

B. HIGHLY SKILLED GLOBETROTTERS: THE INTERNATIONAL MIGRATION OF HUMAN CAPITAL

by

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Overview

Brain drain, skill shortages, and lack of career opportunities have become issues of major concern for policy makers in government, academia, and industry in the final years of the 20th century. Increasing opportunities for labour mobility across political borders, especially among highly skilled labour, provide a solution for the aforementioned concerns to some actors, but engender problems to others. Drawing on various empirical investigations and on previous studies, this paper attempts to provide a mapping of the various types of human resources mobility across national borders. It argues that various groups of highly skilled persons are driven by different push and pull factors. In addition to immigration legislation, other factors, such as taxation, studying abroad, quality of work, openness in communication, business expansion overseas, labour market supply and demand signals, etc. play an important role in the choice of highly skilled migrants to relocate overseas.

Background

In recent years there has been an increasing concern about the future location of research (Etzkowitz & Leydesdorff, 1997), skills shortages (Metcalf *et al.*, 1995), and the migration of highly skilled personnel (Salt, 1997). This paper deals with the geographic mobility of highly skilled personnel in general and aims at providing a systematic analysis of the various mechanisms that influence the mobility of distinct groups of highly skilled personnel.

This issue has lately become a crucial policy concern at both enterprise, governmental, and inter-governmental levels. For instance, the European Commission for Science, Research and Development (DG-XII) has initiated an inquiry into the possibility of a brain drain in certain technological sectors from Europe, particularly, towards highly attractive labour markets such as the United States. Similarly, the government of Canada, and other concerned bodies in industry and academia there, have expressed their deep concern about the relocation of many Canadian highly-trained workers to the south of the borders. Similar complaints have been echoed in the media from South Korea, The Netherlands, Sweden, Switzerland, and other countries across the globe.

The competition for highly skilled workers seems to be intense and fierce. Traditional flows of talented people between countries that tended to go from the south to the north are now in some cases reversed. More countries in the south, particularly, in South East Asia and in Eastern Europe, are catching up technologically and becoming increasingly knowledge-based economies, and thus highly skilled scientists and engineers might stop flowing out from there. Thus, a motion of brain drain and brain gain might be going in all directions: north-north, north-south, south-north, and south-south. This might threaten countries (like the United States) that depend heavily on foreign talent.

Introduction

The labour market for professional skilled personnel is becoming increasingly global, both in terms of the supply of and the demand for skilled labour. Overseas students, for instance, are forming more and more a greater proportion of university students in most industrialised countries, and international mobility schemes for researchers are available at most universities (Stein et al. 1997). Multinational enterprises too draw increasingly on personnel with qualifications that enable them to be sent on long term missions to their affiliates around the world to enhance and ensure a high quality performance (Straubhaar & Wolter, 1997).

These developments might have numerous implications for the future location of highly skilled personnel, especially on the sending countries. Nations increasingly view technology transfer as primarily a people-oriented phenomenon and fear they might lose their competitive edge in what seems like a global competition for certain skills. Immigration is thus becoming increasingly an inseparable segment of national technology policies. The ability of some countries, regions and cities to attract highly talented personnel from all over the world seems to be enormous and governments are increasingly under pressure to react to these developments. Every year, actors in a few locations around the world recruit many highly talented managers, scientists and engineers. Whereas these trends can have mixed effects on developing countries (Simon, 1987), it is believed that they evoke largely negative effects on knowledge-based advanced economies like those of Europe (Mahroum, 1998). A Canadian-based study has estimated that if all the managers, scientists, and health science professionals who went to the United States between 1989 and 1996 had to be replaced, the costs for the Canadian economy could have totalled CAD 11.8 billion (De Voretz & Laryea, 1998). However, immigration to Canada has helped reduce the costs of recuperating these losses to the United States, although to a certain extent only.

In this paper, I argue that the issue of migration and international mobility of highly-skilled personnel is a complex and diverse one and requires thus very highly tailored and diversified policies. Each group of highly skilled professionals is lured and pushed by different sets of circumstances and provisions. I, therefore, shed light on the various push and pull factors that are involved in the process of relocation and mobility of the distinct groups of highly skilled personnel in the OECD area. In doing that, I firstly discuss the conceptual problems associated with the studying of this phenomenon. Secondly, I introduce briefly the notion of brain drain and brain gain, and thirdly, discuss the main drivers behind mobility for the various groups of highly skilled personnel. Finally, I discuss the main conclusions and policy implications of the paper.

Conceptual problems

There are enormous problems associated with gathering and finding data on the migration and mobility of highly skilled personnel. Firstly, there are conceptual problems. There is no agreed definition across countries and among scholars of what characterises a *highly skilled person*. Is a highly trained executive or technician with no formal qualifications considered a highly skilled person? Or should a highly skilled construction worker be included in data on highly skilled persons? Furthermore, what distinguishes between a *migration* and a traditional skills *exchange*?

