International Mobility of the Highly Skilled

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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- to achieve the highest sustainable economic growth and employment and a rising standard of living in Member countries, while maintaining financial stability, and thus to contribute to the development of the world economy;
- to contribute to sound economic expansion in Member as well as non-member countries in the process of economic development; and
- to contribute to the expansion of world trade on a multilateral, non-discriminatory basis in accordance with international obligations.

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FOREWORD

This publication presents a collection of papers prepared for the Seminar on International Mobility of Highly Skilled Workers: From Statistical Analysis to the Formulation of Policies, held in Paris, 11-12 June 2001. This seminar, organised jointly by the Directorate for Science, Technology and Industry (DSTI) and the Directorate for Education, Employment, Labour and Social Affairs (DEELSA) of the OECD, brought together delegates from the OECD Working Party on Migration, the Committee for Science and Technology Policy and its sub-group of National Experts on Science and Technology Indicators (NESTI), as well as other statisticians, experts and policy makers from OECD and non-OECD countries and other international organisations.The OECD wishes to acknowledge the financial support of the NSF for this event.

The work of the Committee for Science and Technology and of NESTI in monitoring science, technology and innovation polices and measuring the knowledge-based economy has in recent years increasingly focused on analysing human resources and their mobility, notably those of researchers and of IT workers. At the same time, the mandate of the Working Party on Migration is to monitor and analyse migration movements and policies. It was therefore a good opportunity to bring together the expertise of these working groups in a context where shortages of highly skilled and specialised workers have had undeniable impacts on national migration policies.

The book is organised in three parts. The first one presents the definitions and measures of international stock and flows of highly skilled workers and human resources in science and technology. The second discusses trends and the economic impact of international mobility of highly skilled workers, through different case studies in OECD Member and non-member countries. The third describes how policy measures, in the area of migration and of science and technology, may influence international mobility of highly skilled workers.

This volume is published on the responsibility of the Secretary-General of the OECD.

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INTRODUCTION

The international mobility of highly skilled workers, in particular human resources in science and technology (HRST), is currently an important policy issue in most OECD countries. Accompanying the high demand for skilled labour, especially in industries and professions relating to information technology, there is apparently a growing shortage of such workers in a number of OECD Member countries. To meet these shortages, an increasing number of countries are implementing measures to facilitate the recruitment of foreign skilled workers. Considering that improved knowledge and understanding of these issues are necessary for informing the policy agenda, the OECD held a seminar on International Mobility of Highly Skilled Workers: From Statistical Analysis to the Formulation of Policies, in Paris on 11-12 June 2001. The seminar was organised by the Directorate for Science, Technology and Industry (DSTI) and the Directorate for Education, Employment, Labour and Social Affairs (DEELSA).

The seminar had three main objectives:

- To provide data on the scale and characteristics of flows and stocks of skilled and highly skilled foreign workers in OECD Member countries and certain non-member countries, to assess the quality of the available data and concepts used and to help improve their comparability.

- To analyse the mobility of skilled workers and HRST and their impact on the economy through case studies covering most of the major regions that send and receive these workers.

- To examine appropriate migration policies for facilitating the mobility of skilled workers in ways that are beneficial both to receiving and sending countries.

These objectives form part of a broader study relating to the economic impact of the migration of skilled labour on both host countries (gains in skills, "brain gain" and productivity and economic growth, the reduction of labour shortages, effect on education expenditure) and origin countries (loss of skilled workers, “brain drain” or improved provision of technological skills, thanks notably to return migrants, *i.e.* international flow of knowledge or “brain circulation”).

Over 20 documents were presented and discussed by the delegates and experts of the OECD Member countries and a number of non-member countries and the representatives of the European Commission and international organisations concerned by international migration and human resources in science and technology.

The studies showed that, while it is difficult to measure the international mobility of skilled workers, there is every reason to believe that these flows rose substantially during the 1990s. This being the case, mobility of HRST has a major impact on countries’ performance in the field of science and technology and therefore on growth. However, these effects remain unequally distributed, especially between sending countries (mostly developing countries) and receiving countries. As a result, policies aimed at facilitating the recruitment and mobility of highly skilled workers, in particular migration policies, must endeavour to ensure a fairer distribution of benefits.

Definitions and the statistical framework for the migration of skilled labour

A number of issues were raised during the discussion of the measurement and definition of these developments. They focused on the definition and identification of highly qualified foreign workers and HRST and the availability, reliability and means of improving the international comparability of statistics in this field.

There are several possible means by which the stock and migration flows of highly skilled workers can be gauged. These include, most notably, censuses, registration data, labour force surveys, administrative data, specific surveys and case studies. None of these provides an entirely satisfactory means of measurement. L. Auriol and J. Sexton (Chapter 1) have made a critical assessment of the various sources and have clearly framed the discussion of concepts and definitions. A number of points emerged from this analysis and the ensuing discussions:

- The definition of HRST provided in the "Canberra Manual" covers a very broad population, and the flows and stocks of HRST as proposed there cannot be completely evaluated using existing statistical sources. In practice, only EU countries and Eurostat have applied the manual's recommendations. Identifying HRST on the basis of the ISCO (International Standard Classification of Occupations) classification appears to be more appropriate.

- Population censuses are exhaustive in coverage and are conducted using standard activity classifications but are carried out too infrequently and do not always provide the information desired (for example, on how long migrants actually stay).

- Labour force surveys, although they also raise problems (sample size, representativeness, etc.) are nevertheless a main source of information available for making international comparisons.

- Administrative sources (*e.g.* work permits, temporary visas) provide relevant data but do not make use of the concepts, definitions and classifications necessary for calculating international statistics.

- Specific surveys which track the highly skilled exist in certain countries (the SESTAT system in the United States; surveys carried out by CEREQ in France and presented in D. Martinelli's contribution in Chapter 6) and deserve to be more broadly used, developed and harmonised.

In general, the information available on migrants' length of stay, emigration flows, return rates and alternative forms of mobility (such as relocated provision of services) is insufficient. It is suggested that the inventory work begun be pursued in greater depth, in particular with respect to specific surveys on migrants or employers (see R. Winkelmann on Germany in Chapter 7) and on the longitudinal data available. It also appears that the "Canberra Manual" should be revised with the assistance of specialists on labour market and migration statistics.

Main characteristics of the mobility of HRST and highly skilled workers and their impact on the economy

Several case studies on OECD Member countries and non-member countries have made it possible to assess the magnitude of the mobility of HRST, skilled workers and students and to describe their main characteristics. Other contributors have focused on the economic impact of the migration of skilled and highly skilled labour on sending and receiving countries.

D. Guellec and M. Cervantes (Chapter 3) showed the main effects anticipated from the mobility of HRST for receiving and sending countries. The positive effects for the main host countries are the stimulation of innovation capacity, an increase in the stock of available human capital and the international dissemination of knowledge. For origin countries, the loss of human capital can be at least partially offset by the return of migrants and the development of networks facilitating the circulation of skilled workers between host countries and their country of origin (as J.-B. Meyer shows for South Africa in Chapter 13). The mobility of skilled workers can also promote investment in training in sending countries and increase inflows of currency through remittances.

As regards the mobility of students and researchers, several contributions showed that OECD countries increasingly seek to attract specialised foreign students, particularly in the field of science and technology, and to facilitate their access to the labour market (see Chapter 2 by K. Tremblay, Chapter 17 by G. Hugo and Chapter 6 by D. Martinelli). This is not only because their tuition fees are of direct financial benefit to the universities concerned but also because they provide a potential highly qualified reserve of labour that is familiar with prevailing rules and conditions in the host country.

More generally, the cases of the United States (Chapter 16 by P. Martin), Ireland (Chapter 8 by A. Barrett), Japan (Chapter 5 by S. Kobayashi), Sweden (Chapter 14 by A.-M. Gaillard) and Canada (Chapter 4 by M. Bordt) fuelled discussions. Five key points should be emphasised:

- The policy objectives regarding the immigration of highly skilled workers in most OECD countries are threefold: *i)* to respond to cyclical labour market shortages; *ii)* to increase the stock of human capital; and *iii)* to encourage the circulation of the knowledge embodied in highly skilled workers and promote innovation.

- The share of skilled foreign workers on the labour market varies considerably across countries but is growing in most OECD countries. In some, inflows of this category of workers are constituted mainly by immigrants admitted on the grounds of family reunification or for humanitarian reasons (refugees and asylum seekers).

- Many countries are affected both by the emigration and immigration of skilled workers, but it appears that the brain drain has been overestimated in developed countries, notably because the return rate is high (see Chapter 14 by A.-M. Gaillard for Sweden and Chapter 6 by D. Martinelli for France).

- Temporary labour migration is becoming increasingly frequent, especially in Australia (see Chapter 17 by G. Hugo) and the United States (see Chapter 16 by P. Martin). The economic downturn that started in Spring 2000, notably in the US high-technology sector, may trigger a readjustment of the flows.

- The mobility of HRST may have an impact on inequalities, for example by reducing them when skilled emigrants return home, and on the long-term equilibrium of the labour market (incentives to invest in initial and vocational training).

The case of non-member countries is illustrated for South Africa (Chapter 13 by J.-B. Meyer), China (Chapter 11 by A. Guochu and L. Wenjun), India (Chapter 12 by V. Gayathri), Israel (Chapter 9 by A. Paltiel), Russia (Chapter 10 by L. Gokhberg and E. Nekipelova) and Chinese Taipei (Chapter 15 by Y.-L. Luo and W.-J. Wang). It appears that developing and transition countries can in general provide their most highly qualified workers only with limited opportunities. Indeed, notwithstanding the effects on public finance linked to expenditures on education, developing countries may benefit in the short run from the emigration of their highly skilled personnel through the effects on remittance flows and reduced labour surpluses as well as, in some cases, the internationalisation of the domestic

economy. In the long run, however, the picture may be very different if emigration of highly qualified workers prevents these countries from reaching a critical threshold level of HRST in some very dynamic sectors with high value added, or if it affects the provision of basic socio-economic services (*e.g.* education, health). The cases of Chinese Taipei, Korea and Ireland, tend to show that when skilled migrants return to their country of origin after a long stay abroad, they make a considerable contribution to the expansion of their national high-technology industry.

Policies facilitating the mobility of HRST and highly skilled workers

A significant portion of discussions dealt with recent migration policy developments aimed at enhancing the mobility of highly skilled workers. Detailed presentations on Germany (see Chapter 18 by H. Werner), Australia (Chapter 17 by G. Hugo), the United States (see Chapter 16 by P. Martin) and the United Kingdom (Chapter 19 by N. Rollason) made it possible to show the diversity of the policies implemented in different OECD Member countries and to discuss their strengths and weaknesses.

The traditional immigration countries have, within the general framework of their migration legislation, developed specific policies to promote the temporary residence (European countries) or permanent residence (Australia, Canada) of foreign HRST, both students and workers. In other countries, measures have recently been adopted that specifically target employment in the information and communications sector, for example, in order to ease labour market tensions. In this regard, a key issue to be considered is how to strike a balance between the interests of the main partners concerned, *i.e.* government, employers, the domestic and foreign workforce and sending countries.

However, even in free-circulation areas, there remains considerable scope for facilitating the mobility of HRST through such policy initiatives as the mutual recognition of diplomas and the transfer of social security and pension rights.

Factors that attract HRST are also significantly linked to science and technology policies. The development of a high-technology and innovative industry is important for attracting HRST of all origins. It is therefore the entire range of policies aimed at encouraging innovation that has an indirect but powerful effect on incentives for these workers to enter the labour market of the country concerned. Such policies address notably entrepreneurship, mechanisms for allocating capital, training and education, public research and its links with business. More specifically, centres of high-quality research and higher education ("centres of excellence") tend to attract foreign researchers and students (some of whom will get jobs in the host country). This is notably the case for certain universities in the United States, and it is an objective of the European policy for centres of excellence. In the case of Chinese Taipei (Chapter 15 by Y.-L. Luo and W.-J. Wang), the creation of science parks has triggered the return of former migrant engineers and researchers trained abroad. Certain countries have specific systems of scholarships for the best foreign students. Conversely, weak public research may be a "push" factor for national researchers, especially the young, owing to scarcity of job openings and resources or to too rigid an organisation that ties career advancement to seniority instead of performance. Finally, policies directed at encouraging HRST based overseas to remain in contact with the home country may also be expected to promote the diffusion of the knowledge and experience gained (Chapter 13 by J.-B. Meyer on South Africa).

PART I

DEFINING AND MEASURING INTERNATIONAL FLOWS OF HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY

Chapter 1

HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY: MEASUREMENT ISSUES AND INTERNATIONAL MOBILITY

by

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SUMMARY AND RECOMMENDATIONS

Policy makers are increasingly interested in the international mobility of highly qualified workers. Yet, the capacity to analyse this mobility is severely limited by the lack of internationally comparable data that capture the flows of such workers.

This chapter seeks to address this problem by identifying the main statistical issues related to measurement of the international mobility of highly skilled workers. The first section shows the lack of an internationally agreed definition of a "highly skilled worker", which limits analysis at international level. One internationally agreed conceptual framework, the "Canberra Manual" on human resources devoted to science and technology (HRST), is then described in length. While this framework is not perfect and requires further development, it may be used to measure the international mobility of the highly skilled by drawing on existing data sources.

HRST are defined as those who have successfully completed education at the tertiary level in an S&T field and/or those not formally qualified in this way but employed in an S&T occupation where such qualifications are normally required. This definition is based both on educational qualification and occupation and therefore covers a very broad population. This is probably one limitation of the definition, which calls for further refinement. A revision of the "Canberra Manual" is planned for the near future and, to be most useful, should draw on the expertise not only of S&T analysts and statisticians but also those involved in the areas of employment, education and migration. The revision should also build on existing national experience to compile HRST statistics from special surveys and databases. One promising example in this regard in the US SESTAT database described below.

The second section of the chapter is more specifically devoted to data sources and measurement of international migration of HRST. There exists a reasonably large body of statistical data on the stock of persons with scientific and technological skills. The principal sources are censuses and labour force surveys. However, while these sources have the potential to provide very useful information on HRST migration flows, they suffer from some deficiencies that limit their analytical utility. The key deficiency of censuses is their infrequency. Labour force surveys raise the problem of sampling variability, an issue when measuring international migration as flows tend to be small relative to the total population, as well as more serious problems. Most notably, not all relevant inflows can be identified in some countries, since information on the country of previous residence, even though it is sought, is often not supplied. Regarding administrative sources (permanent immigration arrangements, temporary working visas, work permits, etc.), there is a vast amount of statistical information available, but concepts and classification systems vary greatly and are not usually maintained in a form that facilitates cross-country comparisons.

The authors feel that it would be worthwhile to encourage countries:

- To refine the definition of HRST when revising the "Canberra Manual".
- To conduct special S&T surveys (of the SESTAT type) on a more systematic and comparable basis.
- To exploit the results of the 2000 censuses for information on HRST and international migration.
- To work on obtaining better migration inflow estimates from national labour force surveys.
- To classify both permanent and temporary inward migrants according to occupation and educational level in a way that facilitates international comparisons through the use of classifications based on ISCO-88 and ISCED 1997.

Introduction

International mobility of the highly skilled has existed for decades as a means of circulating knowledge and promoting scientific and technological development. More recently, as rapid economic growth has had its source in a rather small base of technologically intensive sectors, such as information and communication technologies (ICT), it has come to the attention of the broader economic policy community. The ability of some countries to sustain fast growth in these sectors without being unduly limited by shortages of key workers, such as software engineers, has focused attention on the role of immigration and, more generally, on its impacts on the labour market. The ability to analyse the relevant issues systematically is severely limited by the lack of internationally comparable data on flows of highly skilled workers.

Human resources in science and technology

Highly qualified workers and their definition

Many different terms are used to discuss possible shortages of highly qualified personnel or their international mobility: highly skilled workers, qualified personnel, human resources in science and technology, scientists and engineers, IT workers, "brains" (in "brain drain", "brain gain" or "brain circulation"), etc. The first questions are therefore: What do we want to measure? What is the difference between qualified and skilled? What is the difference between highly skilled and skilled (or qualified)? Or between highly qualified personnel and human resources in science and technology or any of the other terms used above?

The term "skill" refers to the qualifications needed to perform certain tasks in the labour market. In the most general sense, it reflects the level of human capital in the labour markets. The term "upskilling" can be seen as synonymous with human capital development. Skills are multi-dimensional, since most jobs require a multitude of them to perform tasks adequately, ranging from physical abilities like eye-hand co-ordination, dexterity and strength, to cognitive (analytic and synthetic reasoning, numerical and verbal abilities) and interpersonal (supervisory, leadership) skills (Wolff, 1996).

In empirical work, researchers often use proxies based on education and occupation. Education is usually categorised by years of schooling or final degree obtained. Occupations sometimes provide more information on the skills required of workers, but measures vary considerably across countries and may be ambiguous. Measures of education do not necessarily take into account on-the-job learning and, in particular, skills associated with the use of new technology.

When referring to international standard classifications, "qualified" means formal qualification and corresponds to an existing and widely used international classification, the International Standard Classification of Education (ISCED). "Highly qualified" thus refers to a certain level of education or formal qualification and may therefore be differentiated from "qualified". In the International Standard Classification of Occupations (ISCO), skills are defined in terms of "skill level" and "skill specialisation". The first is defined as a function of the complexity and range of the tasks and duties involved with reference to ISCED levels. Skill specialisation is defined by the field of knowledge required, the tools and machinery used, the materials worked with, as well as the kind of goods and services produced.

There is as yet no agreed definition of highly qualified workers at international level. Existing studies have most frequently used the broad categories ISCO 1, 2 and 3 to define highly skilled

occupations. Other definitions have also been used; in particular, the OECD has used an *ad hoc* definition (OECD, 1996).

However, an internationally agreed conceptual framework has been jointly developed by the OECD and Eurostat to measure so-called human resources devoted science and technology (HRST). It is known as the "Canberra Manual" and was prepared by the OECD Group of National Experts in Science and Technology Indicators (NESTI). It is described below.

Basic definition of HRST

The "Canberra Manual" defines HRST as people who fulfil one or the other of the following conditions:

- They have successfully completed education at the tertiary level in an S&T field of study.
- They are not formally qualified as above, but are employed in a S&T occupation where the above qualifications are normally required.

The "Canberra Manual" definition is based both on notions of educational qualification and of occupation and therefore covers a very broad population with either tertiary-level education or an occupation in a field of science and technology (S&T). S&T is understood in a very broad sense, covering all fields of education and occupation, including social sciences and humanities. Tertiary-level education is defined using the former ISCED definitions:[1]

- ***ISCED category 5:*** "education at the tertiary level, first stage, of the type that leads to an award not equivalent to a first university degree".
- ***ISCED category 6:*** "education at the tertiary level, first stage, of the type that leads to a first university degree or equivalent".
- ***ISCED category 7:*** "education at the tertiary level, second stage, of the type that leads to a postgraduate university degree or equivalent".

ISCED distinguishes 21 main fields of study. For macro-measurement of HRST, it is recommended grouping them into the following seven broad fields of study:

- Natural sciences.
- Engineering and technology.
- Medical sciences.
- Agricultural sciences.
- Social sciences.
- Humanities.
- Other fields.

These categories are too broad to capture education in some rapidly developing fields such as biological and computer sciences. It is necessary to disaggregate further to obtain this information.[2]

S&T occupations are defined using the following ISCO-88 categories.

122 Production and operations department managers.

123 Other department managers.

131 General managers.

21 Physical, mathematical and engineering science professionals.

22 Life science and health professionals.

23 Teaching professionals.

24 Other professionals.

31 Physical and engineering science associate professionals.

32 Life science and health associate professionals.

33 Teaching associate professionals.

34 Other associate professionals.

The advantage of the double educational/occupational classification is that it allows for looking at both the supply side of HRST, in terms of qualification, and the demand side, in terms of occupation. Its drawback is that, by definition, it does not allow for homogeneous measurement because the two classifications are based on different premises, and it is too broad to meet specific analytical needs. Hence the need to define subsets of interest within this broad population. This was extensively done in the "Canberra Manual" and has been further refined in subsequent studies.

Figure 1. Detailed categories of HRST

<table>
<tr><td colspan="3" rowspan="3">Occupations</td><td colspan="4">Qualifications</td></tr>
<tr><td colspan="3">HRSTE = HRST with tertiary-level education</td><td rowspan="2">Other ISCED levels</td></tr>
<tr><td>ISCED level 7</td><td>ISCED level 6</td><td>ISCED level 5</td></tr>
<tr><td rowspan="12">HRSTO

=

HRST employed in S&T</td><td rowspan="3">ISCED 1 (subset)</td><td>122</td><td>Production and operations department managers</td><td colspan="3" rowspan="12">HRSTC

=

HRST core

(with tertiary level education and employed in S&T)</td><td rowspan="12"></td></tr>
<tr><td>123</td><td>Other department managers
of which: 1236 Computing services department managers</td></tr>
<tr><td>131</td><td>General managers</td></tr>
<tr><td rowspan="4">ISCO 2</td><td>21</td><td>Physical, mathematical and engineering science professionals
of which: 213 Computing professionals</td></tr>
<tr><td>22</td><td>Life science and health professionals</td></tr>
<tr><td>23</td><td>Teaching professionals</td></tr>
<tr><td>24</td><td>Other professionals</td></tr>
<tr><td rowspan="4">ISCO 3</td><td>31</td><td>Physical and engineering science associate professionals
of which: 312 Computer associate professionals</td></tr>
<tr><td>32</td><td>Life science and health associate professionals</td></tr>
<tr><td>33</td><td>Teaching associate professionals</td></tr>
<tr><td>34</td><td>Other associate professionals</td></tr>
<tr><td></td><td colspan="2">All other occupations</td><td colspan="3" rowspan="3"></td><td rowspan="3"></td></tr>
<tr><td>HRSTU</td><td colspan="2">Unemployed</td></tr>
<tr><td></td><td colspan="2">Out of the labour force</td></tr>
</table>

HRST = human resources in science and technology.
Scientists and engineers = ISCO 21 + ISCO 22.
IT HRST occupations = ISCO 1236 + ISCO 213 + ISCO 312.

The first and most obvious subset is what the "Canberra Manual" calls the "HRST core" population; it consists of the HRST population with both tertiary-level education and an S&T occupation. Many studies have also looked at the population of so-called "scientists and engineers", which is in general defined as ISCO categories 21 and 22. The "Canberra Manual" also gives some guidelines for measuring the IT labour force, which is defined on the basis of ISCO at the third- or fourth-digit level, as: 213: Computing professionals (and presumably also 1236 Computing services department managers) and 312: Computer associate professionals. Figure 1 shows the different categories of HRST.

Some characteristics of the HRST population

Table 1 presents some basic HRST data derived from the EU Community Labour Force Survey (CLFS) and from education statistics. HRST data by occupation are given for EU countries only, where comparability is ensured by the use of a common format for the output from national labour force surveys. Further work would be needed to obtain comparable data for non-EU countries.

Education statistics are better harmonised thanks to joint efforts of the OECD, Eurostat and UNESCO. However, while many statistical sources provide information on levels of educational attainment, problems are often encountered when making international comparisons, as the data tend to reflect not only variations in numbers but also differences in national education systems. This applies particularly to what one might describe as the "grey area" between some parts of secondary education, further (non-tertiary) education and the lower cycle of tertiary-level education. The nature and content of programmes at these levels, and way in which the programmes are classified, vary greatly between countries

Table 1. Basic HRST data, 1999

	Total HRST		HRST employed in S&T (HRSTO)		HRST with tertiary-level education (HRSTE)		HRST core (HRSTC)	
	Total (thousands)	Females (%)	Total (thousands)	Females (%)	Total (thousands)	Females (%)	Total (thousands)	Females (%)
European Union	64 980	46.0	42 327	47.1	45 947	45.5	23 294	46.9
Belgium	2 055	47.5	1 228	46.2	1 679	50.0	852	50.6
Denmark	1 186	47.7	865	49.1	850	49.5	530	52.9
Germany	17 972	43.8	11 798	49.6	11 887	36.7	5 714	40.9
Greece	1 134	43.6	663	44.9	972	43.8	501	45.8
Spain	5 917	47.3	2 815	44.0	5 169	49.1	2 068	47.6
France	10 244	48.4	6 378	45.8	7 752	51.6	3 886	50.5
Ireland	571	48.5	287	46.4	496	50.2	212	49.5
Italy	6 498	45.3	5 092	43.8	3 298	47.2	1 891	44.6
Luxembourg	78	41.5	61	41.6	48	40.2	31	39.7
Netherlands	3 629	45.9	2 662	47.2	2 291	43.7	1 324	44.5
Austria	1 041	46.2	861	47.5	434	44.3	254	47.2
Portugal	817	50.5	664	49.8	518	57.7	365	59.5
Finland	1 263	55.2	789	56.0	949	54.6	475	55.3
Sweden	2 048	48.7	1 450	48.8	1 515	52.2	917	54.7
United Kingdom	10 529	44.8	6 715	45.8	8 088	45.5	4 275	47.7

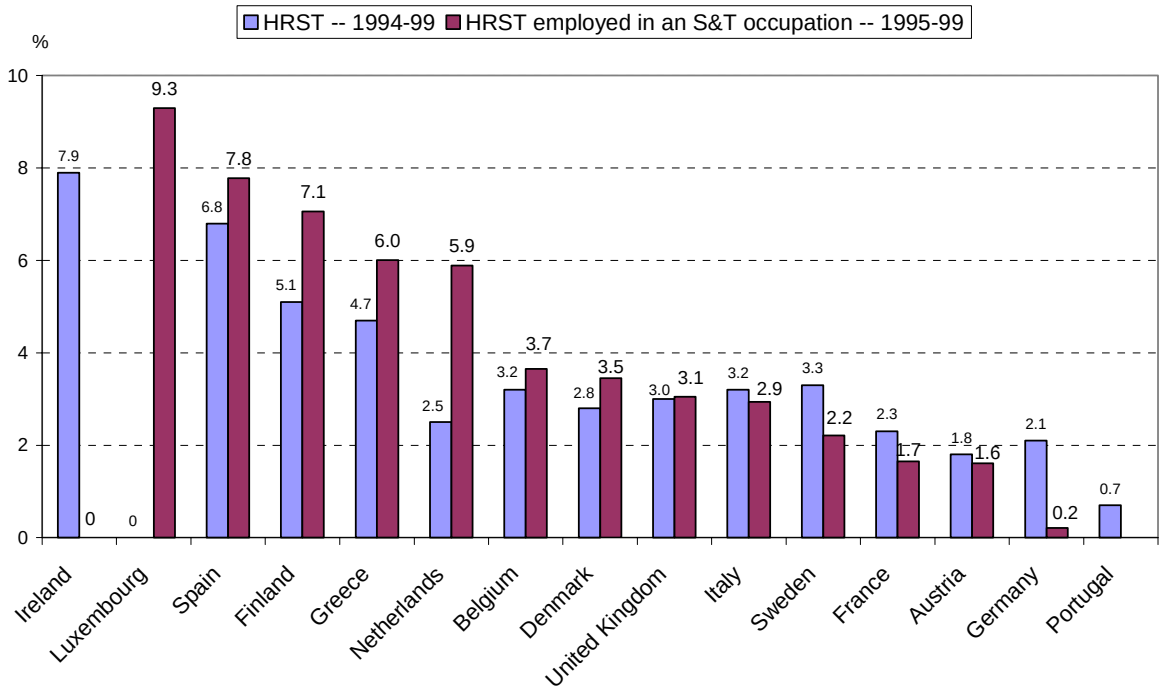
Note: Greece and Ireland, 1997.
Source: Eurostat (CLFS).

There were 65 million HRST in the EU in 1997. Among these, about 42 million were employed in an S&T occupation and 46 million had tertiary-level education. The core HRST population having both an S&T occupation and tertiary-level education was about 23 million. HRST are predominantly men (54%), although women exceed men in Finland and Portugal. In terms of education, women HRST are also more numerous than men in six EU countries: Belgium, France, Ireland, Portugal, Finland and Sweden. Except in Ireland, this is also true for the core HRST population.

Human resources employed in S&T occupations represent about a third of the labour force in Luxembourg, the Netherlands and Sweden, between 20% and 30% in Germany, Denmark, Finland, Belgium, France, the United Kingdom, Italy and Austria, and between 10% and 20% in Ireland, Greece, Spain and Portugal.

Figure 2 shows that occupations for HRST have steadily increased at an average annual rate of 6-8% in the second half of the 1990s in Luxembourg, Spain, Finland, Greece and the Netherlands. In Italy, Sweden, France, Austria and Germany, where the growth rate was below 3%, the overall HRST population, and therefore HRST with tertiary-level degrees, has increased faster.

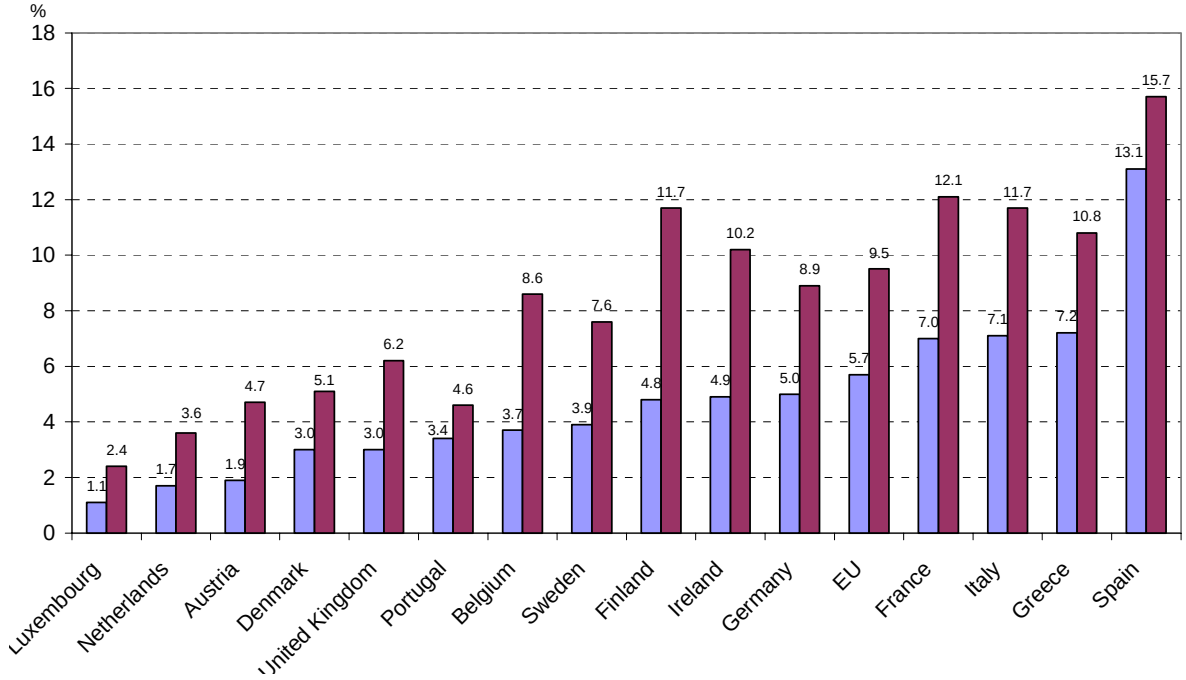
Figure 2. Average annual growth of HRST



Note: Austria: 1995-99; Sweden: 1997-99; Finland: 1998-99; Ireland: 1994-97; Greece: 1994-98 and 1995-98
Source: Eurostat (CLFS).

Unemployment rates of HRST (Figure 3) are about half the unemployment rates of the overall labour force, although the levels are related to those of overall unemployment. Unemployment rates of HRST are below 2% in Luxembourg, the Netherlands and Austria, while they are 7% or more and above the average EU level (5.7%) in France, Italy, Greece and Spain.

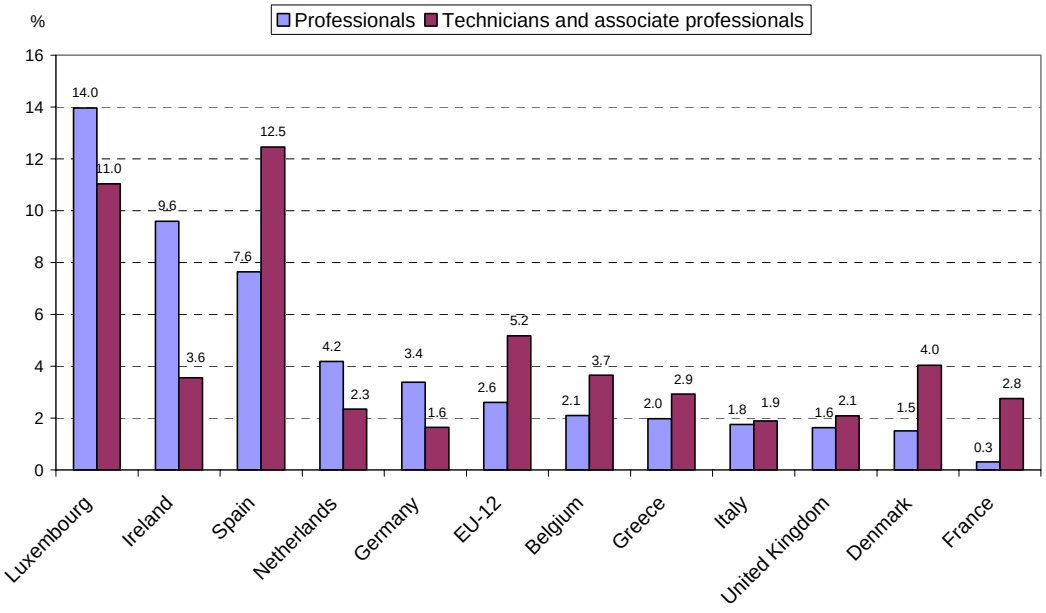
Figure 3. Unemployment rates of HRST as compared to overall unemployment rates, 1999



Note: Ireland, 1997; Greece, 1998.
Source: Eurostat (CLFS).

During the period 1994-97, average annual growth rates of professionals (Figure 4) have exceeded 7.5% in three countries: Luxembourg, Ireland and Spain. In most countries however, the number of technicians has increased faster than that of professionals. EU average rates were 2.6% for professionals and 5.2% for technicians and associate professionals.

Figure 4. Average annual growth rates of HRST by occupational category, 1994-97



Source: Eurostat (CLFS).

In Table 2, scientists and engineers are defined as physical, mathematical and engineering science professionals (ISCO 21) or life science and health professionals (ISCO 22). They numbered about 8 million in the EU in 1999, or about 19% of total HRST employed. The share of women is less than a third of overall EU scientists and engineers, although there are large variations among countries. In particular, there are more women than men scientists and engineers in Ireland and Finland, whereas their share is very low in Germany and France. Average annual growth rates of scientists and engineers generally do not exceed those of total HRST employees (Figure 2). One exception is Finland over the period 1998-99.

Table 2. Distribution of persons employed as scientists and engineers in the European Union, 1999

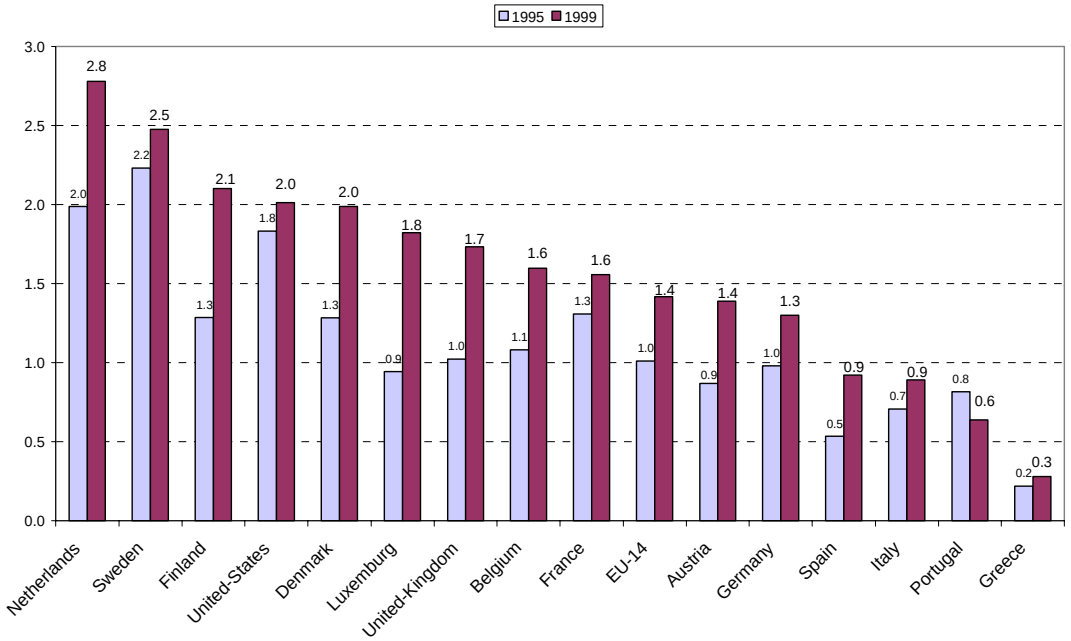
	Total	Females (%)	Annual average growth rate (1994-99)
European Union	7 930 430	31.2	..
Belgium	314 460	47.8	2.4
Denmark	142 780	24.8	6.4
Germany	1 919 540	21.0	3.5
Greece	142 660	29.0	2.9
Spain	573 410	37.3	5.9
France	1 045 550	23.8	2.2
Ireland	111 870	51.0	6.7
Italy	585 070	29.3	4.7
Luxembourg	9 660	20.1	6.4
Netherlands	450 450	31.2	5.7
Austria	82 610	29.0	4.5
Portugal	104 750	43.8	17.6
Finland	200 820	50.9	14.7
Sweden	218 330	40.5	1.9
United Kingdom	2 028 470	37.1	2.9

Note: Greece, 1998; Ireland, 1997. Growth rates: Greece, 1994-98; Ireland, 1994-97; Austria, 1995-99.
Source: Eurostat (CLFS).

Figure 5 shows that computer workers have increased their share in total employment during the second half of the 1990s. The share is higher for northern European countries and the United States than for southern Europe.

Graduation rates at university level, defined as the number of graduates as a share of the population aged 20-24 years (Figure 6), which is the source of the main flow into the HRST population (see also Figure 8), has increased from 5.8% in 1991 to 8.4% in 1997 in the EU-15. Five EU countries (France, the United Kingdom, Ireland, Belgium and Finland) are above the average, together with the United States and Japan. Graduation rates at university level are below 5% in Italy, Austria and Greece. Figure 7 displays the share of graduates in computing science relative to total graduates.

