

Revised

**Globalizing Talent and Human Capital:  
Implications for Developing Countries**

by

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## 1. **Introduction**

The new era of globalization of the late 20<sup>th</sup> century and early 21st century has seen an increase in the international mobility of highly-skilled, talented individuals (i.e. human capital) and entrepreneurs as new job and business opportunities are opened by globalization.

The topic of human capital mobility and brain drain has remained somewhat dormant in the academic and policy literature in the last two to three decades after being actively debated in the 1960s and 1970s. Two views dominated the positions of that time: one was the “internationalist view” championed by Harry Johnson (1964). The alternative view was the “nationalist view” exposed by Don Patinkin (1964) and others. The “internationalists” favored unrestricted international migration of highly skilled individuals as a vehicle to enhance “global efficiency,” while the “nationalists” were concerned with the adverse impact on national development of human capital outflows to advanced economies. In the global economy of the early 21st century the debate is perhaps better framed in terms of the contribution of international mobility of human capital to global knowledge creation and the development of technology in a world with significant inequalities across countries in their capacity to generate and access knowledge and technology.

The international movement of human capital (HC) comprises the movement of scientists, engineers (e.g. in the information sector), executives, and other professionals across frontiers. These are people with special talents, high skills and specialized knowledge in the scientific, technological and cultural areas. Another dimension of the international mobility of talent is entrepreneurial migration, say people with talent for business creation and resource mobilization rather than necessarily individuals with a high stock of formal education.

From the viewpoint of developing countries (and transition economies) the international mobility of HC has been seen with a mix of concern and possibility. On the one hand developing countries encourage national students to earn graduate degrees abroad (typically in the U.S. and Europe) in science, technology and other disciplines as a way to upgrade their knowledge and human resource base. On the other hand, when outstanding scientists and professionals stay abroad, or leave their home country, the concern arises of a “brain drain” due to the flight of scarce human capital and talent whose contribution is needed for economic development at home.

This paper deals with several conceptual topics and policy issues related to the international flows of human capital, talent and entrepreneurs mainly from a developing countries perspective.

Section 2 discusses main global facts and trends in the international mobility of human capital. Section 3 assesses the world distribution of science and technology resources and section 4 deals with issues of definition and statistical measurement of high skill migration. Section 5 examines the determinants of human capital migration and the peculiarities of increasing returns and factor complementarities that characterize the activities of knowledge generation. The paper overviews the issue of brain drain and brain circulation (section 6), the existence of scientific diasporas (section 7) and entrepreneurial migration (section 8). The paper also discusses the impact of human capital migration on global inequality and national development and highlights policies to induce human capital repatriation and greater sharing by developing countries in the benefits of global knowledge creation (section 9 and section 10). The paper concludes in section 11.

## **2. Facts and Trends in the International Mobility of Human Capital**

The global demand for skilled individuals has been on the rise in the last decade or so. The main pole of attraction for foreign skilled people is the United States. Some 40 percent of its foreign – born population have tertiary education levels. Since the early 1990s

some 900,000 skilled professionals mainly information technology (IT) specialists have emigrated to the United States coming from India, China, Russia and some OECD countries (U.K., Germany, Canada). These immigrants often come under the H1-B visa program for highly skilled professionals.

The U.S. is also a main recruiter of foreign students in higher education (it accounts for 32 % of all foreign students in the OECD countries)<sup>2</sup>. Higher education is an important channel for attracting high skill personnel. It is estimated that 25 percent of H1-B visa holders in 1999 were students previously enrolled in U.S. universities.

The U.S. is not the only net importer of foreign talent. Germany, in 2000, launched a “green card” scheme to recruit some 20,000 foreign IT specialists. The main recruiters come from Russia, Poland and other Eastern European nations that have an important pool of scientific and technical specialist trained during the socialist period and afterwards. Similar initiatives have been launched, recently, in the U.K., Australia, and New Zealand (see Box 1). In the developing world, Singapore has been meeting shortages of IT specialists with immigrants from Malaysia, China and other neighboring countries.

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<sup>2</sup> See OECD Observer (2002)

The magnitude and impact on developing countries of the outflow of human capital varies from region to region. In Africa, the International Organization for Migration (IOM), estimates that around 300,000 professionals live and work in Europe and North America. Sending countries include Nigeria, Ethiopia, South Africa, Ghana and others. Casual evidence shows that as a consequence of the large scale emigration of medical doctors in Africa, the poor are forced to seek medical treatment from traditional healers while the rich elite fly to London for their routine medical checkups<sup>3</sup>. A recent study<sup>4</sup> shows that Africa may be losing as much as US\$ 4 billions a year due to the emigration of top professionals seeking better jobs abroad. The study argues that about 20,000 professionals leave Africa each year. This emigration of professionals in Africa has several adverse effects such as reducing the stock of scarce human capital at home, the erosion of the domestic tax base, the failure to form a middle-class of educated people, a stabilizing factor in most societies.

In higher per capita income, developing countries the consequences of the outflow of human capital could to be less dramatic. In China the Ministry of Science and Technology estimates that Chinese returnees from the United States started most internet-based ventures. Returnees from the United States in Taipei

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<sup>3</sup> The Africa Journal (2002).

<sup>4</sup> Aredo, D. (2002)

(Taiwan) have started near half of all the companies emerging from the largest scientific park, the Hsinchu. In India, however, in the year 2000, it was estimated that some 1,500 highly qualified Indians returned from the United States, although more than 30 times that number depart each year (OECD, 2002).

The outflow of human capital is not only led by better opportunities for study and work in the developed countries (pulling factors) but also by economic and political conditions at home (pushing factors). In Latin America a massive exodus of professionals, scientists and intellectuals took place in the late 1960s and the 1970s. In those years, military regimes in Brazil, Argentina, Uruguay, Chile and others countries targeted universities and other academic centers for ideological cleansing and to abate sources of internal opposition and criticism. This experience suggests that the emigration of scientists and intellectuals increased with authoritarian regimes that suppress civil liberties and curtail academic freedom. The restoration of democracy in Latin America in the 1980s and 1990s led to some return of scientists and intellectuals, although this flow would have been probably larger if the economic conditions in universities and research centers --salaries and resources available for research-- were better<sup>5</sup>. There seems to be no clear relationship between democracy and the amount of resources devoted to

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<sup>5</sup> See Pellegrino, A. and J. Martinez (2001); also Hansen et.al. (2002).

universities and research activity. This can be illustrated by the recent experience of post-socialist countries such as Russia, Poland and others. In these countries, particularly Russia, the end of communism and the transition to markets and democracy in the 1990s has coincided with *a net outflow* of skilled professionals, scientists and information technology specialists<sup>6</sup>. For example in Russia it is estimated that around 1,000-2,000 people employed in "science and scientific services" have left Russia since the early 1990s. Germany and Israel account for 86% of the Russian emigrants in this category in 2000 (Gokhberg and Nekipelova 2002). The outflow of scientists in newly democratic Russia is largely attribute to a squeeze in the budget of the science and technology sector that cut salaries, research budgets and deteriorated working conditions in the S&T sector. This, along with changes in legislation that recognized the right of national citizens to take employment abroad (a right restricted under communism), seems to be an important variable explaining the outflow of scientists and professionals from Russia since the early 1990s (Gokhberg and Nekipelova, 2002)

### **3. The World Distribution of Science and Technology Resources**

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<sup>6</sup> For a dramatic account of how emigration of the most talented individuals of the German Democratic Republic severely debilitated the GDR contributing to its unexpectedly rapid demise after the end of the

An important determinant of the international migration of scientists and technology experts is the availability of resources to conduct research, including higher salary levels for researchers, in receipt countries relative to those available at home.