However, some efforts have been made, and are continuing, to develop a proxy definition of what constitute a highly skilled person. For instance, the 1993 *OECD Frascati Manual on Proposed Standard Practice for Surveys of Research and Experimental Development* and the 1995 *OECD Canberra Manual on the Measurement of Human Resources Devoted to Science and Technology* have developed a statistical framework to categorise, collect and analyse data on science and technology workers at the international

level. According to the Frascati and Canberra manuals²⁰, there are four ways to classify science and technology workers: *i*) by qualification, *ii*) by activity, *iii*) by sector and *iv*) by occupation. While educational and activity-based classifications have long been in use, these are now joined by efforts to systematically collect and analyse data on where science and technology personnel are employed by occupation or sector. These different categorisations can be used for many different purposes, for example, to assess the supply of PhDs for high-level teaching and research positions, to identify in which industrial sectors S&T personnel are working, or to evaluate whether there are sufficient molecular biologists or computer programmers to meet future market demand. Most meaningful analyses of trends in science and technology labour markets combine one or more classifications, for example, qualification and occupation. This is used to identify the skill levels needed for different types of jobs. Combining data on workers by occupation and industrial sector indicates what types of workers are being employed in different industries, e.g. computer programmers in the chemical industries. However, as yet, such approaches are not totally harmonised across OECD countries and efforts continue to refine the categorisation of science and technology workers.

In dealing with this issue, the literature on the migration and mobility of the highly skilled is generally grouped into several categories. Firstly, there are studies that look into the international movements of highly skilled personnel in general and detect their inwards and outwards flows for the various countries (Salt, 1997; Carrington & Detragiache, 1998). Another group of studies focuses on individual professions within highly skilled categories, such as medical practitioners (Miller *et al.* 1998), bankers (Beaverstock, 1994), scientists and academics (North, 1995; Gaillard & Gaillard, 1998; Johnson & Regets, 1998; Mahroum, 1999) or individual nationalities (Findlay & Garrick, 1989; Song, 1997). In this group of studies, some stress the impact of scientists emigration on the sending countries (e.g. Bhagwati & Partington, 1976; Mountford, 1995), and others are concerned with the impact of these on the receiving countries (Gover & Huray, 1998; North, 1995).

Mobility and brain gain/drain

The OECD paper (1998) "Science and Technology Labour Markets: Mobility and Flexibility" indicates that there are two main types of mobility: *external* and *internal* mobility. The first can be divided into geographic mobility (regional, national and international) and into mobility from labour turnover (i.e. changes in individuals among jobs, regardless of whether the jobs are new or existing). Internal mobility refers to occupational changes (i.e. moving across occupational categories) and/or movement within the firm (e.g. between divisions, establishments). In the case of the labour market for science and technology personnel, the most relevant types of internal and external mobility concern: *i*) movement from the educational system to the labour market; *ii*) mobility *within* the public research sector (e.g. universities, laboratories, public research institutes) and between public research and industry; *iii*) mobility of S&T personnel within industry and; *iv*) international mobility which sheds light on the temporary and permanent migration of science and technology personnel (i.e. "brain gain" and "brain drain" issues). This paper deals exclusively with the latter, namely, international mobility of S&T personnel.

The main drivers of international mobility

Various sorts of geographical mobility exist, short-term overseas visits, long-term stays, and permanent stays. When highly skilled persons are involved in one of these various forms of mobility, various outcomes might result from it. Gaillard & Gaillard (1998), and later Johnson & Regets (1998), talked of a

20. The information in this section is derived from the OECD paper entitled "Science and Technology Labour Markets: Analytical Framework".

notion of “*brain circulation*”, or of what others have described as a “*professional transients*” movement (Appleyard, 1991). It is believed that this form of mobility, which refers to long term subsequent expatriation of skilled personnel in and out of various locations, is on the increase due to diminishing economic disparities between countries (Salt, 1997). This form of mobility is often perceived as a positive mobility that provides a channel for knowledge transfer. An OECD report (1997) on the movement of the highly skilled identifies, and distinguishes between, two main outcomes for their mobility: “*Brain exchange*” and “*brain waste*”. A “*brain exchange*” implies a two-way flow of expertise between a sending country and a receiving country. Yet, where the net flow is heavily in one direction, the terms “*brain gain*” or “*brain drain*” is used. A “*brain waste*”, however, 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 (OECD, 1997).

There are many various types of professionals within the highly skilled category of migrants and the push and pull factors for their migration are various. The push and pull factors for the migration and mobility of scientists might vary, for instance, across disciplines. The motives for a scientist to relocate somewhere else other than his/her own country might be personal aspirations and scientific curiosity, whereas for a manager, it might be a mere reflection of the employer’s priorities. Governmental policies or industrial lobbies’ policies might also play a role in influencing the incentives to stay or move abroad, such as by instigating incentives for foreign skills to flow in or remain in the country in certain fields (e.g. US policies). Governments’ policies can make certain locations attractive for individuals by for instance providing tax incentives, superior research infrastructures, and preferred wages.

Additionally, the nature and structure of *National Innovation Systems* (NIS) play an important role in shaping the inflows and outflows of highly skilled persons. For instance, countries whose NIS revolves around universities will attract primarily academics from abroad, as universities will be the place where cutting edge national activities in science and technology are happening. The same is true regarding NIS whose core S&T bases lie in industrial research or large public research organisations. Such imperfections across NIS shape to a large extent individual choices for mobility and determine in the long run the patterns of flows between countries. In the United States where the NIS revolves around a number of centres of excellence some of these have become so powerful that their attractiveness goes beyond their regional and national borders into a global scale. The University of Stanford in California and MIT in Massachusetts are two examples of such centres of excellence. Each of these two institutions attracts large numbers of overseas scientists and research students to their realms. Over 50% of all post-doctorates in science and engineering specialisation in these two institutions come from overseas (NSF/SRS, 1998), and already in the Silicon Valley 30% of computer professionals are foreign-born. Likewise, a study conducted in the early 1990s on American scientists in France (Martin-Rovet *et al.*, 1991) found that the majority of these (60%) were hosted by the CNRS, which in turn has over 1 500 laboratories and reflects the centralisation of R&D activities that characterises the French NIS.

