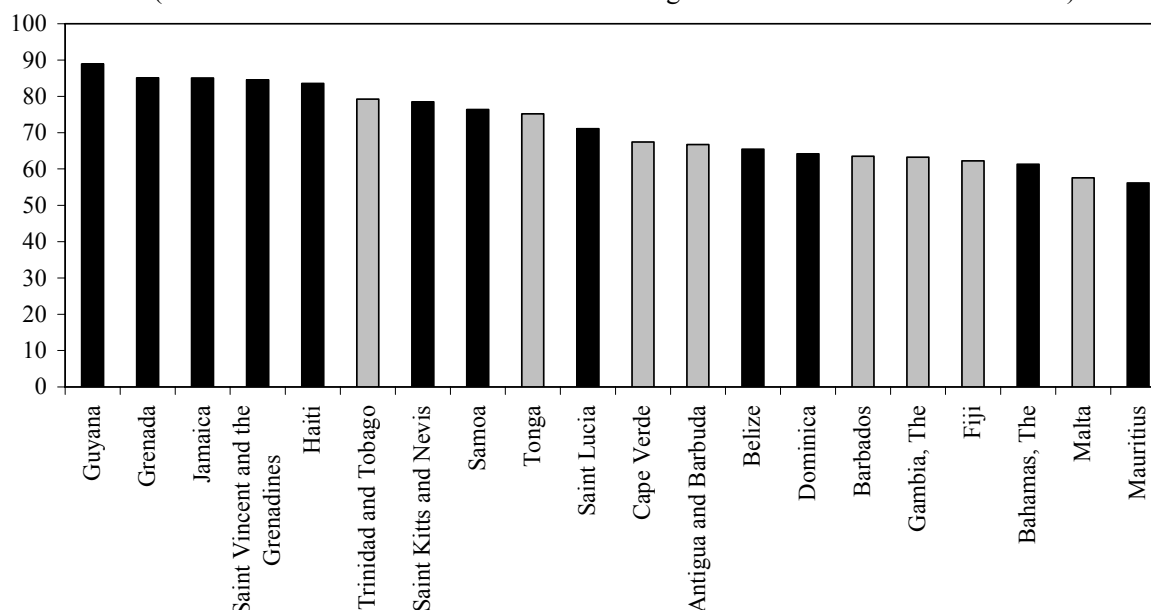
Sources: U.S. Census (2000); and Docquier and Marfouq (2005).

Table 1. Percent of Labor Force That Has Migrated to OECD Member Countries,  
1965–2000, (By Level of Schooling)

	Primary	Secondary	Tertiary
Antigua and Barbuda	9	64	67
Bahamas, The	3	10	61
Barbados	18	28	63
Belize	7	58	65
Dominica	19	67	64
Dominican Republic	6	33	22
Grenada	25	71	85
Guyana	18	43	89
Haiti	3	30	84
Jamaica	16	35	85
St. Kitts and Nevis	32	42	78
St. Lucia	12	21	71
St. Vincent and the Grenadines	18	33	85
Suriname	39	74	48
Trinidad and Tobago	8	22	79
Average	15	42	70

Source: Docquier and Marfouq (2005).

Figure 6. Top 20 Countries in the World with the Highest Emigration Rates, 1970–2000  
(Percent of Educated Labor Force that has Migrated to OECD Member Countries)



Source: Docquier and Marfouq (2005).

Note: Educated labor force is defined as having 12 or more years of completed schooling.

### C. Where Did Migrants Obtain Their Schooling?

The migration rates by schooling do not take into account where migrants obtained their schooling. The estimates of emigration rates by schooling are based on the assumption that the migrants recorded in the OECD censuses received their schooling in the Caribbean. Alternatively, for those who received their schooling in the OECD—the counterfactual assumption is that had they stayed behind, they would have received the same level of schooling. For the migrants who received their schooling in the destination countries, it is not clear that their emigration constitutes shocks to which schooling groups in the source countries.

The censuses in the recipient countries do not record information on where the migrants received their schooling. Hence, given the data, it is not possible to conclude the direction of the bias. However, we can try to adjust for this bias in the case of the migrants to the United States. There is strong evidence in the case of migrants from developing countries like Mexico that those who migrate in their late teens or later are much less likely to obtain their schooling in the United States (Grogger and Trejo, 2002, Gonzalez, 2002, Chiquiar and Hanson, 2005, Clark and Jaeger, 2002).

Table 2. Percent of Labor Force That Has Migrated to the United States, 1965–2000  
(By Level of Schooling)

	Primary	Secondary	Tertiary
Antigua and Barbuda	3	57	56
Bahamas, The	2	10	58
Barbados	4	20	46
Belize	4	54	62
Dominica	6	56	49
Dominican Republic	5	28	18
Grenada	7	61	75
Guyana	7	35	80
Haiti	2	27	79
Jamaica	5	29	78
St. Kitts and Nevis	8	31	65
St. Lucia	2	13	53
St. Vincent and the Grenadines	4	23	71
Trinidad and Tobago	3	17	68
Average	4	33	61

Sources: U.S. Census (2000); and Docquier and Marfouk (2005).

The U.S. Census provides information for the foreign-born on the years spent in the United States. Using this information, it is possible to calculate their age at migration. Restricting the sample of migrants to those who emigrated at an age of 16 years or more, it is less likely that these migrants would obtain their schooling in the United States. Chiquiar and Hanson (2005), and Mishra (forthcoming) use a similar strategy to adjust for the bias. The adjusted emigration rates are shown in Annex Table 1.