Assessing the volume of resources devoted to science and technology present various statistical and definition problems (see next section). They range from the definition of science, which sometimes means only natural sciences (physics, biology, etc.) to the non-reporting or under-measurement of research and development (R&D) expenditure into establish developing countries that makes more difficult to do accurate international comparisons<sup>7</sup>. Intertemporal and international comparisons of resources devoted to science and technology in former socialist countries and western economies are also difficult due to different definitions of S&T activities (and national output) used during the socialist period.

With these caveats in mind, the available information shows very large disparities in the world distribution of resources devoted to science and technology (S&T) between developed economies on one side and developing countries (and transition economies) on the other. In fact, according to UNESCO (2001) the developing

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communist regime in 1990, see Hirschman (1995).

<sup>7</sup> UNESCO and OECD have developed a broad concept of “science and technology activities” ( STA) which includes R&D, “scientific and technical services” (STS), and “scientific and technical education and training” (STET). STS covers activities in museums, libraries, translation and editing of Science and Technology (S&T) literature, surveying and prospecting, testing and quality control, etc. STET refers to S&T education and training, notably tertiary education (see UNESCO, 2001, pp.2).

countries that account for 78 % of world population (and 39 % of world GDP) only contributed to 16 percent of global research and development (R&D) expenditure in 1996/97. In contrast, the developed economies with 22% of world population account for some 84 percent of global R&D expenditure, (see table I and figure 1).

– Insert table I and figure 1 here -

According to table I the U.S has the largest share of world R&D expenditure: 36.4 percent in 1996/97. The European Union accounts for 25.2 percent and Japan 15.2 percent. In the developing world, China accounts for 3.9 percent, of world R&D expenditure; the Newly Industrialized Countries of South-East Asia 4.9 percent; India 2.0 percent and Latin America and the Caribbean 3.1 percent. Particularly low shares in global R&D spending are found in Russia: 1 percent and in Sub-Saharan Africa: 0.5 percent.

– Insert figure 2 here -

Another indicator of the domestic effort in science and technology is as the share of GDP devoted to R& D. This coefficient ranges from 2.9 percent in Japan and 2.6 percent in the U.S. to 0.9 in Russia, 0.5 percent in Latin America and the Caribbean and 0.3 percent in Sub-Saharan Africa (see figure 3).

There is also a significantly lower availability of resources (i.e. salaries, research budgets, equipment) per researcher in the

developing countries and transition economies than in industrial countries (see figure 4)<sup>8</sup>. For instance while in Russia the average R&D expenditure per researcher was U\$ 10,000 (in purchasing power parity dollars) in 1996/97, that ratio was U\$ 167,000 in the European Union, and U\$ 203,000 in the United States. These are ratios of 1 to 17 and 1 to 20. In Latin America the R&D spending per researcher is U\$ 48,000 and in the Asian Newly Industrialized Countries U\$ 111,000, all in PPP dollars (see table I and figure 4).

–Insert figure 3 and figure 4 here –

These indicators point-out to a very unequal distribution of world resources in science and technology that mimics also large disparities in per capita income across nations. Rich countries spend more (as a share of GDP) in science in technology than middle income and poor countries. However, there are some significant outliers such as China and India whose ratios of spending in science and technology to GDP are significantly higher than the international average corresponding to their income per capita levels. These international differentials in resources devoted to S&T must be correlated with the observed outflows of scientists and technology experts from developing countries/transition economies to the U.S. and other OECD countries where they find more

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<sup>8</sup> The number of researchers of the developing countries as a share of world total 28 percent is above their corresponding share of world R&D expenditure (16 percent), see table I and figure 2.

resources (and better pay) to carry out their scientific research and technology work.

#### 4. Definition and Statistical Issues in High Skills Migration

A basic issue highlighted in the previous section is the definition of what we mean by high skilled and talented individuals. Although there is no consensus on the definition of the highly skilled, an accepted definition is to assume them to have a tertiary educational qualification<sup>9</sup>. The definition is not free of problems either, as skills can also be acquired through experience<sup>10</sup>. In general, skills levels can be defined by education level or by occupation level. The main international standard classifications are ISCED (International Standard Classification of Education) and ISCO (International Classification of Occupation). The education approach focuses on the supply side of human resources in terms of their skills and qualifications. The occupations approach looks at the demand side for high skills people. The most recent effort to have an agreed conceptual framework has been developed by OECD and Eurostat to measure Human Resources devoted to Science and Technology (HRST), better known as the “Canberra Manual”.

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<sup>9</sup> Those studies use also broad categories of ISCO (levels 1, 2 and 3 , see Auriol and Sexton, 2002).

<sup>10</sup> The lack of a generally accepted definition is reflected in the problems regarding the recognition of qualifications across countries. As the market for the highly skilled becomes even more global, the issue of international recognition of professional qualifications will become more pressing.

The “Canberra Manual” defines HRST as people that have successfully completed tertiary education, or, in spite of having those qualifications, are employed in a Science and Technology (S&T) occupation, where the above qualifications are normally required. The “Canberra Manual” combines concepts of educational attainment and of occupation. The S&T definition used is broad and includes besides natural sciences, engineering and technology, medical sciences, social sciences and humanities.

For purposes of assessing the international mobility (migration) of HRST it is useful to consider some definitions. According to the United Nations a *long-term migrant* is a person who moves to a country other than his/her usual residence for a period of at least one-year. In turn, *short-term migrants* are those that move to another country for at least three months, but for less than a year (12-months). People that move internationally but are “non-migrants” include tourists, short-term business travelers, frontier workers, pilgrims, etc.

The main sources of migration statistics are: i) national administrative systems for regulating and monitoring immigration, including working visas and work-permits for foreigners; (ii)

population registers and population census; (iii) regular labor force surveys; iv) special surveys<sup>11</sup>.

#### 5. Determinants and Specificities of Migration of Human Capital: Matching, Complementarities and Increasing Returns

The determinants of international migration (relative income differentials, immigration policies in the country of destination, state of the business cycle, network effects, others), in principle, are applicable to individuals of different skills, although some factors (costs of migrating, importance of network effects, cultural barriers, etc.) are probably more relevant for the unskilled migrant than for the emigration of individuals with a high stock of human capital.