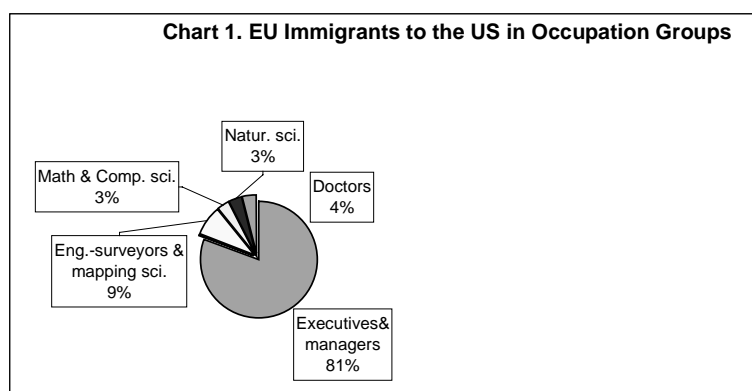
Thus, the flows of professionals tend to go through leagues of cutting-edge *activity-intensive* locations. The reputation as a cutting-edge workplace is a strong attraction for scientists and engineers. This is already evident in industry, academia, and in the service sector. In industry, the IT sector in the US, for example, performs as a magnet for IT specialists from all over the world (Hsiao, 1997). In academia, Cambridge and Oxford universities attract most of Europe’s foreign talents in biosciences and clinical medicine (Mahroum, 1999). In the service sector, particularly, in the banking sector, London, Tokyo, and New York are global magnets of top bankers (Beaverstock, 1994).

The next sections will identify the main push and pull factors and the main channels of migration for the distinct groups of professionals and highly skilled. These are: *i) Managers & Executives, ii) Engineers & Technicians, iii) Academics & Scientists, iv) Entrepreneurs, and v) Students*. This paper uses the definitions and classifications of the *International Standard Classification of Occupations (ISCO)* as a

guideline. Accordingly, the first four groups all fall in the ISCO groups 1, 2, and 3 categories (see OECD, 1995). Students, however, are considered as main supply channels to these groups. These five groups are by far the largest groups of migrant professionals and the most frequent movers.

Managers and executives ⇒ accidental tourists

These are mostly affected by corporate policies, especially regarding expanding activities overseas and internationalisation. A study from Australia has shed some light on the extent of the phenomenon of mobility among managers (Lewis & Stromback, 1998). The study found that in Australia, and during the 1990s, some 10 000 managers (and 25 000 professionals) are arriving and departing each year. The majority of these arrived from and/or left to the United Kingdom, Ireland, and neighbouring Southeast Asian countries. Similarly, in 1996 executives and managers made up 81% of the 7 638 highly skilled permanent immigrants to the United States from the EU (see chart 1 below). Chart 1 shows that the largest group of professional EU immigrants to the US is made up of those who have executive and managerial occupations (4 324 persons).



Source: INS 1998; Data: Author's own calculations.

These are referred to as *accidental* tourists because the decision for their mobility comes often unplanned and surprisingly based upon a new merger or expansion activity of the employing firm. These often originate from temporary intra-corporate transfers that later turn into long term and permanent moves. Salt & Clarke (1998) found that the majority of 13 266 foreign professionals (from non-EEA countries) that have sought residency in the United Kingdom in 1995 were mainly executives and managers resulting from intra-corporate transfers and came from other advanced economies such as Japan and the United States.

Various types of foreign investments necessitate different type of intra-corporate personnel expatriation. For instance, senior engineering staff might be sent abroad to supervise and operate a project in a less advanced developing country which possesses little of such human resources, whereas, senior managerial staff will often be transferred between firms in advanced countries after a merger or a take-over. In the latter, foreign investment necessitates some expatriation of local talents in order to incorporate new businesses abroad into the mainstream corporate environment prevalent at home, and also to reach equal efficiency and quality standards.

In this context, Straubhaar and Wolter (1997) have provided a dynamic picture of the process. In their opinion, the early stage of internationalisation of a firm requires intensified expatriation of some of its managers to run its activities abroad and to provide certain firm-specific expertise. During its later stages

of internationalisation, the consolidation phase, the firm's activities overseas become deeply and fully integrated in their local environments so that expatriation becomes less important. But this differs across national practices. Japanese management, for example, tends to depend on Japanese staff in both the early and late stages and most of the time (Findlay *et al.* 1995). It is not surprising, thus, to find the United States, Europe, and Japan, due to their foreign investments, to be the main sources of highly skilled temporary migrants in South East Asia (Lewis & Stromback, 1998). The United Kingdom sends annually a significant amount of professionals to countries in Australasia (e.g. Hong Kong, China and Singapore), particularly in the banking sector (Beaverstock, 1994). In 1996-97, around 2 340 highly skilled immigrants from the United Kingdom arrived to settle in Australia (Source: DIMA, 1998).