The magnitude of the *adjusted* emigration rates in the tertiary schooling category decreases (as compared to Table 2), but is still much larger in relation to the primary schooling category. In both cases (adjusted and unadjusted), Guyana, Haiti, Jamaica, and Grenada have the highest tertiary emigration rates in the region, followed by St. Vincent and the Grenadines, Trinidad and Tobago, and St. Kitts and Nevis. The highly-educated labor force in the region has been reduced by 58 percent due to emigration to the United States, even after making the adjustment.

#### D. Remittances

Worker remittances are becoming increasingly important as a source of external funding for many developing countries. Worker remittances are defined as the value of monetary transfers sent to the source countries by workers who have been abroad for more than one

year. These are recorded under “current transfers” in the current account of the IMF’s Balance of Payments Statistics Yearbook.

During the last two decades, the economic analysis of remittances has received considerable attention in academic and policy circles. One important region that has received little attention in the literature on remittances is the Caribbean. The Caribbean region is the largest recipient of remittances in proportion to its GDP (Figure 7). The next biggest recipient is South Asia, followed by the Middle East and Northern Africa.

A broader measure of remittances includes worker remittances, compensation of employees and migrant transfers. This measure has been previously used in the literature (Ratha, 2003, and Kapur, 2004). Compensation of employees is defined as the gross earnings of foreigners residing abroad for less than 12 months, including the value of in-kind benefits such as housing and payroll taxes. Migrant transfers are defined as the net worth of migrants who move from one country to another. For example, the value of IBM stock owned by a migrant who moves from France to Germany gets transferred in international accounting from France to Germany. Compensation of employees are recorded under the “income” subcategory of the current account, and migrant transfers are recorded under “capital transfers” in the capital account of the IMF’s Balance of Payments. It is important to note that both the simple worker remittances and the more comprehensive definition of remittances do not include transfers through informal channels such as those carried by hand or by friends or family, or in-kind remittances of jewelry and consumer goods. There are also commercial transfers known as *hawala* that are unrecorded in the estimated remittances.<sup>11</sup>

Remittance flows are the largest source of external funding for the region (Figure 8a). In 2002, *total* remittances (defined as the sum of worker remittances, compensation of employees, and migrant transfers) constituted about 13 percent of the region’s GDP. In comparison, FDI was 6 percent and official development flows (ODA) were only 1 percent of GDP.

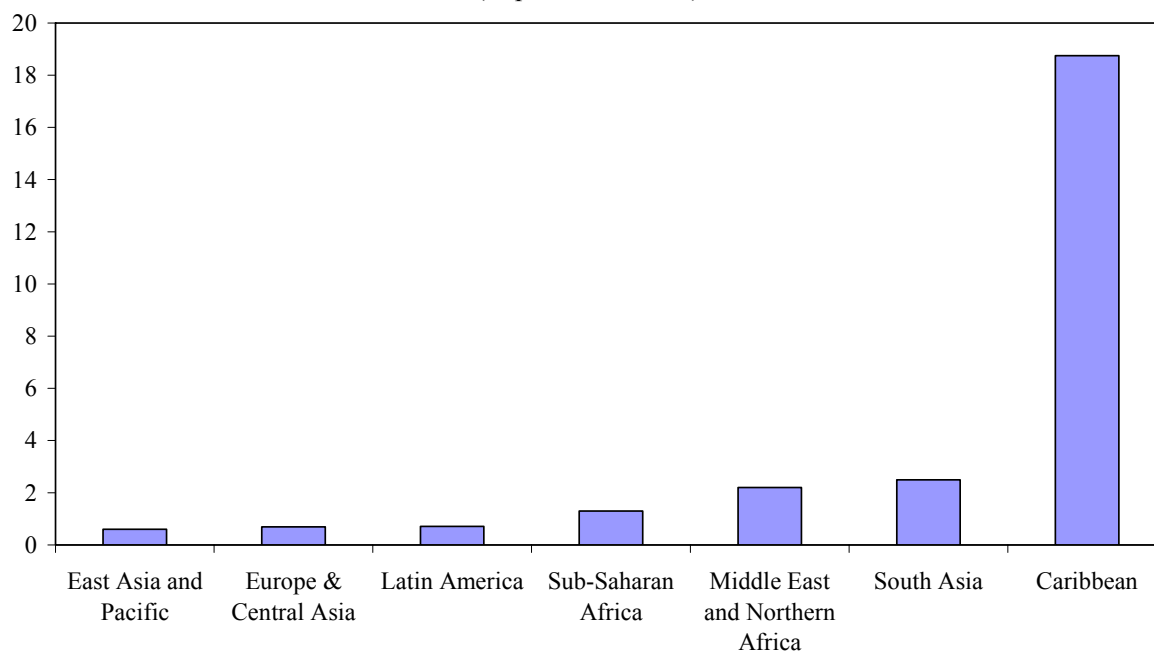
Remittance flows have been rising, while both FDI and ODA have declined. Between 1990 and 2002, ODA declined from 4 percent to 1 percent of GDP. Over recent years, FDI has also declined from 9 percent in 1999 to about 6 percent in 2002. In contrast, remittances increased from 3 percent to 13 percent of GDP during the same time period. As shown in Figure 8b, many Caribbean nations are among the top 30 nations in the world in terms of remittances received as a proportion of their GDP.