There are several types of human capital and talented individuals move across countries. *Students* go to developed countries to pursue graduate studies. Some of those students abroad return back home after completing their studies, while others remain in the host country and find jobs in the private sector, universities, research centers, industry, governments and international organizations. Others return to their home countries. In turn, *researchers and scientists* may leave their native countries attracted not only by better pay abroad, but also by the allure of interacting

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<sup>11</sup> An example of special survey is the SESTAT in the United States (US Scientists and Engineers Statistical Data System). The US National Science Foundation created this system. Another examples are the surveys

with peers of international recognition and the aim of pursuing a successful career abroad. In contrast, the talented individuals that stay at home may find lack of recognition, poor career prospects, modest salaries and the absence of a critical mass of professional peers.

Multinational corporations and international banks are other vehicles for the international transfer of talent. International investment often involves intra-company transfers of employees (managers, engineers, professionals) to overseas locations. Multinational corporations require that *managers and international investors* move internationally to establish contacts in foreign markets, make business deals and set-up commercial offices and production units abroad. Also, multinational corporations and firms that have an international scope hire foreign high skill personnel at home. Foreign personnel bring “foreign competences” such as foreign language and knowledge of international milieus, besides special skills in short supply at home.

Investment projects usually involve the movement, across countries, of *engineers, technicians, project specialists, consultants and skilled workers* in the phases of project design, project implementation and actual operations. Some of these people may

move only temporarily (for a few months), while others move on a more permanent basis (for several years).

The decision to emigrate for students, scientists and professionals, has some specific traits that need to be mentioned besides the standard determinants of migration that we listed before. These people leave their home countries for a variety of reasons: the possibility of acquiring knowledge and first rate education in the best centers of the world (for students)<sup>12</sup>, the allure of interacting with peers of international recognition, the aim of pursuing a successful career abroad (for scientists, researchers and professionals).

Individual researchers benefit from interacting with a critical mass of other researchers and scientists working in the same field. Intellectual creation is rarely a purely individual endeavor. Therefore, the productivity of human capital depends, positively, on the availability of human capital. In other words, there are *increasing returns in knowledge creation*. Matching, complementarities and increasing returns are thus an essential part of the story of emigration of human capital.

As the literature on growth and development emphasizes, the emigration of high skilled individuals can lead to virtuous circles in receiving countries. Receiving countries can set in motion a cycle of

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<sup>12</sup> Another factor that encourages the emigration of students is the availability of financial support for foreign students to pursue Masters degrees, Ph.D or Post-Doctoral studies abroad.

vigorous knowledge creation and application by attracting the most talented from abroad, which combine with an often-strong knowledge base in the host country. Conversely, sending countries can enter in a phase of stagnation in the development of science, technology and knowledge following the outflows of talent as a critical mass of scientists and technical experts disappear, deteriorating the milieu for knowledge generation and assimilation at home<sup>13</sup>. We shall deal with these issues in the next section.

## **6. Brain Drains or Brain Cycle? The Emigration-Return Cycle for Human Capital**

The economic effects of the emigration of human capital depend on the nature and dynamics of the emigration-return process. To understand better these effects we need to move beyond simple characterizations of the emigration of talent as a purely “brain drain” phenomena<sup>14</sup>. Empirical evidence on foreign students studying and working after graduation in the United States, provided by the U.S. National Science Foundation, seems to show a pattern that combines

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<sup>13</sup> See Easterly (2001).

<sup>14</sup> In the academic literature there are various concepts of “brain mobility”. For example “brain exchange” implies a two-way flow of expertise between a sending country and a receiving country. Yet, when the net flow is heavily biased in one direction, the terms “brain gain” or “brain drain” are used. A further term, ‘brain waste’, describes the waste of skills that occurs when highly skilled workers migrate into forms of employment not requiring the application of the skills and experience applied in the former job. In turn, “brain circulation” refers to the cycle of moving abroad to study, then taking a job abroad, and later returning home (OECD, 1997 and Johnson and Regets , 1998)) (1).

a “*brain cycle*” with “*brain drain*”<sup>15</sup>. The “brain cycle” would be roughly the following: a foreign student comes to study abroad (say in a developed country) to earn a graduate degree: a MBA, a Master or a Ph.D. After graduation, talented students, from MBAs to scientists, very often get good job offers in the host country. Thus, the foreign student chooses to remain abroad after completing higher education. The duration of the stay abroad can range from a few years, a decade to eventual retirement. If after a few years of work abroad the individual returns home, the emigration of human capital can be understood more as a “brain cycle” and not an irreversible loss. In the case that the emigrant decides to stay abroad during his whole productive life the loss for the sending country is larger and the situation resembles more the “brain drain” symptom. A relevant question here is the following: is there a net loss for the home country associated with the fact that part of its qualified human resource base lives and works abroad? In a world of lower transport costs and almost instantaneous communications through the Internet, the talented individual living abroad may maintain permanent contact and develop professional exchange with its peers. This may include periodic visits to his or her native country thus contributing (indirectly or directly) to national development in his or her area of expertise. More generally, in a world of instant communication,

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<sup>15</sup> See National Science Foundation (1998)

accessing to ideas and knowledge may not require, as a sine-qua-non condition, the physical presence of the person that generates (or is a specialist) in that knowledge. Of course this is, ultimately, a matter of degree and still the benefits of ideas are likely to be greater when the human capital (a person) interacts directly with other people. In addition, income remittances sent by high-skills emigrants is a benefit for the sending country that should be counted when assessing the costs and benefits of the emigration of human capital.

Returning to the U.S National Science Foundation study, it shows that about 47 percent of the foreign student on temporary visas who earned doctorates in 1990 and 1991 were working in the United States in 1995. In turn, the majority of the foreign doctoral recipients in 1990-91 coming from India (79 percent) and China (88 percent) were still working in the U.S. in 1995. In contrast, only 11 percent of South Koreans who completed science and engineering doctorates from U.S. universities in 1990-91 were working in the U.S. in 1995 (see tables II and III). The NSF study reports that foreign doctoral recipients in science and engineering that were working in the U.S. after 10 or 20 years tend to remain in the country (no significant net return migration). The point is that we seem to observe a “*human capital emigration–return cycle*” (brain cycle) whose shape (duration of stay-rates) varies according to country of origin and skill levels. Understanding better the

determinants of stay-rates and return-rates is another important subject for future research. Still it is reasonable to assume that the decision to stay abroad versus return home depend on variables such as: (i) expected earnings differentials between the host and home country count; (ii) cross country differences in the possibilities for career development, in a broader sense than just income; (iii) the age of the migrant, etc.

## **7. Scientific Diasporas**

Diasporas, coming from the Greek *diaspeirein*, mean dispersion, were scattering. The term is often associated with people and communities dispersed from their home country for various reasons: wars, political and/or ethnic persecutions at home, natural disasters, economic disasters (famines) and other causes<sup>16</sup>. Diasporas often tend to maintain emotional, historical, and family attachments with their homeland.