The international mobility of executives and managers comes more as a result of business expansion than a personal decision. The cost of such mobility usually entails significant financial (as well as social) costs for both the employing firm and the person concerned. As outlined above, it is believed that expatriate managers enhance the control system of the parent company over its subsidiaries abroad. The various benefits and remuneration enjoyed by this group of professionals (e.g. stock options in employing firms) make their mobility often internal to the organisations they work for. However, in a study based on Hong Kong, China, Findlay *et al.* (1996) found that while abroad expatriate managers become part of an international pool of skills that is vulnerable to all sort of offers from other employers, especially from local companies in the host country. Findlay *et al.* add that the probability of changing employer increases with the amount of time spent abroad (*ibid.*, pp 53).

Engineers and technicians ⇒ economy-class passengers

These are largely affected by immigration policies, industrial and labour policies of governments. They are like *Economy-Class Passengers* because they are “pulled” and “pushed” primarily by economic factors, i.e. best offers. Governments, firms, and individuals make their decisions on the labour market in accordance with *supply* and *demand* mechanisms of the labour market. But individuals in particular make their choices according to what they perceive as most rewarding for them. Thus they would go to where the demand for their skills is most needed and most rewarded. Research from the United Kingdom has shown that this group seems to be more responsive to the state of the national economy than other groups (Salt & Clarke, 1998). For instance, greater numbers of highly skilled labour were hired in the United Kingdom in response to a growing foreign investment (including technological investment) in the British manufacturing industry (*ibid.*, pp. 380). Apart from EU countries, the majority of these came from other highly industrialised countries such as the United States and Japan.

In the United States, according to the 1990 census, there were around 234 178 foreign-born engineers representing 12.3% of total engineers (Bouvier & Martin, 1995); of these, there were 104 101 engineers from Asia. Asian immigrant-engineers had the highest pay rate among all engineers in the United States (including native-born engineers), Japanese engineers had the highest pay amongst them all. This observation goes perhaps against the assumption that immigrant professionals push local wages down (as discussed below). Around 20% to 28% of all employed S&E workers with a doctorate in the United States are foreign-born. The United States is expected to attract more engineers from abroad, since employment in science and engineering occupations are expected to increase at more than three times the rate for all occupations (science and engineering Indicators, 1998) in the 1996-2006 period. In 1993, around 5 000 EU technicians and technologists were granted "green cards" in the United States (INS 1998), this number has been almost static over the years.

However, concerns are raised on the effect of this group of immigrants on the local labour market for engineers. Gover & Huray (1998) indicate that with the immigration of engineers to the United States free market mechanisms are sabotaged as supply and demand signals are distorted by the supplies coming from

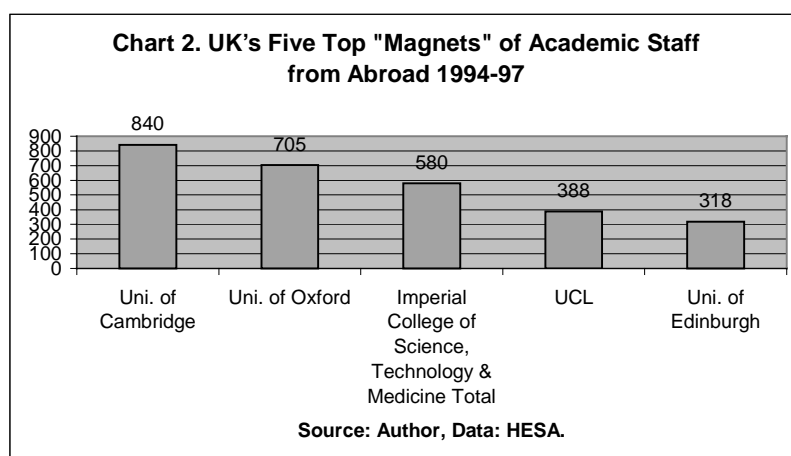
abroad rather than from the local market. The effect of that, the authors say, is an artificial lowering of engineers wages' at home (Ibid., pp. 11). Whereas this argument might be true when considering one single group, the immigration of engineers, and broadly speaking other highly skilled groups too, is widely acknowledged to yield more benefits to the overall society than losses, especially in the longer term (Simon, 1987; Freeman, 1997; Cobb-Clark & Connolly, 1997; Johnson & Regets, 1998; Miller *et al.* 1998). Regets (1997) adds to the debate by indicating that engineers (and scientists) immigrants do not necessarily substitute for local talents but complement them due to existing differences in aptitude and methods of study between countries.