Figure 9 shows the total remittances for the Caribbean countries averaged over 1980–2002. Grenada is the largest recipient in the region, followed by Haiti, Dominica, and Jamaica. Migrant transfers to Grenada constitute about half of total remittances.

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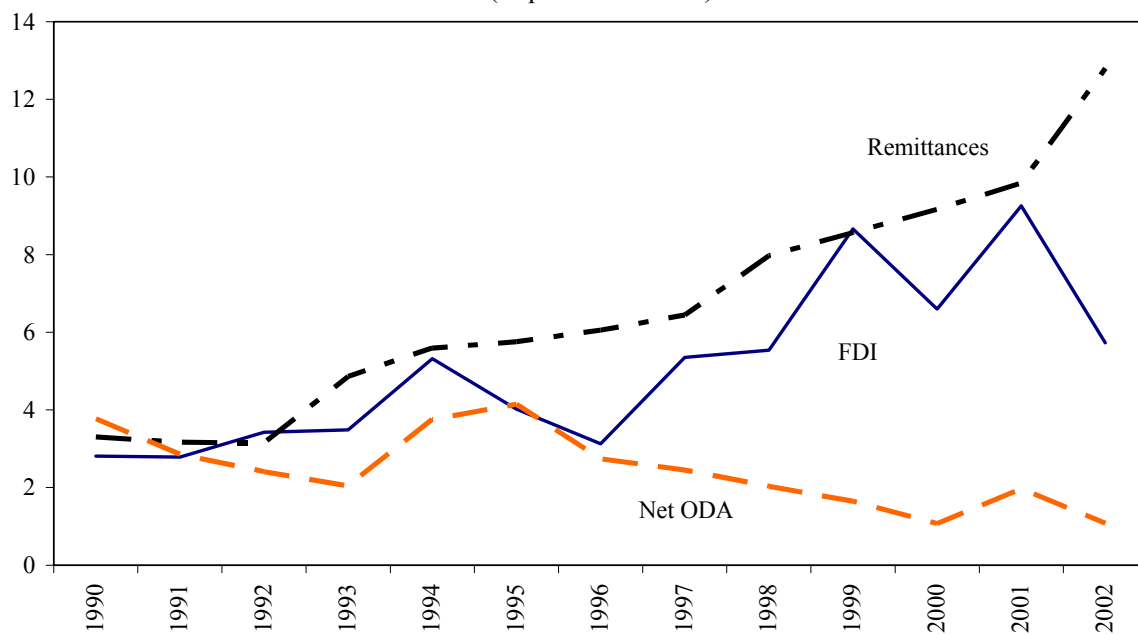
<sup>11</sup> Hawala is defined as an informal transfer system that operates outside the formal banking or financial channels.

Figure 7. Worker Remittances, 2002  
(In percent of GDP)



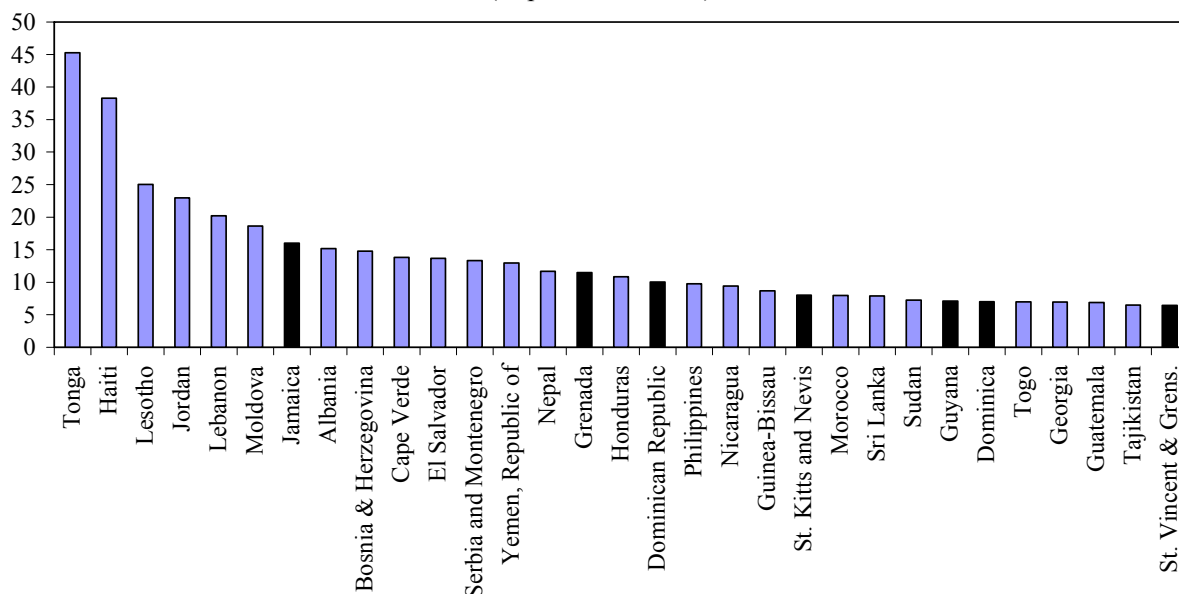
Sources: IMF, Balance of Payments Statistics Yearbook; and country authorities.