Recent literature<sup>17</sup> has identified the existence of "scientific Diasporas ". These Diasporas have created knowledge networks of nationals belonging to a certain scientific field that work or study abroad.

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<sup>16</sup> See Shuval, J. (2000)

<sup>17</sup> See Meyer and Brown (1999)

A main purpose of these networks is to connect professionals and scientists scattered around the globe that are interested in maintaining contact among them. In addition, they are also interested in helping to promote the scientific and economic development of their home countries. These networks may have a link and be supported by national governments or are fully independent. Examples of these networks are the Chinese Scholars Abroad (CHISA), The Colombian Network of Engineers Abroad (Red Caldas), The Global Korean Network, The Silicon Valley Indian Professionals Association (SIPA), and several others.<sup>18</sup>

Scientific knowledge generation taking place in the world can be transmitted through networks, thereby enabling, to some extent, the de-linking of the contribution of scientists from their physical place of residence. This can help the transfer of knowledge to developing countries.

## **8. Entrepreneurial Migration**

An important feature of migration, relatively neglected in the discussions of brain drain, is the international mobility of entrepreneurship. This is people that settle in other countries—developed and developing—and have a talent for business creation and job generation. Historically, world-wide successful

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<sup>18</sup> Other examples are the Polish Scientists Abroad Network, the Reverse Brain Drain Project of Thailand, the Tunisian Scientific Consortium, the South African Network of Skills Abroad (SANSA), The Program of

entrepreneurs and bankers in the late 19<sup>th</sup> and early 20<sup>th</sup> century in the United States and Europe such as Mellon, Vanderbilt, Carnegie, Rockefeller, the famous banking dynasty of the Rostchilds with operations in London, Zurich and other financial centers were foreign-born or first descents of immigrants<sup>19</sup>. In this case, it is interesting to note that the Mellons, Rockefellers and others, besides accumulating a large wealth, had an interest in creating centers of education and learning. In fact, they helped to establish universities and created private foundations devoted to education purposes. Carnegie in particular, was one of the pioneers in the formation of the system of public libraries in the United States at the turn of the 20<sup>th</sup> century. Later on, names such as George Soros, an immigrant from Central Europe escaping nazi persecution in the 1930s, turned abroad into a very successful financier. Soros is another case of a talented entrepreneur with a philanthropic gist manifested in creation of the Soros Foundation and the network of Open Society Institutes throughout the world.

Some studies have observed a connection between ethnic Diasporas and entrepreneurship<sup>20</sup>, (see box 2 for a detailed example). Classic examples of this are the Jewish emigration to the United States. In fact, it is estimated that the contribution of the Jewish community in America to business creation and banking is

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Venezuelan Talent Abroad and several others.

<sup>19</sup> See Ferguson (1999)

far larger than their share in the total population of the U.S. In the context of developing countries, Chinese emigration has played an important role in building a business community (of Chinese origin) in several very dynamic economies of South – East Asia. In turn, immigration from Germany, Italy, Syria, Palestine, Lebanon to Argentina, Chile, Brazil at the turn of the 20<sup>th</sup> century, played a very important role in building the textile sector, banking, agriculture, mining sectors in these Latin American countries<sup>21</sup>.

There is considerable variation in the scale of the business activity created by the entrepreneurship of foreign migrants. Not all entrepreneur immigrants operate at the economic scale of the Rockefellers, Rotschids or Soros. There is, indeed, a plethora of them operating at the level of family business and small firms. A typical example is the ethnic restaurants (e.g. Chinese cuisine, Indian cuisine, Brazilian cuisine, French cuisine, Italian cuisine etc.) in the large cities of the developed countries.

Moreover in the carpet and furniture business in these cities there is a predominance of Turkish, Indian, Pakistani, Moroccan owners. These patterns of immigrant entrepreneurship do not mobilize large amounts of financial resources but they can be quite labor intensive and their business add to services variety in the host countries. The sociological profile of these endeavors is interesting:

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<sup>20</sup> See Kloosterman and Rath (2000)

<sup>21</sup> See Solberg, C.E. (1970)

business are usually owned and run by members of a specific ethnic group and the employees (many times family members) tend to be also of the same ethnicity<sup>22</sup>.

The connections between ethnicity, entrepreneurship and migration and their patterns of integration/exclusion with the local economy and society are themes that deserve further inquire. For example certain ethnic-migrants that form entrepreneurial groups among themselves may have a more difficult time to integrate to the local society than immigrant that develop entrepreneurial activities across a more diverse ethnic spectrum.

The relationship between endowments of human capital and entrepreneurship is also an interesting subject. Entrepreneurs are not necessarily people with a high stock of formal education; in addition, the “psychology of the entrepreneur” is certainly different from that of the scientist, the expert or the intellectual who we usually identify with “human capital”. Typically the entrepreneur is prone to risk- taking, has a talent for combining capital, labor and for entertaining a vision of opportunities and the prospects for profits<sup>23</sup>. In contrast, professionals, scientist, engineers are often employees rather than owners and are supposed to be more risk averse.

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<sup>22</sup> See Ndoen, M. Gorter, C. Nijkamp and P. Rietveld (2000) and Kloosterman and J. Rath (2001)

<sup>23</sup> See Schumpeter (1954)

An important issue regarding entrepreneurial emigration is the extent to which this type of emigration has a negative effect on national development of the sending country. Entrepreneurs are important agents of resource mobilization, investment and innovation. This is a scarce trait in developing countries, so their departure is likely to have a retarding effect on development. In turn, it is important to consider also that, many times, entrepreneurs do return home bringing along fresh capital, new capital and contacts developed abroad with an ensuing positive developmental effect. We could think here in making a distinction between “entrepreneurial drain” and “entrepreneurial circulation”.

## **9. Impact on Global Output, Global Inequality and National Development**

What are the economic consequences of the international mobility of human capital, talent and entrepreneurship? Who gain? Who losses?

In a world without barriers to the movement of people across nations, individuals should be expected to migrate from places where their productivity (and income) is lower to places where their productivity is higher, regardless of national borders.<sup>24</sup>

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<sup>24</sup> This is a simplification since individual attachments to family, language, traditions and culture in the home country also matter in the decision to emigrate.

Then, human capital will go from lower net returns to higher net return places discounted the costs of moving (including the psychological and emotional costs of leaving home). Unless there are some significant negative externalities, “world income” should be higher with more mobile human-capital, as at the margin, the marginal productivity of human capital will tend to be equalized around the world. As a result, there are *global efficiency* gains from increased mobility of human capital, talent and entrepreneurship. This analysis, however, does not consider the *international distributional impact* of such migration flows between sending and receiving nations.

We live in a world of large disparities in levels of per capita income across countries<sup>25</sup> and the movement of human capital from low income countries to rich nations may tend to accentuate these income per capita differentials. In fact, the emigration of the highly skilled increases the stock of human capital in advanced receiving countries and reduces it in lower per capita income (sending) countries. If, as mentioned before, there are increasing returns in human capital and it tends to concentrate in places where the availability of human and physical capital is already high, the result may be an unequalizing process of income and knowledge concentration across countries that tend to be persistent over time.