Academics and scientists ⇒ pilgrims

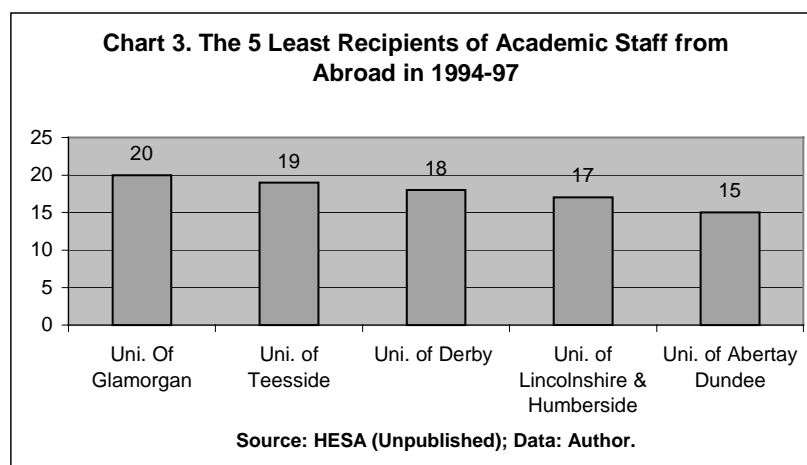
International contacts between scientists from different countries are a normal part of scientific life and an old norm among scientists. The movements of scientists are most affected by bottom-up developments in academia and science, as these are instrumental in the diffusion of scientific ideas. However, scientists do not work only for academic organisations but also for industry and enterprise.

In general, scientists seem to be attracted to the nature of the work they are required to do and the conditions under which they have to conduct their work. For instance, Deeds & McMillan (1998) argue that a "reputation" for scientific openness (i.e. encouraging staff to publish their results) is an important quality for firms wishing to recruit best scientific talents. To test this argument, they conducted a survey of over 400 PhD students to determine if a firm's support for publication matters in their job search; thus they asked students for their opinion regarding a list of twelve US pharmaceutical companies. The results showed that publication support does matter for choosing an employer, although not as much as the quality of research staff in the organisation, working conditions, and salary. However, a ranking of the top three organisations most cited as prospective employers mirrored a ranking that reflects publication records. In other words, organisations that ranked high in the number of scientific publications produced, ranked equally high as desired employers. This suggests that publication records may indeed be a signalling device providing a higher degree of visibility for prospective employees.

In academia, empirical research from the United Kingdom has shown that between 1994 and 1997 around 11 000 foreign academics were employed in the UK higher education system (Mahroum, 1999), the biggest single group of these came from the EU (45%). The distribution of the inflows is random, certain field areas and certain universities have attracted most of these inflows. Chart 2 below provides more details.

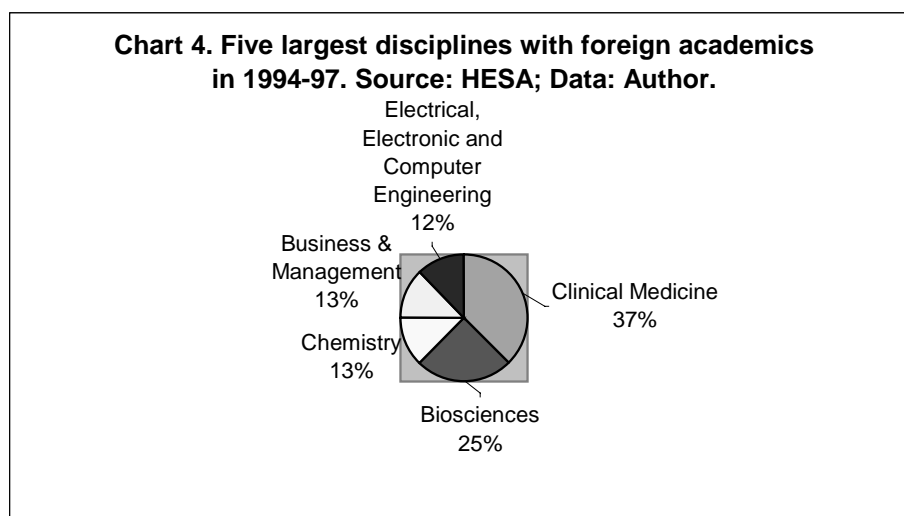


The biggest recipient (University of Cambridge) received 840 foreign scholars, 210 times more than the lowest recipient (Thames Valley University), which recruited a mere four foreign scholars in the whole period. Chart 3 below provides more information on the five least substantial recruiters of foreign academic staff among British universities²¹.



All universities in Chart 3 are former polytechnics who neither enjoy a strong international reputation for excelling in some disciplines nor a long time cumulated prestige. The variation across fields and institutions implies that different sets of factors stand behind the various types of inflows. One might argue that there are two main dynamics for scientific attraction: *i*) the attraction of a country in a particular discipline, *ii*) the prestige of an institution. A country might be known to be strong in a particular discipline and thus gains collectively as a nation a reputation for being good in that particular discipline becomes attractive to scientists working in that discipline worldwide. For instance, the strength of the United Kingdom in clinical medicine and biosciences might explain the international attractiveness of the United Kingdom in this field, as reflected in the proportion of foreign academics in these two disciplines in that country. Chart 4 provides more detail.

21. Universities that had less than 15 recruits from abroad in the 3-year period were left out.



Source: HESA; Data: Author.

However, an institution with a strong prestigious background can capitalise on its prestige²² to attract the best scientists available around the world. Shapin (1998), in his analysis of the role of *trust* in science, indicates that scientists today are attracted towards *expertise* and the institutions that produce and vouch for expertise. He argues that modern science is no less trust-dependent than science in the past, and that scientists put their trust in organisations that are highly reputed for excellence, quality, and originality. Therefore, “attraction” is dependent on the possession of certain qualities that are not available in all organisations, and which are often difficult to assess from the outside. Thus a lot of judgement from outside depends on the prestige and reputation an institution enjoys. In many cases, the reputation and prestige of an organisation are enhanced by the existence of “star” scientists (e.g. Nobel laureates) among the faculty. Kretschmer (1997), for instance, suggests that there is a sort of “homophile” among scientists, that is “persons [scientists] are guided more or less by a deliberate search for persons with similarity in characteristics” (Kretschmer, 1997, pp. 581). Accordingly, scientists’ networks follow the same structure; a top scientist from Harvard will go only to another top organisation abroad that is operating in the same field.