Figure 8a. Remittances, FDI, and ODA to the Caribbean, 1990–2002  
(In percent of GDP)



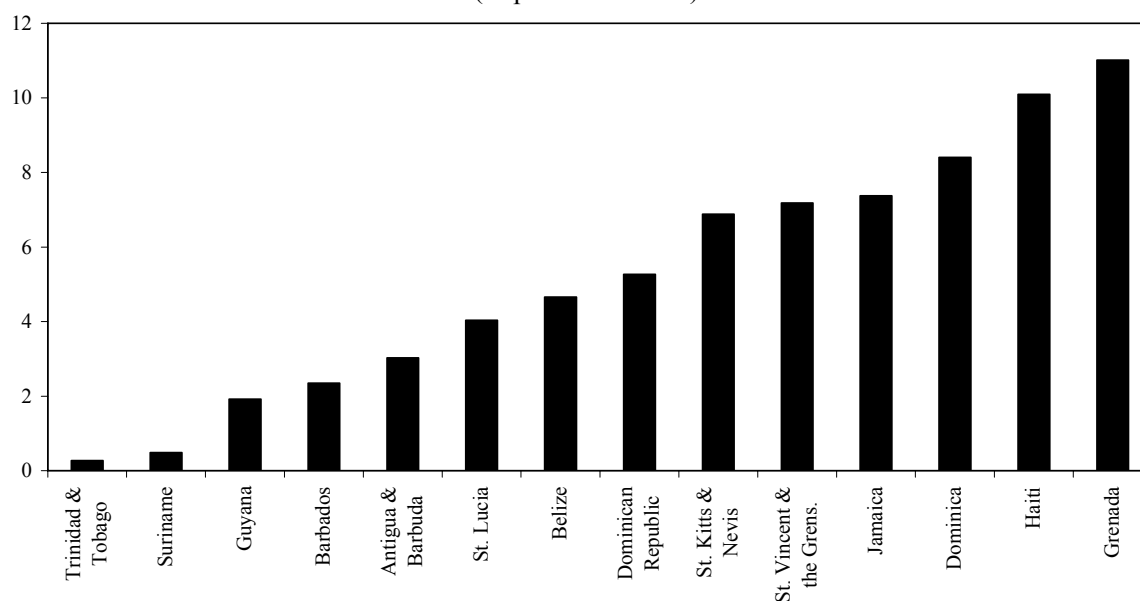
Sources: IMF, Balance of Payments Statistics Yearbook; World Bank, World Development Indicators; OECD; and country authorities.

Figure 8b. Total Remittances, Top 30 Countries in the World, 2002  
Worker Remittances, Compensation of Employees, Migrant Transfers  
(In percent of GDP)



Sources: IMF, Balance of Payments Statistics Yearbook; and country authorities.

Figure 9. Total Remittances, Average 1980–2002  
Worker Remittances, Compensation of Employees, Migrant Transfers  
(In percent of GDP)



Sources: IMF, Balance of Payments Statistics Yearbook; and country authorities.

### **E. Public Expenditure on Education**

Governments in developing countries, including the Caribbean, cover a major portion of the cost of education of their citizens in the form of education subsidies. Table 3 shows the estimates of government expenditure on education per student by schooling categories for countries in Caribbean for which data are available. These estimates are taken from UNESCO (2004), and are averages over the period 1999–2002. For Barbados, Jamaica, and Trinidad and Tobago, the expenditure on tertiary education is much larger relative to the subsidy on primary and secondary education.

The total public expenditure on education is defined as the sum of the expenditure on education and education administration made by local, regional, and central governments. It includes:

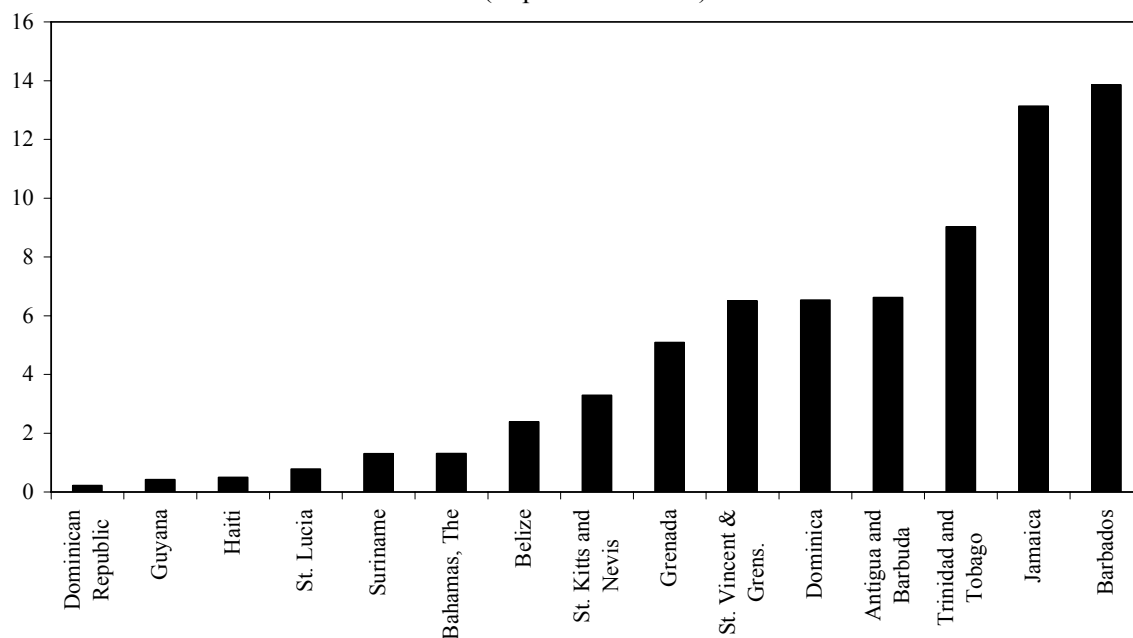
- (i) current expenditure on education—expenditure for goods and services consumed within the current year, e.g., staff salaries, pensions and benefits; contracted or purchased services; other resources including books and teaching materials; welfare services and other current expenditure such as subsidies to students and households, furniture and minor equipment, minor repairs, fuel, telecommunication, travel, insurance, and rents.
- (ii) capital expenditure on education—expenditure for assets that last longer than one year. It includes expenditure for construction, renovation and major repairs of buildings and the purchase of heavy equipment or vehicles.