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<sup>25</sup> See Solimano (2001a)

Under increasing returns, the international mobility of talent and human capital from poor to rich countries may exacerbate global inequalities of income and wealth.<sup>26</sup> There can be other losses as well for the sending countries from high-skill migration: (i) emigration can entail a loss of fiscal revenues; (ii) source country governments lose with emigration their initial educational investments in the highly skilled emigrant; (iii) the science sector can weaken with the departure of qualified professionals and scientists; (iv) the middleclass, often a stabilizing segment in developing countries, can weaken with massive emigration of high-skills individuals.

However, in the medium and long runs things can improve. The human capital that has emigrated, may return home after a few years (or decades) in a “brain circulation” fashion, bringing along accumulated knowledge, skills and, many times, financial capital with the ensuing contribution to national development, benefiting the home country from this return migration. In addition, as mentions in previous sections, during the period the emigrant stays abroad, he may transfer part of their knowledge and experience to the home country through periodic visits and through possible participation in “knowledge networks” that scientific Diasporas set-up abroad. Further positive effects for source countries are

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<sup>26</sup> See Krugman and Venables (1995) for a center-periphery model with increasing returns.

associated with the fact that returning immigrants have often developed contacts with foreign scientific communities and universities, and have a greater exposure with international best practices in their field. The remittances of the emigrants are another benefit of the international circulation of people.

## **10. Policy Issues**

What can developing countries do to stimulate the return of human capital and entrepreneurs residing abroad in order to boost national development? How to increase the share of benefits to developing countries in the process of global generation of knowledge and the development of new technologies? How to improve the world distribution of resources for science and technology? These are important policy questions.

A first point is to recognize that “simple” solutions such as enacting legal impediments for international migration of human capital and/or imposing stiff taxation of those flows are unlikely to succeed in dampening the outflow of qualified people and can be ultimately counter-productive. Those measures are likely to stifle individual preferences for mobility and will dampen the motivation of scientists, technical experts and other skilled individuals. In the era of globalization and rapid technical change the international

mobility of human capital is unavoidable<sup>27</sup>. An important policy objective must be the creation of supportive economic and professional conditions for the high skilled and talented to return home, after studying, working or investing abroad. The data shows that the share of GDP devoted to R&D in many developing countries is well below world averages. This reflects the existence of other public policy priorities for resource allocation such as physical infrastructure and social spending over the development of science and technology. However, this is shortsighted. In the medium to long run, the neglect of the science and technology sector will be reflected in lower productivity growth and competitiveness, with the consequence of hampering the development potential of these countries. There is a role also for foreign aid to support the development of science and technology in developing countries. Foreign aid in S&T can take several forms: support for universities and high-quality research centers in developing countries to enhance research capabilities and induce the repatriation of scientists and professionals. Another mechanism is fostering the development of international exchanges of scientists and highly qualified professionals in which technical experts of developed countries can spend time in developing countries interacting with local researchers, thus contributing to the local development of the

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<sup>27</sup> Solimano (1999b)

science and technology sector. The use of the internet and support for local libraries in upgrading their collections of books, data bases, specialized journals and the like are concrete measures to help in this area. This aid can be channeled bilaterally or through international organizations such as UNESCO, The World Bank, OECD and others. Currently, the World Bank has a lending program for supporting the development of science in LDCs through the Millenium Science Initiative (MSI). The loans go to national governments that, in turn, provide matching funds and give financial support -often through grants- to the formation and maintenance of "centers of excellence" in science in their countries. There is a role also for international private support of science and technology in developing nations through private foundations with an international scope such as Ford Foundation, Rockefeller Foundation, Bill and Melinda Gates Foundation and others. These foundations can support programs in pure and applied science for development. The Gates Foundation's support development of vaccines and cost efficient drugs for Africa seems to be an excellent precedent in this regard.

Another policy-goal is the fostering of the entrepreneurial strata as agents of innovation and economic progress. As many national entrepreneurs reside and invest abroad this policy requires

an environment in which national investors are encouraged to repatriate capital and launch investment projects at home.

## **11. Concluding Remarks**

The increased international mobility of human capital, high skills individuals and entrepreneurs is a consequence of the process of globalization and technological change that characterize the world economy. This paper shows that this process brings along global efficiency gains but that the distribution of those gains is unequal among countries. Global inequalities in per capita income levels between nations is also reflected in large disparities in the world distribution of resources of science and technology among developed nations, developing countries and transition economies. In fact the economies of the OECD account for near 85 percent of world expenditure in research and development. This concentration of resources in the science and technology sector in advanced economies attracts scientists, professionals and human capital from developing countries and transition economies to the developed world. This raises the concern of “brain drain” phenomena although these people also return home.

The evidence shows that traditional “brain drain”, say a permanent and irreversible outflow of human capital, co-exists also

with cycles of emigration and return of national talent (“brain circulation”). Thus, for developing countries, the emigration of domestic talent need not be always a permanent loss. However, although return rates vary from country to country; and poor regions such as Africa suffer particularly hard from the almost permanent emigration of domestic talent.

Current imbalances in the international distribution of resources for science and technology call for more resources and better incentives for the science and technology sector in developing countries and transition economies. This requires action at several fronts: national governments of developing countries need to give a greater priority to science, technology and knowledge generation at home recognizing its pay-off in enhanced productivity, competitiveness and long-run development. Developed countries in turn can increase the transfer of knowledge to LDCs and redefine foreign aid priorities towards science and technology in developing countries. Public policy efforts in S&T can be complemented by grants from international foundations to support science and technology in developing countries supporting for example the creation, of centers of excellence among other initiatives. All this would be a powerful signal to stimulate the return of emigrated talent to the developing world.

The emigration of entrepreneurs shows broader business opportunities from globalization. However, this type of emigration may also reflect the limitations that investors face in their home countries to realize their potential for business creation and resource mobilization in the developing world. This requires a fresh look at the obstacles for business creation that exist in different developing countries. These obstacles may range from lack of credit, poor enforcement of property rights, bureaucratic red tape, macroeconomic uncertainty, political instability and others. More research is needed to gain a further understanding of the causes for the emigration of entrepreneurs. Imaginative policies are needed to harmonize the need for international mobility of scarce human talent in the era of globalization with the aspirations for national development and more equitable distribution of the fruits of knowledge and technology among all nations of the world.