As the demand for skilled scientific labour is expressed increasingly outside traditional fields of academic activity, a reputation for scientific openness, excellent quality, and prestige for excelling in research are important qualities for all organisations engaged in science-based activities and seeking to lure scientists of high calibre.

Entrepreneurs ⇒ explorers

These are business-oriented persons who arrive with capital and ideas aiming at setting up certain business activities. They are stimulated by a variety of policies, most prominently, governmental (visa, taxation, protection, etc.) policies and credit facilities. Some countries like Australia, Canada, and the United Kingdom have certain legislation that allow entrepreneurs to immigrate and settle providing that they invest or bring with them certain “minimums” of capital to the country. A study by David Keeble (1989)

22. Brewer, Gates, & Goldman, (1998) define “Prestige” as the notoriety for being among the best at some activity that is difficult to define or demonstrate concretely.

showed that around 70% of Cambridge area hi-tech entrepreneurs (at the time of the study) were immigrants.

In Australia, for instance, the number of entrepreneur immigrants has risen from 1 900 (ca. 2.5%) in 1993 to 2 700 (ca. 3%) in 1996. The total of these in the whole 1993-96 period was 7 000 business people (DIMA, 1998). The benefits of entrepreneur immigrants are perceived not only in the capital they bring with them, but also in their knowledge of overseas markets and their business networks. A very much sought after group is entrepreneurial scientists and technologists. This group is usually attracted to locations where tax incentives and venture capital for new start-up hi-tech firms are available, or where public funds to support hi-tech entrepreneurs exist. Silicon Valley in the United States is a traditional destination for such migrants and remains for many a model to pursue. In a very recent study carried out by an American research consultancy²³ on behalf of the *Institute for Prospective Technological Studies* entitled "The European Entrepreneurial Presence in the USA" the following was found. About 350 hi-tech companies in the San Francisco Bay Area were created by Europeans from the EU member countries and that, according to the French Consulate General, results in about 500 new French citizens arriving every year in the Bay Area, either to work in local hi-tech companies or to create their own company. On the other hand, the representative of the Netherlands thinks that the flow of Dutch entrepreneurs arriving is now receding. Of 32 founders of hi-tech firms from the EU in the Silicon Valley, the majority has indicated that they would not come back to Europe under any circumstances (60%). The main reasons that were given are:

- Family.
- Too much "red tape" and bureaucracy.
- Unfavourable entrepreneurial climate.
- No flexibility for human resources management (hiring, firing, work hours, ...).
- Lack of venture capital.

The study also noticed that migrating does not necessarily mean "burning the vessels" and breaking the relationship with the home country. On the contrary, most of the entrepreneurs that were interviewed maintain close relations with their home countries. They consider it essential to stay connected with what happens there, especially in the event that they have to return. Yet those who would consider coming back to Europe, would do so:

- To create a business presence for their company in Europe.
- To turn around/start a business in their country of origin.
- For tax incentives.

Emigré EU entrepreneurs have also indicated that more flexibility to manage human resources in the EU, and a better stock option system, would attract them back. These factors are both pull and push factors and can have serious effect on the making of personal decisions for relocation and mobility.

Students ⇒ passengers

These are the main sources of workforce supply to the labour market and to local and global knowledge pools. They are mostly affected by governmental, intergovernmental, and inter-institutional policies. A 1998 survey of European graduates, conducted by the Swedish human resources consultancy Universum,

23. ACTEAM International Corporation.

found that 82% of European students state that they are interested in an international career and 88% are interested in working and living abroad for at least one year. Students today show an increasing recognition of the global workplace. Given a choice of where to locate a career abroad, the United States or Canada are most attractive (63%), followed by the United Kingdom (35%) (Source: Universum, 1998). Smaller countries, such as Sweden, Holland, and Ireland, in particular, seek to produce more internationalised graduates able to work abroad in order to cope with their growing international businesses activities. Participation in international education and training, including the various international exchange schemes and fellowships, has stimulated interest of young scientists to work abroad and has helped internationalise domestic graduates (Stein *et al.* 1996). Students are perceived here as *passengers* who are heading abroad to certain destinations, but the motives or the ultimate destiny of the various passengers at their destinations is unknown to most of us. Table 1 provides information on the increase of foreign students in a number of major host countries from the 1950s to the 1990s.