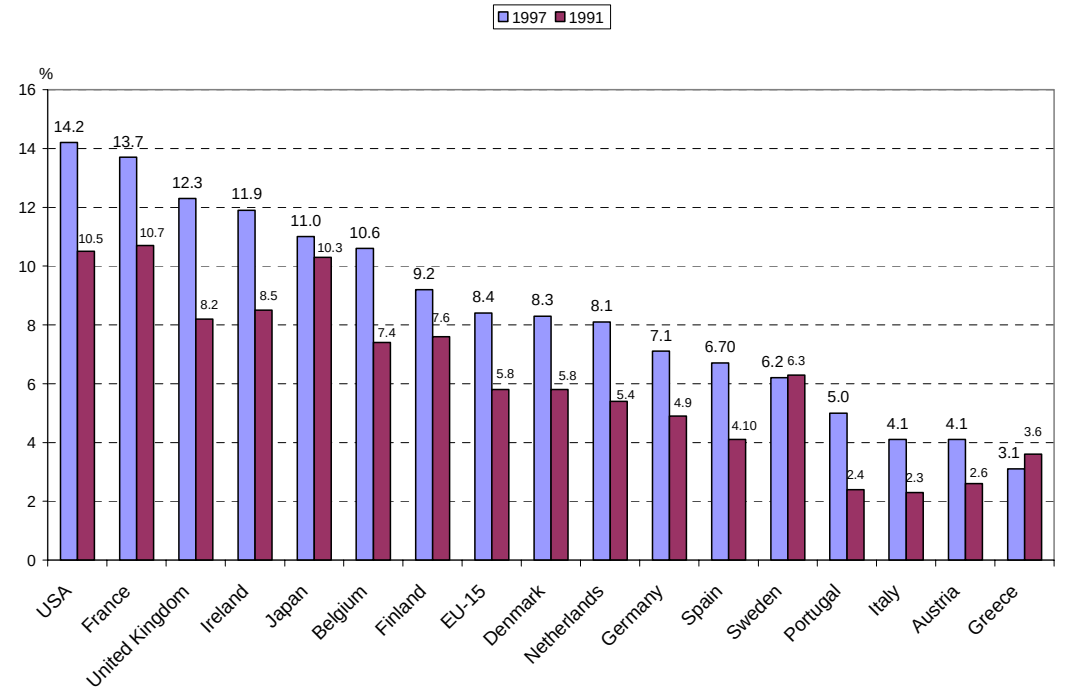
Figure 5. Computer workers as a percentage of total employees in selected OECD countries/regions, 1995 and 1999



1. 1995 data estimated for EU-14. 1997 instead of 1995 for Finland and Sweden.
2. For Europe, computer workers include ISCO-88 categories 213 and 312; for the United States, CPS categories 64, 65, 229, 308 and 309.

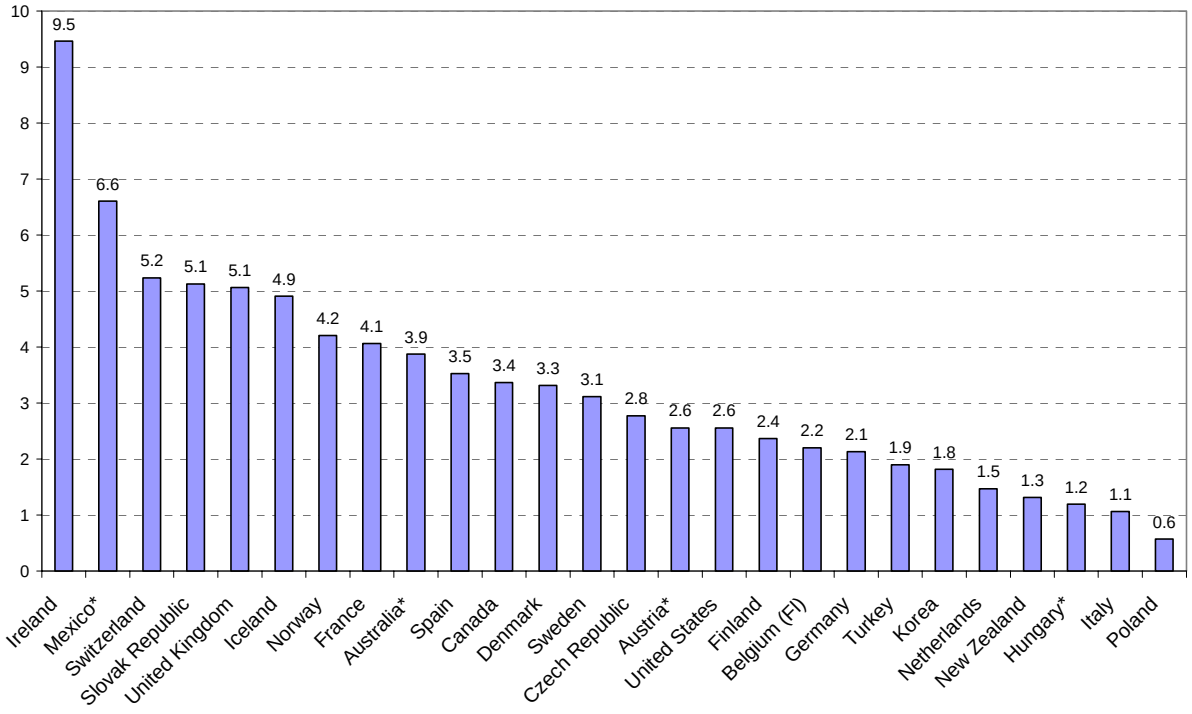
Source: OECD estimates based on data from the European Labour Force Survey (Eurostat) and the US Bureau of Labor Statistics.

Figure 6. Graduation rates from higher education (percentage of population aged 20-24)



Note: 1996 for Belgium (Flemish Community only), Germany, Ireland, Japan, the Netherlands, the United States.
Source: European Commission, 2000.

Figure 7. Tertiary-level graduates in computing as a percentage of all fields of study, 1999



* Data on the first stage of tertiary-level education are not available.
Source: OECD Education database, June 2001.

The US Scientists and Engineers Statistical Data System (SESTAT)

Besides labour force surveys and education statistics, other sources of data for HRST include, in particular, special national population registers or surveys. One is the US Scientists and Engineers Statistical Data System (SESTAT), one of the most comprehensive systems for observing HRST-type data at national level.

SESTAT is a comprehensive and integrated system of information about the employment, education and demographic characteristics of scientists and engineers (S&E) in the United States. It covers those with a bachelor's degree or higher who either work in or are educated in science or engineering, although some additional data are also included.

SESTAT was created by the National Science Foundation (NSF) to provide data for policy analysis and general research. Maintained by the Division of Science Resource Studies at NSF, SESTAT contains data from three NSF-sponsored demographic surveys: the National Survey of College Graduates (NSCG), the National Survey of Recent College Graduates (NSRCG) and the Survey of Doctorate Recipients (SDR). These surveys are conducted biennially from 1993; the 1999 survey is under way. These surveys provide data that are integrated into a single system.

The approach chosen to measure US scientists and engineers (S&E) is very close to that of the "Canberra Manual" in that it looks at the S&E population in terms both of education and of occupation. The coverage of US S&E is, however, more restrictive than that of HRST, *i.e.* it does not

cover certain categories of teaching professionals, managers, other professionals and associate professionals in the ISCO sense. On the other hand, the term "scientists and engineers" in the US sense is much broader than that used in Table 2. Thus, much harmonisation is still needed at international level. Table 3 presents some data extracted from the SESTAT database.

Table 3. US scientists and engineers, by S&E degree status and labour force status, 1997

S&E degree status	Labour force status					
	Total	Employed			Unemployed	Not in labour force
		Total	In S&E	In non-S&E		
Scientists and engineers, total	12 530 700	10 585 600	3 369 400	7 216 200	193 700	1 751 400
Educated in S&E	11 962 100	10 057 600	3 074 800	6 982 800	187 300	1 717 200
Highest degree is in S&E	9 269 200	7 704 000	2 840 800	4 863 200	150 500	1 414 700
Highest degree is not in S&E	2 692 900	2 353 600	234 000	2 119 600	36 700	302 500
No S&E degree[1]	568 600	528 000	294 600	233 400	6 400	34 100

1. The persons without S&E degrees or jobs in 1997 represent individuals who had S&E jobs in 1993, but had later moved to non-S&E jobs, became unemployed or had moved out of the labour force.
Note: The term "scientists and engineers" (S&Es) include all persons who have ever received a bachelor's degree or higher in a science or engineering field, plus persons holding a non-S&E bachelor's or higher degree who were employed in an S&E occupation during either the 1993, 1995 or 1997 SESTAT surveys. Figures are rounded to nearest hundred. Details may not add to total because of rounding.
Source: National Science Foundation, Division of Science Resources Studies (NSF/SRS), Scientists and Engineers Statistical Data System, 1997.

Measuring international migration of HRST

Before giving detailed consideration to the mobility of skilled persons, it is appropriate to refer briefly to the wider general question of measuring migration flows. International agencies (especially the United Nations) have done much to seek to promote the availability of migration statistics by formulating concepts and definitions and striving to establish standardised data collection procedures (UN, 1998a). The aim of the UN is to account for all categories of persons crossing international borders, regardless of their place of residence. The criterion, "duration of stay" in the country of immigration or emigration, in association with the concept of residence, is used as a basic means of distinguishing between "migrants" and "non-migrants". The latter cover such categories as tourists, short-term business travellers, frontier workers, pilgrims, nomads, etc.

The UN recommendations distinguish two basic categories of migrant, long-term and short-term. These are defined as follows:

- A long-term migrant is a person who moves to a country other than that of his/her usual residence[3] for a period of at least one year, so that the country of destination effectively becomes his/her new country of residence.

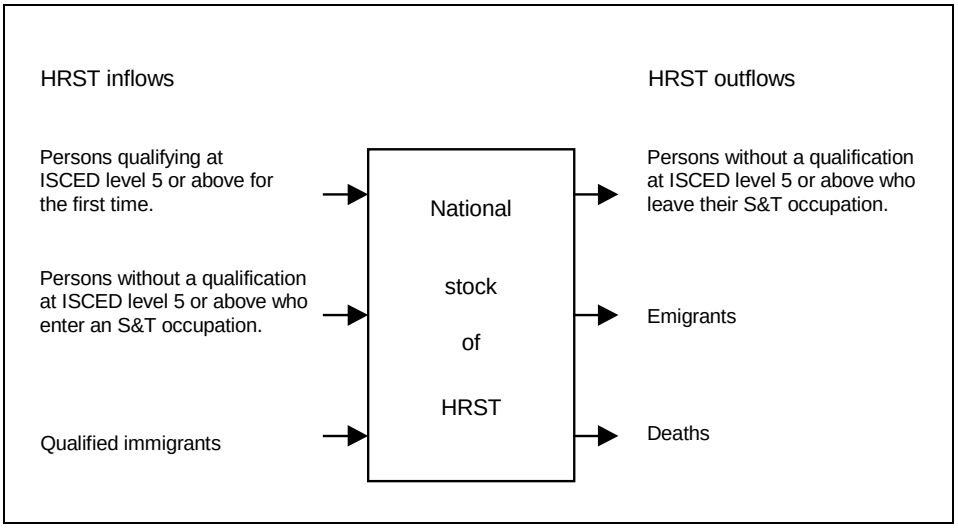
- A short-term migrant is a person who moves to a country other than that of his/her usual residence for a period of at least three months but less than a year (12 months), except if movement to that country is for reasons of recreation, holiday, visits to friends and relatives, business, medical treatment or religious pilgrimage.

Dependants travelling with their parents or carers are also regarded as migrants if the latter are so classified. The definitions apply equally to all population categories, whether nationals or not, foreign-born or not.

While these definitions have not been widely adopted, they provide a useful benchmark and focus for further efforts towards harmonisation.

Before looking at possible measures of international mobility of HRST, it is interesting to look at Figures 8-10, which describe how national stocks and flows of HRST are constituted.

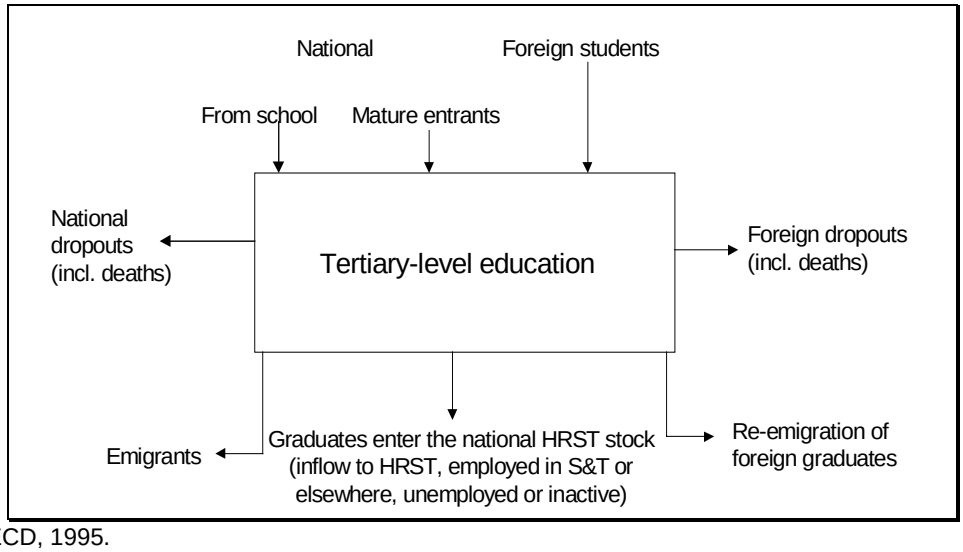
Figure 8. National stocks and flows of HRST: schematic model



Source: OECD, 1995.

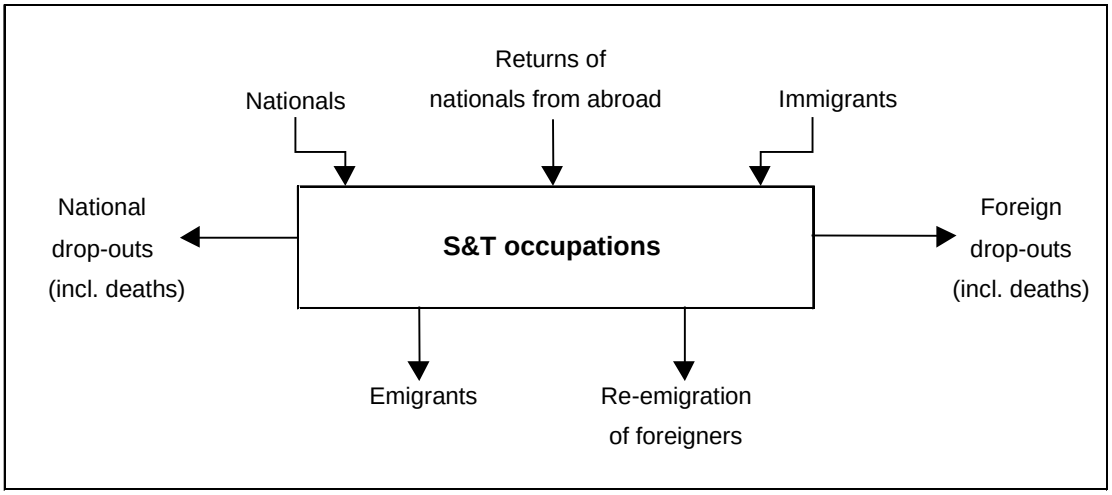
Figure 8 can be refined on the basis of the definition of HRST: Figures 9 and 10 show the stock and flows of tertiary-level students, on the one hand and of S&T workers, on the other.

Figure 9. Main flows in and out of tertiary-level education



Source: OECD, 1995.

Figure 10. Main flows in and out of S&T occupations



It should be kept in mind that the different sub-categories in Figure 10 may, or may not, have completed education at the tertiary level in an S&T field of study (and that, among those having completed tertiary-level education, some may have done so abroad). The "Canberra Manual" defines the "core" HRST population as that with both tertiary-level education and an S&T occupation.

Sources of migration statistics

The principal sources of migration statistics are: *i)* national administrative systems for regulating and monitoring immigration; *ii)* administrative systems relating to temporary residence or work permits for non-nationals; *iii)* population registers; and *iv)* censuses and labour force surveys. However, depending on the circumstances, other data sources are used, such as special surveys, counts of border crossings, analysis of landing cards, studies of personnel transfers within multinational enterprises, etc.[4] It should be noted that published migration statistics are often derived from a number of data sources. In many countries, several sources are used and methods are devised to combine the relevant data in order to achieve comprehensive coverage of relevant categories of persons,. Information from the different sources is also usually published, but variations in the definitions and coverage need to be borne in mind. The manner in which the data from the various sources may differ will become more apparent when these sources are discussed in more detail below.

It is not, of course, the primary objective of this chapter to discuss the merits or otherwise of different data sources on international migration. However, the issue will of necessity have to be considered in the context of providing information on migration flows of qualified or skilled personnel. This is necessary because the possibilities for obtaining information on this specific aspect of migration depend very much on the data sources used.

National systems for regulating permanent or long-duration immigration

Virtually all countries have administrative systems to regulate permanent or long-duration immigration. Broadly speaking, in the context of theses sources, an "immigrant" is usually defined as a non-national who seeks to settle or reside permanently in the receiving country or at least intends to stay for an extended duration. In the United States, for example, the legal concept of "immigrant" relates solely to those persons of foreign nationality who seek to reside there permanently. The

situation in Canada, and in other countries, is similar. Thus, movements under such systems would normally cover only a part of aggregate immigration as conventionally understood and would fall well short of covering the migration inflows envisaged under the UN recommendations previously referred to.

Other qualifications apply to the data derived from these systems. A significant share of those accepted as permanent immigrants are already (legally) resident in the country in a different capacity.[5] Thus, actual movements are not necessarily associated with all persons classified as new immigrants in any one period. Furthermore, administrative initiatives, such as campaigns to clear applicant backlogs or one-off procedures to regularise the situation of non-nationals residing illegally in the country, can cause immigration figures to rise sharply, giving the (erroneous) impression that migration inflows are increasing.

Notwithstanding the statistical disadvantages, administrative-based immigration statistics are important in a number of countries. This applies especially to countries with a long-standing, humanitarian-based tradition of accepting immigrants, such as the United States, Canada and Australia. For these countries, inflows of permanent or long-duration immigrants have always been, and still are, quite large. In the United States, for example, over 660 000 persons were officially classified as immigrants in 1998, of which some 78 000 were admitted under the official "employment preference" category. One positive aspect of data derived from permanent immigration systems is the fact that, as countries are in effect making a significant investment in facilitating the entry of such immigrants, detailed and accurate information on personal characteristics is usually obtained. This would normally include details on occupation and education.

In 1999, 189 600 permanent or long-duration immigrants were allowed to settle in Canada, of whom 105 400 (56%) entered as "economic immigrants" under the Skilled Worker and Business Immigration Programmes. Just over 45 100 (43%) of the latter were principal applicants, the remainder (nearly 60 300) were spouses or other dependants. In the context of assessing skill levels or HRST, it is of interest that over 86% of those who entered Canada under the Skilled Worker Programme in 1999 had tertiary-level qualifications (26% with a master's degree or higher), a share that has been increasing (78% in 1997). In the same year, the share for business immigrants (*i.e.* those seeking to enter Canada in a self-employed capacity) was lower at just over 45%.

Over 92 000 permanent immigrants entered Australia in the year to June 2000 (under the Official Migration Programme), somewhat less than 40% of whom entered under what is termed the "skill stream" sub-component. As the term suggests, this arrangement is designed to facilitate the entry of individuals with particular skills.

The administrative-based migration data for Australia have a number of interesting features. Unlike information for many other countries, they provide comprehensive information on all departures and entries (of whatever duration) and cover Australian citizens as well as non-nationals. Furthermore, in addition to flows of permanent migrants, the published information also distinguishes migrants entering for or departing for more than one year, thus making it possible to compile data in accordance with UN recommendations. Australia appears to be one of the few countries where aggregate gross and net migration flows (in both directions) can be derived directly from administrative sources.

Japan also maintains a very comprehensive system to control and monitor entries and departures, which covers both non-nationals and Japanese citizens. Permanent migration to and from Japan is relatively limited, and the great majority of recorded movements relate to short-term trips for leisure, business or personal reasons. However, the system also involves a range of functional "status of

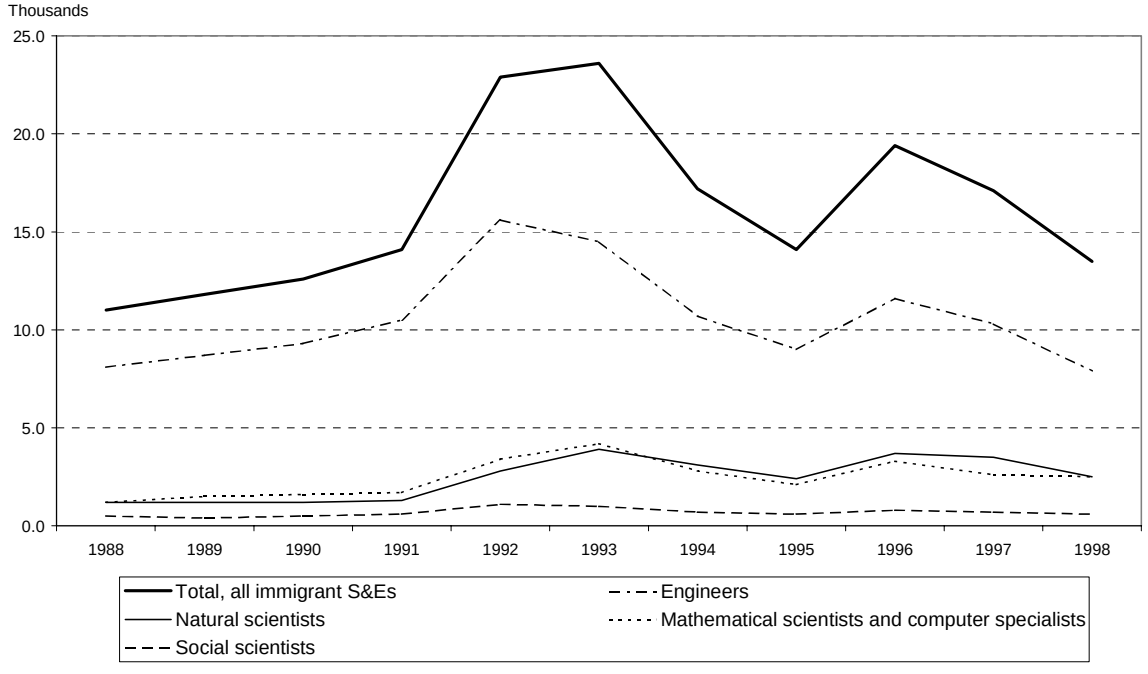
residence" categories designed for those entering Japan on a longer-term (but fixed) basis, many of whom come to work or pursue studies or research. Further details on such entrants are given in the next section.

Working visas, work permits and related programmes

In addition to maintaining systems to deal with permanent or long-duration immigration, most countries also have administrative arrangements for entry on a temporary basis. For the most part, these tend to be related to labour-market needs and involve working visas or work permits, to which certain conditions are attached. Such documents remain valid only for a specified period. Recipients may also be restricted to a particular occupation or industry, or indeed to a particular employer (in which case the onus is usually on the employer to obtain the visa or permit). In circumstances where the arrangements are employer-based, it may also be necessary to demonstrate that the vacancies in question cannot be filled on the national or local labour market.

In many countries the inflows associated with these systems greatly exceed the numbers entering for employment reasons under permanent immigration procedures. Figure 11 shows an indicator for the numbers of scientists and engineers who were permanent immigrants to the United States. Immigration peaks occurred in 1992 and 1993 following a statutory increase in the number of work-related permanent visas. The number of S&E immigrants who entered on a permanent basis has decreased since. Conversely, qualified immigrants allowed to enter on a temporary basis, as measured through H-1B visas (see Figure 1 of Chapter 3), have steadily increased since 1993. In 1999, about 50% of these visas were delivered to Indian citizens. In Australia, nearly 93 300 non-nationals entered the country under long-term working visa arrangements in 1999/2000. Some 34 000 entered under the temporary business entry (long stay) system, and most were to take up professional or managerial jobs.

Figure 11. US Immigration and Naturalization Service counts of permanent visas with S&E occupations



Source: National Science Foundation, *Science and Engineering Indicators 2000*.

In Europe, these systems are normally referred to as work permits. They tend to be restrictive in that a prospective employer is generally obliged to apply for a permit for a named person and a specified job. There are also significant exclusions. Many European countries have negotiated bilateral or multilateral agreements guaranteeing freedom of movement for workers to cross national boundaries between countries that are party to the agreements. Under these circumstances, fewer administrative procedures have to be followed, and, as a result, migration movements may not always be fully recorded. As a result, the usefulness of the system for providing comprehensive data on migration flows is significantly reduced. The EU constitutes the most obvious example, but even before the EU came into existence, a number of European arrangements allowed labour to move freely across national boundaries. The Nordic countries and the labour market arrangements between the United Kingdom and the Republic of Ireland are examples.

In Japan, one of the status of residence categories used to classify non-nationals is defined as "for the purpose of work". Bearing in mind that entertainers entering for a short-term stay are included, the inflow of such persons into Japan increased in recent years, from 82 000 in 1995 to 108 000 in 1999.[6] The aggregate inflow for the broad highly skilled group. covering researchers, engineers, those with occupations in the social sciences and education as well as intra-company transferees, rose from 15 000 in 1995 to 21 000 in 1998. The inward movement for these categories declined somewhat in 1999, presumably owing to the downturn in the Japanese economy, but this is probably a temporary phenomenon; the inward movement is likely to increase as the Japanese economy recovers. Population stock figures for the corresponding category of foreign workers in Japan increased from 88 000 in 1995 to nearly 126 000 in 1999. Interestingly, it continued to increase between 1998 and 1999, an indication that the outflow of such persons also declined somewhat during this period.

Basically, the main objective of governments in allowing temporary or fixed-term employment-related immigration is to meet the human resource needs of national economies. Thus, the great majority of such entries are generally restricted to workers whose skills are in short supply, and whose entry will not adversely affect employment opportunities for the resident population. It is inevitable, therefore, that the working visa and permit systems are strongly oriented towards admitting persons who possess skills and qualifications. In fact, such migrants increasingly receive more favourable treatment, as the global demand for professional and high-technology workers increases and countries compete for what is an increasingly scarce resource. German government sources in early 2000 announced an initiative to facilitate the recruitment of over 20 000 computer/software engineers from outside the EU. The French government enacted a decree in 1999 permitting companies to hire workers skilled in computer science if it can be demonstrated that the company is unable to fill the posts from the local labour market. Another example is provided by the recent enactment of the US Competitiveness in the Twenty First Century Act which substantially alters the terms under which foreign professionals and workers with special skills may obtain and continue to use H-1B visas. The Act increases the number of such visas available (to 195 000 per year starting in 2001), relaxes restrictions on the mobility of such workers and extends their potential duration of residence as H-1B non-immigrants. It actually facilitates a substantially larger number of H-1B admissions than the stated limit suggests, since it exempts from the quota employees of several major sponsors of H-1B workers, such as institutions of higher education, non-profit agencies and governmental research organisations. Basically, the allotment of H-1B visas is now a function of demand.

With regard to the availability of statistical information on working visa or work permit systems, the situation varies greatly between countries. In some, the data collected emphasises occupations or skills (*e.g.* United States, Canada, Australia, Japan) mainly in order to monitor the inflow and ensure that the entrants are restricted to the officially designated skill-based categories. Unlike the situation for permanent immigration, information on formal educational qualifications is rarely collected for these temporary immigrants. In European countries, while work permit systems are also usually

designed to ensure that inflows are confined to highly skilled entrants, information on occupations is only exceptionally available. For the most part, tabulations according to sector are most frequently published. Even where different countries use the same classification variables, there is no uniformity in the use of nomenclature. Therefore it is difficult, if not impossible, to derive comparative data across countries.

Despite the inconsistencies and the general lack of coherence, an inspection of the existing data on temporary work-related immigration for different countries reveals a noticeable tendency towards an increasing level of international migration among the highly skilled. In the United States, for example, the number of admissions under the H-1B visa system rose from 106 000 in 1994 to over 240 000 in 1998. It should be noted, however, that admissions recorded under the different US visa systems include multiple entries by the same person over the period in question. Thus, these figures should not be interpreted as the number of individuals entering the United States under these arrangements. In the United Kingdom, the number of work permits issued to managers and scientific and technical professionals rose from less than 5 000 in 1996 to nearly 19 000 in 2000, a near doubling of the share of all work permits (from 13% to 25%). In Canada, for permanent skilled worker immigrants, the share with tertiary-level qualifications rose from 78% to 86% over the period 1997-99., and there is a similar trend for total permanent adult immigrants into Canada.

In Japan, the number of Japanese citizens recorded as leaving "to assume posts" (presumably mainly skilled) rose from 38 500 in 1992 to over 53 000 in 1998. In the same period, the number of Japanese citizens who left to engage in research, study or technical training abroad increased from 220 000 to nearly 280 000.[7]

In summary, the evidence points clearly to a rising level of high-skill migration in OECD countries. However, because of data problems, it is not possible at this point to use the sources described above to quantify movements in comparative or global terms, even on the basis of the very broad definitions of HRST.

Population registers

Population registers, where they exist, tend to include mainly demographic data, such as age, sex and nationality or citizenship and, with respect to migration, information such as date of entry into the country, intended duration of stay, etc. The main purpose is to provide basic information on the resident population in terms of its composition and associated migration movements. Population registers generally do not seek information on educational levels or labour market characteristics. However, in countries with well-developed register systems (such as the Nordic area) links can be made to other sources (*e.g.* social security registers) to obtain the required information. This opens up the possibility of classifying migration movements (including departures) according to sectors, occupations, etc.

Labour force surveys and censuses

Censuses and labour force surveys have the potential to provide more specific and comparable information on migration inflows of HRST for different countries. These sources have the advantage of being essentially statistical exercises specifically designed to facilitate economic and social analysis, and, increasingly (even in purely national circumstances), they tend to involve international comparisons. At the level of individual survey respondents, relevant information is usually collected on sector, occupation and educational levels, generally in a form that allows classification according to

standard international definitions. Thus, at the data analysis stage, it may be possible to use definitions based on a combination of these data. However, much depends on the level of detail obtained at the data collection stage, even if not entirely reflected in the published results (*e.g.* because of sampling constraints). If the information on occupation, industry, etc., obtained from respondents is reasonably detailed, it can be aggregated in various ways with different objectives in mind, including the compilation of data according to HRST definitions.

Inevitably, however, there may be problems. Information on inward migration is usually obtained by seeking details of survey respondents' place of residence one year prior to the survey.[8] Migration is then defined on the basis of those who are residents in the country when the survey is taken, but who lived abroad one year earlier. Obviously, this approach excludes some short-term migrants. Those who entered the country during the preceding 12 months and left prior to the survey date are not included.[9] Furthermore, it is a well-known feature of "recall" questions that the derived information is less reliable than that relating to a respondent's current situation. In a significant number of instances, responses may fall into the "unstated" or "unknown" categories.

The sampling methods used in labour force surveys in particular limit the possibilities for presenting detailed information. This is especially true with respect to migrants, who tend to be small in number relative to the size of the national population or labour force. There may also be problems of differential response for various groups in the population. Non-response rates for migrants may be higher than for the general population for a number of reasons, including the nature of their accommodation and their level of proficiency in the national language. Some migrants live in hostels and institutions not usually covered in labour force surveys, which tend to be based on samples of private households. While these problems may not affect qualified or skilled migrants to the same degree, they may cause them to be over-represented in the derived population and labour force estimates.

The main advantage of using census data is that they are usually based on a complete enumeration of the population so that problems arising from the use of sampling procedures do not arise. Censuses usually place legal requirements on respondents to co-operate and there should be less missing or unrecorded information. In theory, at any rate, all migration inflows, however small, should be identifiable. However, as census questions on migration are usually formulated on the same "recall" basis as in labour force surveys, many short-term migrants would again be excluded.

Censuses tend to be held infrequently – about every ten years in most countries. However, a set of UN recommendations[10] requested countries to hold a census as close as possible to the year 2000. Thus, it should be possible, as the relevant data become available, to assemble a body of useful information on migration from these sources. This should be facilitated by the fact that the recommendations for the UN Economic Commission for Europe specify the inclusion of a question on "residence one year earlier". Because the current ISCED and ISCO nomenclatures are likely to form the basis of the educational and occupational classifications used in different countries, it should be easier to derive HRST flows, even if on a rudimentary basis.

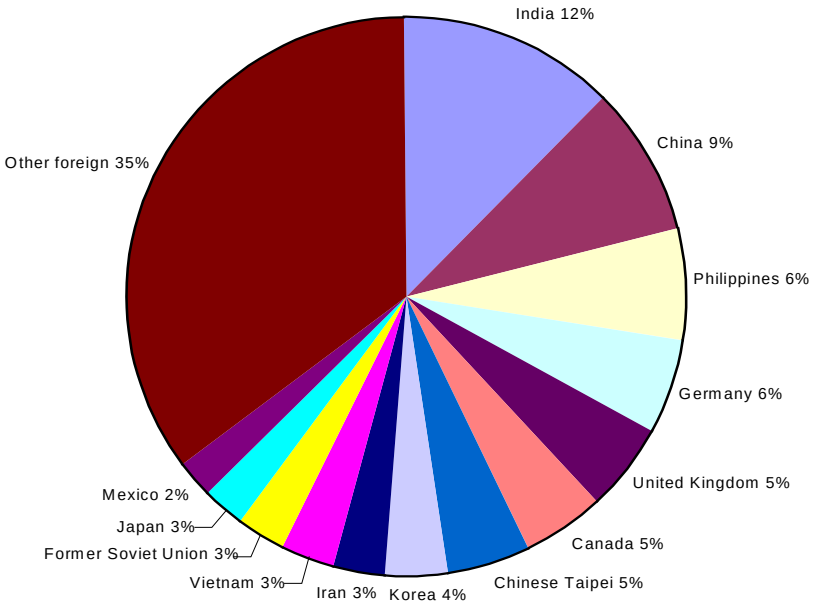
Other data sources

Perhaps the most important other source is the UK International Passenger Survey (IPS). This is a continuing sample survey of international travellers conducted by the Office of National Statistics which covers the principal air and sea routes between the United Kingdom and other countries (excluding travel between the United Kingdom and the Republic of Ireland). Most of those surveyed are short-term travellers, but a sub-sample of "migrants" is identified. The definition of migrant is that

recommended by the United Nations, *i.e.* the concept of minimum duration (either in the United Kingdom or abroad) is based on a time span of one year or more. Data are available on basic demographic characteristics as well as nationality, country of origin, origins/destination and occupational status. However, the sample size for "migrants" is small, about 2 500 in all. Therefore, detailed analyses of migrant characteristics have to be considered with some caution as sampling errors can be high.

Certain countries conduct special surveys of potential relevance for measuring international mobility of the highly skilled, such as SESTAT, which captures the contribution of both foreign-born and non-US citizens to the US labour force in the science and engineering context. Most of the data derivable from this source relate to population stocks, but some broad inferences on migration flows can be drawn from observed changes in the stock of foreign-born graduates.[11] Figure 12 is an indicator, drawn from SESTAT, of the stock in 1997 of immigrant S&E degree holders according to place of birth. They numbered about 1.5 million (12% of the total stock) and countries contributing at least 30 000 are represented in the figure. Immigrant scientists appear to come from a wide variety of countries, none of which dominates.

Figure 12. Place of birth of foreign-born degree holders in science and engineering in the United States, 1997



Source: National Science Foundation, *Science and Engineering Indicators 2000*.

In addition, several OECD countries, including Denmark, Canada, France, Italy, Ireland, Japan and the United Kingdom, maintain annual graduate surveys that monitor the post-graduation labour market performance of recipients of higher-education degrees. In some cases, foreign and foreign-born graduates are distinguished.

Migration outflows

One feature that applies to most of the above-mentioned sources is that they only measure inflows. While many countries provide aggregate estimates for gross migration outflows, it is rarely possible (apart from Australia and Japan) to derive detailed information on emigration. The reasons are fairly obvious. In household surveys it is difficult, if not impossible, to obtain information on persons who have already left the country. As for administrative sources, while governments have cause, for various reasons, to give priority to monitoring and documenting migration inflows, most see little reason to record in any detail the outflow of persons for whom they no longer have responsibility.[12] There have been, from time to time, expressions of concern about "brain drain"; however, these have seldom prompted any structured response in the form of additional data on emigration.

Some estimates derived from labour force surveys

Table 4 shows employment estimates for EU countries for Spring 1998 classified by broad ISCO group and nationality. The nationality variable distinguishes "nationals" of each country as appropriate, "nationals of other EU countries and of other developed countries",[13] and, finally, citizens of all other countries, which are broadly defined as "developing". Classifications involving the employment stock of non-nationals do not, of course, necessarily bear a direct relationship to labour force inflows, as these also include nationals returning from abroad. While they do not give a complete picture, they do provide a guide as to the size of an important component of total employment with which migrant flows are associated. If one defines HRST as broadly those with occupations associated with ISCO major groups 2 and 3, about 27% of those in employment in the EU in 1998 fell in this category. The proportion rises to over one-third if the definition is extended to cover "managers, executives, etc." (ISCO 1).

Table 5 shows the shares of all non-nationals in employment in each country for the broad occupational groups referred to above.

Measuring HRST inflows

The EU Labour Force Survey data were to be used to compile estimates of the migration inflow into employment for individual countries for the three broad occupational groups previously used. This would have involved the compilation of tables somewhat similar to Tables 4 and 5, but relating to gross migration inflows rather than to employment stocks. However, in the course of the compilations, it became clear that it was not possible to do this, owing to the absence of full information on country of previous residence, since for significant numbers of respondents in many countries the entry "country of residence one year ago" was not recorded. This meant relatively large numbers of persons in the "not stated" or "blank" categories. There was no way to determine how they could be distributed between the "immigrant" and "non-immigrant" categories, even though, for some countries, the numbers involved suggested that many must have been resident in the country a year earlier.

Table 4. Total employment in 14 EU countries in 1998 classified by nationality and occupational group

Thousands

Occupation	Austria	Belgium	Germany	Denmark	Spain	Finland	France	Greece	Italy	Luxem-bourg	Nether-lands	Portugal	Sweden	United Kingdom	Total
Nationals															
ISCO 1	267	381	1879	178	1 103	178	1 652	437	665	5	838	335	190	3 851	11 960
ISCO 2&3	822	1 070	11 193	795	2 649	723	6 017	759	4778	39	2 493	628	1 346	6 139	39 450
ISCO 4-9	2 194	2 132	19 640	1 639	9 272	1 262	13 590	2 626	14 721	58	3 834	3741	2 261	15 849	94 267
Total	3 282	3 583	32 712	2 612	13 024	2 163	21 260	3 822	20 165	102	7 165	4 703	3 797	25 839	145 677
Other EU and developed countries															
ISCO 1	12	38	120	(4)	13	-	47	(3)	(6)	4	15	(3)	4	136	408
ISCO 2&3	49	51	366	19	20	(4)	108	6	28	19	59	6	42	225	1 002
ISCO 4-9	208	137	1 376	27	34	7	520	122	66	43	69	13	86	387	3 143
Total	269	226	1 862	51	66	12	675	132	99	67	143	23	132	748	4 553
Developing countries															
ISCO 1	-	5	37	-	5	-	35	-	-	-	(6)	(2)	-	32	126
ISCO 2&3	4	5	95	-	6	-	54	-	(7)	-	(8)	(4)	-	65	254
ISCO 4-9	70	38	830	14	59	3	446	12	85	2	78	32	14	199	1 881
Total	75	48	963	15	70	4	534	13	94	2	92	38	17	296	2 261
All nationalities															
ISCO 1	280	424	2 037	183	1 120	179	1 735	441	672	9	860	340	195	4 019	12 493
ISCO 2&3	874	1 126	11 654	815	2 675	728	6 179	766	4 813	58	2 561	639	1 390	6 429	40 706
ISCO 4-9	2 472	2 307	21 846	1 680	9 365	1 273	14 555	2 760	14 872	103	3 980	3 786	2 361	16 435	99 291
Total	3 626	3 857	35 537	2 678	13 161	2 179	22 469	3 967	20 357	171	7 401	4 764	3 946	26 882	152 490

Source. EU Labour Force Survey. Special tabulations provided by EUROSTAT.