The expenditure per student on primary and secondary education for the Caribbean countries with missing data is approximated by the data from another country in the Latin America and Caribbean region, that is closest in per capita income. However, the expenditure on tertiary education for countries with missing data is assumed to be zero since the countries with missing data might not be spending significantly on tertiary education. The data on expenditure per student is multiplied by the total number of migrants recorded in the OECD censuses.

The estimated government expenditure on the education of individuals who eventually left the Caribbean countries (largely to the United States, between 1965 and 2000) varies across countries but is higher in the larger countries. Figure 10 shows that the estimated government expenditure on education of the emigrants is the highest for Barbados, Jamaica, and Trinidad and Tobago, reflecting primarily the heavy public investment on the tertiary education of migrants in these countries.



Figure 10. Estimated Government Expenditure on Education of Migrants  
(In percent of GDP)



Source: United Nations Education, Scientific, and Cultural Organization, (UNESCO).

Table 3. Government Expenditure on Education, Average 1999–2002  
(Per student, as a percent of GDP per capita)

	Primary	Secondary	Tertiary
Barbados	17	26	62
Belize	17	19	
Dominica	21	35	
Dominican Republic	7	5	
Guyana	1	2	
Jamaica	16	24	76
St. Kitts and Nevis	9	9	
St. Lucia	13	2	
St. Vincent and the Grenadines	28	28	
Trinidad and Tobago	14	15	69

Source: United Nations Education Scientific and Cultural Organization, (UNESCO).

## IV. RESULTS

### A. Emigration Loss

The calculation of the emigration loss as a percent of GDP requires estimates for: (i) elasticity of factor price for labor; (ii) labor's share in national income; and (iii) the emigration rate. The share of labor in national income is assumed to be 70 percent following Borjas (1995) and Hall and Jones (1999). Mishra (forthcoming) in a study of Mexico estimates the impact of emigration on Mexican wages. The paper finds that a 10 percent reduction in the size of the labor force due to emigration to the U.S. increases Mexican wages by 4 percent. Also, the vast empirical evidence on labor demand, surveyed by Hamermesh (1993), suggests that the elasticity of factor price of labor is of the order of -0.3 (that is, a 10 percent reduction in the size of the labor force increases wages by 3 percent). The two elasticity assumptions of 0.3 and 0.4 used in this paper follow from Hamermesh (1993) and Mishra (forthcoming), respectively.

The emigration loss predicted by the labor demand-supply model is small. Table 4 shows the estimates of emigration loss to individual Caribbean countries as a percent of the GDP. In order to put these numbers into perspective, Column 3 shows the figures for remittances to the Caribbean as a fraction of countries' GDP. Since elasticities and the share of labor in GDP are assumed to be the same for all countries, the differences in emigration losses comes only from differences in the emigration rates across countries. On average, official remittances outweigh the emigration loss for the region. Even under the assumption of high elasticity, except for Guyana, Suriname and Trinidad and Tobago, official remittances outweigh emigration loss in all countries. Also, since the wage differentials between the Caribbean and OECD member countries are large, the emigration loss would be easily outweighed by the gains of the migrants themselves.

Emigration loss is, however, an aggregate measure. It is a net effect of a gain to the workers who stay behind and a loss to the owners of other factors that are assumed to be internationally immobile (capital). In other words, emigration involves a redistribution of the reduced aggregate income in favor of the workers. Annex Table 2 shows that this redistributive impact of emigration is significant in magnitude. On average, the gain to the workers who have stayed behind is 6 percent of GDP and the loss to the owners of the other factors is about 7 percent of GDP. Even for Trinidad and Tobago, where the emigration losses are relatively small (in relation to remittances), there is a sizable redistribution in favor of the workers.

### B. Losses Due to High-Skill Migration

The emigration loss due to emigration of skilled labor, *ceteris paribus*, is significant. One of the most significant characteristics of migration from the Caribbean region, apart from the very high rates of migration, is the loss of the educated population. The estimates in Table 5 show that the emigration loss as a fraction of GDP due to emigration of high skilled workers (everything else remaining unchanged) is much larger. The aggregate emigration rate combines the emigration rates of the high- as well as the low-skilled. As lower-skill groups

Table 4. Emigration Loss and Remittances

	Emigration Loss $\epsilon=0.3$	Emigration Loss $\epsilon=0.4$	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	1.5	2.0	3.0
Bahamas, The	0.2	0.2	n.a.
Barbados	1.1	1.5	2.3
Belize	0.9	1.2	4.7
Dominica	1.7	2.3	8.4
Dominican Republic	0.2	0.2	5.3
Grenada	3.0	4.0	11.0
Guyana	1.9	2.5	1.9
Haiti	0.1	0.2	10.1
Jamaica	1.3	1.7	7.4
St. Kitts and Nevis	2.6	3.4	6.9
St. Lucia	0.6	0.7	4.0
St. Vincent and the Grenadines	1.4	1.9	7.2
Suriname	2.4	3.1	0.5
Trinidad and Tobago	0.7	0.9	0.3
Average	1.3	1.7	5.2

Source: Author's calculations.