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## **ANNEX**

Table I: Key indicators on world GDP, population and R&D

Regions/ countries	GDP		Population		R&D expenditure (GERD)				R&D researchers			GERD per researcher (thousands PPP\$)
	Billion PPP\$	% world GDP	Million	% world Population	Billion PPP\$	% world GERD	% GDP (PPP\$)	GERD per inhabit (PPP\$)	Researchers	Researchers	Researchers	
									(thousands)	% world	per million inhabitants	
<b>WORLD</b>	<b>34381.9</b>	<b>100.0</b>	<b>5483.3</b>	<b>100.0</b>	<b>546.7</b>	<b>100.0</b>	<b>1.6</b>	<b>100.0</b>	<b>5189.4</b>	<b>100.0</b>	<b>946.0</b>	<b>105.4</b>
<b>Developing countries</b>	<b>13366.8</b>	<b>38.9</b>	<b>4258.9</b>	<b>77.7</b>	<b>85.5</b>	<b>15.6</b>	<b>0.6</b>	<b>20.0</b>	<b>1476.2</b>	<b>28.4</b>	<b>347.0</b>	<b>57.9</b>
<b>Developed countries</b>	<b>21015.1</b>	<b>61.1</b>	<b>1224.4</b>	<b>22.3</b>	<b>461.3</b>	<b>84.4</b>	<b>2.2</b>	<b>377.0</b>	<b>3713.3</b>	<b>71.6</b>	<b>3033.0</b>	<b>124.2</b>
<b>Americas</b>	<b>11333.8</b>	<b>33.0</b>	<b>782.2</b>	<b>14.3</b>	<b>225.8</b>	<b>41.3</b>	<b>2.0</b>	<b>289.0</b>	<b>1410.5</b>	<b>27.2</b>	<b>1803.0</b>	<b>160.1</b>
North America	8169.0	23.8	295.1	5.4	209.0	38.2	2.6	708.0	1062.2	20.5	3599.0	196.8
Latin America and the Caribbean	3164.8	9.2	487.1	8.9	16.8	3.1	0.5	34.0	348.3	6.7	715.0	48.2
<b>Europe</b>	<b>9186.0</b>	<b>26.7</b>	<b>714.2</b>	<b>13.0</b>	<b>157.7</b>	<b>28.8</b>	<b>1.7</b>	<b>221.0</b>	<b>1768.2</b>	<b>34.1</b>	<b>2476.0</b>	<b>89.2</b>
European Union	7404.4	21.5	373.1	6.8	137.9	25.2	1.8	370.0	824.9	15.9	2211.0	167.2
Central and Eastern Europe	679.2	2.0	115.4	2.1	5.6	1.0	0.8	49.0	167.5	3.2	1451.0	33.5
Comm. Of Independent States (in Europe)	810.4	2.4	213.5	3.9	7.6	1.4	0.9	35.0	733.1	14.1	3434.0	10.3
Other	292.0	0.8	12.2	0.2	6.6	1.2	2.3	539.0	42.7	0.8	3499.0	154.2
<b>Africa</b>	<b>1246.5</b>	<b>3.6</b>	<b>626.5</b>	<b>11.4</b>	<b>3.8</b>	<b>0.7</b>	<b>0.3</b>	<b>6.0</b>	<b>132.0</b>	<b>2.5</b>	<b>211.0</b>	<b>28.5</b>
Sub-Saharan Africa (excl. Arab States)	759.0	2.2	464.0	8.5	2.6	0.5	0.3	6.0	52.5	1.0	113.0	49.1
Arab States (in Africa)	487.6	1.4	162.5	3.0	1.2	0.2	0.2	7.0	79.5	1.5	489.0	14.9
<b>Asia</b>	<b>12172.8</b>	<b>35.4</b>	<b>3331.6</b>	<b>60.8</b>	<b>152.3</b>	<b>27.9</b>	<b>1.3</b>	<b>46.0</b>	<b>1790.6</b>	<b>34.5</b>	<b>537.0</b>	<b>85.1</b>
Japan	3000.3	8.7	125.8	2.3	83.1	15.2	2.9	661.0	617.4	11.9	4909.0	134.6
China	3542.8	10.3	1215.4	22.2	21.1	3.9	0.6	17.0	551.8	10.6	454.0	38.3
Newly Industrialized Economies	2322.5	6.8	405.1	7.4	26.7	4.9	1.1	66.0	240.9	4.6	595.0	110.7
India	1529.5	4.4	945.6	17.2	10.8	2.0	0.7	11.0	142.8	2.8	151.0	75.8
Comm. Of Independent States (in Asia)	168.1	0.5	71.0	1.3	0.6	0.1	0.3	8.0	97.1	1.9	1368.0	6.0
Arab States (in Asia)	398.2	1.2	71.2	1.3	0.8	0.1	0.2	11.0	3.7	0.1	52.0	211.4
Other	1211.3	3.5	497.5	9.1	9.3	1.7	0.8	19.0	137.0	2.6	275.0	67.6
<b>Oceania</b>	<b>442.8</b>	<b>1.3</b>	<b>28.7</b>	<b>0.5</b>	<b>7.2</b>	<b>1.3</b>	<b>1.6</b>	<b>251.0</b>	<b>88.3</b>	<b>1.7</b>	<b>3071.0</b>	<b>81.7</b>
<b>Selected countries/regions</b>												
United States	7511.3	21.8	265.2	4.8	198.8	36.4	2.6	749.0	980.5	18.9	3697.0	202.7
Russian Federation	643.7	1.9	147.7	2.7	5.7	1.0	0.9	38.0	561.6	10.8	3801.0	10.1
Comm. Of Independent States (All)	978.5	2.8	284.5	5.2	8.2	1.5	0.8	29.0	850.8	16.4	2991.0	9.6
South Africa	297.0	0.9	39.9	0.7	2.0	0.4	0.7	50.0	41.1	0.8	1031.0	49.0
Arab States (All)	885.8	2.6	233.8	4.3	2.0	0.4	0.2	8.0	83.2	1.6	356.0	23.6
OECD Countries	21601.0	62.8	1096.8	20.0	463.0	84.7	2.2	422.0	2822.3	54.4	2573.0	164.0

Source: UNESCO estimates August 2000

Table II. Percentage of 1990-91 foreign S&E doctoral recipients from U.S. Universities who were working in the United States in 1995, by country of origin

Country	Foreign S&E doctorates	Percent working in the United States
Total	13878	47
China 1/	2779	88
India	1235	79
Japan	227	13
South Korea	1912	11
Taiwan	1824	42
England	142	59
Germany	177	35
Greece	240	41
Canada	417	46
Mexico	194	30

1/ The high stay rate of Chinese students is attributable to a one-time granting of permanent residence status in the United States (Chinese Students Protection Act) following China's response to student demonstrations.

NOTE: Includes foreign doctoral recipients with temporary visa status at the time of receipt of degrees in 1990-1991 (not permanent residents).