Table 5. Share of non-nationals in employment in different occupations in EU countries, 1998

	Austria	Belgium	Germany	Denmark	Spain	Finland	France	Greece	Italy	Luxem-bourg	Netherlands	Portugal	Sweden	United Kingdom	Total
ISCO 1	5.0	10.1	7.7	2.7	1.5	0.4	4.7	0.9	1.1	44.7	2.5	1.4	2.3	4.2	4.3
ISCO 2&3	6.0	5.0	4.0	2.4	1.0	0.6	2.6	0.9	0.7	33.4	2.6	1.7	3.2	4.5	3.1
ISCO 4-9	11.3	7.6	10.1	2.5	1.0	0.8	6.6	4.8	1.0	43.6	3.7	1.2	4.3	3.6	5.1
Total	9.5	7.1	7.9	2.5	1.0	0.7	5.4	3.7	0.9	40.2	3.2	1.3	3.8	3.9	4.5

Source. EU Labour Force Survey. Special tabulations provided by EUROSTAT.

However, it was still possible to use the available data to make some broad estimates of inflows. By using the subset of the Labour Force Survey data that involved identifiable inward movements, it was possible to estimate, for each country, the share of the partial population inflows which related to inflows into employment and, within the latter group, how these were distributed according to the three ISCO categories noted above.[14] These relationships were then associated with known, independently compiled gross population inflow figures to give estimates of occupation-based migration movements into employment. While these estimates were compiled for individual EU member countries, the country-specific estimates must be regarded as tentative; it was considered prudent to show the estimated flow data at total EU level only (Table 6). Indeed, even at that level, given the nature of the estimation procedure and the possibility of bias, the estimates can only be regarded as giving a broad indication of the size of the aggregates involved.

Table 6. Estimated employment stocks and gross migration inflows for EU countries

Occupation	Total employment, 1998	Migration employment inflow, 1997	Inward migration
	Thousands		Percentage
ISCO 1	12 493	57	0.5
ISCO 2&3	40 706	213	0.5
ISCO 4-9	99 291	436	0.4
Total	152 490	705	0.5

Source: Estimates based on the EU Labour Force Survey and Demographic Statistics.

These combined figures for the 14 EU countries covered put the estimated migration inflow into employment in 1997 at just over 700 000. Some 57 000 (8%) of these migrants were classified in ISCO 1 (managers, etc.), 213 000 or just over 30% were professionals or associate professionals (ISCO 2 and 3) and the remaining 436 000 (or 62%) were associated with other less skilled occupations.

If these figures are compared with employment stock estimates (for 1998), they indicate that the total migration inflow into employment represented about 0.5% of the total number of persons at work in the EU *(i.e.* 152.5 million in 1998). The corresponding proportions for three occupational groups distinguished did not vary very much from this figure.

It is of interest to conclude by considering similar estimates from the US Current Population Survey (CPS). Table 7 contains estimates of inward mobility to the United States from abroad for adult employed civilians for the years ended in March of 1996 and 1999.[15] These data, which at respondent level, are derived in much the same way as in the EU Labour Force Survey, indicate that inflows were 623 000 in 1999, significantly higher than in 1996 (just over 480 000). If the first three occupations shown (managers, professionals, technical support, etc.) are regarded as broadly representing HRST, the related inflow in 1999 was 184 000, or just under 30% of the total. The corresponding share in 1996 was only marginally smaller.

Table 7. Inward mobility to the United States of employed civilians aged 16 years and over, by occupation

Occupation	1995/96	1998/99	1995/96	1998/99
	Thousands		Percentages	
Executive, managerial	39	66	8.1	10.6
Professional, specialist workers	92	111	19.0	17.8
Technical support, etc.	7	7	1.4	1.1
Sales	53	54	11.0	8.7
Administrative support, clerical	25	48	5.2	7.7
Personal services	9	6	1.9	1.0
Protective service	1	8	0.2	1.3
Other services	103	99	21.3	15.9
Precision production, craft workers	35	53	7.2	8.5
Machine operatives, testers, etc.	45	34	9.3	5.5
Transport, material movers	6	17	1.2	2.7
Unskilled labourers, cleaners, etc.	23	58	4.8	9.3
Farmers, forestry, fishing	45	62	9.3	10.0
Total	483	623	100.0	100.0

Note. The periods covered relate to the year ended in March.
Source. US Current Population Census.

NOTES

1. ISCED was revised after the release of the "Canberra Manual". According to research conducted by Eurostat and UNESCO, categories 5b, 5a and 6 of the new ISCED-97 may be considered as the new equivalent of the former categories 5, 6 and 7.

2. The new ISCED offers some interesting developments in the description of these emerging fields. Life sciences are described as: biology, botany, bacteriology, toxicology, microbiology, zoology, entomology, ornithology, genetics, biochemistry, biophysics, other allied sciences, excluding clinical and veterinary sciences. Computer sciences includes system design, computer programming, data processing, networks, operating systems – software development only (hardware development is classified with the engineering fields).

3. The country where a person lives, that is to say, the country in which the person has a place to live and where he or she normally spends the daily rest period.

4. Reference should be made to the Statistical Appendix in the 1999 edition of the OECD publication *Trends in International Migration* (OECD, 1999) for a more detailed overview of data sources on international migration.

5. Some countries distinguish these groups. In the Australian immigration statistics, they are categorised under the heading of "category jumpers".

6. For detailed data on Japan, see the chapter by Kobayashi in the present volume.

7. These data are unique in that Japan is one of the few countries that comprehensively documents departures (Australia is another). There have been studies of the outward migration of skilled Japanese workers in the context of Japanese foreign direct investment (FDI). See, for example, OECD, 1997.

8. One can also attempt to derive information on migration inflows from questions that record "duration of residence in the country".

9. In this regard, see Koser and Salt, 1997. This study argues that short-term movements (including business trips) of qualified workers may become more important as use of new technologies and greater international networking reduces the need for longer-term visits by professional personnel.

10. See UN, 1998b. This publication was prepared jointly by the UN Commission for Europe and Eurostat.

11. One significant limitation of this source is that persons whose only S&E degree is from a foreign institution are counted only if that person was in the United States with that degree at the time of the April 1990 census.

12. In the Nordic countries, population registers (sometimes in association with other sources) are used to provide data on gross population outflows.

13. The category “other developed countries” covers the EEA, central and eastern Europe, other European countries (except Turkey), the United States, Canada, Japan, Australia and New Zealand. This categorisation is used in the annual series of Eurostat Reports on Migration Statistics.

14. This relates to that subgroup of Labour Force Survey respondents for which the country of residence one year prior to the survey date was identified.

15. It should be noted, however, that the data for the EU are obtained by aggregating the inflows for individual member states, which include inward movements from other EU countries. The total inflow from outside the borders of the EU would be smaller.

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Chapter 2

STUDENT MOBILITY BETWEEN AND TOWARDS OECD COUNTRIES: A COMPARATIVE ANALYSIS

by

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Introduction

Against the current background of economic globalisation, international trade in goods, services and information is more important than ever. This global economic integration demands linguistic and cultural knowledge from future partners which might be acquired as part of their education. At the same time, student mobility is made easier by developments in communications and faster information flows.

The result is a growing internationalisation of education systems, which is manifest in the content of programmes and the evolution of student populations, which are becoming increasingly cosmopolitan. The integration of world trade is encouraging student mobility, allowing them to absorb the cultural and social customs of their host country and thus to act as ambassadors for both their own and their host country. The rising power of technology in the economic sphere, and the imperative need for countries to keep pace with technological developments, in particular in key economic sectors, currently hastens the internationalisation of educational courses. It then becomes tempting for countries to encourage some of their students to go abroad for their education, with a view to benefiting on their return from technology acquired at minimal cost. For their part, host countries may take the opportunity to allow some of the foreign students access to the labour market in the form of part-time or seasonal work or else participate in research and development (R&D) as part of their educational programme.

During the last few years, sustained economic growth in most OECD countries and the development of the information economy has led to a considerable increase in migration of human resources in science and technology (HRST). Some Member countries have relaxed their immigration laws to attract qualified and highly qualified foreigners (including students) to sectors where there are labour shortages.

Student mobility provides a potential flow of qualified workers either in the course of their studies or through subsequent recruitment. Moreover, the internationalisation of students in higher education may allow economies of scale in education systems (for example, development of new branches) and bring in additional resources to finance them. Foreign students in significant numbers also have an impact on the life of the local economy (consumption, accommodation, etc.). From the

point of view of the countries of origin, the potential gains related to this mobility (strengthening of cultural and commercial ties, transfer of technology) may be limited as a result of brain drain, mainly at times of shortage of qualified labour in the foreign students' host countries.

Thus, a study of qualified labour flows cannot ignore international student mobility. Based on data standardised by the OECD, UNESCO and Eurostat (see Box 1), it is possible, first of all, to attempt an evaluation of the scale, direction, characteristics and determining factors of student flows. Prior to that, it will be recalled that student flows represent a form of migration of qualified labour and also a precursor of subsequent migration, mainly of HRST. Second, the consequences of this mobility for the countries of origin and host countries will be examined.

Box 1. Statistical sources and methods

For the purposes of this study, the data are from the Indicators for Education Systems (INES) project, conducted jointly by UNESCO, the OECD and Eurostat in OECD countries and certain emerging countries in Africa, Asia, Latin America and central and eastern Europe that participated in the World Education Indicators and PHARE projects. This database contains enrolments in higher education for each country, and records the number of foreign students enrolled. It thus provides information on numbers of migrant students but not annual flows. Moreover, the number of students from each country enrolled abroad is measured from data available in OECD Member countries. Students going to countries that do not provide the OECD with such data or going to non-member countries are not included.

Foreign students are usually identified on the basis of citizenship, or in some cases, by an alternative (nationality, place of birth, former domicile) (see Box 2). The application of these criteria thus generates a bias related to the differences between host countries' policies on obtaining nationality. Indeed, children of non-naturalised migrants may have been living for a long time in the host country (some are born there); this does not, *a priori*, justify attaching them to their country of origin or that of their parents when measuring the proportion of students going abroad for their education. The bias is accentuated by the fact that most of the countries considered cannot distinguish, among foreign students, those with a permanent residence permit (who could be described as "pseudo" foreign students) and those with a student residence permit. A similar bias may appear, for example, in Norway, when the classification "foreigner" is defined on the basis of place of birth and not country of residence. Conversely, the number of foreign students may be underestimated when identification is based on the residential address provided on enrolment (United Kingdom, Ireland), which effectively excludes children of resident immigrants, as well as foreign students who give the address of a resident relative or friend. The same applies when, under bilateral agreements on free movement of people (Trans-Tasman agreements between Australia and New Zealand) or multilateral agreements (Nordic countries), enrolment procedures may not consider as foreigners students who belong to the countries party to the agreements.

Despite these reservations, the data collected under the INES project represent an analytical tool that can serve to give an initial picture of student mobility between and towards the OECD countries.

The educational levels used in this document are defined according to the UNESCO International Standard Classification of Education (ISCED-97), which was developed to facilitate international comparisons. The ISCED 5 level corresponds to the first stages of tertiary education. It comprises programmes that do not lead to an advanced or research qualification (ISCED level 6). ISCED 5 programmes can be broken down between 5A types of programmes, which are mostly theoretical in content and directed towards further study at ISCED level 6, and 5B types of programmes, whose content is more professional (for further details, see OECD, 1999).

Box 2. Criteria for identifying foreign students in OECD countries

Australia	Since 1998, foreign nationality, including permanent residents.
Austria	Foreign nationality, including permanent residents.
Belgium (Flemish)	Foreign nationality, including permanent residents.
Canada	Foreign nationality, excluding former Canadian residents and students declaring themselves as immigrants. Only concerns tertiary type students (ISCED 5A and 6).
Czech Republic	Foreign citizenship, including permanent residents (a register of students should make it possible to distinguish residents in the future). Only concerns full-time students.
Denmark	Foreign citizenship, including permanent residents.
Finland	Foreign nationality, including permanent residents.
France	Foreign citizenship, including permanent residents.
Germany	Foreign citizenship, separation of permanent residents and non-residents exists, but is incomplete (disaggregation by level of study only).
Hungary	Foreign citizenship, including permanent residents, but excluding members of neighbouring countries' Hungarian minorities (a specific questionnaire should make it possible to distinguish residents in future).
Iceland	Foreign citizenship, including permanent residents.
Ireland	Foreign domicile, excluding permanent residents.
Italy	Foreign nationality, including permanent residents.
Japan	Foreign citizenship; separation of permanent residents and non-residents exists, but is incomplete (64% coverage for ISCED 5-6).
Korea	Foreign nationality, including permanent residents.
Luxembourg	Foreign citizenship, including permanent residents (who make up the majority of foreign students, 100% for ISCED levels 1-4).
New Zealand	Foreign nationality (excluding Australian students), including permanent residents.
Norway	Foreign country of birth.
Poland	Foreign citizenship, including permanent residents.
Spain	Foreign nationality, including permanent residents.
Sweden	Foreign citizenship, including permanent residents. However, only students registered in the Swedish population register are considered foreign, which is not the case of all students originating from other Nordic countries.
Switzerland	Foreign citizenship, separation of permanent residents and non-residents exists, but is incomplete (70% coverage for ISCED 5-6).
Turkey	Foreigners entering Turkey for the sole purpose of study.
United Kingdom	Foreign home address.
United States	Foreign citizenship, excluding permanent residents and refugees.

Source: OECD, on the basis of information provided by SOPEMI correspondents.

Student migration: form and prerequisites of migration of HRST

A form of migration of qualified labour

Migrant students who becoming increasingly well qualified in the course of their studies may amount to a kind of HRST migration when they become part of the working population and participate in the host country's production. This combination of student and HRST migration arises in two cases:

- First, as part of their studies, students enrolled in research programmes are required to carry out application or research activities in a professional context (private or academic) in the form of dissertations or theses. To the extent that such activities could be carried out by professional workers, and in most cases lead to the production of a scientific work (publication), they constitute participation in R&D activities in the host country (at ISCED level 6, see Box 1). This contribution is considered significant, especially in Australia, Switzerland and the Netherlands (OECD, 1991).

- In addition, internships are often required at the end of students' studies to validate their theoretical learning by placing them in a position with functions suited to their level of qualification, which can then be considered as a kind of HRST migration.

Clearly, this is not the case for all student migration. The actual scale of the combined form of student and HRST migration depends on the distribution of students by grade, field of study, activity and functions exercised during an internship.

A precursor of subsequent migration, mainly HRST

While student migration sometimes represents a form of HRST migration, it may also be a precursor. Studies of the economics of labour broadly agree that education positively influences the probability and speed of absorption in the labour market. The OECD recently studied the transition from initial education to working life in 14 OECD Member countries[1] (OECD, 2000). It shows that in 1996 in most of the countries, the possession of higher qualifications by young people entering the labour market gave them a clear advantage in the process of transition to working life.

In particular, for young people aged 25-29, possession of a university degree (ISCED level 5 or 6) results, on average, in an unemployment rate about half that of their compatriots with upper secondary education certificates (ISCED 3) and less than a quarter that of their compatriots with lower secondary education (ISCED 2). A university qualification also increases by 9% their likelihood of having paid employment compared to those with upper secondary certificates and by 41% compared to those with lower secondary. Finally, higher education has a stimulating effect on levels of remuneration, although the size of the differential varies among countries. On average, those aged 30-44 with university degrees received levels of remuneration some 60% higher than their ISCED 3 compatriots and double those of their ISCED 2 compatriots. On this last point, a study by Statistics Canada, based on 1994 data (Green and Riddell, 2000) shows that, in that country, each additional year of studies increased annual income by an average of over 8%.

At the same time, studies of the entry of immigrant populations to the labour market of their host country also underline that:

- Among the immigrant population, the most qualified are generally more easily and quickly absorbed in their adoptive labour market (OECD, 2000). This does not mean that they do not

encounter greater difficulty than qualified locals. Their easier absorption is due to the mastery of foreign languages associated with a higher level of education, the greater ability to adjust, to gather and process information and the possibility of acquiring country-specific knowledge more rapidly.

- The better immigrants master the language of their host country, the better they integrate its labour market (Dustmann, 1994). Australian studies show that linguistic mastery affects not only immigrants' employability (a five-fold increase, according to Vandenheuvel and Wooden, 2000), but also their professional status vis-à-vis other workers (+9 to 17%) and their income (+2 to 33%, Wooden, 1994).

- Finally, possession of a degree from the host country gives immigrants an additional advantage. This advantage is partly due to the signal given by a degree "known" to employers, but also to the linguistic mastery that is generally associated with it and the absence of problems of international transferability of human capital (recognition of qualification, institutional framework, lack of country-specific knowledge about the functioning of the labour market, social relations). Immigrants educated in the host country are thus at an advantage compared with their peers educated in foreign education systems which are more difficult to evaluate, and the time spent job seeking is shorter as a result of their country-specific knowledge. A Swedish study (Bevelander and Nielsen, 1999) shows that possession of a foreign degree reduces the probability of being employed for Iranian immigrants, but not for those from other Nordic countries (whose degrees are probably better known). Similar findings exist for Australia (Cobb-Clark, 2000). Taken together, these factors often give applicants for immigration trained locally an advantage for gaining entry to the labour market on arrival and consequently for the process of granting visas.

This shows how student migration can be a precursor of subsequent migration of qualified workers. The factors detailed above suggest that, from the host country's point of view, preference is likely to be given to former foreign students, since their linguistic mastery and their familiarity with the local social manners make it easier to absorb them. From the applicants' point of view, familiarity with the host country's systems has the advantage of limiting the cost and time needed to enter the labour market.

The question then is the proportion of student flows that subsequently lead to HRST immigration. In fact, it is fairly widely accepted that some students who study abroad subsequently settle there, but this has not been widely measured at international level. Data are often incomplete, particularly because of the lack of information on students' change of status to holder of a work permit or permanent immigrant.

A study of a sample of 4 200 temporary immigrants holding an H-1B visa[2] carried out in the United States in February 2000 shows that some 23% previously held a student visa (US Immigration and Naturalization Service, 2000). This finding is hardly surprising given the fact of known degrees and mastery of the host country's language. In the case of North America, it is sometimes suggested that the choice of the United States is part of an explicit strategy for subsequent immigration (US National Research Council, 2000). The American study also underlines the extreme concentration of H-1B visa holders by country of origin. Roughly half come from India, and over 9% from China.

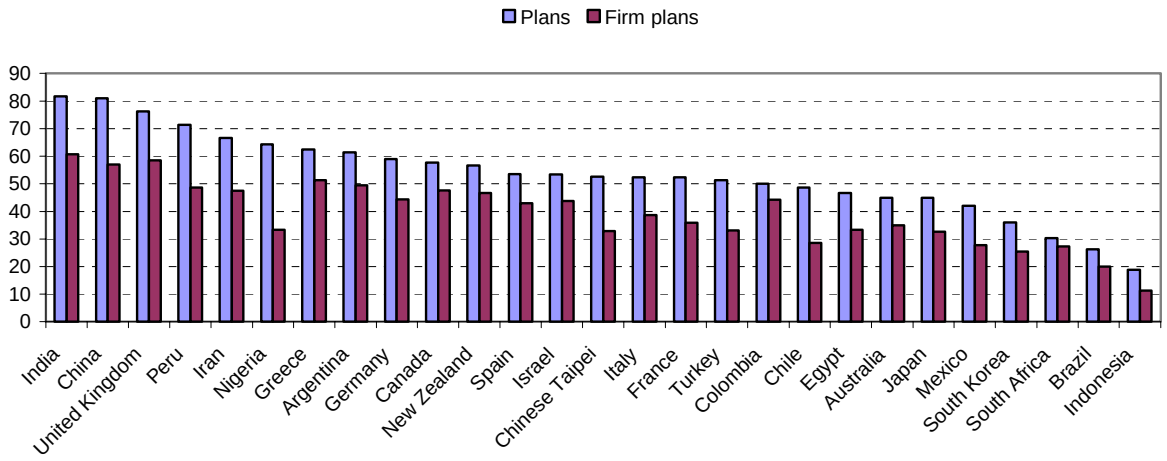
Apart from actual migration, intentions of foreign students can also provide an indication of potential HRST migration generated by student migration. Figure 1 presents data for the United States on the share of foreign doctoral students (resident and non-resident) who intend to stay in the United States on completion of their studies. Students' intentions are classified on the basis of future plans

(potential loss) and firm plans (postdoctoral contracts, offers of work from an American employer) and are therefore a good indication of potential losses for their country of origin. These data demonstrate the very large variability, by country of origin, in the propensity of students to settle in the United States. Losses seem particularly high for students from India, China, Argentina, Peru and Iran, as well as some OECD Member countries (United Kingdom, Greece, Canada, Germany, New Zealand).

The scale of losses following a period of study residence may also be measured through applications for changes of student visas in order to settle and work full-time in the country where the student was educated. It would be necessary to take into account not only applications for conversion of visas into work visas (temporary or permanent), but also those for family reunion (student migration most often occurs at an age when families are forming) and refugees (Chinese students after the Tien An Men events, for example). The latter types of visa often benefit from simplified procedures (in Australia, for example). Statistics on applications for conversion of visas could result in a low estimate of losses to which should be added applications for visas from the country of origin by students who return there temporarily before deciding to emigrate again.

Figure 1. Potential and effective loss for the country of origin of students who finish their PhD in the United States

Percentage of total students (all fields of study), by country of origin



1. Proportion of foreign doctoral students who intend to stay in the United States on completion of their studies.
2. Proportion of foreign doctoral students who receive an offer of work from an American employer on completion of their study.

Source: Science and Engineering Indicators 2000.

At present, data on applications for conversion of student visas are not available in OECD countries. However, by analysing the legislation on conversion of student visas, it is possible to get an idea of the phenomenon. Facilitating conversion procedures may, indeed, be a way of quickly solving specific shortages of qualified labour. Table 1 shows the possibilities for students to change their status in certain OECD countries.

Table 1. Current regulations in OECD countries regarding possibilities for student visa holders to change residence status, 2001

Country	Possibility to change residence status
Australia	Students who have gained Australian qualifications are exempt from the skilled work experience requirement if they apply for a skilled visa within six months of completing their diploma. If eligible,, students can apply for most permanent visas, *e.g.* spouse visas and skills under points-tested skilled entry.
Austria	Not possible in general, but students who graduate in IT can change their status and access the labour market. Free labour market access for students during their stay on the basis of an inter-university student exchange programme or educational programme of the EU. Seasonal work permits in tourism or the agricultural sector possible for all foreigners including foreign students and graduates.
Canada	Students can work (with authorisation) for one year after completion of postgraduate degree (no validation required).
Finland	Stay of a foreign student is seen in Finland as temporary but a student can apply for a permit on new grounds through a Finnish representation abroad. A student does not need a work permit for part-time work (maximum 20 hours/week) during the academic year of his/her institution of education or during holiday seasons of the institution of education.
France	Yes in general but students who graduate in IT in France (engineers) can change status with a simple demand.
Germany	Yes, after they successfully pass their examination (new legislation).
Ireland	Employers may seek to have work permits issued in their field of study for students and students themselves, in certain skills areas, may apply for a work authorisation/working visa when they have an offer of employment.
Japan	Yes. Students may apply for residence.
Korea	Students who have gained a master's degree or higher in the field of IT can apply for a work permit. Those who have obtained a work permit can change their visa status from student to employment status for a maximum of three years.
Mexico	Yes, but there is no special procedure.
New Zealand	Yes, students may apply for residence. The General Skills Category (GSC) awards additional points for qualifications gained in New Zealand. In addition, students with a New Zealand qualification are not required to have any work experience to qualify under the GSC. Students may also apply to remain in New Zealand as temporary visitors or under the work permit policy.
Norway	Yes, for students who have not received financial benefits from Norwegian authorities. No, for students who have received such benefits.
Czech Republic	Yes, but there is but no special procedure.
Switzerland	Yes, but there is no special procedure (new legislation).
United Kingdom	In-country changes to work permit status for students completing degrees in the United Kingdom are allowed in certain circumstances. As a general rule, in-country changes to work permit status are not allowed, except for trainees, who can apply for a Training and Work Experience Scheme visa. Settling procedures are more flexible for Commonwealth, EEA and EU residents.
United States	Yes, but there is no special procedure.

Source: OECD, on the basis of information provided by SOPEMI correspondents.

Australia, for example, recently adopted measures aimed at facilitating the entry of foreign students in information and communications technology (ICT). From July 2001 these foreign students will be able to apply for permanent resident visas on the basis of their skills, without previous professional experience and without necessarily being sponsored by an Australian employer. They

gain additional points by virtue of their Australian degree and do not have to return to their country of origin to apply. In addition, the Australian Immigration Department is developing an on-line immigration application procedure to speed up the process (Australian Government, 2001).

Thus, student migration may be a precursor of HRST migration. The scale of this phenomenon is extremely difficult to ascertain. By analysing the characteristics of foreign students, it is, however, possible to gain a better understanding of the profile of those who might settle in the host country on completion of their studies or decide to emigrate subsequently.

Scale and dynamics of the student migration phenomenon

This section and the next deal with student flows: first, their scale and dynamics and then the geographical trends that emerge.

Numbers of students

The measurement of departures from each country can serve as a starting point for this inventory of student mobility. A first observation concerns the variability of rates of student emigration by country (Table 2). Several points may be noted:

- First, the size of the country's population seems to reduce mobility, as suggested by the low level of mobility of students from the United States, France and the United Kingdom. Conversely, students from smaller countries, such as Austria, Canada, Greece, Ireland, Iceland, Luxembourg, Norway, New Zealand and Switzerland, tend to be more mobile. The most plausible interpretation relates to the nature of the education system. A larger population allows greater diversity of educational services, thus covering all fields of study to the highest level. Another is the strong international outlook of small countries, motivated by economic demands and facilitated by the proximity of frontiers, which may have become permanently part of behaviour patterns.

- Apart from the effect of size, institutional proximity[3] plays a strong role in student migration, as shown by the high rates of mobility among EU countries (some 169 per 1 000 enrolled on average) compared, for example, with the Czech Republic or Poland, which are outside the EU.[4] High mobility among EU countries is facilitated by policies on freedom of movement, recognition of degrees and the existence of exchange programmes and assistance for student mobility (Erasmus, for example).

- Finally, geographical remoteness also acts as a brake on mobility. Students from Australia, Japan and the United States have very low levels of emigration, whereas European students are able to take advantage of education programmes in neighbouring countries.

Extending the analysis to non-member countries shows the role of institutional proximity (African countries, the Slovak Republic[5] whose departures are largely to the Czech Republic) and the barriers created by distance (Latin America,[6] Asia,[7] Latvia and Lithuania in central Europe), and the size of the country (Table 3).

Table 2. Foreign students in OECD countries, 1998
Per 1 000 students enrolled

	Share of foreign students (A) from:				Students from the country who are enrolled abroad (B) (in an OECD country[1])		Net mobility (A-B) for:	
	All countries	*Of whom percentage of total foreign students*			All OECD countries		OECD countries	EU countries
	Per 1 000 students enrolled	From an OECD country	From a non-OECD country	From an EU country	Per 1 000 students enrolled[1]	*Of whom percentage in EU*		
Australia	125.9	*18.4*	*81.6*	*7.7*	5.3	*37.6*	17.9	7.7
Austria	114.9	*65.6*	*34.4*	*50.4*	43.9	*82.9*	31.5	21.5
Belgium (Flemish)	40.1	*63.2*	*36.8*	*54.1*	41.2	*82.8*	- 15.9	- 12.4
Canada[2]	27.9	*42.1*	*57.9*	*20.6*	22.3	*18.1*	- 10.5	1.7
Czech Republic	18.9	*27.6*	*72.4*	*23.3*	5.1	*27.3*	0.1	3.0
Denmark	60.1	*42.0*	*58.0*	*17.8*	31.8	*65.8*	- 6.6	- 10.2
Finland	17.3	*35.9*	*64.1*	*22.3*	32.9	*83.8*	- 26.6	- 23.7
France	73.0	*26.8*	*73.2*	*18.7*	18.3	*67.6*	1.3	1.3
Germany	81.6	*56.3*	*43.7*	*27.0*	22.3	*64.0*	23.6	7.8
Greece	..	..	..	..	146.9	*88.8*	..	..
Hungary	26.1	*35.8*	*64.2*	*23.0*	22.2	*77.3*	- 12.9	- 11.2
Iceland	24.0	*81.4*	*18.6*	*52.6*	285.8	*68.0*	- 266.3	- 181.7
Ireland	48.4	*72.3*	*27.7*	*49.9*	136.2	*92.8*	- 101.2	- 102.3
Italy	12.4	*64.5*	*35.5*	*60.3*	17.6	*78.4*	- 9.6	- 6.3
Japan	14.1	*38.3*	*61.7*	*1.7*	14.0	*16.4*	- 8.7	- 2.1
Japan[2]	6.0	..	..	..	..	..	..	..
Korea	1.0	*31.2*	*68.8*	*1.4*	26.2	*13.5*	- 25.9	- 3.5
Luxembourg	304.6	*84.3*	*15.7*	*84.1*	1 928.5	*92.1*	-1 671.9	-1 520.4
Mexico	..	..	..	..	7.2	*24.4*	..	..
Netherlands	..	..	..	..	26.6	*78.4*	..	..
New Zealand[2]	36.7	*21.5*	*78.5*	*5.9*	34.0	*9.8*	- 26.1	- 1.2
Norway	31.6	*54.5*	*45.5*	*40.8*	60.2	*69.6*	- 43.0	- 29.0
Poland	4.6	*17.7*	*82.3*	*7.1*	10.8	*81.0*	- 10.0	- 8.4
Portugal	..	..	..	..	27.0	*86.4*	..	..
Spain	16.6	*65.7*	*34.3*	*57.9*	12.8	*74.2*	- 1.8	0.1
Sweden	44.8	*63.1*	*36.9*	*41.3*	43.3	*53.6*	- 15.0	- 4.7
Switzerland	159.5	*72.7*	*27.3*	*65.7*	44.7	*69.5*	71.1	73.7
Switzerland[2]	63.0	..	..	..	..	..	..	..
Turkey	13.2	*8.9*	*91.1*	*8.3*	28.9	*77.9*	- 27.7	- 21.4
United Kingdom[2]	108.1	*59.8*	*40.2*	*45.1*	13.5	*44.7*	51.2	42.7
United States	32.4	*39.0*	*61.0*	*9.5*	2.0	*71.7*	10.6	1.6
OECD simple mean	60.3	47.5	52.5	31.9	107.3	62.0	- 82.9	- 71.1
OECD - weighted mean[3]	37.1	43.6	56.4	22.9	15.0	8.6	0.0	- 0.7
UE: simple mean	76.8	58.3	41.7	44.1	169.5	75.8	- 145.1	- 133.9
UE: weighted mean[3]	59.5	51.9	48.1	35.2	25.5	18.9	2.4	0.0

1. The stock of students enrolled abroad is calculated on the basis of data for the following OECD countries: Australia, Austria, Canada, Czech Rep., Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Japan, Korea, New Zealand, Norway, Spain, Switzerland, Turkey, United Kingdom, United States. As a result, the net figures (A-B) may be overestimated.
2. Non-resident foreign students only.
3. Weighted by the relative importance of each education system.
Source: OECD Education database.

It should not, however, be concluded from the data on non-member countries that there is a link between levels of economic prosperity and rates of student emigration. The truth is that two effects pull in the opposite direction. A lower level of economic development may limit resources allocated to education and diversity of educational provision, encouraging students to go abroad to obtain a specialist education. At the same time, however, it impairs mobility because of the cost, in particular if there is no system of education grants.

With respect to the reception of foreign students by OECD countries, the salient fact is diversity.

Table 3. Students from non-OECD countries enrolled in an OECD country, 1998

Country	Number per 1 000 students enrolled[1]	*Of whom percentage enrolled in an EU country*
Argentina	3.4	*47.0*
Brazil	5.3	*37.8*
Chile	7.9	*53.4*
Paraguay	31.9	*30.7*
Peru	6.5	*48.0*
Uruguay	7.8	*46.6*
Latin America – simple mean	***10.5***	***43.9***
China	13.6	*13.1*
Indonesia	12.2	*13.4*
Malaysia	118.9	*34.9*
Thailand	11.4	*15.8*
Asia – simple mean	***39.0***	***19.3***
Tunisia	46.4	*87.7*
Israel	31.6	*58.0*
Zimbabwe	48.1	*57.1*
Africa, Middle East – simple mean	***42.0***	***67.6***
Bulgaria	28.6	*59.7*
Estonia	26.5	*78.9*
Latvia	12.0	*60.2*
Lithuania	17.2	*45.2*
Romania	21.5	*55.5*
Slovenia	22.9	*82.9*
Central and eastern Europe – simple mean	***21.4***	***63.7***

Note: Simple means by region are calculated for the group of countries presented in the table.
1. Calculations on the basis of data for the following OECD countries: Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Japan, Korea, New Zealand, Norway, Spain, Switzerland, Turkey, United Kingdom, United States.
Source: OECD Education database.

The countries examined can be divided into several groups (see Table 2).

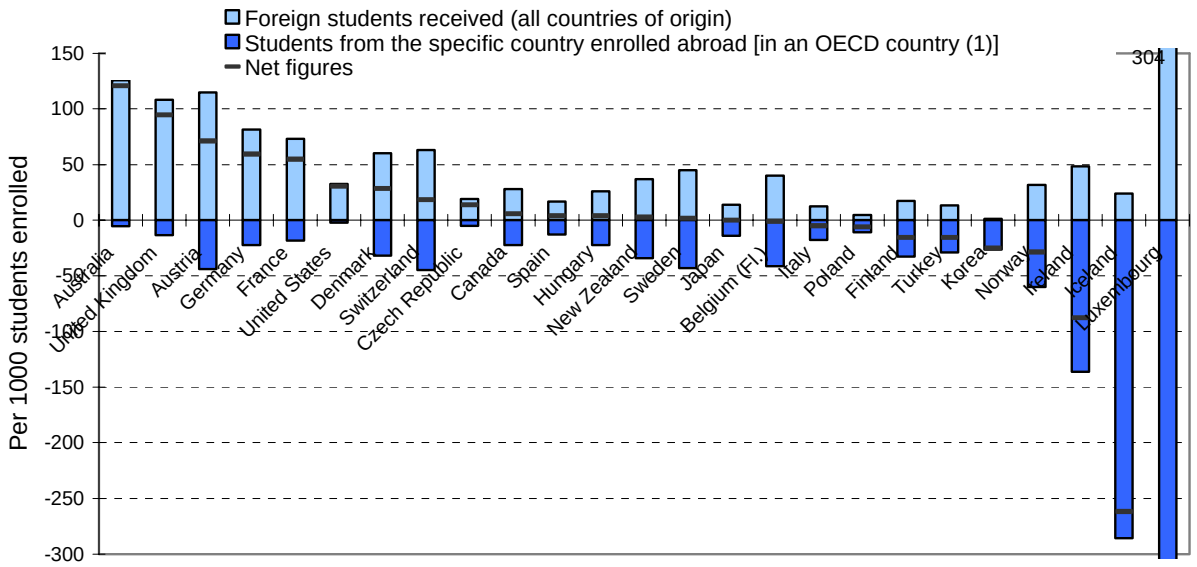
- A first group of countries receives fewer than 24 foreign students per 1 000 enrolled (Korea, Poland, Japan, Italy, Turkey, Spain, Finland, Iceland, the Czech Republic). All these countries, except Spain, have languages that are not widely used internationally. A second group consisting of Hungary and the Nordic countries (Sweden, Norway and especially Denmark) have rates of intake ranging from 26 to 60 per 1 000, despite languages which are also not widely used elsewhere, although they are quite well known at regional level.[8]

- Contrasting with these countries which are relatively closed to foreign students, one group stands out for very high intake rates, over 110 per 1 000 enrolled. It consists of Australia (125), Switzerland (159), Austria (114), the United Kingdom (108) and Luxembourg (304)[9]. For these countries, life at university sites and campuses and the content of programmes are heavily influenced by the size of the foreign student contingent. The latter also help to finance the education system and may have a not insignificant impact on local demand.

Finally, a last group of countries also takes in a high, if somewhat more limited, proportion of foreign students: in descending order, these are Germany, France, Ireland, New Zealand, the United States and Canada. While the effect of size and diversification of education provision can explain why the large industrialised countries are most often host to foreign students, the presence at the top of the list of host countries of smaller industrialised countries like Australia, Switzerland and Austria suggests that high levels of economic prosperity are reflected in per capita educational resources and high levels of technology which attract foreign students in certain areas of excellence.

In analysing international student flows, the net balance for each country is also of interest. It confirms the importance of the large European countries (United Kingdom, France, Germany), the United States and Australia, Switzerland and Austria for the reception of foreign students (Figure 2).

Figure 2. Net student mobility in selected OECD countries, 1998
Per 1 000 students enrolled



Note: Non-resident foreign students for Canada, the United Kingdom, Switzerland, Japan and New Zealand.
1. The stock of students enrolled abroad is calculated on the basis of data for the following OECD countries: Australia, Austria, Canada, Czech Republic, Denmark, Finland, France, Germany, Hungary, Iceland, Ireland, Italy, Japan, Korea, New Zealand, Norway, Spain, Switzerland, Turkey, United Kingdom, United States. As a result, the net figures may be over-estimated.
Source: OECD Education database.

Apart from the scale of student mobility as a proportion of those enrolled in each country, it may also be interesting to compare the relative level of this mobility by adjusting orders of magnitude to the average for OECD countries. This makes it possible to refine the scale of mobility based on the size of the education system.[10]

Table 4. Relative intensity of student mobility, adjusted for the size of education systems,[1] 1998

Intensity of mobility (norm=1)	Origin of the foreign students enrolled					Enrolment of students to:	
(ratio = mobility country *x* / mobility reference zone)[1]	All countries	OECD	non-OECD	EU	EU	OECD[2]	EU[2]
Reference for comparison	OECD[2] mean	OECD[2] mean	OECD[2] mean	OECD[2] mean	EU[2] mean (intra-EU mobility)	OECD mean	OECD mean
Australia	3.4	1.4	4.9	1.1	..	0.4	0.2
Austria	3.1	4.7	1.9	6.8	2.8	2.9	4.2
Belgium	1.1	1.6	0.0	2.6	1.0	2.7	4.0
Canada	0.8	0.7	0.8	0.7	..	1.5	0.5
Czech Republic	0.5	0.3	0.7	0.5	..	0.3	0.2
Denmark	1.6	1.6	1.7	1.3	0.5	2.1	2.4
Finland	0.5	0.4	0.5	0.5	0.2	2.2	3.2
France	2.0	1.2	2.6	1.6	0.7	1.2	1.4
Germany	2.2	2.8	1.7	2.6	1.1	1.5	1.7
Greece	..	..	..	..	..	9.8	15.2
Hungary	0.7	0.6	0.8	0.7	..	1.5	2.0
Iceland	0.6	1.2	0.2	1.5	..	19.1	22.6
Ireland	1.3	2.2	0.6	2.8	1.2	9.1	14.7
Italy	0.3	0.5	0.2	0.9	0.4	1.2	1.6
Japan	0.4	0.3	0.4	0.0	..	0.9	0.3
Korea	0.0	0.0	0.0	0.0	..	1.7	0.4
Luxembourg	8.2	15.9	2.3	30.2	12.2	128.6	206.9
Mexico	..	..	..	..	..	0.5	0.2
Netherlands	..	..	..	..	..	1.8	2.4
New Zealand	1.0	0.5	1.4	0.3	..	2.3	0.4
Norway	0.9	1.1	0.7	1.5	..	4.0	4.9
Poland	0.1	0.0	0.2	0.0	..	0.7	1.0
Portugal	..	..	..	..	..	1.8	2.7
Spain	0.4	0.7	0.3	1.1	0.5	0.9	1.1
Sweden	1.2	1.7	0.8	2.2	0.9	2.9	2.7
Switzerland	4.3	7.2	2.1	12.3	..	3.0	3.6
Turkey	0.4	0.1	0.6	0.1	..	1.9	2.6
United Kingdom	2.9	4.0	2.1	5.7	2.3	0.9	0.7
United States	0.9	0.8	0.9	0.4	..	0.1	0.2
Total OECD						1.0	1.0
Total OECD[2]	1.0	1.0	1.0	1.0			
Total EU[2]					1.0		

1. See note 10 for details on the calculation of the indicator.
2. Greece, Mexico, the Netherlands and Portugal do not provide data on foreign students numbers. OECD and EU means are adjusted accordingly.
Source: OECD Education database.