Note:  $\epsilon$  denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force). Emigration loss is calculated using equation (2).

have smaller emigration rates, their inclusion results in a smaller measure of emigration rate. If instead, only the high-skilled workers are considered, the emigration rates are higher. Consequently the emigration loss is also larger. Still, remittances outweigh or almost equal the emigration loss due to high-skilled migration for the region as a whole and for most of the countries (except Guyana, Suriname, and Trinidad and Tobago).<sup>12</sup>

<sup>12</sup> In the calculations, the assumed skilled labor share of GDP is 0.3. This follows from the assumption that the highly educated belong to the top 20 percent of the income earners. The average income share of the top 20 percent is about 0.4 as estimated by Dollar and Kraay (2002). Consequently, the assumed share of skilled labor in GDP is: overall labor share in GDP  $\times 0.4 = 0.7 \times 0.4 = 0.28$ .

Table 5. Emigration Loss Due to High-Skilled Migration

	Emigration Loss e=0.3	Emigration Loss e=0.4	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	2.0	2.7	3.0
Bahamas, The	1.7	2.3	
Barbados	1.8	2.4	2.3
Belize	1.9	2.6	4.7
Dominica	1.9	2.5	8.4
Dominican Republic	0.2	0.3	5.3
Grenada	3.3	4.3	11.0
Guyana	3.6	4.7	1.9
Haiti	3.1	4.2	10.1
Jamaica	3.3	4.3	7.4
St. Kitts and Nevis	2.8	3.7	6.9
St. Lucia	2.3	3.0	4.0
St. Vincent and the Grenadines	3.2	4.3	7.2
Suriname	1.0	1.4	0.5
Trinidad and Tobago	2.8	3.8	0.3
Average	2.3	3.1	5.2

Source: Author's calculations.

Note: e denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force). Emigration loss is calculated using equation (6).

The loss due to emigration is amplified if emigrants confer a positive externality on nonemigrants. In that case not only is the surplus on the inframarginal workers lost due to emigration (emigration loss), but there is a loss of the positive externality as well (the external effects). Two values for the elasticity of marginal product with respect to the aggregate stock of skilled labor ( $\gamma$ ) are assumed, 0.05 and 0.1, respectively (Borjas (1995) also uses identical values).

Annex Table 3 shows the estimates of emigration loss due to high-skilled migration in the presence of external effects. For high values of the elasticities, in the presence of external effects, emigration loss outweighs remittances for many Caribbean countries—Antigua and Barbuda, Barbados, Belize, Guyana, St. Lucia, Suriname, and Trinidad and Tobago. Emigration loss almost equals remittances for Jamaica, St. Kitts and Nevis, and St. Vincent and the Grenadines. The magnitudes of the emigration losses are much higher than the estimates of immigration surplus in the presence of external effects in Borjas (1995), which range between 0.3–0.7 percent of GDP. The reason for the larger effect is that emigration rates from the Caribbean are greater relative to the immigration rate into the United States.

Table 6 shows the total losses due to skilled emigration. The total losses comprise: (i) emigration loss from the simple labor demand supply framework; (ii) external effects i.e., the impact on productivity of those who have stayed behind; and (iii) government expenditure on the education of migrants. The results shown in Table 6 are under the assumption of high elasticities.

The first observation from Table 6 is that the total losses due to high-skill emigration are indeed significant for most countries. The losses range from 2 percent of GDP in the Dominican Republic to 20 percent of GDP in Jamaica. Second, on average, the losses outweigh the official recorded remittances for the Caribbean region and for almost all the individual countries (except Dominican Republic, Haiti, Grenada, and St. Lucia). For Grenada and St. Lucia, the total losses are almost equal to remittances. Even under assumption of low elasticities (not shown in the table), the losses outweigh remittances for most countries.

Table 6. Total Losses Due to High-Skill Emigration vs Remittances

	Estimated Education Expenditure (As a percent of GDP)	Emigration Loss (As a percent of GDP) ( $\gamma=0.1$ , $\epsilon=0.4$ )	Emigration Loss + Estimated Education Expenditure	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	8.8	5.4	13.2	3.0
Bahamas, The	1.1	4.2	4.4	
Barbados	7.4	4.9	18.5	2.3
Belize	2.7	4.8	6.8	4.7
Dominica	5.0	5.2	11.5	8.4
Dominican Republic	0.2	1.4	2.1	5.3
Grenada	5.7	7.7	11.0	11.0
Guyana	6.8	7.8	9.5	1.9
Haiti	0.8	6.6	9.0	10.1
Jamaica	7.7	7.2	20.4	7.4
St. Kitts and Nevis	9.4	6.8	9.7	6.9
St. Lucia	2.0	5.3	3.8	4.0
St. Vincent and the Grenadines	7.0	7.2	10.7	7.2
Suriname	1.3	3.9	7.8	0.5
Trinidad and Tobago	6.2	6.3	16.8	0.3
Average	4.8	5.6	10.3	5.2

Source: Authors' calculations.