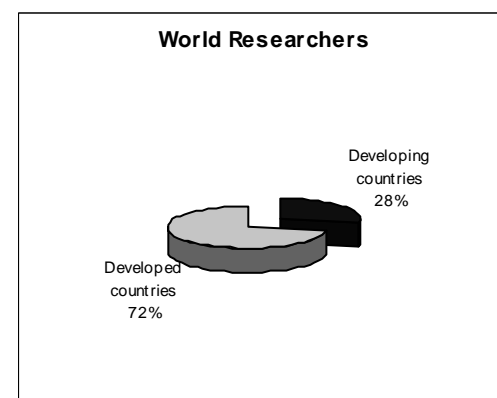
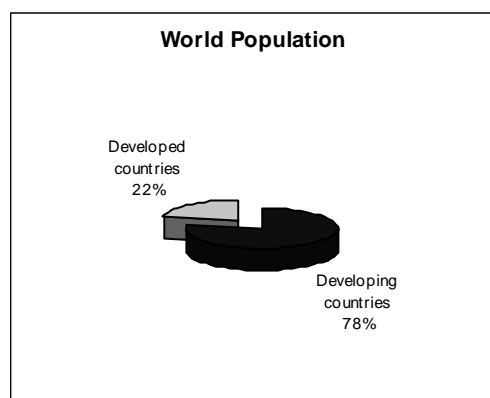
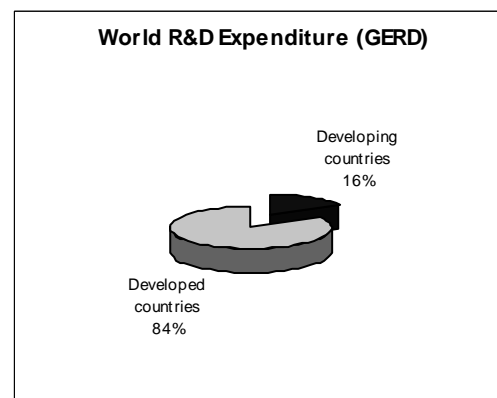
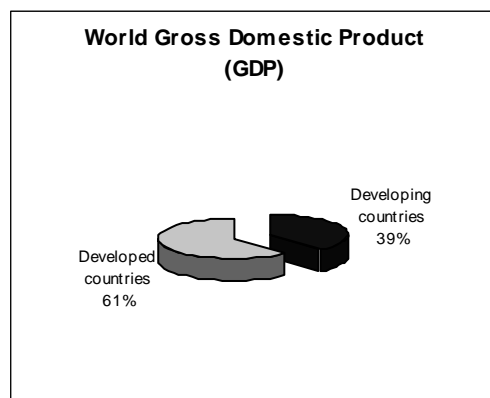
SOURCE: NSF, 1998

**Table III. Chinese students studying abroad and returning, 1978-99**

<b>Year</b>	<b>No. of students studying abroad</b>	<b>No. of students returning</b>
1978	860	248
1980	2124	162
1985	4888	1424
1986	4676	1388
1987	4703	1605
1988	3786	3000
1989	3329	1753
1990	2950	1593
1991	2900	2069
1992	6540	3611
1993	10742	5128
1994	19071	4230
1995	20381	5750
1996	20905	6570
1997	22410	7130
1998	17622	7379
1999	23749	7748

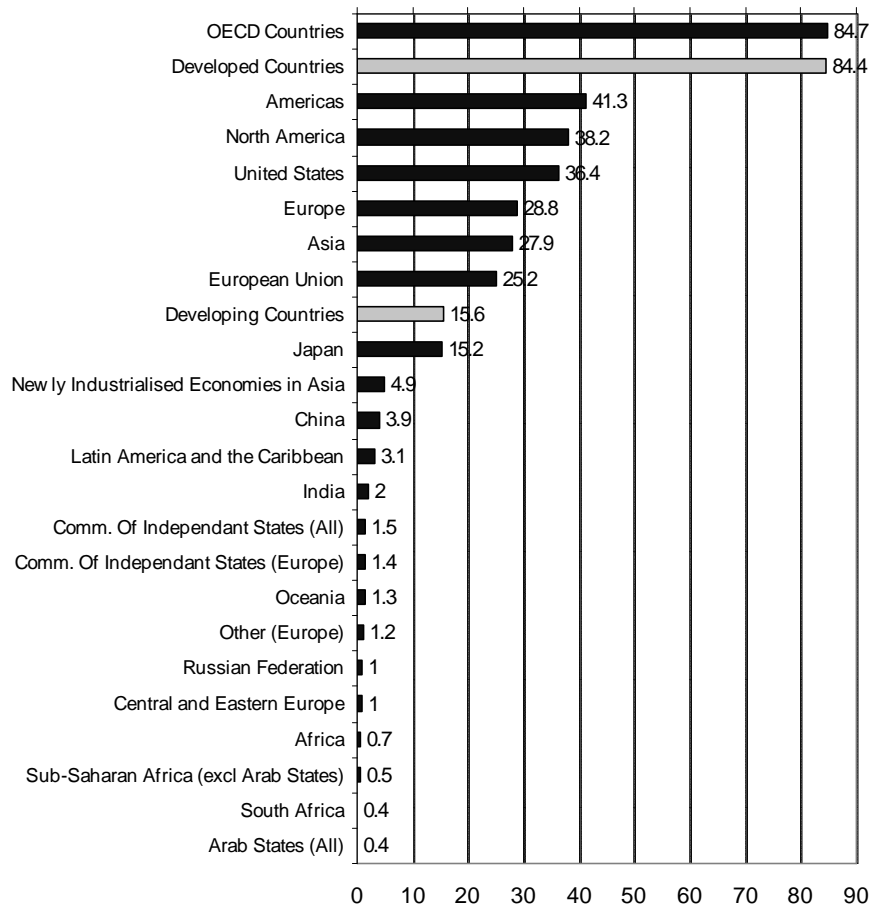
Source: OECD 2002.

**Figure 1. World GDP, population and R&D resources in developed and developing countries 1996/1997.**



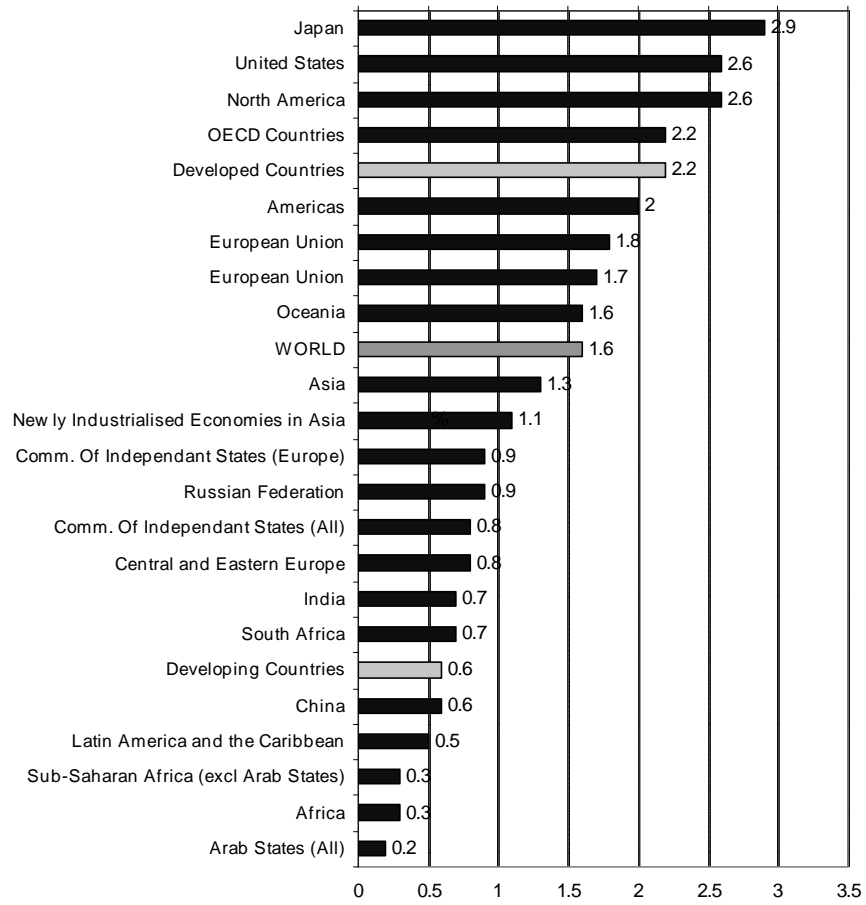
Source: Table I.