Table 4 indicates that Switzerland, Australia, the United Kingdom, Austria, Denmark, France and Germany host very large numbers of foreign students relative to the size of these countries. With respect to sending students abroad, the most dynamic countries relative to their size are Iceland, Ireland, Greece, Belgium, Norway, Switzerland and Denmark.

This analysis based on relative size also makes it possible to distinguish among the geographical areas with which they have the closest links. In terms of reception of students from non-member countries, Australia, France, the United Kingdom, Denmark and Switzerland lead. For entry of students from OECD countries, Switzerland, the United Kingdom and Austria dominate. With the addition of Belgium, the same ranking applies to students from EU countries.

Analysis of the scale of student flows highlights the main variables governing student mobility. They are the size of the country of origin and host country, geographical remoteness, languages used in the education system, institutional proximity, and considerations of an economic nature relating to tuition fees and living costs on university sites and campuses.

Dynamic trends

Concerning the dynamics of student mobility, a comparison at an interval of three years shows that the share of foreign students[11] in OECD countries[12] rose by 4.6% between 1995 and 1998. This trend reflects the increased internationalisation of education in OECD countries.

The overall rise, however, masks some significant differences. Among the major host countries, Australia is first with almost a 40% rise over the period concerned, followed by Switzerland, the United Kingdom and Denmark and, far behind, Germany (+14%) and the United States (+2.5%).

Geographical polarisation of student migratory flows

A phenomenon concentrated in a few large countries

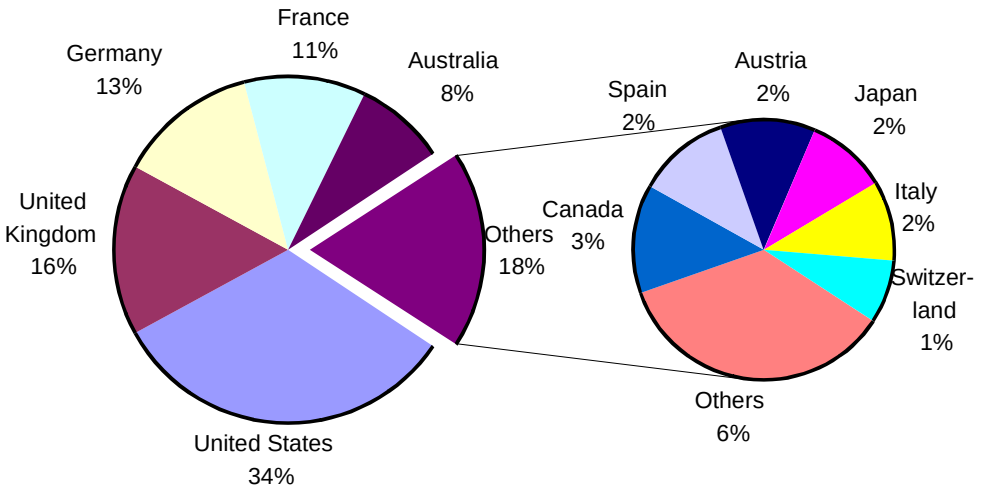
An analysis of the geographical distribution of foreign student flows shows a very high geographical concentration of foreign students of all origins, as 80% go to only five countries: the United States, the United Kingdom, Germany, France and Australia (Figure 3).

For each country, the breakdown of arrivals by major region of origin also underlines the existence of favoured student flows to OECD countries. For the sake of clarity, this analysis is confined to countries receiving the most students in absolute terms (the United States, the United Kingdom, Germany, France and Australia), or relative to their size (Austria, Switzerland and Denmark), although there are also data for other countries (see Table 4).

Table 5 presents the distribution of foreign students by regions of origin. Especially striking are the differences in the geographical origin of students admitted in the main host countries. The share of entries of students from OECD member countries varies between 20% for Australia and 70% for Switzerland. The countries which take in a majority of students from non-member countries are Australia, France, the United States and Denmark, while Switzerland, Austria, the United Kingdom and Germany have more entries from Member countries.

Figure 3. Main receiving countries of foreign students

Percentages



Source: OECD Education database.

Table 5. Foreign students by region of origin, 1998

Percentage of the stock of foreign students enrolled in the country

Host country	OECD[2]	*of which:* EU[3]	Africa	Asia/ Oceania	South America	Non-OECD European countries
Australia	18.4	*41.7*	2.0	73.8	0.5	1.3
Austria	65.6	*76.9*	3.5	14.0	1.1	17.3
Belgium (Flemish)	62.8	*85.7*	15.4	18.1	2.4	1.9
Canada	42.1	*48.8*	15.5	39.4	3.1	2.7
Czech Republic	27.6	*84.5*	6.2	13.9	1.3	34.0
Denmark	42.0	*42.4*	2.3	12.0	1.1	20.5
Finland	35.9	*62.1*	14.2	23.6	1.4	27.3
France	26.8	*69.6*	43.1	11.2	2.3	3.8
Germany	56.3	*48.0*	9.3	35.9	2.3	0.7
Hungary	35.8	*64.2*	3.2	16.3	0.3	49.0
Iceland	81.4	*64.6*	0.5	6.7	3.1	24.2
Ireland	72.3	*68.9*	4.4	23.1	0.1	2.5
Italy	64.5	*93.5*	10.4	14.2	3.3	7.0
Japan	38.3	*4.5*	1.0	92.3	1.3	0.9
Korea	31.2	*4.4*	1.3	80.3	1.3	3.2
Luxembourg	84.3	*99.8*	1.1	0.2	0.4	1.8
New Zealand	21.5	*27.2*	1.1	84.4	0.8	0.7
Norway	54.5	*74.9*	10.5	19.1	2.7	17.0
Poland	17.7	*40.5*	9.2	19.3	1.0	56.5
Spain	65.7	*88.1*	10.3	3.9	14.9	4.2
Sweden	63.1	*65.5*	3.4	18.7	3.0	23.0
Switzerland	72.7	*90.4*	5.8	6.9	3.0	5.8
Turkey	8.9	*93.3*	2.7	72.5	0.1	15.9
United Kingdom	59.8	*75.4*	7.1	34.2	1.2	3.3
United States	39.0	*24.2*	4.8	65.0	5.3	2.7

1. Total below 100% due to non-stated countries of origin.
2. Excluding the Slovak Republic.
3. As a percentage of the stock of students from an OECD country.

Source: OECD Education database.

A further breakdown by region of origin makes it possible to identify the predominant flows, in particular for Australia, where some three-quarters of foreign students come from Asia or the Pacific region.[13] There are major migratory flows between Africa and France (over 40% of entries), between Asia-Pacific on the one hand and the United States on the other (two-thirds of entries) and between non-OECD European countries and Denmark (20% of entries). Among countries that mainly admit students from OECD countries, Switzerland and Austria mainly take in Europeans, while Germany and the United Kingdom take in students from Asia and the Pacific (one-third of entries) as well as a large contingent of European students. The United Kingdom's special relations with India and Malaysia probably explain the large number of Asian students in that country. In the case of Germany, it may be the result of the importance of the Turkish community in the country's population.

Apart from these favoured flows, differences can be observed in the degree of geographical diversification in the countries studied: Austria, Germany, Denmark and France appear to be more eclectic in terms of the regions from which they recruit than Australia, Switzerland, the United States or the United Kingdom.

If one considers countries, and especially bilateral flows, by country of origin (Table 6), students from China, India, Japan and Korea make up a significant proportion of the total number of foreign students in the United States. The same applies to those from Greece, Malaysia and Ireland in the United Kingdom, from France, Italy and Germany in Switzerland, from Italy and Germany in Austria, and finally from Morocco, Algeria and Tunisia in France**.** This table also illustrates the importance of bordering (or neighbouring) countries, and the role of geographical proximity in the case of Australia, for flows to Germany (Austria, Italy) and the United Kingdom (Ireland, Germany). The influence of historical, cultural and linguistic links is reflected in the flows to France (Maghreb) and the United Kingdom (Malaysia, Ireland).

Table 6. Main countries of origin of foreign students in selected OECD countries, 1998
Percentage of total stock of foreign students enrolled

Host country	1st rank	2nd rank	3rd rank	4th rank	5th rank	6th rank
Australia	Malaysia (14.7)	Singapore (13.4)	Hong Kong (China) (12.2)	Indonesia (7.2)	United Kingdom (4.9)	
Austria	Italy (23.3)	Germany (19.1)	Turkey (4.0)	Bulgaria (3.7)	Iran (3.3)	
Canada	France (10.7)	United States (10.0)	Hong Kong (China) (8.2)	China (7.2)	Japan (4.0)	
Denmark	Norway (10.5)	Iceland (5.7)	Germany (5.3)	Sweden (3.9)	Iran (3.9)	
France	Morocco (11.8)	Algeria (10.9)	Germany (3.5)	Tunisia (3.4)		
Germany	Turkey (15.2)	Iran (5.2)	Greece (5.0)	Austria (4.0)	Italy (4.0)	Poland (4.0)
Italy	Greece (49.1)	Germany (4.4)				
Japan	China (45.6)	Korea (33)	Malaysia (3.7)			
New Zealand	Malaysia (32.0)	Japan (6.1)	Hong Kong (China) (4.9)	United States (4.9)	Thailand (4.8)	
Spain	France (13.4)	Germany (11.0)	Italy (10).0	United Kingdom (8.1)	Morocco (6.8)	
Switzerland	Germany (22.4)	Italy (15.6)	France (10.6)	Spain (6.0)		
United Kingdom	Greece (12.1)	Malaysia (8.2)	Ireland (7.8)	Germany (6.2)	France (6.0)	
United States	China (9.8)	Japan (9.8)	Korea (8.9)	India (7.0)	Canada (4.6)	

Note: Countries accounting for less than 3% of all foreign students are not included.
Source: OECD Education database.

This analysis by country of origin also illustrates, in the case of Germany and Japan, the skew caused by the fact that most of the foreign students are permanent residents.[14] Indeed, Turkey is the main country of origin of foreign students in Germany (15% of the total), as Korea is for Japan (33%). The large share is explained by the fact that foreign students born in Germany and Japan are added to those who come to study (Table 6).

Taken overall, analysis of the geographical distribution of students by country and host region leads to the conclusion that the United States appears to have looked to the Asian continent and to Canada, as Australia has looked to Asia and the United Kingdom. The incidence of European regional integration and historical links with certain countries explain flows to France, Germany and the United Kingdom.

Mobility within/outside the OECD area

In terms of internal exchanges within the OECD area, there are huge disparities in the shares of entries. In Turkey, for example, foreign students from another OECD country account for only 9% but they account for 84% in Luxembourg. A number of observations can be made:

- Countries of central Europe that have recently joined the OECD show rather low intakes of students from OECD countries. This may be due to a lesser institutional proximity and a level of economic development that is still lower than the average for OECD Member countries. On the other hand, there is a strong institutional proximity to the other countries of central and eastern Europe and the former USSR.

- Similarly, Australia, New Zealand, Korea and Japan show relatively low levels of student intake from other OECD countries. This again illustrates the influence of geography, which can discourage applicants from distant OECD countries (Europe, North America) but has a certain advantage for applicants from Asia. In the case of Japan and Korea, the language barrier is certainly an additional factor.

- As far as the other OECD countries are concerned, it is striking that countries with extensive education systems (France, United States and, to a lesser degree, Canada, Germany and the United Kingdom) tend to receive a lower share of students from the OECD area. This may be due to the attractiveness of their diversified educational provisions for non-OECD applicants, and, for Britain and France, special relations with the former colonies.

- Finally, the European countries as a whole have very high shares of students from OECD countries, owing to their geographical, cultural and, in some cases, linguistic proximity, which is reinforced for those that are members of the European Union by institutional facilities which encourage mobility.

The population concerned: characteristics of foreign students

This section looks at the composition of these flows by discipline and level of studies, in order to identify the most fields which are most concerned by international flows.

Level of education

A breakdown by level of education shows the split between general higher education (ISCED category 5A) or professional (5B) and between general higher education (5A) and advanced research (ISCED 6). This type of breakdown is not, however, available for all OECD countries. For instance, in Germany and France, ISCED categories 5A and 6 are merged. It is thus not possible to distinguish doctoral students from others in higher education (Table 7).

Table 7. Foreign students by level of education in selected OECD countries, 1998
Percentages

	ISCED 5A	ISCED 5B	ISCED 6	ISCED 5A-6	ISCED 5-6
Australia	85.1	9.7	5.2	90.3	100.0
Austria	85.3	3.5	11.2	96.5	100.0
Denmark	59.0	34.6	6.4	65.4	100.0
France[1]	..	7.7	..	77.7	100.0
Germany[2]	..	11.0	..	89.0	100.0
Switzerland[3]	58.3	..	41.7	100.0	100.0
United Kingdom	73.2	15.5	11.3	84.5	100.0
United States[4]	83.3	..	16.7	100.0	100.0

Note : Non-residents only for Germany, Switzerland and the United Kingdom.
1. The French data do not distinguish between ISCED 5A and ISCED 6 levels. Moreover, data are not available by nationality and level of education for 14% of foreign students.
2. The German data register ISCED 6 level separately.
3. ISCED 5B data are not available separately for non-residents.
4. ISCED 5B data are not available.
Source: OECD Education database.

Table 7 gives the distribution of foreign students by level of education and orientation. From the host country's point of view, the bulk of foreign students are enrolled in general disciplines (5A), except in Denmark and to a lesser extent the United Kingdom. The low level of internationalisation of professional disciplines can be explained by the fact that programme content is more specifically geared to national characteristics (legislation and other institutional aspects) or that certain professions (nurses, lawyers, doctors, dentists) require the award of national diplomas, which may discourage foreign students not intending to settle in the country where they study. Moreover, professional programmes are probably little publicised abroad (while university research ensures international promotion of their programmes). Finally, the low level of internationalisation of traditionally short professional courses may also be a result of the lower mobility of students during the initial stages of higher education.

In terms of the share of foreign students for each level of education (Table 8), it is greater in all countries at doctorate level (ISCED 6) than at the first or "undergraduate" stage of tertiary-level education (ISCED 5A). This can be explained by a number of factors:

- First, the higher the level, the greater the specialisation in precise disciplines or techniques for which the centres of excellence may be located abroad. Moreover, students may, with time, be tempted to discover other academic environments, and greater possibilities of financial support at doctoral level make this easier to do.

- It is also possible that the economic benefit of a period of study abroad (in terms of subsequent income) may rise with the level of education. In this case, for virtually the same

cost (tuition fees, living costs), the investment is more attractive for higher levels of education. This notion is supported by the fact that differences in the shares of foreigners enrolled at levels ISCED 5 and 6 are much greater for countries where studies are the most costly: Switzerland (by a factor of six at doctoral level), United Kingdom (by a factor of three) and United States (by a factor of seven).

- A final explanation for this over-representation at the highest levels of study may relate to students' immigration strategies. Their mobility would then satisfy the dual objective of obtaining a recognised degree in the intended country of immigration and prospecting the local labour market for an employer who might sponsor them. Under this hypothesis, the opportune time to go and study abroad is thus at the end of one's undergraduate studies.

Table 8. Share of foreign students by level of education in selected OECD countries, 1998
Percentage of total students enrolled by level of education

	ISCED 5A	ISCED 5B	ISCED 6	ISCED 5A-6	ISCED 5-6
Australia	15.0	4.8	22.4	15.3	12.6
Austria	12.1	4.1	14.4	12.3	11.5
Denmark	6.5	4.8	16.6	7.0	6.0
France	..	2.4	..	7.4	7.3
Germany	..	4.1	..	5.8	5.6
Switzerland	5.4	..	32.7	8.3	6.3
United Kingdom	12.0	5.5	33.9	13.1	10.8
United States	3.5	..	24.7	4.1	3.2

Note: Data cover only non-residents for Germany, Switzerland and the United Kingdom. Please refer to the notes in Table 7.
Source: OECD Education database.

Disciplines

The distribution of foreign students by discipline can be used to identify the most internationalised disciplines. Based on the data available for five countries (Table 9), it is clear that numbers of foreign students in science and engineering are relatively low compared with those enrolled in the social sciences and humanities. This under-representation of science students should be tempered by the fact that data for flows to the United States, the United Kingdom and France are not available and thus not included. These countries take in a large number of students in the scientific disciplines both because of their traditions in this field and because of the more widespread use of English and French in foreign language courses.[15]

The share of foreign students in science and engineering is equal to the share of students in the social sciences and humanities. There is a slight "humanist" bias in Austria and Germany, while science and engineering appear to be more internationalised in Australia, Denmark and Switzerland (Table 10).

Table 9. Foreign students by field of study (all tertiary levels) in the main OECD host countries, 1998
Percentages

	Australia	Austria	Denmark	Germany	Switzerland	Simple mean for these five countries
Agriculture	1.0	1.8	2.2	1.5	1.1	1.5
Engineering, manufacturing and construction	12.7	15.6	7.6	18.5	16.0	14.1
Health and welfare	9.9	8.9	21.6	7.1	6.6	10.8
Arts and humanities	9.0	27.9	20.5	23.2	16.5	19.4
Sciences	12.7	12.1	6.6	11.7	14.4	11.5
Services	2.8	0.4	0.6	1.6	8.9	2.8
Social sciences, business and law	46.5	33.2	25.8	24.9	31.1	32.3
Total	100.0	100.0	100.0	100.0	100.0	100.0

1. Some data by nationality are not specified by field of study so that the sum of percentages does not equal 100%.
Source: OECD Education database.

Table 10. Foreign students by field of study in selected OECD countries, 1998
Percentage of total enrolments, by field of study

	Australia	Austria[1]	Denmark	Germany	Simple mean for these four countries
Agriculture	6.6	7.9	7.3	5.9	6.9
Engineering, manufacturing and construction	14.6	11.8	8.8	9.2	11.1
Health and welfare	9.2	11.3	5.6	3.6	7.4
Arts and humanities	7.3	19.8	7.3	11.6	11.5
Sciences	14.1	10.8	5.2	7.8	9.5
Services	9.3	12.3	1.8	3.8	6.8
Social sciences, business and law	17.3	9.1	5.8	7.9	10.0
Total	12.6	9.5	6.0	8.2	9.1

1. Numbers of students by field of study measure enrolments (not head counts). Students enrolled in several programmes are thus counted several times.
Source: OECD Education database.

The science and engineering fields

Bearing in mind the growing importance of science and technology in the contemporary, so-called "knowledge" society, and the links between the mobility of students specialising in these areas and HRST, it is worth analysing in more detail the characteristics of this student population. In particular, the breakdown of foreign students by discipline and level of education makes it possible to determine the potential pool of HRST in OECD countries.

From this point of view, differences in countries' profiles emerge. Science and technology students as a whole represent a highly variable proportion of foreign students, ranging from around 7% (Iceland) to 36% (Canada).[16]

Table 11. Foreign students by field of study and by level of education, 1998
Percentage of foreign students at each level[1]

	Engineering, manufacturing and construction			Sciences			Arts and humanities			Social sciences, business and law			Others		
	ISCED 5	ISCED 6	ISCED 5-6	ISCED 5	ISCED 6	ISCED 5-6	ISCED 5	ISCED 6	ISCED 5-6	ISCED 5	ISCED 6	ISCED 5-6	ISCED 5	ISCED 6	ISCED 5-6
Australia	17.0	13.1	13.5	11.9	13.6	13.5	11.3	9.3	9.5	39.8	50.0	49.1	20.0	14.0	14.5
Austria	24.6	15.3	15.6	31.1	11.5	12.1	19.3	28.1	27.9	11.0	33.9	33.2	14.0	11.1	11.2
Canada	..	..	17.5	..	..	18.3	..	..	15.8	..	..	36.0	..	..	12.3
Czech Republic	7.1	15.1	14.5	1.7	6.4	6.1	36.0	11.9	13.7	31.3	21.9	22.6	23.9	44.7	43.1
Denmark	19.5	3.4	9.0	5.8	8.9	7.8	5.9	33.8	24.2	16.7	37.6	30.4	52.1	16.3	28.6
Finland	13.2	25.0	23.8	2.8	12.2	11.2	8.3	27.1	25.2	51.2	20.6	23.8	24.5	15.0	16.0
Germany	..	..	20.9	..	..	13.2	..	..	26.2	..	..	28.1	..	..	11.6
Hungary	..	..	12.1	..	..	3.7	..	..	20.2	..	..	13.3	..	..	50.5
Iceland	-	2.5	2.2	-	5.0	4.4	95.2	67.1	70.3	-	15.5	13.7	4.8	9.9	9.3
Italy	..	..	13.2	..	..	6.9	..	..	17.6	..	..	23.6	..	..	38.7
Japan	33.1	20.3	17.7	0.0	3.3	2.6	37.9	24.6	21.4	23.7	39.0	32.5	5.4	12.9	25.8
Luxembourg	10.0	..	10.0	4.4	..	4.4	10.0	..	10.0	71.9	..	71.9	3.7	..	3.7
New Zealand	12.4	7.7	8.3	0.2	12.7	11.1	6.7	14.8	13.8	68.7	53.9	55.8	12.1	10.9	11.0
Norway	1.1	11.0	10.5	13.1	13.8	13.8	8.3	31.3	30.1	59.2	24.7	26.5	18.2	19.2	19.2
Poland	..	..	25.3	..	..	-	..	..	7.3	..	..	22.5	..	..	44.9
Switzerland	16.8	17.0	17.0	4.2	17.5	15.2	0.7	20.8	17.4	27.5	34.0	32.9	50.8	10.7	17.5

1. Foreign students whose field of study is specified.
Source: OECD Education database.

The breakdown by level in Table 11 shows that the share of foreign students enrolled in scientific and technological disciplines is sometimes much higher up to master's degree level, for example, in Austria, Denmark, Japan and Luxembourg than at doctoral level, as is the case, for example, in Iceland, Finland, the Czech Republic, Norway, New Zealand and Switzerland.

Determining factors in student mobility

The effect of centres of expertise, the role of language barriers and the influence of institutional factors are among the principal factors that determine student mobility.

Centres of expertise

One of the economic arguments for sending students abroad is the opportunity for their countries to educate young people in specialist disciplines for which the domestic supply and demand are insufficient to reach the critical mass needed to achieve satisfactory quality. This kind of arbitrage is common in scientific and technical research where the use of certain experimental methods involves high costs both for equipment and remuneration of technical staff. This makes it more rational to use specialist research centres abroad. Similarly, the massive investment required for certain types of specialist education is sometimes not justifiable because of the small number of candidates. Sending individuals abroad can then be much cheaper and also make it possible to select the educational institutions that offer the most expertise.

In the absence of detailed data on foreign students and their host institutions, it is impossible to quantify the influence of centres of expertise on student flows. Qualitative information is, however, available from a comparative study by the European Commission on the mobility of doctoral students in member states of the European Union (Blume, 1995). This study, involving 200 European teachers and doctoral students, sheds light on their motivation and criteria in selecting host institutions. It finds greater incentive to mobility in the scientific disciplines, in line with the idea of critical mass and economies of scale. Furthermore, student perceptions of the prestige of institutions seem to play a crucial role, as illustrated by the case of a young Danish doctoral candidate: "He plans to stay abroad as a PhD student, either in the United States or Great Britain, because he thinks the best institutions are in these countries." (Blume, 1995) This kind of argument partly explains the higher international mobility of students from small countries, of doctoral students, and of those in the scientific and technical disciplines. It does not, however, explain the international mobility, which is also high, of students in the social sciences and commerce, which suggests that factors of a cultural and linguistic nature need to be considered.

The role of cultural and linguistic factors

Analysis of the geographical breakdown of student migratory flows suggests, in fact, that while language barriers seem to be an obstacle for attracting students to countries whose languages are little used internationally, countries where the teaching is in historically or economically important languages (English, French, German) are characterised, on the contrary, by a much greater propensity to host foreign students. The question then arises as to what extent language barriers inhibit mobility.

Table 12. Distribution of outgoing students by language of the destination country, 1998
Percentages

Country of origin	Language of the destination country (OECD area)			
	Different language	Percentage of which are:		
		French-speaking	German-speaking	English-speaking
Australia	21.7	9.4	7.0	
Austria	31.3	10.4		62.4
Belgium	70.2		19.9	60.2
Canada	4.9		2.7	
Czech Rep.	100.0	22.6	7.9	73.0
Denmark	100.0	8.5	14.7	50.8
Finland	100.0	5.5	17.4	43.6
France	82.9		27.3	72.2
Germany	76.7	24.4		65.7
Greece	100.0	5.7	37.4	51.4
Hungary	100.0	9.3	56.2	29.9
Iceland	100.0	3.9	12.8	31.8
Ireland	9.1	3.6	3.8	
Italy	88.4	23.2	52.6	29.0
Japan	100.0	4.7	4.2	92.2
Korea	100.0	3.3	7.9	63.1
Luxembourg	18.1			93.1
Mexico	92.7	10.6	3.8	88.7
Netherlands	76.7	7.9	22.5	51.3
New Zealand	3.6	2.6	1.3	
Norway	100.0	5.6	12.1	58.2
Poland	100.0	14.2	60.5	19.6
Portugal	100.0	42.2	23.3	30.5
Spain	100.0	22.5	32.3	50.4
Sweden	100.0	10.3	13.2	63.2
Switzerland	52.0			91.1
Turkey	100.0	6.5	68.1	24.9
United Kingdom	43.1	18.2	13.5	
United States	40.8	21.9	18.4	

Note: Data for the following host countries are not taken into account in this table: Mexico, the Netherlands and Portugal. For multilingual countries (Canada, Luxembourg, Switzerland, Belgium), it is assumed that students from these countries were fluent in all official languages. Hence, studying in a French or English-speaking country (Canada), German or French-speaking country (Switzerland, Luxembourg and Belgium) did not involve adjusting to a different language environment. For these countries, mobility towards countries with a different language may thus be under-estimated.
Source: OECD Education database.

In the case of migration of workers, mastery of the language of the host country is important for entering the labour market (Dustmann, 1994). However, the main purpose of student migration is to acquire knowledge and professional expertise. Students can then acquire or improve linguistic skills which later have an economic value. On that hypothesis:

- The share of students going to countries where the teaching is in a language other than their mother tongue should be particularly high in countries where English, French and German are spoken (Table 12).

- Conversely, there should be less emigration by Anglo-Saxon students to countries with another language given the predominance of English in international economic, scientific and technical exchanges.

- The mobility of students to countries with a different language should also be higher for countries that are very open to trade in goods and services. Similarly, it could be expected that international mobility of students would be higher in the commercial disciplines.

Analysis of student mobility from one OECD Member country to another shows that the rates of mobility to countries with a different language vary considerably, from less than 4% (New Zealand) to 100% for countries like Hungary, Finland or Greece.

Most mobility to countries with a different language is to English-speaking countries. This propensity is particularly marked for Japan (92%), the bulk of whose trade is with the English-speaking countries of North America and the Pacific, and for countries specialising in banking services (Luxembourg, Switzerland).

Students from English-speaking countries do not favour destinations in countries where English is not the language, apart from students from the United Kingdom wishing to master a second European Union language. The propensity to study in a country with a different language is very high for Mexican students (93%) and French, German and Dutch students, while it is relatively low for Austrian students.

A breakdown of students by mother tongue, host country and discipline is not possible. However, in Australia, for example, most foreign students come from the Asian countries which are Australia's main trading partners and they mostly enrol in commercial disciplines.

In conclusion, the choice of students to go to countries with a language other than their mother tongue is driven by motives of an economic nature and is linked to exploiting language skills on the labour market. The attraction of the Anglo-Saxon countries confirms this and thus draws attention to the migration of students for whom the language barrier can be turned into a professional advantage.

The role of institutional factors

Finally, institutional factors can also help to explain student migration, as is the case in Europe. This area is very open to student migration and is institutionalised in agreements between universities or countries. This offers a number of advantages to students because it reduces the time and cost of gathering information. Moreover, the existence of earlier student networks formed via these institutional channels reduces the uncertainty involved in mobility and facilitates the decision to go abroad. Furthermore, the institutionalisation of mobility is generally accompanied by requirements to do part of the course of study in another member country, as well as by procedures for the equivalence of degrees and validation of qualifications obtained abroad. Finally, this type of mobility is quite often accompanied by material advantages (accommodation, grants). Blume (1995) points out that the institutionalisation of student mobility for doctorates in science translates into higher financial benefits than students could obtain through their own efforts.

General conclusion

In concluding this analysis, three findings are clear. First, student mobility is constantly increasing. Second, host countries benefit greatly, although the effects for countries of origin are more varied. Third, migration policies should encourage student mobility.

Rising level of student mobility

Analysis based on INES data from UNESCO, OECD and Eurostat underlines the rising volume of migration of foreign students, with the proportion of the total number of students enrolled in OECD countries rising by an average of 5% between 1995 and 1998.

Situations vary, however, mainly owing to the nature and range of educational provision, the characteristics of demand and the expectations of foreign students. Mobility is relatively higher from the smaller non-English-speaking countries with less varied education systems which are geographically close to other countries with more diversified education systems. Large countries whose language is more widely used internationally attract a larger number of students, especially if they come from one of the member countries of a regional economic group (European Union, NAFTA). The direction of student migration is governed by geographical, linguistic, cultural, historical, institutional and academic considerations. Finally, student migration is greater the higher the level of education, degree of technical content of the field and the need for foreign students to master foreign languages (commercial disciplines, for example).

Beneficial effects for the host countries

The growing internationalisation of education systems encourages students to be more mobile while meeting their requirements. By offering many benefits to host countries, internationalisation leads them to open up their education systems further, as the integration of foreign students into national education systems expands sources of financing. This additional contribution may be direct (payment of tuition fees by foreign students) or indirect through the growth in the size of the education system and the possibility of achieving the critical mass required to engender economies of scale.

Certain OECD countries have, in fact, adopted a policy of charging foreign students enrolment fees at actual cost, thus creating a source of additional revenue for higher education institutions with large enrolments of foreign students and powerful incentives for others to receive such students (Australia since 1988, the United Kingdom since 1980 and the Netherlands since 1993 for non-EU students; see Throsby, 1996). However, there is the possibility that, in an increasingly integrated and competitive international educational environment, the imposition of such charges may push students to less costly destinations. The financial gains of the new charging system might then fail to offset the loss of other advantages deriving from the intake of foreign students. However, charging at actual cost is not the only way to profit from receiving foreign students. For example, there is the possibility of achieving economies of scale, which can be quite considerable, notably for small universities where the regional student population is limited, and this alone may justify hosting foreign students.

Other advantages of a qualitative order may also result from opening education systems and campuses to foreign students. Foreign students may help to increase the flexibility of the economy. Students encountering an international environment in the course of their studies, growing up on campuses open to international competition and forced to receive an increasing number of foreign students may improve their ability to adjust to the demands of the labour market. This may, in turn,

have an impact on their productivity and their income, and thus on future tax revenues in host countries.

In addition, foreign students contribute to domestic demand in the host country during their stay by spending on accommodation, food and leisure. For the United States, this contribution was estimated at USD 12.3 billion for the academic year 1999-2000 (Institute of International Education, 2001). This kind of contribution may be much more important at local level, especially in highly cosmopolitan university towns of moderate size.

Attempts at cost-benefit analysis have been made in some countries. Additional revenues attributable to the presence of foreign students were estimated at USD 9 000 to USD 10 000 per student in Canada in the late 1980s, for an additional cost of USD 5 000 to USD 6 000. In the United States, foreign students generated USD 11 000 of additional income in their host region, or double their marginal cost (OECD/CERI, 1991). Along the same lines, Throsby (1996) and the Institute of International Education provide estimated costs and benefits of hosting foreign students up to master's degree in the early 1990s for the Netherlands, Sweden, the United States, the United Kingdom and Australia (Table 13).

Table 13. Annual costs and gains of receiving undergraduates foreign student
USD per foreign student

	Netherlands 1992	Sweden 1994-95	United States 1999-00	United Kingdom 1992-93	Australia 1994
	Amsterdam University	Mälarden University	Average US colleges		Monash University
Cost of living (housing, daily expenses) borne by foreign students	+7 100	+1 700	+19 077	+8 000	+7 400
Average tuition fees (foreign students) borne by foreign students	+ 400	0	+11 669	+9 500	+7 000
Teaching costs (excluding research) borne by host institutions	..	- 500	..	-6 600	-3 200
Administration cost specific to foreign students (international relations offices, international marketing, scholarships, foreign students support, etc.) borne by host institutions	-700	-5 000	..	..	-450
Cost or gain for the host country	+3 800	+1 200	+30 746	+10 900	+10 750
	Overestimated		Overestimated	Overestimated	

Source: Author's estimate based on data from Throsby (1996) and Institute of International Education (2001) for the United States.

Finally, student migration may in some countries help to relieve stresses on the labour market, notably shortages of qualified labour. Young foreign graduates may be authorised to settle and work temporarily or permanently in the country where they were trained. Some OECD Member countries recently changed their legislation on access of foreigners to the labour market to allow a larger number of foreign students who have completed their studies to enter. These decisions have revived concerns about brain drain in students' countries of origin.

More varied effects on countries of origin

These concerns should be refined. Sending young people abroad for their education can facilitate transfers of technology and individual education in highly advanced and specialist fields, where the

country of origin does not have the critical mass of students or a sufficient level of technology to provide the required education. The alternative of education abroad may make it possible to profit from centres of excellence, giving the country highly qualified labour more cheaply. These transfers of technology may be particularly important in the case of doctoral students, whose research, although conducted abroad, may meet the needs of their country of origin.

Apart from transfers of technology, interaction of students with the local population during their studies can give them a better knowledge of the language, as well as the cultural and social customs of the country. This knowledge may later make them ideal ambassadors for economic and commercial relations between the two countries. The policy in Australia of admitting students of Asian origin on a massive scale is a case in point.

The corollary for countries of origin is obviously the risk that some of their students will be captured by the labour market in the host country and will not return to work in their country of origin. While this risk is certainly present, its degree depends on the family status of the migrating student, the existence of institutional safeguards[17] and the comparative employment opportunities in the two countries. Increased international co-operation between host countries and countries of origin of migrants could help to minimise this risk.

Implications for migration policy

Bearing in mind the many advantages offered by student migration, both for them personally and for their countries of origin and the host countries, this type of mobility deserves encouragement, if possible in a framework of institutional agreements.

Mobility could be increased by more transparent procedures for equivalence of degrees or simplified conditions for obtaining student residence permits. The introduction of safeguards to limit the risk of brain drain and thus ensure an adequate rate of return home of foreign students would help to ease the concerns of countries of origin which might be tempted to reduce the international mobility of students. For example, making available a greater number of bursaries conditional on return would minimise the brain-drain risk. Finally, greater co-ordination and co-operation between students' countries of origin and destination would lead to a fairer sharing of the advantages linked to international student mobility.

NOTES

1. Australia, Austria, Canada, the Czech Republic, Denmark, Finland, Hungary, Japan, Norway, Portugal, Sweden, Switzerland, the United Kingdom and the United States.

2. The study concerns H-1B visas issued between May 1998 and July 1999. These temporary visas are issued for a maximum of six years to highly qualified persons sponsored by an American employer who cannot find an equivalent applicant in the United States. They may replace a student visa, and they are often the first stage in a permanent immigration process.

3. Institutional proximity, in this study, means belonging to area of regional integration (European Union, NAFTA) or the existence of a common tradition of educational institutions and systems (*e.g.* countries where French, German or English are spoken).

4. In the case of these two countries, it is likely that considerations of an economic nature are also an obstacle to mobility (education fees, living costs).

5. The Slovak Republic joined the OECD in December 2000, and was thus not a member when the data on educational indicators was collected in 1998. It is thus not included among OECD countries for the purposes of this study.

6. These can be misleading, to the extent that flows within the area are excluded (OECD destinations, excluding Mexico, for which data are not available). A strong propensity to emigrate is evident in Paraguay, where, once again, the small size of the country may explain this.

7. Malaysia, with a very high emigration rate, is an exception in the region. This is probably due to the advantages enjoyed by those of Malaysian origin in entering university, as a result of which young people of Chinese origin are often obliged to pursue their studies abroad because of the quotas to which they are subject locally.

8. For Hungary, the presence of Hungarian minorities in neighbouring countries plays a fundamental role.

9. Luxembourg is a special case, as it only provides a one-year general university education. As a result, it will be excluded from some of the analysis for the sake of comparability.

10. It means comparing the weight of a country in international student mobility on emigration or arrival with its weight in a reference education system (EU, OECD). This amounts to comparing the country to the weighted average of the reference group. The ratio thus calculated is as follows:

$$\text{Ratio of country } i = \frac{\dfrac{\textit{entries / exits country } i}{\textit{entries / exits reference group}}}{\dfrac{\textit{enrolments country } i}{\textit{enrolments reference group}}} = \frac{\dfrac{\textit{entries / exits country } i}{\textit{enrolments country } i}}{\dfrac{\textit{entries / exits reference group}}{\textit{enrolments reference group}}}$$

Thus, a ratio higher (lower) than one reflects higher (lower) mobility than the country's weight in the international system would suggest, or an over(under)-mobility compared with the reference mean.

11. As no distinction was made in Switzerland and Japan between resident and non-resident students for the two dates, the trend is calculated on the basis of the total number of foreign students.

12. Excluding Greece, Luxembourg, Mexico, the Netherlands, Poland, Portugal, Sweden and Belgium, for which no data are available.

13. This finding is more striking when it is considered that New Zealand students are not included in the Australian statistics on foreign students (see annex).

14. See Box 1 for a discussion of the problems of statistical measurement of foreign students.

15. The language barrier is probably a greater obstacle to science students because their studies have placed less emphasis on learning foreign languages.

16. Measuring the actual size of these HRST pools, however, would involve comparing the number of students in science and technology with the active population with this type of qualification.

17. Many countries offer foreign study bursaries to their brightest students on condition that they come back to work in their country of origin for a certain number of years.