Table 1. Third-level foreign student numbers and total higher education enrolments: six major host countries: 1950-1990

| | 1950 | 1960 | 1970 | 1980 | 1990 |
|--|-------|-------|--------|--------|--------|
| Foreign student enrolments ('000) | | | | | |
| Australia | 0.3 | 5.0 | 7.5 | 8.8 | 29.0 |
| Canada | 3.2 | 7.3 | 22.3 | 28.4 | 35.2 |
| France | 13.5 | 27.1 | 34.5 | 110.8 | 136.0 |
| Germany* | 2.1 | 21.7 | 27.8 | 61.8 | 107.0 |
| United Kingdom | 8.2 | 12.4 | 24.6 | 53.0 | 80.2 |
| United States | 29.8 | 53.1 | 144.7 | 311.9 | 407.5 |
| Total | 57.1 | 126.6 | 261.4 | 574.7 | 794.9 |
| All higher education enrolments ('000) | | | | | |
| Australia | 36 | 81 | 180 | 324 | 485 |
| Canada | 82 | 142 | 642 | 1 173 | 1 917 |
| France | 134 | 215 | 801 | 1 077 | 1 699 |
| Germany | 151 | 265 | 504 | 1 223 | 1 799 |
| United Kingdom | 134 | 169 | 601 | 827 | 1 258 |
| United States | 2 297 | 3 583 | 8 498 | 12 097 | 13 710 |
| Total | 2 833 | 4 454 | 11 226 | 16 725 | 20 868 |
| Foreign students as proportion of all students (%) | | | | | |
| | 2.0 | 2.8 | 2.3 | 3.4 | 3.8 |

* FRG only.

Source: UNESCO.

The number of foreign student enrolments has increased in all countries as the number of total enrolments is growing. Nevertheless, Table 1 shows that the proportion of foreign students has increased from 2.0% in the 1950s to 2.3% in the 1970s to reach 3.8% in the 1990s. Not only did the absolute numbers of foreign students increase but also their proportion in total enrolments. These numbers are expected to grow in the next 10 to 25 years to reach around 4.9 million students seeking to study abroad, of which 2.9 million will come from Asia. Table 2 provides the figures.

Table 2. Forecast of number of students seeking higher education abroad

| | 1992 | 1.4 million students studying abroad |
|--|------|--------------------------------------|
| | 2010 | 2.8 |
| | 2025 | 4.9 |

Source: IDP Education Australia (1995).

Host countries are often the main beneficiaries of these inflows as stay rates are often quite high. For instance, about 50% of all Europeans who finish their PhD training in the United States stay there for longer. Many stay there permanently (Finn, 1997). This however fluctuates and varies across regions and countries of origin. European doctorate graduates have a much higher stay rate in the United States than their Korean and Japanese counterparts. The difference between Japan and Europe in the propensity to stay is very big, only 8% of Japanese PhD graduates stay. Graduates from England have the highest European stay-rate in the United States. Whereas most German graduates return (ca.75%), only ca. 30% of English graduates do. Variations appear across fields of graduation, if we take England as an example, 73% of engineering graduates stay compared to 65% of Life sciences, and 60% in Physical sciences. According to a recent study, 30% of the foreign students in the Universities of Northern California (primarily UC Berkeley, Stanford, San Francisco SU, and San Jose SU) stay and work in Silicon Valley (ACTEAM, 1999).

Richard Lambert, in his study of foreign students flows, indicates that, in the United States, “it is in the elite research universities that the share of foreign enrollees among graduate students is most dramatic” (Lambert, 1992). In a study on brain drain from France to the United States (Terouanne, 1997), it was found that the states that host some of the United States' finest higher education institutions, such as California, Massachusetts, and New York have attracted most French post-docs to the United States. In 1997, almost 50% of all post-docs at Stanford University, and over 55% of those at Harvard and MIT, were from overseas (NSF/SRS, 1998). There is growing evidence that post-graduate students are most influenced by the quality of the organisations they choose to enrol with (Lambert, 1992; Mahroum, 1999), and equally important, by the after training opportunities that exist in the host country.

But the host country is not always the main, or the sole, beneficiary of the movement of students. The concept of “brains circulation” (Gaillard & Gaillard, 1998; Johnson & Regets, 1998), which refers to the cycle of moving abroad to study, then taking a job there, and later returning home to take advantage of a good opportunity, increases knowledge transfer to the home country. This sort of circular migration has been observed amongst Malaysians who had studied in Australia (Kritz & Caces, 1992), and it is the sort of mobility that governments often have in mind when supporting their students in going abroad. Yet when the outflows of students are permanent and are not replaced by equal inflows from other countries, then a case of brain drain occurs and the source country is largely perceived to be on the losing side. This remains largely true unless the host country is benefiting from its émigrés by maintaining contacts with them and setting up relations with them, as is the case with students from Japan, Korea, Chinese Taipei, and China. For some developing countries it may even pay off to keep these students abroad so that they continue to send important remittances back home.

Conclusions and policy options

This paper has identified five major channels for international mobility of highly skilled personnel. It has shown that different *push* and *pull* factors influence the volume, the frequency, the length, and the direction of mobility in the various channels. Today, countries, regions, cities, universities, research centres and firms all around the world are competing to maintain their attraction for highly skilled personnel in the various professional areas. The United States, Canada, and Australia have all raised the ceiling of skilled immigrant quotas, and the expression of brain drain fear is no longer confined to developing countries. In management professions, the expansion of business and industrial activities overseas is an important factor in driving some of the best local talents abroad. For entrepreneurs, tax allowances and the availability of supporting funds and venture capital represent a major attraction for them to relocate. More important though is the availability of legislation that allows them to immigrate to the country of concern. In academia and science, “colleges” and “scientific norms” operate a self-organised motion between and

among research colleges that are embodied in various institutions. Finally, following education and training programmes abroad is another major source of long term, or even permanent, expatriation in almost all professional areas.