Note:  $\epsilon$  denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force).  $\gamma$  denotes the elasticity of marginal product of labor (the percentage change in marginal product of skilled labor due to 1 percent change in aggregate stock of skilled labor). Emigration loss is calculated using equation (7) in the Appendix.

The results from the welfare calculations are similar when we consider only emigration to the United States. Since an overwhelming majority of Caribbean migrants come to the United States, it is instructive to look at the magnitude of emigration loss from migration to the main destination country. Also, the U.S. Census allows the calculation of adjusted emigration rates by restricting the sample to migrants only above a certain age at migration, to filter out those migrants who are likely to have received their education in the source country.

Annex Table 4 shows the total losses due to emigration to the United States., under assumptions of high elasticities. The results in Annex Table 4 are similar to the cases when the emigration rates to OECD member countries are considered (Table 6). On average, the total losses due to high-skilled emigration outweigh the remittances to the region. Also, total losses outweigh or almost equal remittances for most individual countries (except the Dominican Republic, Grenada, and Haiti).

Annex Table 5 shows the corresponding losses due to emigration to the United States, when the migrants are restricted to have migrated at an age of 16 or more years. On average, the total losses still outweigh official remittances to the Caribbean. For the individual countries, the losses almost equal or are larger than the remittances for many countries—Antigua and Barbuda, Belize, Barbados, Guyana, Jamaica, St. Vincent and the Grenadines, and Trinidad and Tobago.

## V. CONCLUSIONS

For most countries in the Caribbean, the total losses due to skilled migration (which includes the emigration loss predicted by the labor-demand supply framework, augmented with external effects, and government expenditure on educating the migrants) outweigh remittances. The caveat remains there are many other possible costs and benefits, the measurement of which is beyond the scope of this paper.

There are two possible approaches countries could take with regard to migration: (i) minimize losses by trying to retain the high skilled; and/or (ii) seek to increase the benefits of emigration by adopting a “Diaspora Approach.” The latter uses the diaspora to build networks for trade, tourism, and investment promotion; harness its knowledge, skills, and assets; and attract higher and more efficient forms of remittances.

Even if countries incur a net loss due to emigration, a border tax might not be the most reasonable policy response. Appealing to the pioneering work of Bhagwati in the 1970s and 1980s on policy responses to emigration, there could be an argument for a border tax on migrants (similar to a Tobin tax). The tax was proposed by Bhagwati (1976), with the prior that developing countries lose due to migration. It is in principle also an extension of the idea of progressive income taxation—the improvement of the well being of migrants is taxed for the benefit of those left behind.

The main reasons for the border tax not being reasonable are the problems in implementing such a tax. Taxes can also have distortionary effects. Since the absolute number of migrants from Caribbean countries is not very large, the per capita tax rate will have to be very large to raise a sizeable revenue. In fact, the United States is the only country that taxes individuals on the basis of citizenship rather than place of residence.

Retaining the high skilled without the possibility of taxes would be facilitated by reorienting education. The high rates of emigration from the region are due not only to the “pull factor” i.e., higher wages abroad, but also the limited opportunities for highly, but similarly, educated people in the same small geographical areas (i.e., the “push factor”). One approach to creating the right incentives is to reorient the higher education system towards providing

skills in demand within the region, in particular the services sector, which dominates these economies. Such reorientation could include, for example, the establishment of hotel management institutes or specialized banking and finance institutes. It is particularly important for the Caribbean governments to consider the possibilities for reorienting education, as a major portion of the cost of education of their citizens is covered by education subsidies. Governments might reap higher returns by investing in education infrastructure that leads to more retention of the high skilled.

Since the international experience has been that it is difficult to prevent emigration, the real policy challenge is how Caribbean countries can maximize the benefits from their population living and working overseas. Remittances should be the most immediate focus, as they can affect growth through investment, both physical and human. Evidence from micro-level studies suggest that remittances lead to greater human and physical capital investment (Cox et. al. (forthcoming) study of El Salvador, Hanson and Woodruff (2001) and Woodruff and Zenteno (2001) studies of Mexico, Lucas (1987) study of Africa)). Countries need to recognize the importance of remittances and improve recording of the data.

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Annex Table 1. Percent of Labor Force that Has Migrated  
to the United States, 1965-2000  
(Restricting age at immigration to 16 or more years)

Country	Primary	Secondary	Tertiary
Antigua and Barbuda	8	37	79
Bahamas, The	5	29	76
Barbados	2	27	76
Belize	7	61	73
Dominica	4	24	67
Dominican Republic	3	18	65
Grenada	8	31	62
Guyana	5	56	59
Haiti	2	11	55
Jamaica	3	58	53
St. Kitts and Nevis	2	14	48
St. Lucia	7	57	45
St. Vincent and the Grenadines	4	20	43
Trinidad and Tobago	5	30	17
Average	5	34	58

Sources: U.S. Census (2000); Docquier and Marfouq (2005); and author's calculations.