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PART II

TRENDS AND ECONOMIC IMPACT IN OECD COUNTRIES

Chapter 3

INTERNATIONAL MOBILITY OF HIGHLY SKILLED WORKERS: FROM STATISTICAL ANALYSIS TO POLICY FORMULATION

by

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Summary

The international migration of highly skilled personnel is increasing and is high on the agenda of policy makers and business leaders, not least because knowledge-based economies rely more on people with higher skill levels than in the past, especially in science and technology. This chapter examines the recent trends and drivers behind the international mobility of highly skilled personnel in science and technology (notably researchers, engineers and information technology experts) and reviews the impacts on innovation and economic development in sending and receiving countries. The main findings may be summarised as follows:

- Skilled migration, especially from Asia, to the United States, Canada, Australia and the United Kingdom is increasing, particularly with regard to students and the temporary migration of skilled professionals such as IT workers. Skilled migration among advanced OECD countries is also on the rise but appears dominated by temporary flows, suggesting more a pattern of brain circulation than of brain drain. Data show that countries such as Germany, the United Kingdom, Canada, and France are an important source of temporary skilled migrants to the United States (e.g. postdoctoral students, researchers, company transferees), but less so in terms of permanent skilled migration. With the exception of temporary student flows, there are few data available on the intra-EU migration of skilled EU nationals.
- The drivers of migratory flows of skilled workers among advanced OECD countries appear to differ from those that characterise skilled migration from developing to advanced countries. They include opportunities for high-technology entrepreneurship, access to leading clusters of research and innovation, bottlenecks to employment opportunities in public and private research at home and the globalisation of the R&D activities of national firms. These drivers also play a role in flows from developing countries. Yet, the larger economic differentials between countries, the existence of immigrant networks, the pro-skill immigration policies of receiving countries, the financial support offered to foreign students and the possibility of permanent settlement (*i.e.* via a change in immigration status) may all act as more important drivers for skilled migrants from developing countries.
- At world level, international mobility can generate positive benefits as knowledge flows intensify and the match between supply and demand for skills improves. However, the distribution of gains and losses may be uneven. Receiving countries benefit from a larger pool of talent, both scientific and technological skills and entrepreneurial capacities. The contribution of immigrant human resources in science and technology (HRST) to innovation and growth in the United States and a few other countries is increasingly recognised, even if evidence on the distributional effects is inconclusive. For sending countries, capturing benefits mostly depends on the success of national policies in attracting skilled emigrants who return with new technological and entrepreneurial competencies acquired abroad as well as capital and access to international S&T networks. It also depends on national policies for maintaining contact with expatriate workers, which may generate some benefits even if the migrants do not return.
- The policy challenge is to facilitate the circulation of highly skilled workers across frontiers while generating benefits for both sending and receiving countries. Science and technology policies play a key role in this regard. Developing centres of excellence for scientific research and framing the conditions for expanding technological innovation and entrepreneurship are important in making a country attractive to highly skilled workers, both from within the country and from abroad. While sending countries may view their domestic pool of skills depleted and public investment in human capital lost, those that create opportunities for research, innovation and entrepreneurship at home are more likely to benefit from return flows of migrants, capital and access to international innovation networks.

Introduction

The international mobility of S&T personnel is an integral feature of a globalisation process that includes both industrial R&D and higher education systems. There is a perception that highly skilled migrants, despite their relatively small numbers, may substantially affect innovation and economic growth. The recent growth performance of the United States may be linked to immigration, particularly of highly skilled S&T personnel (OECD, 2000a). Immigration policies in a number of countries have become more selective and skills-based, while shortages of certain specialists, particularly information technology (IT) workers, have led to more relaxed immigration policies for skilled workers. How important is the migration of skilled personnel in S&T and what are the principal origin and receiving countries? What drives highly skilled people to migrate and how do these drivers differ from the traditional "push" and "pull" factors that characterise most migratory flows? What are the impacts on the innovative and economic capacity of receiving countries? How can sending countries benefit from the emigration of their students and professionals to foster innovation and high-technology entrepreneurship at home? This chapter attempts to shed some light on these questions, particularly that of the impact on innovation and economic performance.

Measuring the international migration of skilled personnel: a difficult task

To measure the immigration of human resources in science and technology (HRST), it is first necessary to define what constitutes the immigrant population in a given country and second, what constitutes the population of the highly skilled in the host country according to a standard criterion for assessing immigrants' skills. In simplified terms, the population that intersects the two categories is then the *stock* of the population that is both immigrant and highly skilled (foreign HRST). This stock is of course affected by *flows* of incoming and departing skilled immigrants. Some of these flows may consist of temporary migrants, such as students or speciality workers, or permanent immigrants. The upskilling or subsequent educational/labour market training of non-HRST immigrants in the host country also affects the stock of foreign HRST.

As noted in Coppel *et al*. (2001), the definition of the immigrant population varies in OECD countries. European countries, Japan and Korea define the immigrant population as individuals holding foreign nationality. "Settlement" countries (Australia, Canada, New Zealand, the United States) count the immigrant population as those who are foreign-born, a group that may include naturalised citizens of the host country. In the case of the former countries, the definition makes it difficult to distinguish temporary from permanent immigrants, as individuals may legally and administratively have a temporary status but be *de facto* long-term immigrants.

Determining the foreign or immigrant share of the HRST population in a given country is in general very difficult, not least because of limitations inherent in the internationally agreed definitions of HRST. The OECD "Canberra Manual" (OECD, 1995) defines HRST as the population that: *i)* has completed education at the tertiary level in a S&T field of study; and/or *ii)* is not formally qualified but is employed in an S&T occupation where the above qualifications are normally required. Use of the Canberra definition to measure the population of HRST is limited by the fact that the data sources used, namely labour force surveys, international education statistics and census data, do not always permit a clear breakdown. Various occupational categories of HRST are also involved: IT specialists, research scientists, entrepreneurs. There may also be substitution on the labour market as individuals may change their trajectory.

There are no internationally comparable data on flows and stocks of highly skilled migrant workers, and it is even difficult to get a complete picture of the situation for a given country. Most of

the national sources available for counting numbers of migrating scientists, researchers and other specialists rely on the same sources for recording migration flows in general. However, these data sources – namely, population registers, censuses, temporary employment permits – were not initially designed to record the educational or occupational background of immigrants in science and technology, even if they do provide some data on the skills profile of migrants. The information that exists relates mainly to migration inflows; data on outflows are rarely collected. Where relevant data exist, classification systems (*e.g.* for occupations), while appropriate to individual countries, do not always allow for reliable cross-country comparison. Labour force surveys provide a potential source of information on gross inward migration flows. However, while this source has a wider coverage and greater possibilities for adapting the data to conform to a particular definition of HRST, in other respects it is limited: the sample size in particular is insufficient to allow for drawing a precise picture of a relatively small population (Sexton, 2000).

Trends in the migration of scientists, researchers and other highly skilled personnel

Small but growing share of highly skilled immigrants in certain OECD countries

For practical purposes, data on migration trends can be separated between stocks and flows. Flow data can be divided into flows of permanent immigrants and of temporary migrants, including students and speciality labour migrants. Skilled migrants may enter a country either as permanent immigrants or as temporary migrants. Data on flows of permanent immigrants show that highly skilled immigrants represent quite a small share of general immigration flows. For example, although the United States, Canada, Australia and other countries have established admissions systems that include entry on the basis of skills, education and employability, most legal immigrants to OECD countries arrive as dependants or as humanitarian cases. Table 1 shows that family reunification constitutes the largest category of immigrants to the United States, Canada, and France and the United Kingdom, all countries with a long history of significant immigration. In these countries, except the United States, the share of immigrants admitted under a skills-based category has nevertheless increased. In the United States, the share of those entering under family reunification has increased, from over half in 1993 to nearly two-thirds in 1998, although the numbers of skilled migrants has also increased (notably on H-1B visas, which offer a three-year permission to stay, renewable once).

When immigrants possess low or high skills, spouses and other relatives immigrating through family-based categories may tend to have similar profiles. Generally, there is a high probability that direct family members of a highly skilled immigrant also have a relatively high level of educational training; conversely, relatives of a low-skilled migrant are likely to be similarly low-skilled. The immigration literature, however, has demonstrated that, in some cases, immigration of a skilled family member (*e.g.* a student) may be part of a family's economic strategy to establish a right to family reunification immigration for members of the family.

OECD countries maintain different entry categories for permanent and temporary migrants. Data on flows of skilled migrants can show the skills profile of migrants. However, most permanent immigrants (whether foreign-born and foreign or foreign-born and naturalised in the host country) acquire most of their educational qualifications in the host country. Flow data may thus tend to underestimate the contribution of migrants to the stock of the highly skilled in the host population. Migration patterns for the highly skilled also appear to be tied to historical migration streams. In other words, skilled migration from India, for example, while increasingly directed to the United States and Canada, also flows to the United Kingdom and other Commonwealth countries for historical and linguistic reasons as well as family networks.

Table 1. Immigration by eligibility category in selected OECD countries[a]
As a percentage of total

	Family		Skills		Refugee		Other[2]	
	1993	1999	1993	1999	1993	1999	1993	1999
Australia[3]	42	26	29	33	14	10	15	31
Canada	65	61	15	26	10	13	10	-
Denmark[4]	29	32	12	10	19	15	40	42
France[5]	60	71	28	15	12	8	-	7
New Zealand[6]	20	42	73	49	5	9	2	1
Slovak Republic	30	23	43	47	1	1	26	30
Sweden	21	49	-	1	75	26	4	24
Switzerland	41	31	26	34	4	2	29	34
United Kingdom[7]	40	46	41	46	14	8	4	-
United States[8]	53	74	16	9	14	7	17	7

1. Refers to permanent settlers or equivalent, unless otherwise noted.
2. The category "other" varies according to country. For Australia, this category includes New Zealanders, who may emigrate to Australia without a visa. In Denmark and Sweden "other" includes European Economic Area nationals and students. For the Slovak Republic, this includes mainly students, and for Switzerland it includes mainly students, rentiers and spouses of Swiss nationals.
3. Fiscal year ending June 30.
4. Refers to residence permits.
5. Entries of EU family members are estimated. Excluding visitors. Among those who benefited from the 1997 regularisation programme, only those who received a permit under the family reunification procedure are counted. The "family" category also includes spouses of French citizens who received the new permit category "vie privée et familiale".
6. Data refer to 1993 and 1998 respectively.
7. Passengers, excluding European Economic Area nationals, admitted to the United Kingdom. The data only include certain categories of migrants: work permit holders, spouses and refugees.
8. Fiscal year ending 30 September.
Source: OECD (2001), *Trends in International Migration*, Australian Department of Immigration and Multicultural Affairs (DIMA), Citizenship and Immigration Canada, New Zealand Immigration Service, US Immigration and Naturalization Service, European Migration Centre (EMZ).

The number of permanent residents admitted to the United States has decreased substantially since 1992, especially for engineers and computer scientists (it has increased for physicians and health-related technicians) (Table 3). The share of HRST has also declined. This was a reversal of a sharply rising trend in the late 1980s. There has been at the same time a sharp increase in quotas for H-1B visas, which mainly concern IT experts who receive permission for a temporary stay (three years, with the possibility of a single renewal). During the 1990s, the yearly quota was often filled far before end of the year, an indication of the strength of demand from industry. The quotas were increased for the years 2001-03 (up to 195 000 visas a year). The structure of H-1B visa recipients by nationality is highly skewed: 45% are from India, 9% from China and the rest from various countries, each with less than 3% (Figure 1).

Table 2. Foreign and national adult populations classified by level of education in selected OECD countries[1]

1995-98 average, percentages

	Lower secondary		Upper secondary		Tertiary level	
	Foreigners	Nationals	Foreigners	Nationals	Foreigners	Nationals
United States[2]	35.0	15.7	24.1	35.0	40.9	49.3
Germany	49.4	16.5	35.4	59.3	15.2	24.2
France	66.4	36.2	19.7	42.0	13.9	21.8
Italy	49.8	55.8	37.2	34.6	13.0	9.5
United Kingdom	30.3	19.4	30.5	53.3	39.3	27.3
Canada[3]	22.2	23.1	40.0	60.3	22.9	16.6
Sweden	30.1	22.5		48.5	29.9	29.1

1. The educational attainment classification is defined as follows: lower secondary refers to pre-primary education or none, primary or lower secondary; upper secondary refers to upper secondary education or post-secondary non tertiary education; third level refers to tertiary education. Data refer to individuals aged 25 to 64.
2. Foreign-born and native populations aged 25 and over. Lower secondary refers to less than high school diploma, upper secondary Foreign-born and native populations aged 25 and over. Lower secondary refers to less than high school diploma, upper secondary refers to high school diploma and third level refers to some college or more.
3. Foreign-born and native populations aged 25 to 44. Lower secondary refers to below grade 9, upper secondary refers to grades 9 to 13 and third level refers to some post-secondary education plus university degrees.
Source : OECD (2001), *Trends in International Migration,* Labour force surveys (Eurostat), Statistics Canada, US Bureau of the Census.

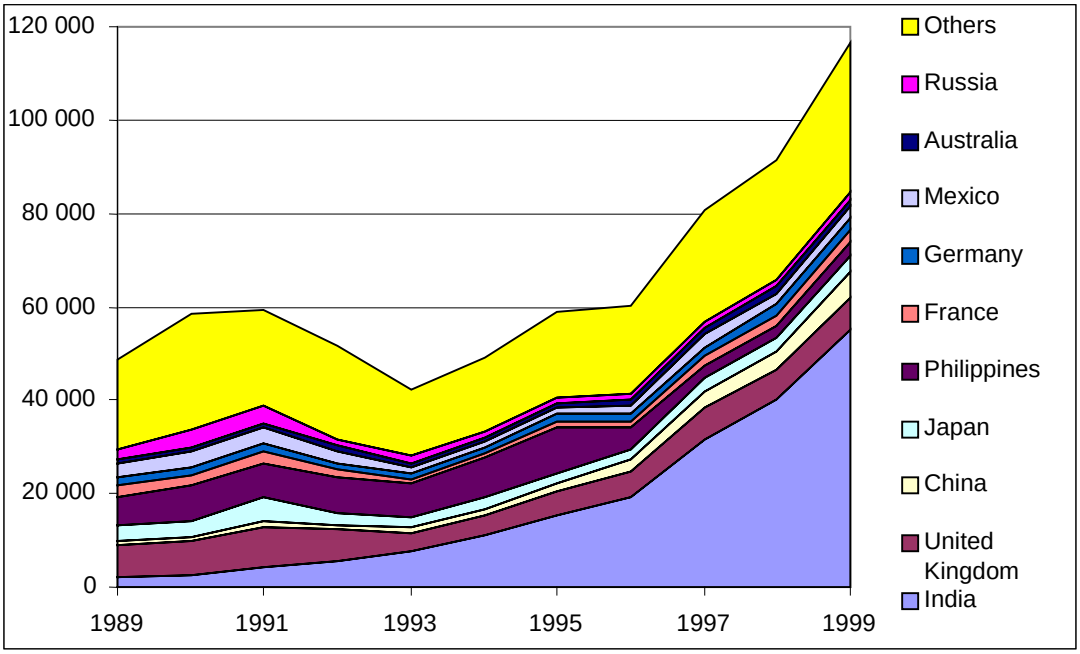
Table 3. Immigrants admitted to the United States for permanent residence, aged 16-64, by occupation

	1988	1992	1995	1998
Engineers	8 200	15 457	8 990	7 863
Computer scientists	2 000	3 399	2 127	2 541
Natural scientists	2 000	2 783	2 371	2 490
Doctors		3 600	4 072	3 824
Technicians, health		904	737	3 532
Technicians excl. health		7 146	6 639	2 076
Total highly skilled S&T		33 289	24 936	22 326

Source: US Department of Justice, Immigration and Naturalization Service, 2000.

Two observations merit attention. First, insofar as the H-1B visa programme is temporary, return flows should be larger in the future (as the number of visas issued has increased). In a way, the temporary character of the H-1B favours the international circulation of knowledge.[1] Second, preliminary data available for 2001 tend to show a sharp decrease in demand for H-1B visas. In addition, many workers with H-1B visas are concerned by the recent increase in layoffs in the US IT industry (a H-1B visa holder is supposed to leave the United States after ten days of unemployment). This may indicate a possible reversal in the upward trend of the past ten years.

Figure 1. US H-1 visas issued by country of origin, 1989-99



Source: OECD, adapted from Lowell, 2000.

In Japan, against a background of stagnating flows of non-temporary new entrants from 1992 to 1998, the number of highly skilled S&T workers grew by 8% a year (Table 4). The share of this category in total new non-temporary entrants grew by 60%, from 2.7% to 4.4%. Engineers are the main contributors to this increase, followed by professors. This may reflect a growing openness of Japanese S&T to foreign brains, but the level is still very low (the flow of entrant researchers was 0.2% of the number of researchers in Japan in 1997). On the other hand, for 1996-98, there is no evidence of an increase in Japanese researchers and engineers going abroad for non-temporary stays.

Table 4. New non-temporary entrants in Japan

	Share (%)		Annual growth rate (%)
	1992	1998	1992-98
Professor	0.32	0.54	9.19
Researcher	0.32	0.46	6.13
Instructor	0.96	1.25	4.33
Engineer	1.12	2.15	11.42
Total high-skilled S&T	2.72	4.40	8.25
Total non-temporary	100	100	-0.09

Source: Japanese statistics on immigration control, Table 4.

In Australia, as in other traditional immigration countries, net flows of foreign talent are significant: between 1988 and 1996, 30 700 scientists and engineers migrated to Australia, including 22 000 engineers, among whom 7 000 in electronics (Australian Bureau of Statistics). In Ireland, formerly a source country, around half of the 250 000 immigrants in the period 1995-2000 were returning Irish nationals. It is thought that a large share of return migrants are skilled workers. Data

show that among recent Irish emigrants, the number of those in the 25-34 age cohort, where the propensity to return is generally strongest, is decreasing. This decline is expected to continue, mainly because the volume of Irish out-migration fell in the 1990s. As a consequence, Ireland is also seeking to attract non-Irish skilled migrants. In 2000, some 1 400 fast-track work visas[2] were granted to allow foreign professionals to bring their families to Ireland (MacEinri, 2001).

In 1997, according to official Canadian sources (Statistics Canada) on permanent migration of skilled workers, inflows were 33 000 and outflows were 23 000. Hence, Canada is a net recipient of skilled workers. In terms of permanent migration between the United States and Canada, Canada is a net loser (of about 5 000 skilled workers in 1997). In addition, a large share of emigration to the United States (in the range of 9 450-14 250 in 1997) is with temporary visas (H-1B and NAFTA). These figures classify "skilled workers" as managers, teachers, artists, social scientists, engineers, computer and natural scientists (18.4% of skilled emigrants to the United States in 1997), doctors and nurses. In addition, as much as 30% of the outflows to the United States concern highly skilled immigrants who were initially attracted to Canada, and 10-20% of the temporary migrants to the United States are intra-company transfers.

Migration of students: a stepping stone to "permanent" skilled migration?

Students are a central component of international migration of HRST, and the evidence shows that the flows in OECD countries are distinctly skewed and concentrated.[3] More than one-third of foreign students study in the United States, and more than 70% of all foreign students are located in the four leading countries: the United States (37.1%), France (13.9%), Germany (11.9%), the United Kingdom (10.4%). Asian countries are the main sending countries, accounting for 45% of the total number to OECD countries. The high number of foreign students from countries like China, Korea, Japan, India, Hong Kong (China) and Malaysia points to demographic issues but also to active policy initiatives to acquire skills abroad in the region's sending countries (OECD, 2000b).

The population of foreign students at higher levels (master's, PhD, postdoctoral research) is of particular interest to policy makers because many of these students go on to work in research in companies or in public research institutions in the host country. In the United States, the share of foreigners among graduate students and doctoral recipients experienced a sharp increase in the 1980s and has since maintained these high levels (Tables 5 and 6). The share of foreigners is higher in S&E than in other fields; it is especially high (and increased over the 1990s) in mathematics and computer sciences and in engineering. It is higher at the PhD level than at lower levels. Whereas American-born students increasingly tend to favour business, law or medicine, foreigners predominate in science and technology. While Asians predominate among foreign students, the United States nevertheless remains a main destination for European students at the PhD level, although European countries are increasing their attractiveness. In an Italian survey of PhDs' preferences for study abroad, 33.5% reported the United States, but more than 50% reported the United Kingdom, Germany and France. There were differences among disciplines: engineers prefer the United States, but students in disciplines such as social sciences increasingly prefer to pursue further study in Europe (Avveduto, 2000).

Table 5. Share of foreigners in graduate enrolments in S&E in the United States, by field of study
Percentages

	1983	1990	1995	1997
Total S&E	20.2	25.9	23.3	24.2
Natural sciences	17.7	27.3	24.7	23.8
Mathematics & computer science	25.6	32.3	31.8	34.8
Social sciences	12.5	13.7	11.8	12.0
Engineering	30.2	35.5	33.0	36.1

Source: NSF, *Science and Engineering Indicators 2000*.

Table 6. Share of foreigners among earned doctoral degrees in the United States
Percentages

	1977	1989	1995	1997
All fields	13.5	27.1	23.2	28.3
Total S&E	17.4	32.9	28.4	32.9
Natural sciences	16.3	27.8	24.2	30.6
Mathematics & computer science	20.2	44.0	36.6	43.9
Social sciences	12.4	24.8	19.2	23.1
Engineering	32.1	50.9	44.4	45.8

Source: NSF, *Science and Engineering Indicators 2000*.

Foreign scholars and researchers

Foreign scholars are another category of temporary migrants. Statistically, such individuals may be counted as postdoctoral students or visiting researchers under a temporary non-immigrant visa. They include not only postdoctorates in the narrow sense, but also research fellows, young scholars and scientists in "tenure track" positions (*e.g.* assistant professors), as well as guest researchers and visiting professors holding temporary work permits. Data for the United States show that there were 74 571 foreign scholars at US academic institutions in 1999/2000, up 5.8% over the previous year. Much of the increase was due to the sustained flow from China and India, which account for 25% of the foreign scholars in the United States. Over four in ten (43%) foreign scholars in the United States come from Asia. European scholars make up 36% of the scholars in the United States and their number (27 214) has also grown. German nationals (5 016) outnumber those from Russia (3 195), France (3 076), and the United Kingdom (2 916). Russians account for the second largest group of scholars from Europe and the seventh largest worldwide. In the United States, foreign scholars are mainly involved in research as opposed to teaching; over 76.5% are involved solely in research activities. Most of the scholars are concentrated in the fields of health sciences (23.8%) and the life sciences (16.8%) (Open Doors, 2001).

Data on foreign scholars in public research labs in France (Table 7) show that most visiting foreign scholars are concentrated in information and communications technologies (ICT), agricultural sciences and health and medical research. Most foreign researchers in computer science and information technologies (INRIA) come from Europe, followed by North Africa, central and eastern Europe and the Americas. In 1998, the French government reformed the immigration law, creating a residence card with the status of scientific immigrant and granting research institutions the authority to recruit foreign personnel irrespective of national labour market conditions.

Table 7. Foreign scholars in major French public research institutions, 1997

Research institution	Number of visiting scholars[1]
CNRS	338
INSERM	106
INRA	771
INRIA	836
ORSTOM	100

1. Duration of stay is determined by institution guidelines (*e.g.* CNRS: up to three years; INSERM: 6-12 months; INRIA: 6-24 months).
Source: French Senate, 1999.

Flows of highly-skilled workers among other categories of migrants

Highly skilled migrants do not always enter a country as students, business or skill-class immigrants or guest researchers and professors. The highly skilled may also be found among asylum seekers and refugees (UK Home Office, 2001). They may also be found among migrants who enter a country illegally or among migrants who entered a country legally but whose situation subsequently becomes illegal. A survey of illegal migrants found that skilled workers whose situation in France is irregular found undeclared employment in science and language teaching (Garson, 2000). In addition, illegal migrants also enter the education systems of a number of countries. In the United States in 2000 there were an estimated 25 000 illegal immigrants enrolled in American public universities and community colleges, with only 200 at private institutions[4] (*New York Times*, 2001).

Main drivers behind the international mobility of highly skilled personnel

The migration literature classifies international migration as being driven by "push" and "pull", in other words, by supply and demand. Since the beginning of civilisation, intellectual capital has moved in response to demand. During the Renaissance, Italian maritime personnel were hired in Spain while Italian architects and painters were much in demand in France and northern Europe. In 17th century England, Dutch expertise in instrument making and weights and measures was actively courted as a way to help England establish a lead in this area. In the 21st century, demand for IT specialists is driving industrial demand for foreigners with such skills, especially in the United States and in European OECD countries. Among the "push" factors, especially for non-OECD countries, economic distress, underemployment for skilled workers, as well as political instability are often important drivers.

The major drivers of the international mobility of HRST are: relative demand and supply for labour in various countries (including job creation and differences in wage levels); career and earning prospects (which may be related to the way research is organised); attractiveness of the education and research systems; the global R&D activities of companies; and the strategies of individuals seeking international experience. They are investigated in more detail below.

Imbalances in supply and demand lead to greater demand for foreign S&T skills

Differences in labour market conditions are a primary driver of international flows of HRST, but not the only factor. Job opportunities, wages and career prospects for highly skilled workers may differ across countries, leading some to move to where the situation looks more favourable. These

market conditions result from demand and supply forces: on the supply side, the creation of new high-skill jobs differs across countries; on the demand side, numbers of new graduates of the higher education system able to fill such jobs also differ. A gap between supply and demand may result in increased migration. Demand for highly skilled workers is driven by the dynamism of certain activities, notably R&D (private and public sector) and innovation, and by the level of activity in high-technology sectors (industries and services). In such areas, OECD countries have clearly diverged in the second half of the 1990s.

The number of researchers per thousand labour force in the OECD area has grown from 5.5 in 1995 to 6.1 in 1998, after stagnating in the first half of the 1990s. Moreover, there are substantial cross-country differences (Figure 2). Growth has been much higher in the United States than in Japan and the European Union. Certain European countries such as Ireland, Finland, Portugal and Spain have experienced high growth, whereas others (notably Germany) have lagged behind. Overall, the business sector has created more jobs than the public sector.

Figure 2. Growth rate of numbers of researchers, 1995-98
Percentages

Source: OECD, *Main Science and Technology Indicators*.

The number of IT-related occupations has increased very rapidly in recent years (Table 8).

Table 8. Average annual growth rate of employment in ICT industries and services, 1995-98
Percentages

Canada	4.3
Denmark	6.5
Finland	8.6
France[1]	5.8
Netherlands	9.9
Sweden	7.8
United Kingdom	5.6

1. 1997-98.
Source: OECD, 2000c.

Over the past two decades, a slowdown in the supply of skills (especially in the S&T fields) and an acceleration in the demand for such skills is the standard explanation for the increase in wage inequalities between high- and low-skilled workers in the United States and, to a lesser extent, in some other OECD countries. It is probably also one factor behind the increased international flows of highly skilled workers in recent years. Demand for foreign skills in receiving countries may also result from a lack of flexibility for adjusting supply in domestic education systems. Romer (2000) argues that in the United States, the increase of foreign students in science and engineering at the master's and doctoral level in the 1990s compensated for bottlenecks in domestic enrolment of US students at the undergraduate level.

According to the "self-selection model" (Borjas, 1994), skilled workers may be more willing to migrate when the host country offers higher relative rewards for skills (or greater differential between skilled and unskilled workers' wages) than their own country. This has been increasingly the case in the United States over the past two decades and may partly explain the shift in the composition of migrants.

In recent years, there have been claims of a shortage in certain segments of the labour market, especially those related to IT. Recent OECD work (OECD, 2000d) suggests that the evidence is mixed in this regard: although there are shortages of certain specific skills, there is little evidence of an overall shortage. There is more a skill mismatch than a real shortage. However, this mismatch generates tensions on the labour market which have probably affected migration. Industrialists present immigration as a response to this shortage, thereby justifying an increase in quotas and weakening conditions for highly skilled immigrants. International mobility is not, however, the only possible response to rising demand for skills: greater effort to train the national labour force is another, as is foreign direct investment (investing where the skills are located rather than physically recruiting skilled migrants).

In recent years, increased demand for skilled labour, driven by the rapid expansion of technology-based activities, has played a key role in the rise in migration in some countries. As the economy has slowed sharply in certain countries, notably the United States, particularly in the technology sector, international mobility may reverse in the near future.

Differences in expected income are an important aspect of labour market conditions that affect the decision to migrate, especially when these differences are large, as they are between poor and rich countries. In nominal terms, the difference between the wage a programmer can expect in India and in

the United States is usually estimated at around 1 to 10 or more. The effect of wage differentials for countries with similar GDP per capita is less clear, as the cost of moving becomes significant and as wages are not the only factors that the highly skilled may value: quality of work, the possibilities for conducting research or working in their fields of expertise/interest or lifestyle may be more important factors. Regets (2000) shows that the highest share of foreigners among PhD holders employed in the United States is found in fields where the salary is the highest.

Entrepreneurs are at the "high end" of the mobile population, which has a strong impact on the economy although it concerns a small number of individuals. Immigrants have created many companies in the United States (famous examples include e-Bay, Inktomi, 3Com and, earlier, Wang and Intel). Survey evidence indicates that nearly 30% of the Silicon Valley start-ups in 1995-98 were founded by ethnic Chinese or Indians (Saxenian, 2000). Conditions for entrepreneurship differ across countries, in terms of access to capital, competencies, customers and regulatory barriers (some of which may specifically target foreign nationals). Individuals report that potential entrepreneurs in certain countries have gone abroad to carry out their project, as they did not find the necessary conditions in their home countries (in most cases, the lack of investors to fund their project). Also, some individuals who migrated to find a job may start a business after a few years, when they have a better knowledge of the country they moved to.

Quality of higher education and research: attracting the best students from a global talent pool

Temporary migration is often motivated by educational opportunities, especially at the higher level (PhD), or by a desire to acquire international experience and language skills that increase returns to skills in the home country. Insofar as the best students around the world prefer to go to the best universities, wherever they are, differences in the quality of higher education systems are another reason for the international mobility of potential highly skilled workers. In the case of foreign scholars/researchers, working conditions are also important, notably the autonomy given to young researchers (rather than highly hierarchical systems, where senior researchers control resources and choose projects) and the resources available for research (funds, equipment, manpower) (CRIS, 2001).

Barriers to academic employment in sending countries, such as lack of tenure track positions, may also act as a "push" factor, even in advanced countries. The hiring freeze in many higher education institutions in European countries, due in part to budget constraints, combined with the over-recruitment of the 1970s and an increase in temporary employment, has been cited as "push" factor among PhD graduates in several countries. Limited opportunities for academic employment and low research budgets in certain fields have been cited as a push factor in Canada (Finnie, 2001). In France, limited employment opportunities in the public sector, combined with weak industrial demand for S&T personnel at the PhD level, have been evoked as possible reasons for the migration of young researchers (who prefer basic research in universities abroad to applied research at home) (Martinelli, 1999).

International migration of students is influenced not only by the quality of education and research in the host country but also the availability of financial support. The US experience shows that the availability of financial support for academic research is a major pull factor. In 1996, more than 75% of the 10 000 foreign doctoral recipients at US universities reported that their universities were the primary source of support for their graduate training (NSF, 1998).

Surveys indicate that much international migration of scientists and engineers is in fact highly localised around knowledge-intensive clusters and specific research areas (*e.g.* biosciences). In the

United Kingdom, for example, the universities of Cambridge and Oxford alone received some 15% of all foreign academics employed in the country between 1994 and 1997 (Mahroum, 1999). A study of German scholars in the United States found that one-third were employed on the West Coast, with 28% in the academic centres of gravity of California: the San Francisco Bay and greater Los Angeles areas and San Diego. Just under 30% were on the east coast: Boston, New York, Washington, DC (CRIS, 2001).

The attractiveness of a particular knowledge cluster is measured not only by the amount of R&D but also by presence of top researchers in a given discipline. Up to the early 20th century, Germany was the centre of excellence in physics and chemistry, two disciplines that have contributed significantly to modern innovation. Since World War II, and in part as a result of immigration, the centre has shifted to the United States, with Europe as a whole closely behind. The US share of Nobel Prizes in the medical sciences has increased from just over 50% to 74%. Many US Nobel prize winners are in fact concentrated at a small number of research universities (*e.g.* MIT, Stanford, Berkeley) and public labs as well as some R&D-intensive companies (*e.g.* Lucent Technologies). The United Kingdom is also a magnet for foreign researchers in clinical medicine, the life sciences and chemistry. In 1997, data from the Higher Education Statistical Agency (HESA) show that most foreign academics were working in clinical medicine and the that most researchers originate from elsewhere in Europe (45%) followed by North America (Mahroum, 1999).

Immigration and other policy drivers

Despite the increase in flows, international migration remains highly regulated for reasons of sovereignty and protection of domestic labour markets, including wages of nationals, the sustainability of social security systems and social cohesion. Even for the highly skilled, the relative restrictiveness of immigration legislation and related administrative procedures in the host country is a main factor in hindering or facilitating migration. In several OECD countries, notably the United States, Canada, Australia, New Zealand and the United Kingdom, legislative reforms to immigration laws during the 1990s have tightened entry criteria to the benefit of highly skilled migrants. Economic demands from industry (and academia) as well as domestic political pressures to reduce the costs to national welfare systems of unskilled migrants have been behind many of the legal changes. In the United States the Immigration Reform Act of 1990 gave visa preference to applicants with science and engineering skills.

As discussed above, demand for foreign skilled workers and for foreign students in science and engineering is driven in part by the need to meet perceived shortages in the ICT industries. Several OECD countries have initiated policies to facilitate the immigration of so-called IT professionals. Furthermore, in several countries, this category of immigrants is sometimes exempt from labour market tests that aim to limit the replacement of national workers by foreign ones. In France, for example, an administrative decree established that under certain conditions[5] the labour market situation could not be used to oppose the hiring of a foreign computer specialist. The US H-1B visa programme requires labour market testing and obliges companies to pay fees that are used to support training of nationals. Box 1 illustrates some recent OECD-area policy initiatives to attract foreign talent.

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 harmonise 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 programme to issue 20 000 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 198 000 to 248 000. 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 programme whose statutory limit in 2000 is presently set at 195 000 visas per year until 2003.

Source: OECD from various national sources.

International mobility as a component of the globalisation process

According to theory, foreign direct investment (FDI) may either substitute or complement international mobility. On the one hand, multinational enterprises (MNE) may relocate facilities abroad to access low-cost labour instead of creating jobs locally that might be filled by foreign workers. On the other, FDI may also be driven, as illustrated by the evidence on Israel and India, by access to skilled labour, including R&D staff. On the other hand, as physical capital and skills are complements, FDI and international mobility of skilled workers may go hand in hand. When an MNE opens new facilities abroad, at least some high skill (management and technical) jobs are filled by members of the company's senior staff who move abroad.[6] In addition, an MNE may hire foreign staff in their headquarters to act as liaison between their headquarters and their overseas facilities (for example, a Japanese company may hire a few Indians in Japan to act as links to Indian software programmers working in India). An estimate by the Canadian authorities shows the importance of intra-company flows: in 1997, flows of the highly skilled from Canada to the United States were as follows: 5 000 permanent, 9 450-14 250 temporary (H-1B), and 950-2 200 intra-company transferees (L visa). Intra-company transfers thus accounted for 5-10% of the total flows of skilled workers from Canada to the United States.

The increasing internationalisation of research activities is also apparent in the share of joint patent applications by researchers residing in two different countries. These doubled between the mid-1980s and the mid-1990s (Guellec and van Pottelsberghe, 2001). As researchers collaborate more and more across national frontiers, thanks to decreasing transportation and communication costs and to the increasing specialisation of research, they may actually have greater incentive to move abroad, at least at some time during their career.

Economic integration, in particular in terms of the harmonisation of labour rules in certain groups of countries (EU, Nordic countries), may also affect international mobility of skilled workers. In the case of EU member states, free mobility of labour across borders is one element of the Maastricht treaty. In the absence of statistics, it is not clear whether this has affected actual movements, but there is some evidence that the mobility of researchers, many of whom are employed in the public sector, has increased little, perhaps in part because of barriers in public sector labour markets as well language and institutional regulations. Across the EU, much remains to be done to reap economies of scale from an integration of research and skilled labour markets (*e.g.* portability of pension rights, mutual recognition of diplomas). The European Commission has made an easing of the structural conditions for intra-EU flows of labour a priority (declaration by the EC President, Romano Prodi, in April 2001).

Economic impacts of the international mobility of highly skilled workers

The previous section reviewed the main push and pull factors affecting the migration of highly skilled personnel and highlighted some trends in selected OECD countries. Standard assessments of the social and economic impacts of international migration have focused mainly on the fiscal impacts and effects on the labour market, especially in the receiving country (Borjas, 2000a). On balance, much of the research suggests that immigration can confer small net gains on the host country, gains that may be greater in the longer term (OECD, 2000a). With regard to the evidence on the impact of highly skilled migrants in particular, much research in this area has grown out of the literature on "brain drain", which found net losses for sending countries. While research on the migration of scientific personnel has moved forward to integrate the dynamic effects of migration, including return flows of people, capital and technological skills, sending countries remain concerned about a large-scale, permanent loss of skilled workers that would increase the gap in growth between countries and, in the case of the least developed countries, limit their ability to catch up.

In receiving countries, recent research has sought to analyse the effects on the academic and business labour markets of specific categories of highly skilled migrants, such as undergraduate and graduate students, IT personnel, researchers, professors and nurses. Generally, the research, which comes mainly from the United States and Canada, has stressed the benefits of foreign HRST to receiving countries and, in certain cases, to sending countries (Stephan and Levin, 1999; Regets, 2000; Zhao, 2000). Yet there remain concerns over the potential for the crowding out of nationals by immigrants in academic and industrial labour markets and over wages and other incentives for nationals to pursue S&T education and occupations. Table 9 illustrates potential costs and benefits from migration. Insofar as these are unevenly distributed, some countries may experience more negative effects, particularly in the shorter term.

Table 9. Possible economic effects of high-skill international migration

SENDING COUNTRIES: POSSIBLE POSITIVE EFFECTS	RECEIVING COUNTRIES: POSSIBLE POSITIVE EFFECTS
Science and technology • Knowledge flows and collaboration, return of natives with foreign education and human capital, increased ties to foreign research institutions • Export opportunities for technology • Remittances and venture capital from diaspora networks • Successful overseas entrepreneurs bring valuable management experience and access to global networks ***Human capital effects*** • Increased incentive for natives to seek higher skills • Possibility of exporting skills reduces risk/raises expected return from personal education investments • May increase domestic economic return to skills	***Science and technology*** • Increased R&D and economic activity due to availability of additional highly skilled workers • Entrepreneurship in high growth areas • Knowledge flows and collaboration with sending countries • Immigrants can foster diversity and creativity • Export opportunities for technology ***Higher education systems*** • Increased enrolment in graduate programmes/ keeping smaller programmes alive • Offset ageing of university professors and researchers ***Labour market*** • Wage moderation in high growth sectors with labour shortages • Immigrant entrepreneurs foster firm and job creation • Immigrants can act as magnets for accessing other immigrant labour (network hiring effects)
SENDING COUNTRIES: POSSIBLE NEGATIVE EFFECTS	**RECEIVING COUNTRIES: POSSIBLE NEGATIVE EFFECTS**
Human capital effects • "Brain drain" and lost productive capacity due to (at least temporary) absence of higher skilled workers and students • Lower returns from public investment in tertiary education (waste of national public resources)	***Higher education systems*** • Decreased incentive of natives to seek higher skills in certain fields, may crowd out native students from best schools ***Science and technology*** • Technology transfers to foreign competitors and possible hostile countries
POSSIBLE GLOBAL EFFECTS	
• Better international flows of knowledge, formation of international research/technology clusters (Silicon Valley, CERN). • Better job matches, including: greater employment options for workers, researcher's ability to seek the work most interesting to them and greater ability of employers to find rare/unique skill sets. • International competition for scarce human capital may have net positive effect on incentives for individual human capital investments.	