**Figure 2. Shares of world R&D expenditure (GERD) by principal regions/countries 1996/1997(%)**



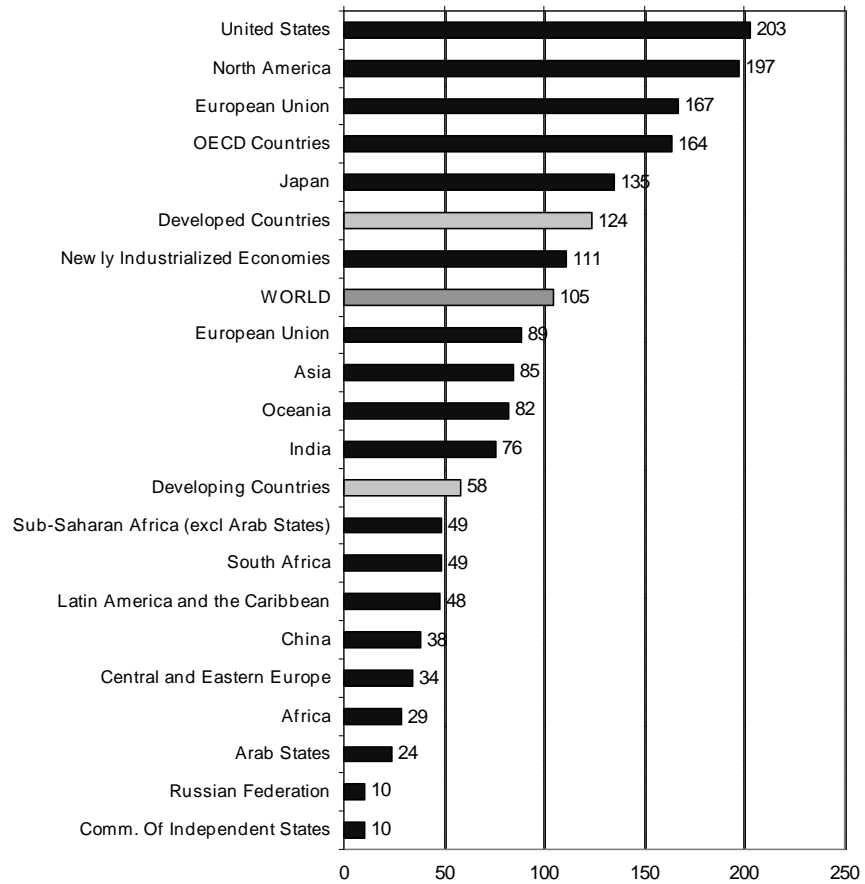
Source: Table I

**Figure 3. GERD as a % of GDP by principal regions/countries  
1996/1997**



Source: Table I.

**Figure 4. R&D expenditure (GERD) per researcher by principal regions/countries 1996/1997 (thousand ppp US\$)**



Source: Table I.

### **BOX 1. Recent policy initiatives in OECD countries to attract foreign talent**

**Canada (Quebec Province):** The provincial government of Quebec is offering five-year income tax holidays (credits) to attract foreign academics in IT, engineering, health science and finance to take employment in the provinces' universities.

**European Union:** As a follow-up to the Bologna Charter on education, efforts are under way to harmonize educational certification and qualification systems among member states in order to encourage greater student mobility within the EU.

**Finland:** The government has taken steps to encourage the enrolment of foreign students in Finland, including from Asia.

**France:** Several recent measures seek to facilitate the temporary migration of foreign scientists and researchers. In 1998, the government established an agency, EduFrance, with a budget of FRF 100 million to attract a greater number of students to France, particularly from Asia and Latin America.

**Germany:** The government seeks to increase foreign student inflows through grants and fellowships schemes. In addition, it launched a program to issue 20000 immigration visas to fill IT job vacancies. In the second quarter, only one-third of the visas had been granted, mainly to people from India and eastern Europe who were hired by small firms.

**Ireland:** The shortage of skilled workers, especially in IT, has led to government campaigns in 2000 and 2001 to attract foreign workers as well as former Irish emigrants. Government-sponsored job fairs have been held in Canada, the Czech Republic, India, South Africa and the United States. In addition, work visas were introduced in 2000 specifically to allow the entry of highly skilled workers in areas where shortages exist in Ireland (MacEinri, 2001).

**Japan:** The government seeks to double the number of foreign students through the use of scholarships.

**United Kingdom:** In 1999, the UK government launched a major campaign to increase the number of international students in higher education from 198000 to 248000. The strategy is based on: i) a promotional/marketing campaign; ii) streamlining of visa procedures and rules on employment for foreign students; and iii) special scholarships for top achievers.

**United States:** The US Congress has temporarily increased the annual cap on the number of temporary visas granted to professional immigrants under the H-1B visa program whose statutory limit in 2000 is presently set at 195000 visas per year until 2003.

**Source:** OECD (2002)

### **BOX 2. Asian venture capital in the Silicon Valley**

According to estimates from industry sources, there are several dozen Asian venture capital firms in Silicon Valley – 31 from Chinese Taipei alone and others from Japan, Hong Kong (China), Korea, Singapore and Malaysia. Most of their money goes to start-ups that specialize in the Internet or semiconductors. A handful of venture funds, such as the Taipei-based InveStar Capital Inc., founded in 1996, invest more heavily there than in Asia. In 1998, 80% of their investments (more than USD 100 million) went to Silicon Valley firms. While there are no venture funds and few private financiers from the Indian subcontinent, the community is overflowing with local Indian investors who provide enough early funding to give companies the momentum to attract the attention of mainstream venture capital firms. As the San Francisco Bay Area's Asian ethnic communities reached a critical mass in the 1990s, their networks and associations have expanded. Among the largest Chinese and Indian associations are the Monte Jade Science & Technology Association (1000 members), formed in 1990 by wealthy individuals from Chinese Taipei, and the Indus Entrepreneurs (600 members), founded in 1993 by businessmen from South Asia.

**Source:** OECD (2002).