Table 3 below provides a systematic mapping of the various groups of mobile professionals, the relevant push and pull factors, and the corresponding policies.

Table 3. A classification of highly skilled mobility, types of influencing factors and policies

| Group | Type of push & pull factors | Type of policies |
|-------------------------|---|--|
| Managers & Executives | Benefits and remuneration | Business-oriented |
| Engineers & Technicians | Economic factors (supply and demand mechanisms) | Immigration legislation Income tax |
| Academics & Scientists | The state of the national economy Bottom-up developments in science Nature & conditions of work Institutional prestige | Inter-institutional and intergovernmental policies |
| Entrepreneurs | Governmental (visa, taxation, protection, etc.) policies Financial facilities Bureaucratic Efficiency | Governmental and regional policies Immigration legislation |
| Students | Recognition of a global workplace Accessibility problems at home Inter-cultural experience | Intergovernmental, and inter-institutional policies Immigration legislation |

Source: Author.

As the mapping of Table 3 reveals, different policies should be tailored out to suit the very different organisational and cognitive structures of the various sectors and professions. As has been shown in this paper, various groups of professions are driven by different push and pull factors. Therefore, supplementary and complementary immigration and non-immigration legislation, such as income-tax allowances, investment capital tax relief, and copyright legislation should be introduced to encourage the inward flows of skills and expertise.

Nonetheless, immigration legislation remains the first and utmost important legislation area where human mobility is concerned. Countries that have designated special legislation to allow highly skilled immigrants to take jobs in their local job markets stand better chances of benefiting from a growing international pool of high calibre human resources. For example, the United States government has agreed to raise the ceiling of skilled immigrants intake from 54 000 to 140 000 annually (Gover & Hurray, 1998). Australia, another major immigration country, is set to lower the ceiling of the *Points System* it operates for immigration intakes and through which it discriminates in favour of young and productive skilled persons.²⁴ The number of immigration entries to Australia was estimated to have increased by around 11 000 to total 98 000 entries in 1995-96 up from 87 000 in 1994-95. Singapore, too, according to *Nature* (August 5 1998), has set up an active policy to attract foreign talents from abroad. Singapore today has 4 000 scientists of whom 40% are foreigners. Likewise, Chinese Taipei is about to introduce a science and technology law, which will make it easier to recruit overseas nationals, and wants to simplify regulations for intellectual property rights. Schemes for short- and long-term visits (e.g. postdoctorals) for scientists from overseas have been increased. Finally, China is planning and working to recruit scientists from overseas. However, China realises that, in contrast with Chinese Taipei and Singapore, most of these will have to come from the Chinese Diaspora in the West. The *Chinese Academy of Science* is targeting the

24. Department of Immigration & Multicultural Affairs, 1998.

so-called “Mobile Researchers”, such as graduate students, postdocs, and visiting professors. It hopes to more than double the number of *mobile* researchers to around 10 000 in the next three years, and to further boost the number to 30 000 in the year 2010.

Higher education is the major backdoor for international mobility; however, internationalising higher education and training should not only mean preparing local students to work overseas, but also foreign students to work in local labour markets. For instance, anecdotal evidence points to the *after-training* opportunities that exist in the United States for foreign students as a major pull factor for those seeking education abroad. In 1996, around 1 000 United States-trained European PhD graduates started their own businesses in the United States (Mahroum, 1998). The availability of venture capital and a business friendly climate in the United States has lured many foreign students to stay on. Other facilities such as the right for a spouse of a student to join his wife and take employment in the host country; or to spend a couple of years working in the host country after the completion of education are two examples of important tools in stimulating foreign students and enriching the human resources potential of the host country. Consequently, further important preparatory efforts should be made such as language and culture classes for foreign students to make it possible to draw on foreign students, upon completion of their training, in professions with skills deficits. Last but not least, accreditation and recognition of foreign qualifications and experiences are essential for nurturing a skill attractive area in order to ease the inflows and outflows of skills. Without full recognition of training and qualifications gained abroad, the potential mobile researcher or student will be reluctant to take opportunities that exist outside his/her national borders.

Mobility programmes should expand to provide mobility opportunities for students and young researchers to go where they think it is best for them to go. This secures a “bottom-up” driven mobility that is driven by inter-institutions collaborations and inter-personal contacts. In other words mobility programmes should be qualitative oriented rather than geographically oriented. Shifting quantities from one direction to another might not be the right thing to do. The important thing is to maintain a two-way flow of talent. For instance, European Commission mobility programmes could be designed to include two stages of mobility, where the first destination could be anywhere in the world, but the second and final destination has to be in an EU member country.

Last but certainly not least, the migration of young high-tech entrepreneurs, particularly to the United States, might eventually become a problem for the source countries in quantitative terms, but even more so in qualitative terms. For instance, it is the most creative people who leave Europe for the United States. This might delay the establishment of new growth areas in Europe and heavily affect the future development of, for instance, a *European Information Society* or a strong European biotechnology sector. In order to make Europe attractive to these young entrepreneurs, easier availability of venture capital would be important, as well as the removal of cumbersome bureaucratic rules for setting up firms and the ease of access to financial services.

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