Source: OECD, expanded on the basis of Regets, 2000.

Impact on innovation and entrepreneurship

Contribution to technology-intensive industries

While foreign IT specialists are in demand in many countries, the evidence on their impact comes essentially from the United States which received large numbers of IT experts during the 1990s. These migrants are often credited with having contributed to the rapid development of ICT industries. Most temporary migrants entering with an H-1B visa are ICT experts trained in India, China or Europe. Between 1990 and 2000, they numbered over 750 000 out of a total employment in US ICT industries estimated at 4 521 000 in 1997 (OECD, 2000c). In other words, one-sixth of IT workers were new immigrants. These two figures are not fully comparable, as certain H-1B visa holders are not ICT experts and some are employed in ICT activities in industries other than ICT. Nevertheless, given that some employment in ICT industries does not concern ICT experts, one-sixth may not be an overestimate. The UK national statistics agency reported that immigration of foreign professionals and managerial workers and IT workers helped to restrain wage growth as the economy grew rapidly in London and the Southeast region during the late 1990s (UK Home Office, 2001).

High-technology immigrant entrepreneurs and venture capital

Like immigrants in general, highly skilled immigrants contribute as entrepreneurs. Media reports often cite examples of the success of individual skilled immigrants in receiving countries, particularly in high-technology industries (IT, Internet services, telecommunications). Insofar as skilled immigrants are associated with the creation of firms in fast-growing economic sectors, what are the employment and wealth effects? Research on self-employment of skilled immigrants based on census data in the United States finds that highly skilled immigrants have lower rates of self-employment than nationals. However, self-employed immigrants have higher predicted earnings relative to salaried nationals or immigrants (Lofstrom, 2000). In Australia, a study of the impact of highly skilled immigrants arriving under the "business class" category since 1992 found that 86% were in engaged in a business and that 77% of these businesses were start-ups. The value of investments by these businesses averaged AUD 600 000 (Australian Department of Immigration and Multicultural Affairs, 1998). Another perspective comes from an often-cited survey by Saxenian (2000). According to this study, immigrants from China and India led a quarter of Silicon Valley companies in 1998 and collectively accounted for USD 16.8 billion in sales and 52 282 jobs. As the survey results were based on firms headed by immigrant CEOs, the overall creation of firms and wealth by Asian immigrants is likely to be greater. Comparison of employee/sale ratios between these firms and those of non-immigrants found immigrant firms to be as productive.

While the literature has long recognised the contribution of migrant remittances (*e.g.* from Mexico, India and the Philippines), it is increasingly recognised that highly skilled immigrants can bring venture capital, as well as managerial and technical expertise, to receiving and sending countries. Precise data on the amount of immigrant venture capital flows are non-existent, partly because they largely originate from informal investors and family sources. A survey of the 100 Silicon Valley firms that received the most mainstream venture capital funding in 1998 shows that 7% have CEOs of Asian descent. In 1999, venture capitalists from Chinese Taipei brought at least USD 400 million to Silicon Valley, compared with USD 4.55 billion from American investors (see Box 2). Although small in comparison, the amount of immigrant venture investments is probably greater, given that many ethnic venture capitalists rely on their own communities for talent and identifying opportunities. In the longer term, return flows of people and capital may not only offset some potential negative effects of international migration but also constitute a form of economic development strategy in sending countries. In Chinese Taipei, for example, some 50% of companies emerging from that economy's largest science park, Hsinchu, were started by returnees from the United States. In China, the Ministry of Science and Technology estimates that returning overseas students started most Internet-based ventures.

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 specialise 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 (1 000 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: Mercury News, 2001.

Are foreign scientists more productive?

To the extent that migrants "self-select", there is a perception in both sending and receiving countries that the "cream of the crop" responds to demand signals and that immigrant talent in science and technology is more productive than national talent. An examination of more than 3 000 members of the United States National Academy of Sciences and the National Academy of Engineering, and authors of major scientific papers, indicated that the foreign-born and foreign-educated are disproportionately represented among individuals making exceptional contributions to science and engineering in the United States. Evidence on the contribution of foreign scientists and technologists to innovation in the United States finds that 18.1% of recipients of highly cited patents (the top 3.5% over the period 1980-91) and of innovator awards (1992) are foreign-born. This percentage is significantly higher than the expected one (11.8%), given the composition of the overall population of scientists and engineers with four or more years of college (estimated using the 1982 post-census survey). Moreover, 25% (20 out of 80) of the individuals who were either founders or members of scientific advisory boards for start-up enterprises in the biotechnology industry (those floating initial public offerings over the period 1990-92) are foreign born. Again, this share is significantly different from the expected one (14.1%) given the composition of the highly skilled (MD/PhD) scientific labour force in the life sciences (estimated again from the 1982 post-census survey) (Stephan and Levin, 1999).

The preceding tends to suggest that immigrants contribute disproportionately to innovative capacity in the United States. A pioneering Canadian study of the performance of Quebec university researchers who had emigrated during the period 1994-98 found that the quality of emigrant researchers in natural science and engineering was equal to that of Quebec researchers in terms of number of publications. Quebec emigrants in the social sciences were less productive by this measure (OST, 2000). The results should be interpreted with caution, however, as researchers who leave the country are younger on average, and therefore have fewer publications. It may be that longer-term success in the host country depends greatly on the country of destination and the opportunities for research and innovation available there. Additional research is needed to ascertain whether the quality of immigrants when they entered the host country was superior to that of their colleagues who remained in the home country or than that of nationals in the receiving country. The quality of immigrants may be high if one considers that, in the case of students studying abroad on a temporary basis, the academic institution of the sending countries often plays a role in selecting the best applicants for study abroad (CRIS, 2001).

Foreign students in the higher education sector

Immigration of foreign students has significant costs and benefits for higher education systems in OECD countries. Some are tangible and short-term, such as tuition revenue; others are intangible and longer-term, such as positive network externalities. The impact depends on the size of the population of foreign students in the education system. In countries with high numbers of private and tuition-based tertiary education institutions (*e.g.* the United States, the United Kingdom, Canada), foreign students constitute a source of revenue for the institutions and for consumption in the local economy. A study for the National Association of International Educators (NAFSA) found that immigration of foreign students contributes USD 12.3 billion to the US economy. An estimated 67% of the 515 000 foreign students in the United States in 1999-2000, who account for 3.8% of total enrolment in US colleges and universities, were self-sponsored or fully funded by overseas sources (Open Doors, 2001). The Australian government estimates educational exports to generate AUD 3.5 billion each year.

In many European countries where university tuition is heavily subsidised by the government, the financial costs to the state of providing education to foreign students may exceed the revenue generated. Consequently, certain countries apply different tuition rates for nationals and non-nationals.[7] Net costs, however, also depend on the level at which a foreign student enters the host country's education system and whether he/she remains or departs. In addition, many foreign students, especially at the graduate level, receive some support from their host institution. Institutional support to foreign graduate students may be higher, as government funds are often restricted to permanent immigrants or citizens/nationals. Particularly in the physical and natural sciences, the cost of educating an engineer or computer scientist (PhD level) is higher than that of educating a secondary level graduate. This could also have a bearing on the "net" benefits to the receiving country but also to the individual graduate.

Do foreign students crowd out national students?

The concentration of foreign students in certain disciplines and at higher levels of education has stimulated research on whether foreign students crowd out national students in the education system. From an economic perspective, immigration increases the costs and benefits of education to nationals. Insofar as both groups compete for school slots, the marginal cost to nationals will rise. If the migrants are less skilled, theory predicts that the benefits to nationals will rise owing to greater returns to higher skills. A study by Regets (2000) examined the risk of displacement owing to foreign student enrolment, using the National Science Foundation's *Survey of Graduate Students and Postdocs* (GSS) from 1982 to 1995. Using a pooled longitudinal file with academic departments as the unit of observation, Regets found that an increase in enrolment of 1.0 foreign student was associated with a increased enrolment of one-third (0.33) of a white US student, of an additional 0.02 US under-represented minority student and a decrease of 0.07 US Asian student. With the exception of the small decrease for US Asians, increases in the enrolment of one group were associated with increases in the enrolment of all groups, suggesting that displacement does not take place. However, discussions in the literature have raised the issue of whether displacement may not take place downstream in the educational system where the "marketing" efforts of universities place foreign students at the top of the applications queue, above minorities in the national population.

Impact on the academic labour market and research

Immigration legislation in most countries limits foreign students from participating in the labour market except during holiday periods or for part-time employment in an academic context or for taking up traineeships. Students nevertheless do participate in the academic labour market in several countries, especially at the graduate, PhD and postdoctoral levels, where they may also carry out applied research or patent new inventions. Generally, such employment is tied to the overall financial support foreign students may receive from the host university (*e.g.* tuition exemption, access to university-subsidised housing and medical insurance) or from the host government.

From 1985 to 1996, the number of foreign doctoral students primarily supported as research assistants in the United States more than tripled, from 2 000 in 1985 to 7 600 in 1996 (NSF, 1998). The increase in the numbers of foreign teaching and research assistants has raised the issue of whether this has adversely affected the quality of teaching or the standards of graduate education. Research on PhD completion rates of the foreign-born in the United States found that immigrants have faster and higher PhD completion rates, suggesting that they do not lower standards (Espenshade and Rodriguez, 1997). However, foreign students may have an additional incentive to complete their degrees faster due to relatively higher costs and limited sources of funds in the host country. A study (Borjas, 2000b)

of foreign-born teaching assistants and the academic performance of students at a large public university found adverse effects on the academic performance of undergraduate students in a course on principles of economics. A later study on a similar population by Fleischer *et al*. (2001) found that foreign teaching assistants did not adversely affect student outcomes and to some extent performed better than nationals. Of course, additional research on a longer-term and aggregate basis is necessary to assess fully the impact of foreign teaching assistants across a broader range of disciplines and institutions. One possible implication is that, insofar as language plays a role in the ability of foreign graduate students to contribute to the university's teaching mission, international migration and education policies of host countries must address integration measures and language competence. New Zealand's skilled migration policy, for example, was revamped after it emerged that the contribution of skilled migrants was hampered by lack of language training support.

Impact on the ageing of the researcher labour force

The general migration literature has shown that migration can partly offset more slowly growing or declining OECD populations, even if it is not in itself a solution to the budgetary implications of ageing populations (Coppel *et al.,* 2001). The impact of migration may be greater in segmented labour markets such as those of public research institutions and laboratories. In several OECD countries, the enrolment of students in science and engineering fields has fallen. At the same time, the legacy of massive recruitment in the 1970s in academic employment has resulted in inverted age structures, with many current professors and researchers nearing retirement. However, in many countries, research employment is dominated by the public sector, where provisions regarding employment (including nationality and qualifications criteria) may constitute a barrier to permanent access by foreign skilled migrants.

The labour market for highly skilled workers

Do skilled immigrants displace skilled nationals?

Immigrants in professional occupations have been viewed as providing labour that would not otherwise be available. This perception is reinforced by political and economic agendas but also by immigration itself; in some occupations, immigrants are highly visible and this reinforces the notion of "dependency", especially in areas critical to social economic welfare (*e.g*. high-technology industries, health systems, agriculture). In the United Kingdom, for example, immigrants account for 30% of doctors and 13% of nurses. The positive view of the impact of skilled migrants has also followed as an extension of the migration literature that generally finds that the impact of immigrants on the labour market, relative to nationals, is, in the aggregate, minimal. Borjas (1994), in a well-documented survey of the literature, estimates the elasticity of wages of national to immigrants to be very low (-0.01 to -0.02).

Like migrants in general, however, skilled migrants are a heterogeneous group. Their impact on the labour market may vary according to educational background, labour market status (*e.g.* active vs. inactive; self-employed vs. salaried/wage earners) and occupation (*e.g.* academic vs. IT professional) as well as country of origin. In that skilled migrants may be concentrated in particular labour markets, the costs and benefits of skilled migration may also be quite important to specific occupations and economic sectors. Reliance on foreign skilled labour in a specific field/sector may reduce incentives for nationals to seek certain occupations. There are also long-run effects; the presence of foreign workers may decrease the rate at which wages increase and working conditions improve. Economic cycles also affect the degree to which substitution can take place. During periods of labour shortages,

competition between immigrants and nationals may be muted. An aggregate oversupply or weaker demand might increase competition between the two groups.

There are few comprehensive studies of the success on the labour market of highly skilled immigrants relative to that of highly skilled nationals. Research on the immigration of skilled nurses has found no direct displacement of US registered nurses and no wage differentials between natives and immigrants (Levine *et al*., 1993). According to Regets (2000), an examination of the involuntarily out-of-field (IOF) rate,[8] a measure of labour market distress for PhD holders, showed that there was a negative correlation (-0.36) between the percentage of foreign-born and the IOF rate for recent PhDs across engineering fields. Similarly, there is a positive correlation (+0.75) between the percentage of foreign-born and median salaries for recent PhDs. In general, more foreign-born PhD scientists and engineers are found in fields with good labour market conditions. This association does not prove causation, as healthy fields of study may draw more immigrants or more immigrants may make for a healthier field.

Other research found that foreign-born US PhDs earn higher median wages than native-born, regardless of the time since earning their degree (Anderson, 1996) (Table 10). Case study evidence on the education and wages of foreign-born workers in Silicon Valley's high-technology industries found that 40% of the Chinese and 55% of the Indian-born technology workers had at least a master's degree. However, their wages were on average equal to that of native-born high-technology workers, of whom only 31% had a graduate degree (Saxenian, 2000). This apparent wage differential may have resulted from differences in relevant work experience between natives and foreign-born rather than wage discrimination. Canadian research also finds that in high-demand occupations, such as computer science, immigrants perform nearly as well as nationals, with slight upward and downward differences according to age and length of time in Canada. In 1996, immigrant computer scientists aged 15-49 with less than ten years in Canada earned significantly less than Canadian-born, while immigrants with more than ten years' residency had similar or higher incomes. Analysis of the expected lifetime earnings of young immigrant computer scientists gave results comparable to those of their Canadian-born counterparts (at 1% below the salaries of nationals), suggesting that younger skilled immigrants have a better chance of success on the labour market (Zhao, 2000). Additional research, including from other OECD countries, would be necessary to help identify the extent to which highly skilled immigrants succeed relative to nationals on the labour market and the implications for policy.

Table10. 1993 median salaries of US recipients of PhDs in science and engineering: foreign-born vs. native-born

Years since earning degree	Foreign-born	Native-born
1-5 years since degree	USD 44 400	USD 40 000
6-10 years	USD 55 400	USD 49 200
11-15 years	USD 64 000	USD 56 000
16-20 years	USD 70 000	USD 60 000
21 years or more	USD 70 200	USD 68 000

Source: Anderson (1996) based on an unpublished National Science Foundation tabulation of the 1993 Survey of Doctoral Recipients and the 1993 National Survey of College Graduates. Foreign-born includes naturalised US citizens, permanent residents and workers on temporary visas (including H-1B visas).

Impact of brain drain, brain gain and brain circulation

Even if policy makers and researchers increasingly recognise that migration can no longer be viewed as a zero-sum game, it remains that the costs and benefits are likely to be unevenly distributed,

so that some countries may in fact experience a "brain drain", at least in the short term. Insofar as temporary student flows are a major source of immigration, countries increasingly attempt to monitor students' stay and return rates. Data from the United States show that the share of foreign doctoral recipients with plans to stay in the United States increased significantly over the 1990s. The situation does not differ significantly across fields of study (Table 11).

Survey evidence on the share of foreign PhD graduates in S&T who actually remained in the United States following their degree show that, on average, 47% of foreign-born PhD graduates remain in the United States. There are striking differences among countries of origin, however. The stay rates in China (88%), India (79%) and the United Kingdom (59%) are very high, suggesting low circulation and the risk of brain drain. Other countries have low stay rates, suggesting high circulation and a considerable direct gain from earlier outflows: Japan (13%), Korea (11%), Mexico (30%) (Finn, 1997).

Table 11. Foreign doctoral recipients from US universities with plans to stay in the United States
Percentages

	Plans		Firm plans		Ratio 97/90	
	1990	1997	1990	1997	Plans	Firm plans
All fields						
Asia	45.8	65.6	33.1	46.1	1.43	1.39
Europe	49.2	65.3	37.5	49.8	1.33	1.33
S&E						
Asia	48.2	69.3	34.7	49.0	1.44	1.41
Europe	47.8	65.7	35.9	51.0	1.37	1.42
Engineering						
Asia	47.4	67.3	31.3	46.3	1.42	1.48
Europe	44.9	66.2	31.2	53.2	1.47	1.71

Source: NSF Science and Engineering Indicators, 2000.

Another indicator of potential brain drain or circulation comes from survey data in sending countries. A 1999 survey of French PhD graduates found that three years after completing their dissertation, only 7% of PhDs resided abroad, mainly for postdoctoral work in other European countries. Among French PhD graduates not pursuing postdoctoral work, only 2% resided abroad. Among engineers and researchers, only 1 500 resided in the United States, the same number as for nationals of Hungary and the Czech Republic (Martinelli, 2000). In France, more than 10% of new hires at the national centre for scientific research (CNRS) had undertaken a postdoctoral position in the United States, suggesting a higher return on overseas experience as well as a pattern of brain circulation (*Le Monde*, 5 July 2000). Since 1998, the French Ministry of Research has sponsored a programme to help SMEs recruit postdoctoral students, including those with training overseas.

For sending countries in the developing world with a higher risk of brain drain, programmes to repatriate scientists and engineers from abroad may help some of them to retain talented workers and increase the flows of technology and skills. The World Bank, the International Office of Migration (IOM), UNESCO,[9] non-governmental organisations (NGOs) and other actors in sending countries have long sponsored a number of programmes to foster return migration. Countries that have succeeded in fostering the return of skilled migrants have done so not just through specific return migration programmes but through long-term and sustained efforts to build the national innovation infrastructure. The success of countries such as Korea, India and China in fostering return migration has been attributed to industrial policy and investments in public R&D capacity in those countries

(Meyer and Brown, 1999; Aneesh, 2000). Developing countries with some infrastructure in R&D are more successful in attracting return migrants than those that lack such opportunities. Indeed, there are often media reports of successful Indian entrepreneurs in the United States who establish branches or even firms in India. In 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 (Industry Standard, 2000). China has recently launched "Project 21" which is aimed at developing 100 (selected) universities into world-class institutions that not only provide higher education training but also academic employment and research opportunities. Hong Kong (China) and Malaysia have also announced plans for IT education and training in order to meet domestic demand for skilled workers.

The role of immigrant networks

The existence of "scientific diaspora" and "immigrant entrepreneur networks" can also play a role in helping sending countries capture some benefits and know-how from emigrants overseas (Kaplan, 1997). Such networks are often sponsored at the local and institutional level, but national and international support is often an important catalyst (see the example of South Africa in Box 3). In India, immigrant networks of overseas businesses and entrepreneurs have been the primarily drivers of knowledge and return flows to India (Saxenian, 2000). The Indian government has contributed to the emergence of such private networks through legislative and tax rules that foster remittances and investment by Indians overseas (Aneesh, 2000). South Africa has also developed, in conjunction with a French partner, a database on South Africans abroad (see Box 3).

Box 3. The South African Network of Skills Abroad

The South African Network of Skills Abroad (SASA) was initiated as a joint venture of the Science and Technology Policy Research Centre (STPRC) and the French Institute of Scientific Research for Co-operation and Development (ORSTOM) and is managed by the National Research Foundation. SASA links skilled people living abroad who wish to make a contribution to South Africa's economic and social development and connects them with local experts and projects. The network is built around a database containing information on the location, qualifications and other characteristics of highly qualified South Africans residing abroad and willing to engage in local developments and projects. Although the network is not restricted to former South Africans living abroad, it is principally directed at them. Overseas participants take part in the network by:

- Receiving South African graduate students in laboratories, or training programmes.
- Participating in training or research with South African counterparts.
- Transferring technology to South African institutions.
- Transmitting information and results of research that are not locally available.
- Disseminating cultural and artistic creation.
- Facilitating business contacts.
- Initiating research and commercial projects.

Source: South African National Research Foundation.

Tentative conclusions: policy implications and questions for discussion

This chapter has reviewed the main trends, drivers and impacts of the international mobility of skilled workers, in particular in science and technology. The picture that emerges is that countries whose higher education and research systems are internationalised and which have an environment conducive to entrepreneurship and innovation are generally more successful in increasing the pool of foreign talent (students, scholars, IT workers) in science and technology. In receiving countries, the available literature suggests that the benefits may exceed the costs of migration. However, as these

benefits are unequally distributed throughout the economy, policy responses should be commensurate with social and economic costs in order to limit externalities.

The acceleration in international migration has increased the need for international co-operation in managing legal flows and fighting illegal immigration. OECD countries and sending countries in the developing world have also stepped up dialogue and co-operation, in particular on a bilateral basis, to foster economic development and reduce incentives for emigration. An increase in high-skill migration introduces another challenge into the debate on migration and development: how to share the benefits of foreign talent without hampering the ability of developing countries to access human capital for their own development. For sending countries, even those that have captured benefits (*e.g.* remittances, venture capital) from emigrants, there remain risks of a "brain drain", particularly in the short term.

The challenge for policy makers is to facilitate the circulation of highly skilled workers across frontiers while generating benefits for both sending and receiving countries. Science and technology policies play a key role in this regard. Developing centres of excellence for scientific research and framing the conditions under which technological innovation and entrepreneurship may expand are important for making a country attractive to highly skilled workers, both from within the country and from abroad. While sending countries may view their domestic pool of skills depleted and public investment in human capital lost, those that create opportunities for research, innovation and entrepreneurship at home are more likely to benefit from return flows of migrants, capital and access to international innovation networks.

NOTES

1. Recent debate on the H-1B visa category has raised the issue of whether these visa holders may become *de facto* permanent migrants through changes in status, including to permanent resident (*i.e.* "green card").

2. In Ireland, work permits are issued to non-EEA nationals and mainly for less skilled work. In 2000, 18 000 of these work permits were issued (granted to employers, not employees). Work visas are a new development targeting well-educated and highly skilled migrants in the IT sector and in nursing. In contrast to work permit holders, work visa holders may change employers within the same skills category.

3. For a detailed study on the trends in international students flows, see Chapter 2 in the present volume.

4. According to Michael A. Olivas, Director of the Institute for Higher Education Law and Governance at the University of Houston Law Center, "There are probably another 50 000 to 75 000 undocumented students who are qualified and desirous of a college education, but they are discouraged from applying because of fear of the INS and soaring tuition."

5. The *Circulaire du 16 juillet 1998 relative au recrutement des ingénieurs informaticiens étrangers* gives a foreigner the right to work if he/she has a diploma equivalent to that of French computer engineer, a salary equal to FRF 180 000 gross, and is hired by a firm that has hired computer specialists within the preceding two years.

6. When Renault took control of Nissan, dozens of Renault staff moved to Japan.

7. It is noteworthy that even in the United States where individual states fund much of higher education, non-residents (including US citizens and permanent immigrants originating in other states in the United States) are generally required to pay higher out-of-state tuition costs at public state-funded universities and community colleges.

8. Regets uses a measure of actual labour market distress, as opposed to unemployment, given that PhDs have made a significant investment in a particular field of knowledge.

9. UNESCO's Talven (*Talentos Venesolanos*) network, for example, sponsors the temporary return of expatriate Venezuelan artists and scientists to lecture at home country institutions. Between 1995 and 1998, some 170 expatriates participated in the programme and lectured in over a dozen Venezuelan universities and research institutes (UNESCO, 2001).

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Chapter 4

THE MEASUREMENT OF INTERNATIONAL MIGRATION TO CANADA

by

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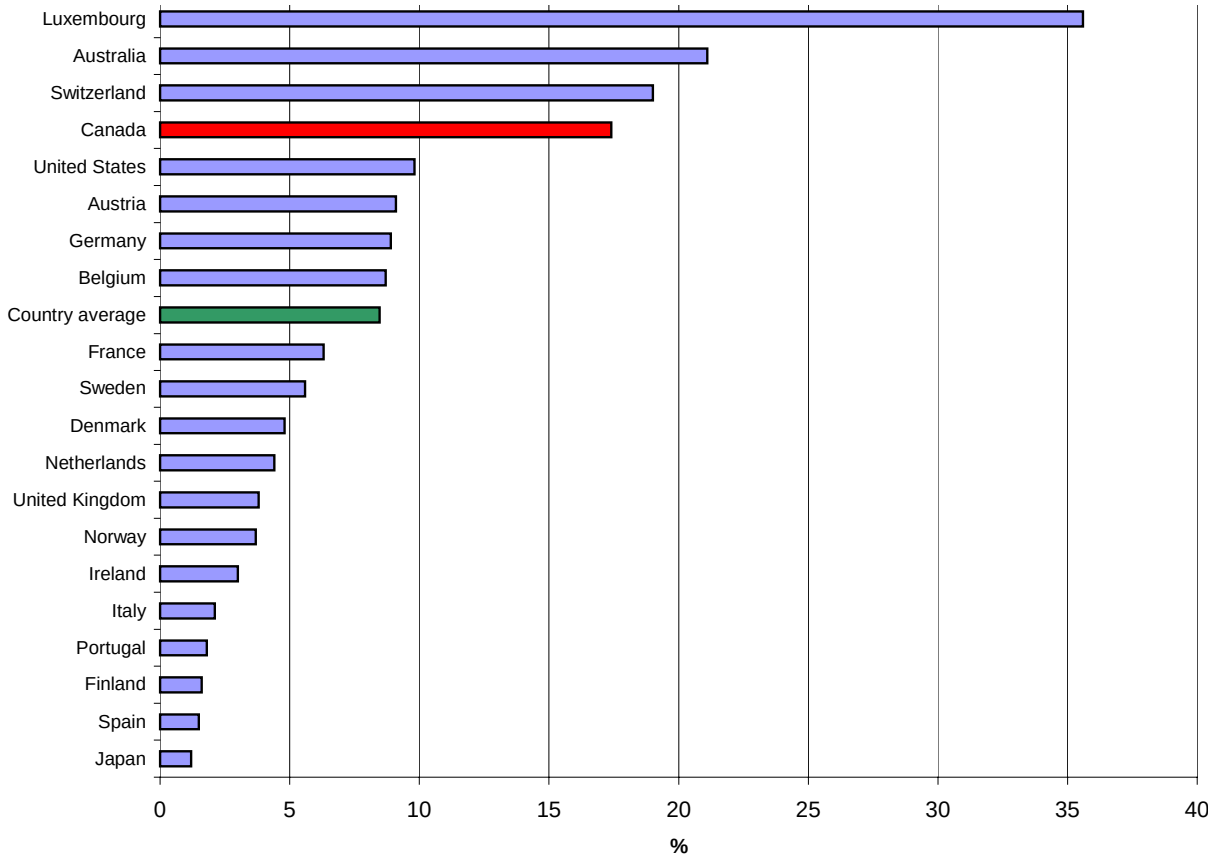
Introduction

A "cultural mosaic", Canada has a higher proportion of immigrants in its population than most OECD countries (Figure 1). With globalisation, movements of goods, services and people have been facilitated, especially between Canada and the United States. This situation has characterised the Canadian population and economy since the Free Trade Agreement with the United States (1989) and the North American Free Trade Agreement with the United States and Mexico (1993).

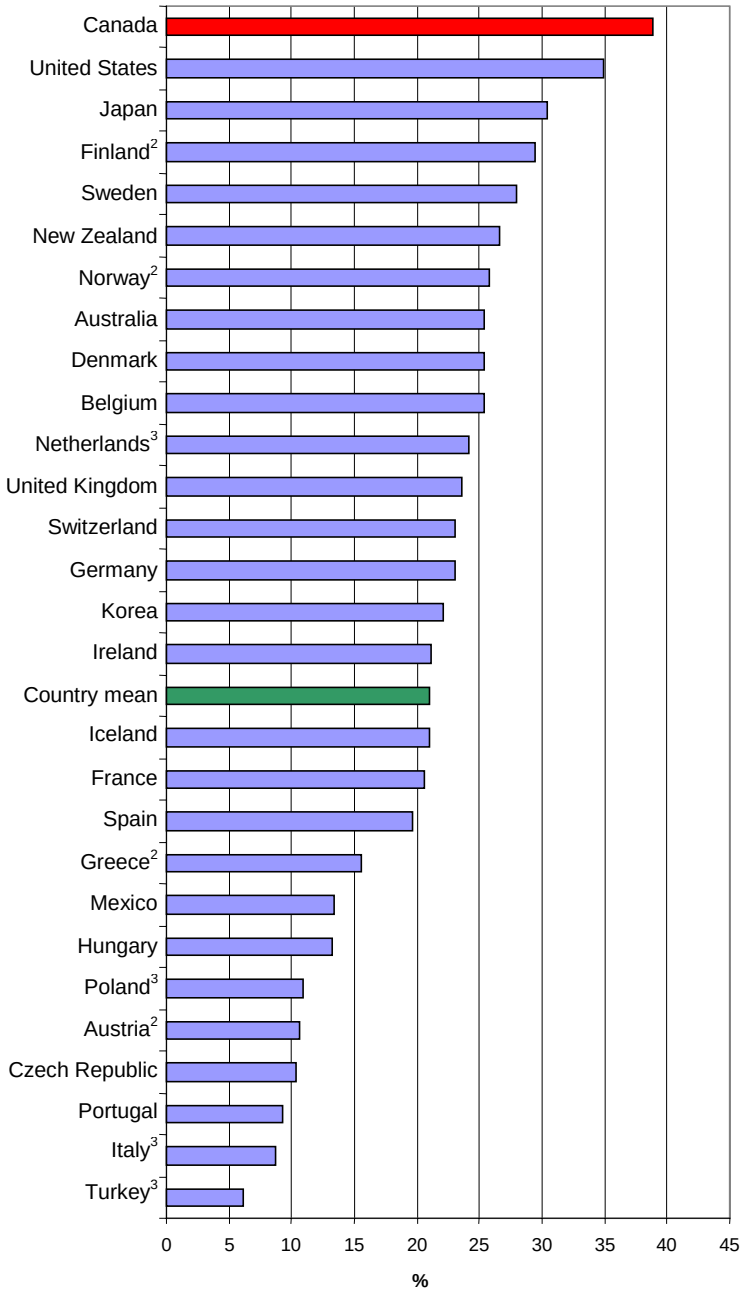
Figure 1. Foreign population, 1998



Source: OECD in Figures, 1999.

A large share of highly skilled workers who emigrate go to the United States, and Asia has overtaken Europe as the main source of new immigrants. Canadian students and workers are relatively free to migrate temporarily or permanently. The Canadian workforce is well-educated (Figure 2) and highly mobile, both internally and externally.

Figure 2. Population with at least tertiary type B education, 1998



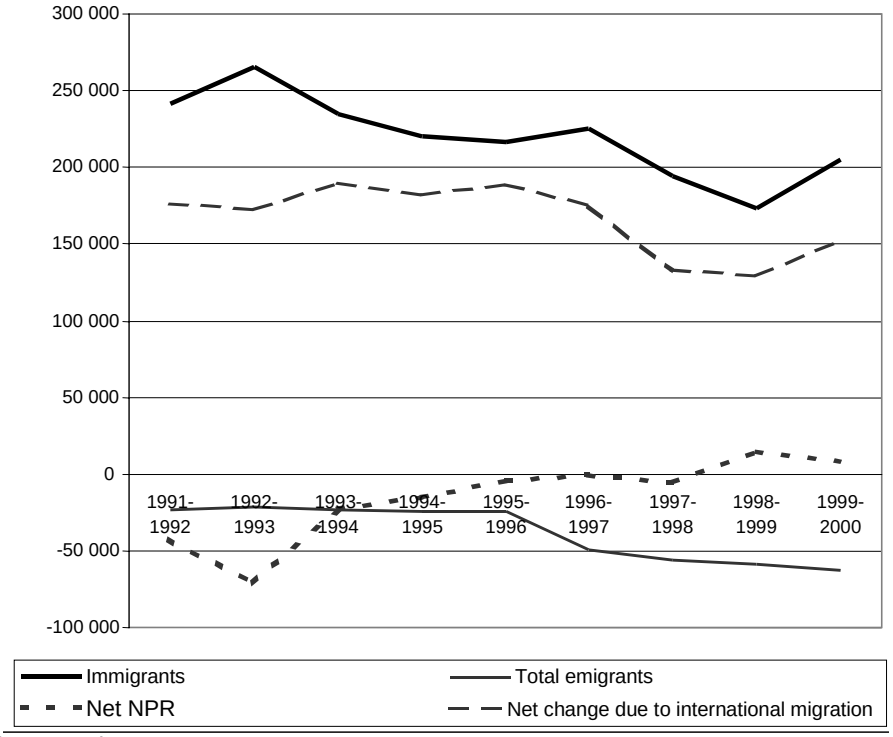
1. The category “at least tertiary type A” includes tertiary type A and advanced research programmes.
2. Year of reference: 1997.
3. The level of educational attainment of tertiary type A includes tertiary type B.
Source: OECD, Education Database.

Current situation

Stocks and flows

Each year, some 170 000 to 260 000 permanent immigrants come to Canada, while some 20 000 to 60 000 emigrants leave the country permanently. The balance of temporary immigration and emigration ranges from negative to positive (Figure 3). It is estimated that about half of permanent emigration and a third of temporary emigration is to the United States.

Figure 3. Net immigration and net non-permanent residents, 1991-92 to 1999-2000



Source: Statistics Canada, 2000a.

Those who come and those who leave

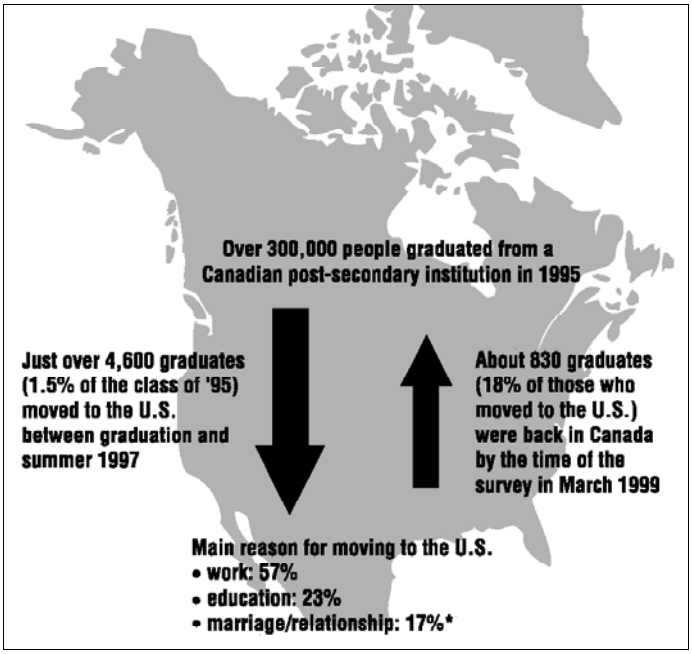
Between 1990 and 1996, 28% of arriving immigrants aged 24-44 years had university degrees, while in the Canadian population, only 17% of this age group had university degrees.

Emigration is harder to measure, since there is no formal procedure for emigration from Canada. The best data are for emigration to the United States (Zhao *et al*., 2000, based on data from the US Current Population Survey and Canadian income tax data):

- There is a greater proportion of emigrants in the 25-44 year age group than in the Canadian population as a whole.
- The share in the higher income ranges (over CAD 150 000/year) is higher than in the Canadian population as a whole.
- About 49% have university degrees.

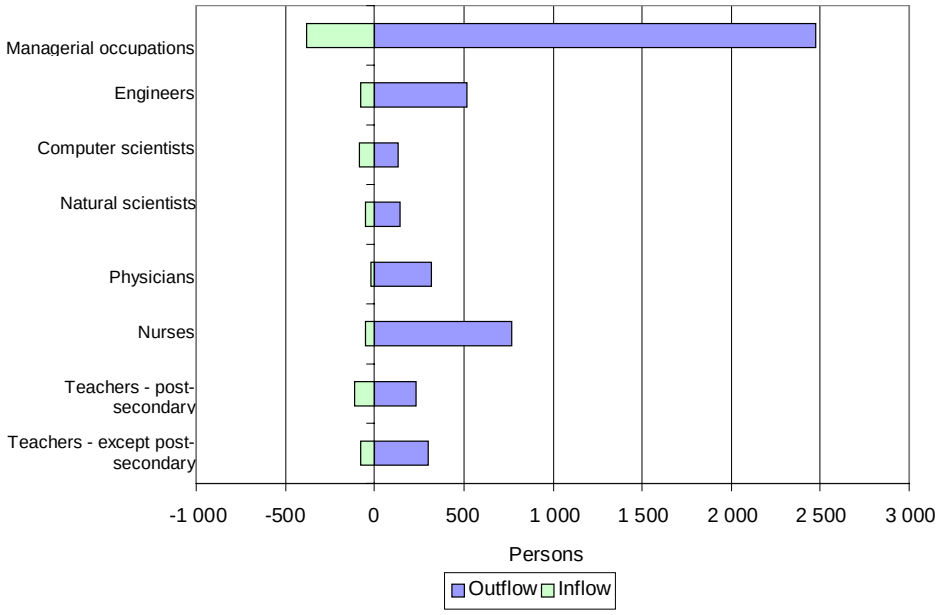
About 1.5% of 1995 university graduates moved to the United States within two years of graduation, but 12% of PhD graduates (Figure 4).

Figure 4. Flow of post-secondary graduates from the class of 1995



Source: Statistics Canada, 1999.

Figure 5. Outflow and inflow from permanent migration between Canada and the United States, selected occupations, total 1990-97



Source: Zhao *et al.,* 2000.

A comparison of balances with the United States by occupation shows net losses in several occupation groups (Figure 5). However, except for the medical profession, the losses are offset by immigration from other countries.

The impact

Industry reports shortages of certain very specialised skills (ACTS, 1999). Skill shortages are likely in niche areas in the near future, because of retirements or difficulties for recruiting. For example, in the automotive and aerospace sectors, a wave of retirements by skilled tradespeople will strain supply channels over the next decade. In other sectors, owing to rapid growth or the need for extremely specialised skills, some firms have difficulty filling positions with fully qualified people. The shortages seem to concern mainly the combination of technical skills with managerial, communication, team building and project management skills.

The immigrant population of the 1990s finds employment, often in sales and services. Their situation is less good than that of those who arrived in the 1980s (Badets and Howatson-Leo, 1999). The situation is similar for recent Canadian graduates.

Data sources and initiatives

Census of population, Reverse Record Check

Reverse Record Check (RRC) is a programme designed to measure gross undercoverage in the Canadian census. Its aim is to estimate the number of persons and households missed in the census and to study the characteristics of such individuals and households and identify possible reasons for their absence. It also gives, as a by-product, estimates of flows for permanent emigration and stock estimates for temporary emigration of Canadians citizens and landed immigrants. These estimates are used by Statistics Canada to benchmark its estimates of emigration every five years.