Annex Table 2. Distributional Impact and Remittances

	Gain to Workers e=0.3	Gain to Workers e=0.4	Loss to Other Factors e=0.3	Loss to Other Factors e=0.4	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	4.9	6.6	6.4	8.5	3.0
Bahamas, The	2.2	2.9	2.4	3.2	n.a.
Barbados	4.6	6.1	5.7	7.6	2.3
Belize	4.3	5.8	5.2	6.9	4.7
Dominica	5.1	6.8	6.8	9.1	8.4
Dominican Republic	2.4	3.2	2.6	3.4	5.3
Grenada	5.2	7.0	8.3	11.0	11.0
Guyana	5.1	6.8	7.0	9.3	1.9
Haiti	2.1	2.9	2.3	3.0	10.1
Jamaica	4.8	6.4	6.1	8.1	7.4
St. Kitts and Nevis	5.2	7.0	7.8	10.4	6.9
St. Lucia	3.7	5.0	4.3	5.7	4.0
St. Vincent and the Grenadines	4.9	6.5	6.3	8.4	7.2
Suriname	5.2	7.0	7.6	10.1	0.5
Trinidad and Tobago	4.0	5.3	4.6	6.2	0.3
Average	4.3	5.7	5.6	7.4	5.2

Source: Author's calculations.

Note: e denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force). The distributional impact is calculated using equations (3) and (4).

Annex Table 3. Emigration Loss with External Effects Due to High-Skilled Migration

	Low Elasticities Gamma = 0.05, e = 0.3	High Elasticities Gamma=.1, e=0.4	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	3.3	5.4	3.0
Bahamas, The	2.6	4.2	n.a.
Barbados	3.0	4.9	2.3
Belize	3.0	4.8	4.7
Dominica	3.1	5.2	8.4
Dominican Republic	0.7	1.4	5.3
Grenada	4.8	7.7	11.0
Guyana	5.0	7.8	1.9
Haiti	4.3	6.6	10.1
Jamaica	4.6	7.2	7.4
St. Kitts and Nevis	4.2	6.8	6.9
St. Lucia	3.3	5.3	4.0
St. Vincent and the Grenadines	4.6	7.2	7.2
Suriname	2.2	3.9	0.5
Trinidad and Tobago	4.0	6.3	0.3
Average	3.5	5.6	5.2

Source: Author's calculations.

Note: e denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force). Gamma denotes the elasticity of marginal product of labor (the percentage change in marginal product of skilled labor due to 1 percent change in aggregate stock of skilled labor). Emigration loss is calculated using equation (7). Skilled emigration rate to the United States, with restricted age at migration, is used for the calculations.

Annex Table 4. Total Losses Due to High-Skilled Emigration to the United States vs Remittances

	Estimated Education Expenditure (As a percent of GDP)	Emigration Loss (As a percent of GDP) ( $\gamma=0.1$ , $\epsilon=0.4$ )	Emigration Loss + Estimated Education Expenditure	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	4.7	5.4	10.1	3.0
Bahamas, The	1.5	5.6	5.3	n.a.
Barbados	7.4	4.3	8.9	2.3
Belize	2.2	6.0	8.2	4.7
Dominica	4.2	4.6	8.4	8.4
Dominican Republic	0.2	1.5	1.9	5.3
Grenada	3.1	7.7	9.6	11.0
Guyana	0.2	8.3	12.5	1.9
Haiti	0.4	8.2	9.0	10.1
Jamaica	9.1	8.0	14.1	7.4
St. Kitts and Nevis	1.9	6.4	13.5	6.9
St. Lucia	0.4	5.0	3.8	4.0
St. Vincent and the Grenadines	3.2	7.2	8.4	7.2
Trinidad and Tobago	5.5	6.8	10.9	0.3
Average	3.1	6.1	8.9	5.6

Source: Author's calculations.

Note:  $\epsilon$  denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force).  $\gamma$  denotes the elasticity of marginal product of labor (the percentage change in marginal product of skilled labor due to 1 percent change in aggregate stock of skilled labor). Emigration loss is calculated using equation (7); the skilled emigration rate to the United States, is used to do the calculations.

Annex Table 5. Total Losses Due to High-Skilled Emigration to the United States vs Remittances  
(Age at migration restricted to 16 or more years)

	Estimated Education Expenditure (As a percent of GDP)	Emigration Loss (As a percent of GDP) ( $\gamma=0.1$ , $e=0.4$ )	Emigration Loss + Estimated Education Expenditure	Remittances (As a percent of GDP) Average 1980–2002
Antigua and Barbuda	3.7	3.3	7.0	3.0
Bahamas, The	1.0	3.4	4.4	n.a.
Barbados	6.0	2.4	8.4	2.3
Belize	1.8	3.9	5.7	4.7
Dominica	2.9	2.6	5.5	8.4
Dominican Republic	0.2	0.7	0.9	5.3
Grenada	2.5	5.3	7.8	11.0
Guyana	0.2	5.9	6.1	1.9
Haiti	0.3	5.6	5.9	10.1
Jamaica	7.1	5.6	12.7	7.4
St. Kitts and Nevis	1.4	4.1	5.5	6.9
St. Lucia	0.3	2.8	3.1	4.0
St. Vincent and the Grenadines	2.4	4.6	7.1	7.2
Trinidad and Tobago	4.4	4.5	8.9	0.3
Average	2.5	3.9	6.4	5.6

Source: Author's calculations.

Note:  $e$  denotes the elasticity of factor price of labor (i.e., percentage change in wages resulting from a 1 percent change in the size of the labor force).  $\gamma$  denotes the elasticity of marginal product of labor (the percentage change in marginal product of skilled labor due to 1 percent change in aggregate stock of skilled labor). Emigration loss is calculated using equation (7); the skilled emigration rate to the United States, with restricted age at migration, is used for the calculations.