Data from the 1991 and 1996 RRC indicate an increase of 14% (from 241 600 to 282 500) in the number of permanent emigrants, while the number of temporary emigrants almost doubled (from 84 900 to 154 900, an increase of 45%) in that five-year period.

Up to the 1996 RRC, few characteristics of the persons classified as having emigrated between two censuses or residing abroad at the time of the latest census (age, sex, country of destination) were noted. It was thus known that they were young and that their main destination was the United States (a destination for about 45% of permanent migrants and one-third of temporary migrants). In the 2001 RRC, information will be collected on reason for departure, languages, immigration status, marital status, five-year mobility. Also, to measure the “brain drain” from Canada to the United States, questions on education, occupation and industry are added for emigrant workers or students who have moved to the United States.

Income tax data

Most people in Canada complete income tax forms every year. Residents leaving the country as well as non-residents are obliged to report income earned in Canada. Tax data are used to obtain detailed data on some emigrants, but there are several sources of statistical error.

First, income tax data generate underestimates since not everyone completes a tax return after leaving the country. Dependants are underestimated as they do not always need to be reported on the tax forms. Another source of underestimation involves emigrants who maintain Canadian addresses.

Citizenship and Immigration Canada

Citizenship and Immigration Canada maintains information on permanent and temporary immigrants. Statistics Canada links these data with income tax records to provide a longitudinal (1980-98) economic profile of immigrants.

Longitudinal survey of immigrants

The Longitudinal Survey of Immigrants to Canada is a new survey designed to study how newly arrived immigrants adjust over time and is conducted by Statistics Canada. Citizenship and Immigration Canada will be a primary client for the survey results and has worked in partnership with Statistics Canada to develop the survey.

About 20 000 persons aged 15 or more are to be selected from the approximately 190 000 immigrants who settle in Canada in an average year. Beginning in April 2001, their first interview is to take place six months after they arrive in Canada. The first wave of interviewing will continue until March 2002. Interviews will be repeated two and four years after immigration.

The US Current Population Survey

Since 1994, the US Current Population Survey has collected information on country of birth, US citizenship and year of entry into the United States. Since the survey collects only country of birth and not country of last residence, it only gives the "stock" of Canadian-born persons who reside in the United States at the time of the survey.

The survey provides detailed information about employment and unemployment, earnings, hours of work, occupation, industry and class of worker, demographic characteristics (age, sex, race) and other indicators. The data on those who are foreign-born is usually published in the March supplement because additional data are collected on educational attainment, marital status, geographical mobility, poverty status, income, household and family characteristics, etc.

The sample of Canadian-born residents in the CPS is small and even smaller when one looks at people who have entered the United States in recent years. Hence, standard errors for the estimates are large.

US administrative sources

The US Immigration and Naturalization Service maintains data on permanent immigrants, by country of birth and last permanent residence. For temporary visas, entries, not persons, are counted (*i.e.* one person with multiple entries is counted at each entry).

National Graduates Survey and the survey of graduates who moved to the United States

The National Graduates Surveys are conducted by Statistics Canada in partnership with Human Resources Development Canada. They are specifically designed to obtain information on the relationship between education/training and labour market activities, on the long-term labour market experiences of graduates, their employment, earnings, occupation and additional educational experiences and qualifications (Statistics, Canada, 1998). Every four years, a cohort of new graduates is surveyed. Each comprises on average 40 000 graduates, sampled from a total of approximately 300 000. The survey is conducted two years after graduation and a follow-up is conducted five years after graduation:

Year of graduation	Year of surveys
1982	1984, 1987
1986	1988, 1991
1990	1992, 1995
1995	1997, 2000

In 1999, a special follow-up was conducted to find 1995 graduates who could not be located two years after graduation. A sample of 531 graduates who had moved to the United States were located and interviewed. The 15-minute interview covered the respondent's background as well as work status before moving and reason for moving to the United States.

Canada/US migration study

Both the Canadian and the US censuses contain detailed information on country of birth, age, sex, level of schooling, occupation and industry and labour force participation. A comparative study of the 1980 (US) and 1981 (Canadian) censuses analysed the differences between US-born persons in Canada and Canadian-born persons in the United States. The study was repeated for the 1990/1991 census and will be repeated for the 2000/2001 census.

Other sources

Other sources of data exist but have not been fully exploited. For example, the Labour Force Survey is conducted monthly and collects information on the immigration status of the respondent.

The Workplace and Employee Survey is a new Statistics Canada-Human Resource Development Canada undertaking designed to provide an integrated view of the activities of employers and their employees (Statistics Canada, 2000b). It has both employer and employee components. Employers are sampled by physical location and employees are then sampled from employer-provided lists at each location. The survey enables researchers to link employer policies, practices and outcomes with employee characteristics, activities and outcomes.

Conclusions

Migration of highly skilled workers is a complex issue. Many questions remain about the skills of emigrants and the permanency of their stay. As Zhao *et al.* (2000) note, there are also many questions regarding the extent to which skilled immigrants compensate for losses of skills due to emigration.

Statistics Canada continues to work with other government departments to improve the data to better inform the public debate and policy making.

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Chapter 5

INTERNATIONAL MOBILITY OF HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY IN JAPAN: AVAILABLE DATA, QUALITY OF SOURCES, CONCEPTS AND PROPOSALS FOR FURTHER STUDY

by

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Introduction

International mobility of human resources in science and technology (HRST) has become an important policy issue in Japan. The second Science and Technology Basic Plan, decided by the Cabinet at the end of March 2001, stated that opportunities for foreign scientific and technological personnel to engage in research and development (R&D) in Japan should be expanded, and that the R&D system should be more international. As a result, the government has become more and more interested in statistical analysis and policy formulation relating to international mobility of S&T personnel.

Another sign of reform of immigration policy towards highly skilled workers is visible in the "e-Japan" plan formed by the government in January 2001. The plan clearly states that Japan should receive approximately 30 000 outstanding foreign IT experts by 2005.

However, at this stage, there are no detailed statistical data describing international mobility of HRST in Japan.

Statistics on migrants, immigration and foreign nationals residing in Japan are publicly available and include data on HRST. Among them can be found data on foreign nationals classified by residence status, such as professor, researcher, engineer, college student and others. Although such categories are closely related to HRST, they are not exactly the same. These data, which are broken down by nationality, can be used to calculate rough indicators of international mobility of S&T personnel among countries. On the other hand, data classified by research area, technical field, industry, etc., are not available. The Japanese government should provide material on international mobility of HRST to prepare the coming knowledge-based economy.

This chapter first examines the concepts and definitions relating to migrants, immigration and foreign nationals residing in Japan and then introduces related statistics. The main statistical tables on international mobility of HRST are shown in English in an annex to the chapter.

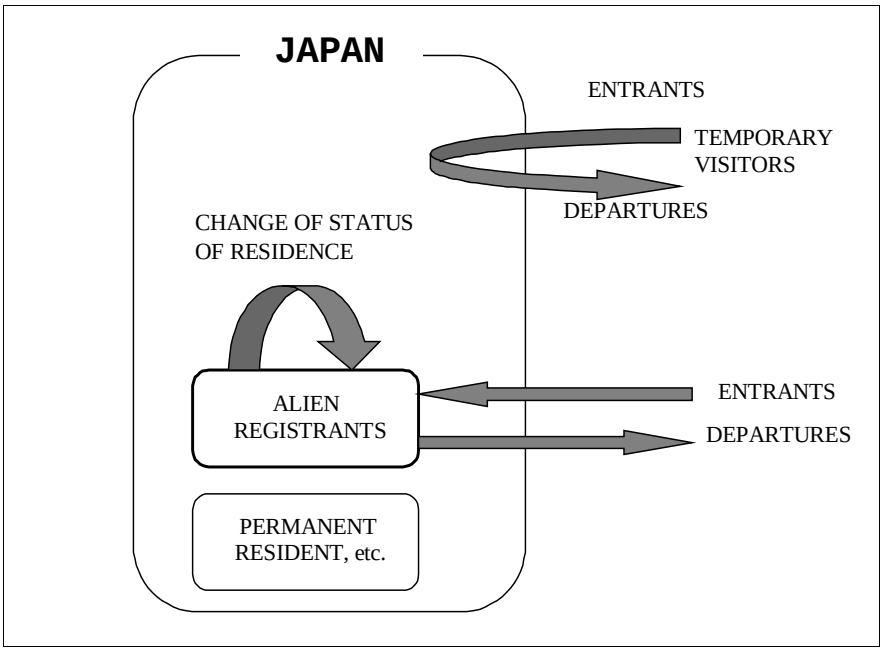
Concepts and definitions

Flows and stocks

Foreign nationals

Figure 1 outlines flows and stocks of foreign nationals in the Japanese Immigration Control system.

Figure 1. Flows and stocks of foreign nationals



Source: Kobayashi (in press).

The flow of foreign nationals consists of temporary visitors and long-stay visitors. Temporary visitor residence status is approved for those who intend to stay fewer than 90 days and is recorded in immigration flow data. There is no need to register as an alien. Therefore, this category is not counted as stock. For those staying longer than 90 days, residence status is accorded on the basis of purpose of visit and is recorded in flow data. It is necessary to register as an alien. This category is included in data on stock.

Residence status can be changed for foreign nationals who have already submitted alien registration forms and remain in Japan. For example, foreign students graduated from universities can change their status to engineer and remain in Japan. Such cases are significant from the viewpoint of international mobility of HRST. Such changes in residential status are the responsibility of Immigration Control and are officially recorded.

The stock of foreign nationals also is divided into two types: long-stay visitors, who remain longer than 90 days and permanent residents.

The stock of long-stay visitors is officially controlled, since they must register as alien residents. However, some foreign residents, such as diplomats and public officials, are not reflected in stock data, because they are not obliged to register as alien residents. From the viewpoint of HRST, this does not matter.

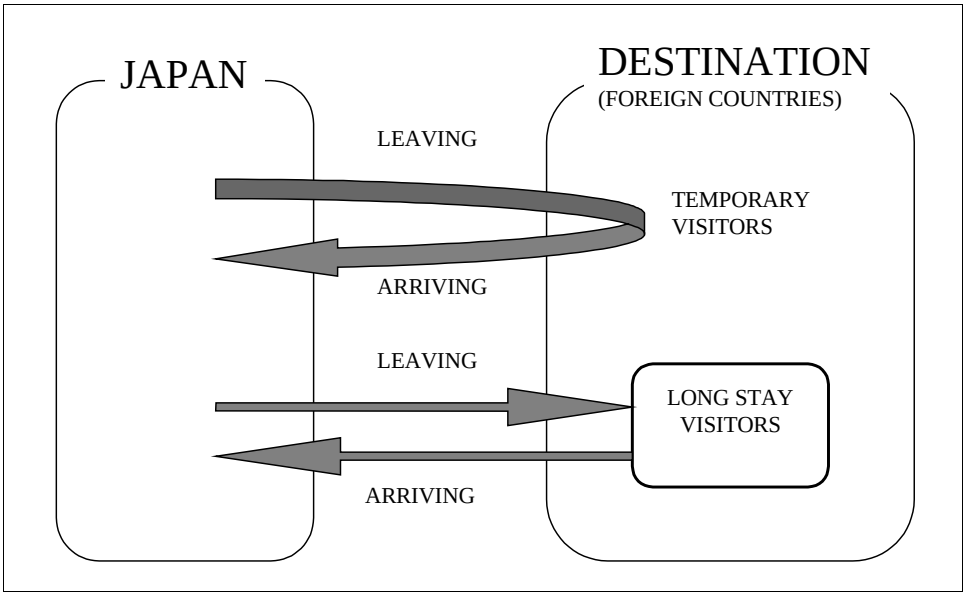
For permanent residents, the period of stay is indefinite. Stock data are officially controlled, since every permanent resident is required to register as an alien. Their residence status does not, however, reflect their activities, so that it is not possible to know whether their activity is science-related or not. However, occupational information can reveal whether their activity is science-related.

Both long-stay visitors and permanent residents must to obtain permission to re-enter before they leave Japan temporarily to visit other countries or regions. Such types of inflows and outflows of foreign nationals are separate from new entries and ordinary departures. From the point of view of the international mobility of HRST, it is necessary to separate out and look at re-entrants, since the flow itself of such permission holders is insufficient to give information on this point.

Japanese nationals

Japanese nationals who visit and/or stay abroad and return to Japan can be conceptualised in much the same fashion as the flows and stocks of foreign nationals (Figure 2).

Figure 2. Flows and stocks of Japanese nationals



Source: Kobayashi (in press).

For leaving and returning Japanese nationals, information about purpose and destination of every visit is maintained by Immigration Control. Those staying in other countries or areas longer than three months or those who are permanent residents abroad should register at Japanese consulates. Hence, data can be obtained on the stock of Japanese nationals overseas.

Science and technology personnel

Foreign nationals

For foreigners entering and/or leaving Japan, data on residence status of individuals are obtained by Immigration Control. This is also the case for long-stay residents and permanent residents. Residence status also serves as a measure for identifying the flow of HRST.

However, temporary visitors are only recognised as temporary visitors, although some data on detailed purpose of visit are exceptionally recorded. It is also impossible to identify whether permanent residents constitute HRST simply on the basis of their residence status. Other data are used to compensate. The following categories are used for residence status: diplomat, official, professor, artist, religious activities, journalist, investor/business manager, legal/accounting services, medical services, researcher, instructor, engineer, specialist in humanities/international services, intra-company transferee, entertainer, skilled labour, cultural activities, temporary visitor, college student, pre-college student, trainee, dependent, designated activities, permanent resident, spouse or child of Japanese national, spouse or child of Japanese resident, long-term resident.

The status of HRST therefore does not exist. Certain types of status are related, such as professor, researcher, engineer, specialist in humanities/international services, intra-company transferee, and college student. These are defined in Table 1.

Table 1. Residence status related to science and technology

Professor	Research activities, direction of research or education at colleges, equivalent educational institutions or *Koto senmongakko* (colleges of technology).
Researcher	Person engaged in research on the basis of a contract with public or private organisations in Japan (excluding the activities described under Professor).
Engineer	Person engaged for a service that requires technology and/or knowledge pertinent to physical science, engineering or other natural science fields, on the basis of a contract with public or private organisations in Japan.
Specialist in humanities/international services	Person engaged for a service that requires knowledge pertinent to jurisprudence, economics, sociology or other human science fields or engaged for a service that requires specific ways of thought or sensitivity based on experience with foreign culture, on the basis of a contract with public or private organisations in Japan.
Intra-company transferee	Personnel transferred to business offices in Japan for a limited period of time from business offices in foreign countries by public or private organisations that have head offices, branch offices or other business offices in Japan and who are engaged at these business offices in the activities described under Engineer or Specialist in humanities/international services.
College student	Study at colleges or equivalent educational institutions.

Source: *Legal Migrants 1998* (in Japanese).

Types of status such as professor, researcher and engineer, have a strong relationship with HRST. However, areas such as philosophy and history with little relation to science and technology are also included under Professor.

Specialists in humanities/international services, intra-company transferees and college students may constitute HRST, but this is not necessarily the case. For example, specialists in social studies, such as economics and policy studies, are included as specialist in humanities/international services.

Intra-company transferees may be either engineers or specialists in humanities/international services, but they fall into the same category. College students are not HRST but may become them and some join in university research activities as part-time researchers.

Residence status categories other than those mentioned in the table, such as medical services, instructor, skilled labour and trainee, may also have a relation to HRST. Medical services include doctors and nurses, including trainees in university hospitals. The category of instructor applies to teachers at primary, secondary and vocational schools. Craftsman and skilled production process worker are classified as skilled labour. Trainees include entrants whose purpose is technical training. It is not necessary to include these residence status categories in HRST, since most are not involved in any S&T-related activities.

Japanese nationals

There are no clear ways of categorising Japanese nationals leaving and returning, or staying abroad, as there are for foreigners.

Japanese travellers are required to declare their purpose of travel while undergoing immigration procedures at Immigration Control. Such purposes include: official, short-term business, to assume post, research, study or technical training, to provide services, to settle permanently, to join family, sightseeing, etc.

In this list, research can be regarded as part of the flow of HRST. However, temporary travel, such as attending an international conference, is also included in most cases. As a category similar to intra-company transferee for foreign nationals, the category "to assume post" includes engineers, who represent HRST, but also managers. Study or technical training includes college students, as well as short-term language studies, and most cannot be viewed as flow of HRST. Occupational data are maintained for Japanese nationals staying abroad. Occupations are roughly categorised as follows: private company, journalist, professional, student/researcher/teacher, official, others. HRST may be found under private company, student/researcher/teacher, as well as many other types of personnel. Therefore, this classification is not very accurate.

The flow of leaving and returning Japanese nationals became unavailable when Immigration Control discontinued keeping records in July 2001. Therefore, the number of Japanese nationals leaving and returning by purpose of travel can no longer be obtained.

Other attributes

Regarding the flow and stock of foreign and Japanese nationals, attributes other than residence status are used, based on variables such as occupation, address in Japan, nationality/area of origin, age, sex, type of work, type of business, period of stay, other. Some statistical data are aggregated in line with those attributes. They can be used for analysis of international mobility of HRST.

Data sources

List of data sources

The following is a list of official statistical reports, which have data relevant to the international mobility of HRST:

- *Legal Migrants*: Immigration Bureau, Ministry of Justice, ed., Printing Bureau (annual).
- *Statistics on Immigration Control*: Japan Immigration Association (annual).
- *Annual Report of Statistics on Legal Migrants*: Judicial System and Research Department, Minister's Secretariat, Ministry of Justice, ed., Printing Bureau (annual).
- *The Immigration Newsmagazine*: Immigration Association (monthly).
- *Statistics on Foreign Nationals Residing in Japan*: Immigration Bureau, Ministry of Justice, ed., Immigration Association (annual).
- *Annual Report of Statistics on Japanese Nationals Overseas*: Ministry of Foreign Affairs, Printing Bureau (annual).

Legal Migrants

Legal Migrants is an annual report compiled by the Immigration Bureau of the Ministry of Justice. It includes Immigration Control data and residence status data on foreign nationals. Such data are compiled from data published in *Annual Report of Statistics on Legal Migrants*, *Immigration Newsmagazine* and *Statistics on Foreign Nationals Residing in Japan*. It is a convenient reference, since the report covers a wide range of data presented as time series. The available data relevant to HRST fall under the following headings (the main tables are translated into English in the appendices indicated):

- Number of new entrants (Annex Table 1) is arranged by residence status. This covers actual entrants, excluding entrants holding permission to re-enter. Residence status includes status relevant to HRST. Therefore, the table shows data on flow of HRST for foreigners.
- Number of Japanese nationals leaving is listed by purpose of travel (Annex Table 2). Status relevant to HRST is included in categories of purpose of travel. This table provides data relevant to the flow of HRST for Japanese nationals; however, as noted above, these data can no longer be obtained.
- Number of permissions to change residence status from college student to permitted to be employed in Japan can be obtained by nationality/area of origin and new status. Annex Table 3 shows the number of such permissions. College students are relevant to HRST. Under the new status, specialists in humanities/international services, engineers, professors and researchers are the most likely to be relevant for the flow of HRST. The table provides information on those whose former residence status was that of college student. As for nationality/area of origin and new status, the categories are merged into "miscellaneous", except major ones.

- The number of alien registrations is shown by residence status (Annex Table 4). Status relevant to HRST is included in residence status. The table provides data relevant to the stock of HRST for foreign nationals.

- The flow (new entrants) and stock (alien registration) of college students, researchers, engineers, specialists in humanities/international services, intra-company transferees, which are relevant to HRST. They are listed by nationality/area of origin in this report.

Data in the report are given in time series and are therefore convenient for seeing the broad lines. However, the report makes few two-way or three-way tabulations using important attributes to analyse the international mobility of HRST.

In addition, regarding the flow and stock of foreign nationals, the data are not suitable for use as basic data to build a flow matrix from nation to nation because they only give nationality/area of origin of foreign nationals. Furthermore, data describing destinations of Japanese nationals are not listed.

Statistics on Immigration Control

Statistics on Immigration Control is the annual report compiled by the Immigration Association. It includes many statistics regarding immigration control and foreign residents. As for *Legal Migrants*, the data are not original but are rearranged from data in the *Annual Report of Statistics on Legal Migrants*. There is some data overlap with *Legal Migrants*.

Here again, some data are given as time series. However, there is less variety than in *Legal Migrants*. All of the data in the report reproduce existing official statistics reports. They are useful since they are presented in both English and Japanese. The available data are as follows.

- For new entrants, the table is the same as in *Legal Migrants*, but covers a different period. The data are relevant to the flow of HRST for foreign nationals. Data on new entrants classified by nationality/area of origin are available in table form. The table is compiled from the *Annual Report of Statistics on Legal Migrants*, described below. The data can be used to produce a flow matrix among countries since nationality/area of origin is almost always listed as a criterion of classification. Purpose of stay, including cultural activities, for temporary visitors is also available from the data.

- There is a table with data on departures of Japanese nationals classified by two criteria, destination and purpose of travel for a specific year. It can be used to estimate the flow among countries, since almost all destinations are included. Purpose of travel includes categories such as research and study or technical training. Therefore, the flow of HRST for Japanese nationals can be known to some extent. Data in this table are based on original data provided by *Annual Report of Statistics on Legal Migrant*s. However, as Immigration Control has discontinued collection of such data, they are no longer available.

Annual Report of Statistics on Legal Migrants

The *Annual Report of Statistics on Legal Migrants* provides the basic statistical data relevant to the international flow of Japanese and foreign nationals. The report is compiled from Immigration Control statistics by the Ministry of Justice.

- Three basic tables on total entrants, new entrants and re-entrants cover entry of foreign nationals. All include nationality/area of origin and residence status. Re-entrants are those who hold permission to re-enter. The tables on new entrants are suitable for use for flow data on total entrants, new entrants and re-entrants. Table data can be used to calculate the flow of HRST, using status of resident as a criterion. This can be used as a basis for building a flow matrix, since nationality/area of origin are shown in detail.

- Two tables cover departure of foreigners: total departures and departures with permission to re-enter. Both are collected by nationality/area of origin and residence status. Data for departure without permission to re-enter should be used, if new entrants are used as entrant data. However, the report does not provide such data. Therefore, it is necessary to estimate net departures by subtracting departures with permission to re-enter from total departures. These tables can thus be used to build the flow matrix among countries, since the detailed data include nationality/area of origin.

- In the case of new entrants as temporary visitors with designated activities, the relevant table shows purpose of entry by nationality/area of origin. The category of cultural activities includes research-related activities. The table is valuable for examining temporary mobility, since it complements data on entrants.

- There is a table showing departures of Japanese nationals classified by destination and purpose of travel. It can be used as the basic data to estimate flows among countries. Temporary visitors are also included. The table is valuable for estimating temporary mobility of HRST, for example technical instruction. However, although temporary mobility is excluded from the analysis, the data do not allow for distinguishing temporary visitors from all Japanese leaving.

- Another table gives data on arrivals of Japanese nationals by period of stay and purpose of travel. Temporary visitors can be identified on the basis of their account of the period of stay. However, the table lacks information about destination of travel. Here again, the breakdown can no longer be obtained owing to the discontinuation of the work of Immigration Control in this respect.

This report provides the basic data on international flows of Japanese and foreign nationals. However, it has no value for analysing long-term mobility of the Japanese. Other data should be used.

Immigration Newsmagazine

Immigration Newsmagazine provides statistics on immigration, which are collected by the Ministry of Justice and is distributed by the Immigration Association. It annually publishes detailed data regarding new entrants whose residence status is engineer or specialist in humanities/international services, which are principal categories of residence status for new entrants (Annex Tables 5 and 6). Original data regarding status changes of college students, which are not contained in the *Annual Report of Statistics on Legal Migrants*, appear in the magazine.

Relevant data in this magazine are as follows:

- Regarding new entrants approved for status as engineer or specialist in humanities/international services, data are classified by monthly salary, type of business and type of work. Type of business, which has many sub-categories, can be used as an approximate criterion for research field for S&T personnel (see Annex Tables 7 and 8).

However, these data cannot be used to construct flows among countries, since nationality/area of origin is not identified.

- As for permission to change residence status from college student, there are tables classified by nationality/area of origin, new residence status, type of work and type of business (see Appendices 9 and 10). These are original data on foreign residents who are permitted to change status in Japan.

While the data available here are detailed, they cover only a few aspects of the flow of HRST.

Statistics on Foreign Nationals Residing in Japan

Statistics on Foreign Nationals Residing in Japan gives the basic statistical data on the stock of foreign nationals. There are data on current foreign residents, based on the Alien Registration Law, which are compiled by the Ministry of Justice and distributed by the Immigration Association. The usable data in this report are as follows.

- One table gives the number of alien registrants listed by nationality/area of origin and residence status. It can be used as the basic data for the stock of HRST.

- Another table gives the number of alien registrants by address in Japan (Prefecture) and residence status. In addition to such tables relevant to all foreign nationals, data are provided on Korean, Chinese and Brazilian registrants, who form a major part of alien registrants.

- A third table breaks down aliens by nationality/area of origin, occupation and sex. Here again, data are provided on Korean, Chinese and Brazilian registrants. Categories relevant to HRST, such as engineers, professors and teachers and scientific researchers, are available as occupations. However, teachers of primary and secondary education are included among professors and teachers.

This report provides important basic statistical data on the stock of HRST for foreign nationals. It is convenient to use data classified by occupation to calculate the stock, including for permanent residents. However, occupational data should not be used if permanent residents are not included. In such cases, it is better to use data classified by residence status.

Annual Report of Statistics on Japanese Nationals Overseas

The *Annual Report of Statistics on Japanese Nationals Overseas* gives basic statistics on the stock of Japanese overseas. Both those who stay abroad longer than three months and permanent residents have to register at local Japanese consulates. The Ministry of Foreign Affairs develops statistics based on these registrations. However, it is not a complete survey.

This report makes available a table showing the number of long-stay visitors classified by country/area and occupation which should make it possible to count the number of HRST for overseas Japanese. However, as the only relevant categories are those such as student, researcher and teacher, it is not possible to identify S&T personnel sufficiently.

The table does not provide enough information, although it is the only data source on HRST for overseas Japanese.

Available data

Table 2 summarises the available data sources according to the conceptual framework of stock and flow of foreign and Japanese nationals introduced at the beginning of this chapter. The Ministry of Justice has decided not to survey destination and purpose of travel for Japanese nationals at Immigration Control after July 2001. Therefore, it is feared that the *Annual Report of Statistics on Legal Migrants* will not continue to be published and that flow data for Japanese nationals will not be available.

Table 2. Available data on international flow and stock of HRST

Data	Classification	Range of data	Note	Identifying S&T personnel	Data source
Foreign nationals					
	Nationality X Residence status	All		Better	*Annual Report of Statistics on Legal Migrants*
New entrants	Monthly salary, type of business, type of work	Partial: Engineer and Specialist in Humanities /International Services	No nationality classification	Partial	*Immigration Newsmagazine*
Departure	Nationality X Residence status	All: leaving without permission of re-entering	Calculation required	Better	*Annual Report of Statistics on Legal Migrants*
Status change	Nationality X New residence status	Partial: college students		Partial	*Immigration Newsmagazine*
	Types of work, types of business	Partial: college students	No nationality classification	Partial	*Immigration Newsmagazine*
Registrants	Nationality X Residence status	All		Better	*Statistics on Foreign Nationals Residing in Japan*
	Nationality X Occupation X Sex	All	Including permanent residents	Not good	*Statistics on Foreign Nationals Residing in Japan*
Japanese nationals					
Arriving	Period of stay X Purpose of travel	All	No destination classification	Not good	*Annual Report of Statistics on Legal Migrants*
Leaving	Destination X Purpose of travel	All	Including short-term travel	Not good	*Annual Report of Statistics on Legal Migrants*
Overseas residents	Destination X Occupation	All	Including permanent residents	Not good	*Annual Report of Statistics on Japanese Nationals Overseas*

Proposals for further study

Problems of indicators

Measuring HRST as a whole

There are basic statistical data on foreign and Japanese nationals who enter, leave and reside. Such data are classified by residence status and purpose of travel. However, there is no category that corresponds exactly to HRST.

A first way to cope with this situation is to change the classifications for official statistical data. This is the best alternative. For the flow of foreign personnel, it is difficult to change the classifications, since these follow the law defining residence status. For stock data, it is possible to change classifications of activity. In this case, however, it is necessary to make clear whether permanent residents are to be included or not.

The second way is to use human resources in existing S&T data. Since there is no specific category for HRST among the categories of residence status, the problem is which residence status or purpose of travel can be used as a proxy for activities relating to science and technology? There are two alternatives: one is to define some categories as HRST; the other is to estimate HRST by dividing relevant categories proportionally. The first lacks accuracy but is easier to do. The second, which is preferable, needs further investigating regarding methods of estimation. Development of a method of estimation is the next target.

The third way is either to seek new statistics or produce new files. For instance, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) publishes statistics on foreign professors in universities, although the data are not classified by research fields. In 1999, among 147 579 university faculty, there were 4 776 foreign professors.

The population census is carried out every five years in Japan. The report contains tables describing the number of employed foreigners by nationality, occupation and sex. However, occupations are roughly classified. The number of HRST is not explicitly given. In principle, anyone seeking to use such data for non-profit purpose is allowed to use raw data files with official permission. Though the procedure for obtaining permission is usually lengthy, files of the population census can be used to estimate foreign S&T personnel in Japan.

Breakdown of HRST

Certain types of data on HRST, such as type of business or type of work, can be gleaned from statistics in Japan. However, data on educational background, research field, technological field, age distribution, etc., are not provided. The problem is to obtain new data to study the breakdown of HRST.

Studying international mobility of HRST in Japan

International mobility of human resources remains at a low level in Japan owing to its geographic situation. In addition, there are not many permanent or long-stay residents. However, the trend of accepting more foreign S&T personnel is increasing. It is not rare for Japanese technicians/engineers

to visit and train abroad. It becomes important for Japan to study the international mobility of human resources. Obviously, it is necessary to collect the relevant data and to conduct case studies.

As described at the beginning of this chapter, the second Science and Technology Basic Plan stated that opportunities for foreign S&T personnel engaged in R&D in Japan should be expanded. Thus, the government has become more interested in statistical analysis on international mobility of S&T personnel. Some changes have appeared.

The MEXT conducted a survey of R&D in the private sector. The survey included a questionnaire about the number of foreign researchers. The results are to be described in the White Paper on Science and Technology.

The Survey of Research and Development carried out by the Statistics Bureau of the Ministry of Public Management has been revised to meet a new policy demand and in response to discussions at the OECD's NESTI. Among many issues to be reviewed, the number of foreign S&T personnel is one of the most important points from the viewpoint of policy makers, but the Statistics Bureau is reluctant to include a questionnaire on this topic.

Also, the Council for Science and Technology Policy (CSTP) in the Cabinet Office, which was established at the beginning of this year following the government reform, intends to survey annually the number of foreign S&T personnel in the public and university sector.

In sum, the present situation is very fluid. At the next stage, it would be necessary to investigate how the government could promote international mobility and how international mobility of HRST could affect S&T activities, the national economy and so on.

ANNEX TABLES

Annex Table 1. Number of new entrants by residence status

Status/year	1992	1993	1994	1995	1996.	1997.
Total	3 251 753	3 040 719	3 091 581	2 934 428	3 410 026	3 809 679
Professor	843	1 045	1 187	1 296	1 309	1 463
Researcher	860	812	862	870	1 080	1 251
Instructor	2 573	2 635	2 506	2 963	2 847	3 068
Engineer	2 979	1 758	3 194	3 717	4 426	5 128
Specialist in humanities/international services	5 703	5 265	5 198	4 982	6 144	6 709
Intra-company transferee	4 639	4 438	3 076	3 074	2 831	3 354
Skilled labour	2 441	1 768	2 071	2 210	3 336	2 833
College student	10 368	10 722	10 337	10 155	11 717	12 408
Pre-college student	27 367	18 127	11 947	9 928	9 436	11 755
Trainee	43 627	39 795	36 612	40 591	45 536	49 594

Source: Legal Migrants 1998 (in Japanese).

Annex Table 2. Number of Japanese nationals leaving by purpose of travel

Purpose of visit/year	1992	1993	.1994	1995	1996	1997
Total	11 790 699	11 933 620	13 578 934	15 298 125	16 694 769	16 802 750
Study or technical training	130 401	136 162	151 318	165 257	180 086	187 257
Research	91 606	90 047	98 837	104 430	110 390	109 756
To assume post	38 473	39 516	41 992	46 239	49 591	52 549

Source: Legal Migrants 1998 (in Japanese).

Annex Table 3. Number of permissions to change residence status from college student to permitted to be employed in Japan

Status/year	1992	1993	1994	1995	1996	1997
Total	2 181	2 026	2 395	2 390	2 927	2 624
Specialist in humanities/international services	1 284	1 170	1 480	1 478	1 880	1 620
Engineer	682	657	643	614	734	711
Professor	68	97	108	129	144	144
Researcher	89	50	65	80	76	90

Source: Legal Migrants 1998 (in Japanese).

Annex Table 4. Number of alien registrations by residence status

Status/Year	1992	1993	1994	1995	1996	1997	1998
Total	1 281 644	1 320 748	1 354 011	1 362 371	1 415 136	1 482 707	1 512 116
Professor	2 575	3 182	3 757	4 149	4 573	5 086	5 374
Researcher	1 328	1 477	1 697	1 711	2 019	2 462	2 762
Engineer	9 195	9 922	10 119	9 882	11 052	12 874	15 242
Specialist in humanities/ international services	21 863	23 455	24 774	25 070	27 377	29 941	31 285
Intra-company transferee	5 135	5 718	5 841	5 901	5 941	6 372	6 599
College student	56 309	60 110	61 515	60 685	59 228	58 271	59 648

Source: Legal Migrants 1998 (in Japanese).

Annex Table 5. Specialists in humanities/international services and engineering, newly entering by type of business

Status/type of business	Manufacturing	Others	Total
Specialist in humanities/international services	377	6 565	6 942
Engineer	854	2 439	3 293
Total	1 231	9 004	10 235

Source: Immigration Newsmagazine, August 1999 (in Japanese).

Annex Table 6. Specialists in humanities/international services and engineering newly entering by type of business (manufacturing)

Status/type of business	Electrical	Machinery	Telecom-munication	Automobile	Chemistry	Food	Textile	Steel	Others	Total
Specialist in Humanities/ int'l. services	85	48	13	21	19	32	41	1	117	377
Engineer	304	115	68	60	38	15	6	7	241	854
Total	389	163	81	81	57	47	47	8	358	1 231

Source: Immigration Newsmagazine, August 1999 (in Japanese).

Annex Table 7. Specialists in humanities/international services and engineer, newly entering by type of business (not manufacturing)

Status/type of Business	Education	Commerce/ Trade	Computer Service	Finance	Transpor-tation	Construction	Professional	Public organisation
Specialist in humanities/inter-national services	4 364	586	122	388	123	33	170	174
Engineer	59	148	1 661	125	39	93	7	1
Total	4 423	734	1 783	513	162	126	177	175

Status/type of Business	Journalism	Research	Publishing	Hotel	Advertising	Others	Total
Specialist in humanities/inter-national services	82	13	54	33	41	382	6 565
Engineer	6	15	2	1	16	266	2 439
Total	88	28	56	34	57	648	9 004

Source: Immigration Newsmagazine, August 1999 (in Japanese).

Annex Table 8. Specialists in humanities/international services and engineering, newly entering by type of work

Status/ type of work	Education	Translation/ interpretation	Technological development	Design	Overseas business	Information processing	International finance	Sale/business
Specialist in humanities/ international services	4 310	673	45	31	163	37	256	259
Engineer	56	59	1 393	309	90	991	11	34
Status/ type of work	Legal service	Trading business	Management	Research	Advertising/ public relation	Journalism	Others	Total
Specialist in humanities/ international services	185	121	201	38	32	36	555	6 942
Engineer	1	2	58	50	2	1	236	3 293

Source: Immigration Newsmagazine, August 1999 (in Japanese).

Annex Table 9. Permission to change residence status from college student, by nationality/area of origin and new residence status

Nationality/ residence status	Specialist in humanities/ international services	Engineer	Professor	Research	Total
China	907	500	65	53	
Total Asia	1 320	705	113	77	
Total Europe	23	7	10	3	
United States	13	1	3	1	
Total North America	16	1	3	1	
total South America	5	5	2	2	
Total Oceania	11	0	0	0	
Total Africa	5	3	4	2	
Total	1 380	721	132	85	2 391

Source: Immigration Newsmagazine, August 1999 (in Japanese).

Annex Table 10. Permission to change residence status from college student, by major types of work

Type of work	Number of permissions
Translation/interpretation	709
Technological development	336
Sale/business	183
Overseas business	163
Education	131
Information processing	124
Design	119
Research	108
Management	96
Trading business	87
Advertising/public relation	20
Medical service	18
Accounting	15
Journalism	12

Source: Immigration Newsmagazine, August 1999 (in Japanese).

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Chapter 6

A BRAIN DRAIN AMONG YOUNG PhDs: MIRAGE OR REALITY?

by

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Céreq, France

Introduction

As part of its work for France's *Observatoire National des Entrées dans la Vie Active*, which monitors labour market entry, Céreq conducted a survey in 1999 among PhD graduates who had left higher education in 1996 (Box 1). 2 000 graduates were interviewed, with the help of funding from the Ministry of Research. The survey covered PhDs who had remained in France but also those who had moved abroad.

The 1999 Céreq survey on labour-market entry by PhDs who graduated in 1996

The survey on PhD graduates and labour market entry covered French PhD graduates (excluding doctors of medicine) who qualified in 1996, were under 35 years of age and had entered the labour market. Many of the 1996 PhD graduates (particularly in the humanities) were relatively old. Because the focus was on labour market entrants, the survey was confined to those aged under 35 in 1996.

It was also confined to French PhDs for several reasons. It is practically impossible to contact foreign PhDs who have returned to their home countries and therefore, the findings would concern only those who had remained in France and would thus be unrepresentative.

The telephone survey was conducted from April to September 1999. It took the form of an interview with simultaneous computer-controlled data capture (CATI).

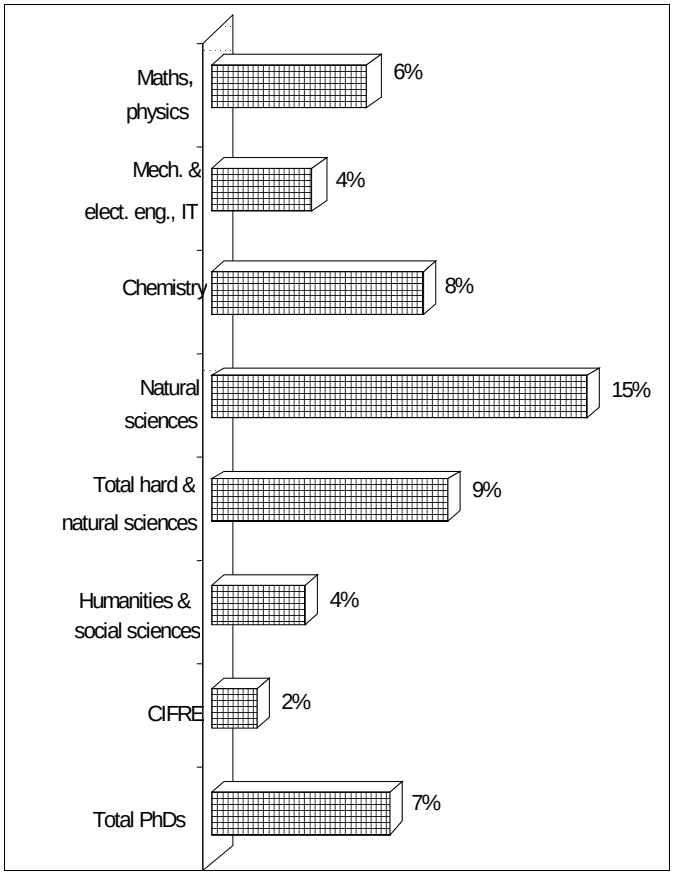
PhDs' telephone numbers were obtained with sophisticated telephone search techniques. Their addresses were matched with those in the France Télécom database. When the numbers were not considered reliable, a country-wide homonym search was carried out. A surname search was also conducted in localities in the vicinity of former places of residence or study. A final search was carried out manually, via the Minitel.

It was possible to contact 2 131 PhD graduates (including 312 CIFRE). These groups are very hard to find and rates of response varied depending on the quality of the available address file (from 62% for CIFRE to 40% for PhD graduates in the arts and humanities).

The findings showed a sharp increase in postdoctorby PhDs i the sciences, much of it abroad (Figures 1 and 2). Almost half of the PhDs in chemistry and life sciences on the labour market for three years had spent time in traiing. Conversely, very few of those with CIFRE (*Conventions*

industrielles de formation par la recherche) or humanities and social science doctorates had spent any time in postdoctorl training.

Figure 1. Share of 1996 PhD graduates abroad after three years on the labour market



Source: 1999 Céreq survey.

No massive brain drain

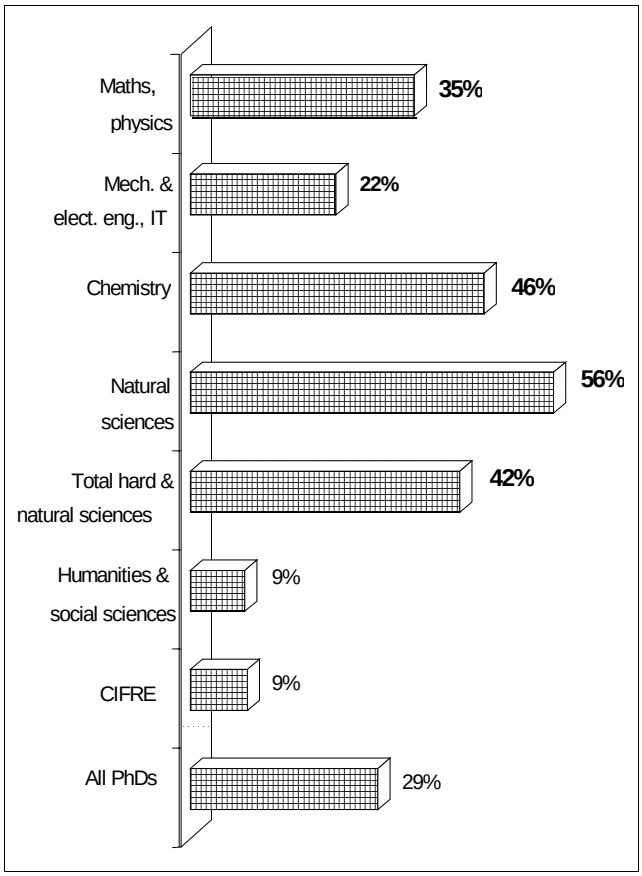
In spite of the increase in postdoctoral training among PhDs in the sciences, only a small proportion lived abroad after three years on the labour market. Of the PhDs who qualified in 1996, 7% were living abroad in 1999 (18% of those with postdoctoral training, 2% of those without).

Among those living abroad in 1999, only 21% did not wish to return to France. Almost 60% wanted to return as soon as possible or in a year's time.

Their circumstances abroad explain why French PhDs wished to return home. Whereas most young PhDs working in France had indefinite contracts in 1999, 79% of those living abroad had fixed-term contracts. Many were on postdoctoral training courses that were satisfactorily remunerated (around FRF 12 500 net). Most expatriate PhDs planned to return to France once they had completed their training.

It is mostly PhDs in disciplines where job opportunities do not abound who move abroad. For instance, 8% of chemistry graduates and 15% of graduates in natural and life sciences were living abroad after three years on the labour market. Those specialising in the life sciences were probably attracted by the North American boom in biotechnology, a sector that was just beginning to grow in Europe.

Figure 2. Share of 1996 PhD graduates with some post-doctoral training



Source: 1999 Céreq survey.

Early postdoctoral training improves access to research posts

Postdoctoral training is on the rise, mainly in the exact and natural sciences, where the share of PhD graduates with some postdoctoral training rose from 31% to 42% in the space of two years. One-half of PhD graduates in chemistry or the natural sciences had some such training in the three years following their degree. In an overwhelming majority of cases, this took the form of fixed-term posts in public-sector research abroad.

The impact of postdoctoral training on one's chances of finding a job has changed in the space of two years. Postdoctoral training no longer appears to be a drawback when seeking employment. In fact, it appears to do much to facilitate access to public-sector jobs. After taking their degrees, those with postdoctoral training take less time to find work thanks to that training. Fewer are unemployed after three years on the labour market. More of them enter public service, which explains why their

pay is slightly lower. Subsequently, however, many PhD graduates with postdoctoral training have fixed-term posts.

Postdoctoral training has a beneficial impact on labour-market entry when it takes place right after graduation (Table 1). It then markedly shortens the amount of time required to find work and does not appear to be a great drawback for recruitment by the private sector. Early postdoctoral training often leads to an indefinite-term post.

Table 1. Labour market access with/without postdoc training
1996 doctorates

Field	Postdoc or not	Indicator					
		Fixed-term first job	Fixed-term job in 1999	Months of unemployment before first job	Unemployment rate in 1999	Share of private sector jobs	Median salary in 1999 (FRF)
Maths, physics, IT	Without postdoc	28%	10%	3.8	6%	51%	13 000
	Postdoc	89%	48%	1.3	4%	24%	12 000
	Total	46%	21%	3.1	5%	43%	12 500
Chemistry, life sciences	Without postdoc	43%	22%	5.2	14%	49%	12 000
	Postdoc	86%	55%	2.3	9%	34%	12 000
	Total	66%	40%	3.7	11%	41%	12 000
All PhDs	Without postdoc	33%	15%	3.7	8%	41%	12 500
	Postdoc	86%	51%	2.1	7%	31%	12 000
	Total	49%	25%	3.2	8%	38%	12 000

Source: Céreq.

Later postdoctoral training has a more negative impact on access to jobs (Table 2). However, a three-year horizon cannot give a sufficient picture of PhD graduate careers after this kind of training.

Today, postdoctoral training appears to be practically compulsory for anyone wishing to enter research after taking a degree in the exact or natural sciences. After such training, almost half of the PhD graduates take up research posts in government laboratories. The rest teach in higher education. But one in two of these posts are fixed-term for those beginning their careers, particularly in government research.

PhD graduates in the exact and natural sciences with no postdoctoral training tend to find employment as engineers in the private sector or as teachers. An overwhelming majority were in indefinite-term posts in 1999.

Table 2. Labour market access by date of postdoc training
1996 doctorates

Postdoc	Indicator					
	Fixed-term first job	Fixed-term job in 1999	Months of unemployment before first job	Unemployment rate in 1999	Share of private sector jobs	Median salary in 1999 (FRF)
No postdoc	32%	15%	3.6	8%	41%	12 500
Postdoc before 1998	81%	22%	1.2	6%	37%	12 000
Later postdoc	93%	67%	2.7	9%	26%	11 500
All postdocs	49%	25%	3.2	8%	38%	12 000

Source: Céreq.

Easier access to the labour market in specialities with few postdoctoral training opportunities

Among science PhDs, those specialising in applied sciences (mechanical or electrical engineering, computing, etc.) and engineering have the best access to the labour market. They soon find work, and unemployment is insignificant three years after graduation. Those with PhDs in the exact sciences (mathematics, physics, etc.) also have good access to jobs, although more are unemployed early in their careers (Tables 3-6).

Table 3. Employment in 1999 of PhDs who graduated in 1996, by speciality

Speciality	Indicators									
	Fixed-term first job	Fixed-term job, 1999	Months of unempl. before first job	6 mos.+ unempl. over 3 yrs.	Unempl. rate in 1999	% of managers in 1999	Net pay[1] in 1999 (Q1)	Net pay[1] in 1999 median (FRF/ month)	Net pay[1] in 1999 (Q3)	Number
Mathematics, physics	45%	20%	3.7	27%	6%	93%	11 000	12 000	14 300	1 080
Mech. & elect. engineering, IT	44%	19%	2.1	19%	3%	94%	11 000	12 000	15 000	1 113
Chemistry	63%	29%	4.6	39%	15%	90%	10 390	12 000	14 500	772
Natural and life sciences	62%	39%	2.9	23%	8%	92%	10 300	12 000	13 700	1 915
Total “hard” and natural sciences	54%	28%	3.2	25%	7%	93%	10 800	12 000	14 000	4 880
Law, economics	27%	10%	2.4	21%	6%	95%	11 700	13 600	21 000	965
Arts, humanities	32%	17%	2.3	16%	6%	86%	10 000	12 000	15 000	1 807
Total humanities and social sciences	30%	14%	2.3	18%	6%	89%	10 500	12 500	16 000	2 772
CIFRE theses	22%	9%	2.8	18%	5%	96%	12 000	14 200	16 000	417
Total PhDs	44%	23%	2.9	22%	7%	92%	10 974	12 300	15 000	8 069

1. Net monthly wage incl. allowances.
Source: Céreq.

Table 4. PhD graduates: number of jobs held in first three years on the labour market

Field	Number of jobs						Average number of jobs
	0 %	1 %	2 %	3 %	4 %	Total %	
Mathematics, physics	2	43	38	15	3	100	1.8
Mech. & elect. engineering, IT	2	30	45	16	7	100	2.0
Chemistry	2	39	40	17	3	100	1.8
Natural and life sciences	1	42	41	15	1	100	1.7
Total “hard” and natural sciences	1	39	41	15	3	100	1.8
Law, economics	1	43	37	17	3	100	1.8
Humanities	3	42	35	15	5	100	1.8
Total humanities and social sciences	2	42	36	16	4	100	1.8
CIFRE theses	2	50	35	12	1	100	1.6
All PhDs	2	41	39	15	3	100	1.8

Source: Céreq.

Table 5. PhD graduates: unemployment before first job

Field	No period of unempl. %	1-6 months %	7-12 months %	Over one year %	Total %	Average number of months	Number of PhDs
Mathematics, physics	66	13	10	11	100	3.8	1 076
Mech. & elect. engineering, IT	69	20	6	5	100	2.1	1 109
Chemistry	54	22	12	12	100	4.6	772
Natural and life sciences	67	18	7	8	100	2.9	1 905
Total “hard” and natural sciences	65	18	8	9	100	3.2	4 862
Law, economics	82	5	7	6	100	2.2	962
Humanities	81	5	6	8	100	2.5	1 794
Total humanities and social sciences	82	5	6	7	100	2.4	2 756
CIFRE theses	75	12	5	8	100	2.8	415
All PhDs	71	13	7	8	100	2.9	8 033

Source: Céreq.

Table 6. PhDs: unemployment in first three years on labour market

Field	No period of unempl. %	1-6 months %	7-12 months %	Over one year %	Total %	Average number of months	Number of PhDs
Mathematics, physics	58	15	11	16	100	4.8	1 076
Mech. & elect. engineering, IT	60	21	11	8	100	3.0	1 109
Chemistry	42	19	19	21	100	6.6	772
Natural and life sciences	59	18	11	12	100	4.0	1 905
Total “hard” and natural sciences	56	18	12	13	100	4.4	4 862
Law, economics	71	8	13	8	100	3.2	962
Humanities	77	7	7	10	100	3.0	1 794
Total humanities and social sciences	75	7	9	9	100	3.0	2 756
CIFRE theses	72	10	8	10	100	3.4	415
All PhDs	63	14	11	12	100	3.9	8 033

Source: Céreq.

On the other hand, access is not easy for chemistry PhDs. They have difficulty finding their first jobs and experience relatively long periods of unemployment early in their careers. In 1999, 15% still had not found work. Of those working, 30% had fixed-term contracts. Their wages were average (FRF 12 000). Chemistry PhDs work largely in the private sector; economic problems in the field at the time of the survey probably explain the poor figures for labour-market entry.

PhDs in the life sciences are in a more favourable situation. They take less time to find work than chemistry graduates, and most do not experience unemployment. However, they are often employed on fixed-term contracts, even after three years on the labour market.

PhD graduates in law and in economics access the labour market under good conditions. They soon find work and gain access more easily than before to management posts in the private sector. They are the highest paid of all those leaving higher education, on a par with CIFRE graduates (FRF 14 000 net in March 1999). After three years on the labour market, over 90% of the PhDs in law and economics held indefinite-term contracts.

PhD graduates in arts and humanities do not have major problems for finding work. However, 14% do not have management status (as engineers, managers in the private sector, researchers or teachers with tenure). Following their degrees, some traditionally become teachers in primary and secondary education. The decline in teacher recruitment at this level is probably a factor in the development of intermediate professions among this category of PhDs.

A closer look at the careers of PhD graduates shows that two-thirds experienced no unemployment during their first three years on the labour market. Those in the humanities and social sciences and CIFRE graduates are particularly well protected against unemployment. PhDs in the exact and natural sciences are the least protected. Of the latter, chemistry PhDs experience relatively long periods of unemployment, 40% having spent more than six months looking for work during the period in question. Conversely, the survey confirms that PhDs in applied science have easy access to the labour market and find work very rapidly. They are also quite mobile, and two-thirds held two or more jobs during their first three years on the labour market.

Chapter 7

WHY DO FIRMS RECRUIT INTERNATIONALLY? RESULTS FROM THE IZA INTERNATIONAL EMPLOYER SURVEY 2000

by

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University of Zurich

Introduction

International mobility of the highly skilled is a hotly debated topic in European labour and education policy, as the recent public discussion of the Green Card initiative in Germany has shown. Scientific research on the topic is lagging behind, however, partly because adequate data are hard to come by. Thus, many basic facts about mobility remain unclear (for some exceptions, see Bittner and Reisch, 1991; List, 1995; and Jahr *et al*., 2001). The lack of data is especially serious for firms, which are the demand side for foreign, highly skilled employees. As a consequence, there has been almost no research on the extent of and the reasons for firms' international recruitment or on the role that international competence or international transfer of know-how play for a firm's success in a globally competitive environment.

The IZA International Employer Survey 2000 was an attempt to fill this gap. It was jointly financed by the German Ministry for Education and Research and the IZA. Fieldwork for this unique Europe-wide firm survey of 850 firms took place in the autumn of 2000. Germany accounts for 340 and France, the United Kingdom and the Netherlands account for 170 each.

This chapter introduces the data set, and then analyses firms' decisions with regard to hiring highly qualified foreign employees. Why do some firms recruit internationally, while others do not, or only on a limited scale? What importance do firms attribute to the institutional barriers for hiring non-EU-citizens? What roles do lack of social acceptance and problems of integration play? How do firms assess their own demand for future years? Only after answering these questions will it be possible to understand the economy-wide importance of the migration of highly qualified people, to define the relevant problems and consequently to evaluate the need and scope for immigration policies by means of a cost-benefit analysis.

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1. Financial support through the German Federal Ministry of Education and Research (BMBF) is gratefully acknowledged. The views expressed are those of the author and do not commit the BMBF. A full report is available in German (Winkelmann *et al.*, 2001). Oliver Bruttel and Stefan Niemann gave excellent research assistance.

Theoretical considerations

Discussion of the importance of international mobility of highly qualified workers needs to address the consequences of globalisation and technological change. Both phenomena have profound implications on the way specialised labour is utilised in production:

- *Shortage of skilled labour*. Technological change has been skill-biased, i.e. it has shifted the demand for labour in favour of highly skilled workers. This process can lead to temporary shortages that can be met by mobility, at least as long as not all countries or regions are equally affected.
- *Diffusion of knowledge*. The speed of technological change, together with increasing competition, implies that it becomes increasingly important to have access to advanced key technologies, while the time available for adaptation becomes shorter. The mobility of highly qualified labour can facilitate the rapid diffusion of knowledge.
- *International competence*. The increasingly international dimension of competition creates an increasing demand for international knowledge. Such knowledge includes the command of foreign languages, markets, cultures, etc.
- *Externalities and spillovers*. Their occurrence in the information society tends to favour spatial concentration, notwithstanding the occasionally voiced expectation that information and communication technologies reduce the need for it.
- *Declining importance of mass production*. Increasingly, products are adjusted to the individual customer, requiring increased flexibility as well as mobility.

The overall effects of globalisation speak for increased demand for internationally mobile, highly qualified employees.

For a different angle on the same issue, one may characterise the relationship between domestic and highly qualified foreign workers as either complementary or substitutable. It is possible that foreign workers possess skills and knowledge that domestic workers do not. In this case, foreign and domestic employees are not rivals but *complements*. On the other hand, it is also possible that foreign workers possess the same skills and knowledge as domestic workers. Recruitment of foreigners will occur for example when they demand lower wages, or when there is a shortage of domestic labour. In this case, foreign and domestic highly qualified workers are rivals, or *substitutes*. If foreign and domestic employees are complements, then increased hiring of foreign employees is advantageous for domestic employees because their marginal product rises. This is not the case if there is a substitutive relationship.

From the firms' perspective, recruitment in foreign labour markets is associated with costs and benefits. Benefits accrue regardless of whether highly qualified foreign employees are substitutes or complements. However, the nature (and therefore potentially also the amount) of the benefit differs. In the case of complementarity, the employment of highly qualified foreign employees positively affects the productivity of other factors, including that of domestic workers. With substitution, this effect does not exist. Here, firms gain either via a reduction in wages or – arguably more realistically – via a reduction or lack of upward pressure on wages in times of skilled labour shortages. Moreover, capital productivity rises.

An alternative point of view emphasises the heterogeneity of workers. If it is possible to recruit both domestic and foreign graduates, vacancies can be filled with better workers because of the larger

pool of applicants. Consequently, employees' skills will on average better match employers' needs. Hence, average productivity increases. Likewise, the "superstar" phenomenon is based on heterogeneity; despite high costs and the uncertainty of success, it may be worthwhile in some cases to compete for international stars, for example to improve reputation.

The benefits have to be compared to the perceived costs of recruiting internationally. Some firms may expect costs to be so high that they never consider employing foreigners. In principle, besides wages, the costs include factors like communication problems, lack of social acceptance by colleagues, information costs, uncertainty with respect to qualifications and difficulties in obtaining a work permit.

The IZA International Employer Survey 2000

The IZA International Employer Survey 2000 appears to be the first data set of its kind. It contains observations for 850 firms, 340 in Germany, and 170 each in France, the United Kingdom and the Netherlands. A firm is defined as the head of human resources' area of competence for recruitment. The sample is confined to five industries and to firms with at least 100 employees. All firms without highly qualified employees were excluded, but the employment of highly qualified foreign workers was not a precondition for inclusion in the sample. The five selected industries (with target/actual percentages in brackets) are:

- Chemical industry (20%/20%).
- Manufacturing (30%/31%).
- Financial services (20%/22%).
- Information technology (20%/16%).
- Research and development (10%/9%).

The sample was stratified by firm size (firms with 100-499 employees and firms with 500 and more employees, each group accounting for 50% of the sample). In the actual sample, 7% of the cases fell below the lower limit. The share of firms with 100-499 employees is 52% and that of firms with more than 500 employees is 39%. For 2% of the firms information on size is not available.

Table 1 displays the share of highly qualified employees (HQE) in the firms interviewed. For the purpose of this survey the category "highly qualified employee" comprises all employees with university degrees, regardless of type. It can be seen that, with a share of 28%, Germany lies close to the overall average.

Table 1. **Average share of highly qualified employees**
Percentage

Germany	28.13
France	39.38
United Kingdom	31.36
Netherlands	19.66
Total	29.00

Source: Author's calculations based on IZA International Employer Survey 2000.

Highly qualified foreign employees (HQFE) are a subset of all HQE. These are employees who received degrees abroad and are not citizen of the country where the firm is located. Table 2 shows the share of firms employing HQFE as well as that of HQFE among all HQE in firms with HQFE, for the four countries surveyed.

It can be seen that in Germany about 39% of the surveyed firms employ HQFE. In these firms their average share in total HQE is 9%. The average share falls to 3.5% (= 9% x 39%) if all German firms are taken into account (rather than only those with HQFE). The international comparison indicates that Germany is very close to the overall average with respect to the incidence of HQFE, while the proportion of HQFE in firms that employ HQFE is below average. Here, the Netherlands leads with a proportion of almost 17%.

Table 2. Employment of highly qualified foreign employees by country
Percentages

	Share of all firms employing HQFE	Average proportion of HQFE in firms with FQHE
Germany	38.91	9.13
France	34.39	10.86
United Kingdom	49.65	10.91
Netherlands	33.33	16.73
Total	38.80	11.08

Source: Author's calculations based on IZA International Employer Survey 2000.

The incidence and proportion of HQFE across the various industries are displayed in Table 3 for German firms and for all firms. Information technology (IT) and research and development (R&D) have by far the highest shares of firms with HQFE and of HQFE among all HQE. Across all surveyed firms, the average share of HQFE is 6.4% for the IT industry, and 9.9% for R&D. However, even in industries where one would expect most HQFE, the average share does not exceed 10%. It is worth noting that in Germany the incidence of HQFE is relatively high in the IT and R&D industries, while the shares of HQFE in firms with HQFE are below the overall average in both of these industries.

Table 3. Employment of highly qualified foreign workers, Germany and other countries, by industry
Percentages

Industry	Share of all firms employing HQFE		Average share of HQFE in firms with FQHE	
	Germany	All	Germany	All
Chemical industry	40.98	41.51	9.93	12.23
Manufacturing	30.17	30.95	7.08	8.73
Financial services	30.77	30.77	4.98	6.08
Information technology	57.14	50.81	10.18	12.65
R&D	68.42	61.43	12.56	16.14
Total	38.91	38.80	9.13	11.08

Source: Author's calculations based on IZA International Employer Survey 2000.

Table 4 gives figures indicating firms' international exposure. In 17.9% of all German firms interviewed, the person responsible for personnel was responsible for foreign subsidiaries. Such firms are here called "multinationals". Ownership structure is a separate issue; 34.6% of all firms are at least partially owned by foreigners. Finally, foreign business accounts on average for 32.2% of all business.

Table 4. International character of German firms
Percentages

	Share
Multinational company	17.9
Foreign ownership	34.6
Main competitor abroad	17.6
English the most important language at management level[1]	85.2
Share of foreign business	32.2

1. German firms with HQFE.
Source: Author's calculations based on IZA International Employer Survey 2000.

Table 5 deals with a further dimension of entrepreneurial activities that may be important with respect to demand for internationally mobile HQFE, namely the firms' technological orientation. Most of the surveyed firms invest actively in R&D. For most of these firms, this is reflected in patent registrations. The table shows that use of the Internet is almost universal, while only 43% have adopted telework.

Table 5. Technological orientation of German firms with HQFE
Percentages

Firm engaged in own R&D	76.5
Telework	42.9
Registration of patents during the last two years	61.5
Marketing and sales via the Internet	86.7

Source: Author's calculations based on IZA International Employer Survey 2000.

The demand for highly qualified foreign employees

This section examines the reasons for and the extent of the recruitment of HQFE. Two dimensions of demand are distinguished. A first is the question of whether or not firms employ HQFE. The second is the share of HQFE among all HQE in firms that employ HQFE. These two dimensions can be viewed as a two-stage decision process concerning recruitment.

A good understanding of the demand for HQFE will shed light on a number of issues. It can help to explain why demand for HQFE is currently relatively low. It is also necessary for estimating potential future developments in demand. Finally, knowledge about the determinants of demand can be used to evaluate a fundamental question. Is demand for HQFE predominantly due to local shortages of skilled labour (in which case they are substitutes), or is it due to their different competencies and qualifications (in which case they are complements)?

This section provides two types of evidence. The first is qualitative in nature, as interviewees were asked about their perceived reasons for recruiting internationally. Second, a quantitative analysis relates a firm's demand for HQFE with its measured characteristics. The section concludes with an international comparison.

Subjective reasons

One advantage of this survey was the possibility of asking the interviewee directly about the reasons for international recruitment. Table 6 shows the responses to a number of items (the questions were only asked of firms that employ HQFE). For example, 51.6% of firms disagree with the statement, "We hire foreign employees because overall they are the best applicants." The highest proportion of "strong agreement" (46%) was to the statement, "We hire foreign employees because they speak foreign languages."

Altogether, the results lead to some initial conclusions about the motives for international recruitment by German firms. Particularly high rates of agreement are obtained for all statements that emphasise aspects of international competence (knowledge of foreign markets, command of foreign languages, especially English). Smaller rates of agreement were obtained for statements that emphasise the comparison with German applicants ("they are the best applicants", "there is a lack of good German applicants"). These results suggest that the evidence is in favour of the complementarity hypothesis.

Table 6. Subjective reasons for the employment of HQFE among German firms employing HQFE
Percentages

	Strongly agree	Somewhat agree	Disagree
We employ foreign workers because...			
... overall they are the best applicants.	8.87	39.52	51.61
... there is a lack of good German applicants.	11.11	43.65	45.24
... they know foreign markets.	34.92	28.57	36.51
... they speak foreign languages.	46.46	25.20	28.35
... they speak English well.	33.07	33.07	33.86
... the type of knowledge required for these jobs is not produced by the German education system	4.72	23.62	71.65
... their skills better fit our work tasks	14.96	36.22	48.82
... they demand lower wages.	0.79	9.45	89.76
... they work harder.	1.60	12.00	86.40

Source: Author's calculations based on IZA International Employer Survey 2000.

Two further results deserve attention. First, one can ask what sort of competence is of particular interest to German firms. Besides international competence, transfer of expertise or know-how is a potential candidate. However, this factor seems to play only a minor role from the firms' point of view. Only 4.7% of the firms strongly agree that HQFE have a type of knowledge that "is not produced by the German education system".

Second, there does not seem to be any evidence of a superior work ethic among foreigners, as 86.4% of all surveyed firms do not think that HQFE "work harder" than domestic HQE. By contrast, the literature on immigration often starts from the assumption of positive selection and the motivational advantage of immigrants (*e.g.* Chiswick, 1978). Of course, this does not mean that HQFE do not have a higher than average motivation, but only that this is not the reason for their employment.

Quantitative determinants of demand

This section looks at "objective" measures in two stages. First, the differences between firms with and without HQFE are examined. Next, an attempt is made to see whether, and to what extent, the different shares in firms with HQFE can be explained by various characteristics of the firm.

In the German subsample, there are 128 firms (39%) with HQFE and 210 firms (61%) without. Table 7 shows the results of a multivariate regression. Although the dependent variable (HQFE yes) is binary, a linear model rather than a Probit was estimated for the sake of simplicity, as the estimated parameters directly show the specific effects of a variable on the probability of employing HQFE. The problem of heteroskedasticity in the linear probability model is addressed by the use of robust standard errors (Greene, 2000).

Table 7. OLS results
Dependent variable: firm employs HQFE

	Par.	t-value
Multinational company	0.076	0.871
Share of foreign business	0.004	3.363
Foreign ownership	0.032	0.514
Share of HQE	0.004	2.994
Foreign language important	0.082	0.913
Experience abroad important	-0.096	-1.386
Engaged in R&D	0.124	1.741
Telework	-0.031	-0.445
Manufacturing	-0.046	-0.600
Financial services	-0.006	-0.057
Information technology	0.193	1.785
R&D	0.237	1.539
100-249 employees	-0.015	-0.135
250-499 employees	0.137	1.115
500-999 employees	0.286	2.369
>1 000 employees	0.306	2.387
Constant	-0.214	-1.389
Number of observations	225	
R-square	0.2681	
Regression with robust standard errors (White)		

Source: Author's calculations based on IZA International Employer Survey 2000.

The table shows that the share of foreign business, the share of highly qualified workers and firm size are highly significant. For instance, the estimated probability of a firm with at least 1 000 employees employing HQFE is 31% higher than the corresponding probability for a firm with 99 employees or less.

How should these results be interpreted? Again, the international orientation of a firm seems to play a decisive role in the demand for HQFE. This supports the qualitative finding that HQFE are hired primarily because of their international competence (and thus as complements for domestic HQE). On the other hand, the share of HQE among all employees is an important determinant for the employment of HQFE as well. This might signal a lack of qualified domestic applicants among firms with above-average demand. However, this variable could also be a proxy for a firm's progressiveness

and use of advanced technologies. Such firms might recruit internationally at least in part in order to transfer know-how. Unfortunately, these two interpretations cannot be distinguished with the amount of information available here.

Clearly, this regression leaves many questions unanswered. The R-square coefficient of determination is 0.27. Although this value is not uncommon in cross-section analyses, it nevertheless means that the model does not explain a major part of the dependent variable's variation. However, before turning to an analysis of further dimensions of demand – where the HQFE come from, what skills they bring and in what functions they are employed – as a way to clarify the main reasons for recruiting internationally, the second stage in firms' decision to employ HQFE is examined.

Determinants of HQFE proportions

If the analysis is restricted to the 128 German firms that actually employ HQFE, there are major differences in the extent of employment. The share of HQFE among all HQE varies from 0.7% to 86%. Some dimensions of this variation have already been discussed. Table 3, for instance, shows that the share of HQFE fluctuates according to industry, ranging from 5% in financial services to 13% in R&D. The parameters that determine the share of HQFE among all HQE are discussed below.

Table 8 shows the Ordinary Least Squares (OLS) estimates. Overall, the results are weaker than those of the binary first-stage model. One reason is the smaller sample size, as the regression is limited to the 79 German firms that employ HQFE and provided valid information on all variables involved in the model.

Table 8. OLS results
Dependent variable: share of HQFE among all HQE

	Par.	t-value
Multinational company	-1.646	-0.818
Share of foreign business	0.122	1.574
Foreign ownership	-0.685	-0.280
Share of HQE	-0.034	-0.459
Foreign language important	-0.501	-0.145
Experience abroad important	-2.891	-1.220
R&D	3.827	1.295
Telework	-1.707	-0.752
Manufacturing	2.734	1.371
Financial services	7.880	0.999
IInformation technology	7.678	1.231
R&D	15.501	1.080
100-249 employees	-6.189	-1.214
250-499 employees	-6.367	-1.313
500-999 employees	-4.185	-0.758
> 1 000 employees	-9.182	-1.982
Constant	4.871	0.718
Number of observations	79	
R-square	0.2498	
Regression with robust standard errors (White)		

Subsample: All German firms employing HQFE.
Source: Author's calculations based on IZA International Employer Survey 2000.

The t-values exceed the critical value for a 5% or 10% significance level only in one case. A firm size of more than 1 000 employees is associated with a share of HQFE that is significantly below that in firms with 99 or fewer employees. There are plausible reasons for the negative effect of firm size. One can imagine, for instance, that the factor "international competence" is subject to increasing returns to scale. Given a basic stock of employees with knowledge of foreign markets, one may expand general employment and production (*e.g.* by increasing exports) without the need to employ additional HQFE. On this view, HQFE give rise to something like the technological fixed costs unrelated to firm size that occur once one wants to operate internationally. Of course, there may be other explanations for the declining share of HQFE with firm size, such as measurement error. A given overestimation of the number of HQFE will lead to much bigger (positive) deviations of the share in small firms than in large firms.

International comparison

So far, analysis of the demand for HQFE has focused on the German subsample. The international comparison raises a few additional questions, first and foremost, why the share of firms with HQFE (*i.e.* with a propensity to recruit internationally) differs among the four countries. In principle, two hypotheses can be considered. On the one hand, the differences may be systematic and have their roots in country-specific differences, such as traditions (including a colonial past) and institutions. On the other hand, they may result from different industrial structures, orientation towards foreign markets and firm size composition of the sample. The latter effects can be accounted for with the information collected by the survey.

The regression results reported in Table 9 make such a comparison. In the first model, the indicator variable "HQFE yes/no" is regressed on three dummy variables for France, the United Kingdom and the Netherlands; Germany is left out as country of reference. This model should in principle replicate the results of Table 2. However, this is not the case because a smaller sample (425 firms) was used. This limitation was necessary to make the comparison between the different columns of Table 9 by using the same sample in both models and accounting for missing values.

As in Table 2, the United Kingdom has the highest proportion of firms with HQFE among the four countries. Its share exceeds the German share by 11.1 percentage points, even though the difference (with a t-value of 1.5) is insignificant. In the second model, the country dummies are augmented by the full set of previously used explanatory variables. The country coefficients now measure differences in the probability of employing HQFE between two firms that operate in different countries but are identical in all other respects (*i.e.* same size, same industry, etc.). This is the *adjusted* country difference.

Rather than explaining differences among countries, the adjustment reinforces them. The difference between Germany and the other countries tends to become larger. The effect is especially strong with regard to the United Kingdom, where the difference increases from 11.1 to 15.8 percentage points. The highly international character of UK firms in terms of recruiting becomes especially evident. Because of the values of the explanatory variables, one would expect that recruitment by UK firms would tend to be less internationally oriented than that of German firms. Empirically, the opposite can be observed, so that the "unexplained" country effect is larger after the adjustment.

Table 9. OLS results
Dependent variable: Firm employs HQFE

	Par.	t-value	Par.	t-value
France	-0.017	-0.268	-0.048	-0.767
United Kingdom	0.111	1.531	0.158	1.787
Netherlands	0.012	0.197	0.050	0.900
Multinational company			0.092	1.296
Share of foreign business			0.003	3.641
Foreign ownership			0.066	1.433
Share of HQE			0.004	4.341
Foreign language important			0.065	0.988
Experience abroad important			-0.025	-0.485
R&D			0.054	1.031
Telework			0.040	0.782
Manufacturing			-0.076	-1.358
Financial services			-0.103	-1.368
Information technology			0.063	0.753
R&D			0.118	0.978
100-249 employees			0.082	1.052
250-499 employees			0.137	1.562
500-999 employees			0.275	3.168
>1000 employees			0.306	3.339
Constant	0.351	10.925	-0.151	-1.406
Number of observations	425		425	
R-square	0.0162		0.2220	
Regression with robust standard errors (White)				

Source: Author's calculations based on IZA International Employer Survey 2000.

Altogether, the estimations in this section insufficiently explain the demand for internationally mobile skilled workers. The variation in the demand for HQFE in German firms cannot be fully explained, nor does the multivariate regression produce explanations for the different patterns of recruiting in the four countries. Therefore, it seems necessary to take into consideration other evidence of possible determinants of demand which cannot, however, be directly integrated into a regression framework. Thus, the following section examines the countries of origin of HQFE, their fields of study and their functions and positions within the firms that employ them.

Additional dimensions of international demand

The primary issue remains what determines firms' demand for HQFE. The previous two sections examined subjective reasons for recruiting skilled workers internationally and related the characteristics of firms to the incidence and share of HQFE in order to derive an "objective" demand function. This section takes a third, complementary approach. The characteristics of the HQFE (in those firms that employ them) are studied. Certainly the reasons for recruitment should manifest themselves in the competencies of the HQFE, their functions within the firms and their positions. In the IZA survey, their personal skills are measured by two proxy variables, namely country of origin and field of study.

Country of origin

The country of origin of HQFE can be seen as a first, if incomplete, indicator for the specific knowledge and competence of HQFE. If, for instance, HQFE are recruited because of their knowledge of foreign markets, one expects the distribution of HQFE by home countries to be related to the trade relations between the two countries. If, instead, the transfer of know-how related to advanced technologies is the most important factor, one expects foreigners to originate mostly from the leading industrial countries. If one recruits because of a local shortage of skilled labour, countries with a surplus of skilled labour or countries from which there is a willingness to migrate, for instance because of large salary differences, are more important. The migration of engineers from eastern Europe is an example of the latter category. In practice, these basic motivations hardly ever occur in pure form. It is necessary to allow for a variety of reasons and to attempt to identify some priorities.

The IZA survey question about the country of origin of HQFE has two components. First, respondents are asked to list all the countries from which HQFE in the firm originate. In the likely case of multiple origins, it was then asked which of the countries had the greatest number. Table 10 shows the distribution of the answers for the German subsample. For example, 42% of the surveyed firms with HQFE employ HQFE from France, but only for 12% of the firms is France the most important country of origin. These numbers should not be interpreted as the share of French HQFE among all HQFE. The collection of such detailed quantitative information would have been highly problematic in the context of a computer-assisted telephone interview.

An analysis of Table 10 reveals that there is a wide variation among countries of origin, although EU countries dominate. However, eastern Europe is an important region of origin as well, as 41% of all firms with HQFE employ HQFE from eastern Europe. For 18% of all firms, eastern Europe is the most important region of origin and clearly takes the lead over other non-EU regions such as North America and Asia, with 8% and 5%, respectively.

Table 10. Country/region of origin of HQFE in German firms
Percentages

	Any HQFE from…	Most HQFE from…
France	41.94	11.65
Netherlands	21.77	5.83
United Kingdom	40.32	8.74
Austria	29.84	10.68
Switzerland	18.55	0.97
Other EU countries	53.23	24.27
Eastern Europe	41.13	18.45
North America	37.10	7.77
Asia	29.84	4.85
North Africa	16.94	1.94
Others	16.94	4.85

Source: Author's calculations based on IZA International Employer Survey 2000.

Table 11 offers a comparison of the regions of origin of the HQFE for the four countries examined in the survey. The ten initial countries/regions are aggregated into two groups: HQFE from EU countries and HQFE from non-EU countries. France has the largest share of all firms that employ

HQFE exclusively from EU member countries (plus Switzerland). In this sense, France corresponds to its reputation as the "centre of Europe".

Germany has the smallest share of firms that exclusively employ HQFE from EU countries and very clearly the largest share of firms that predominantly or exclusively employ HQFE from non-EU countries. More than 36% of all German firms are in this situation. This may seem surprising since it is commonly claimed that obtaining a work permit in Germany can be highly problematic, and since the recruitment of these HQFE from non-EU countries took place prior to the German Green Card initiative. The data clearly show that recruiting internationally was possible even under the previous legal framework.

Table 11. International comparison of region of origin of HQFE
Percentages

	EU member states		Other countries	
	Exclusively	Predominantly	Predominantly	Exclusively
Germany	31.78	31.78	13.08	23.36
France	53.19	21.28	19.15	6.38
United Kingdom	42.22	33.33	2.22	22.22
Netherlands	34.21	42.11	5.26	18.42
Total	38.40	31.65	10.97	18.99

Source: Author's calculations based on IZA International Employer Survey 2000.

Table 12 further differentiates the group of non-EU employees according to their region of origin. As expected, the table shows that eastern Europe plays a prominent role for German firms. In 56% of all firms that employ HQFE from predominantly or exclusively non-EU-countries, eastern Europe is the most important region of origin. With a large gap, North America and Asia follow. In the other three countries, eastern Europe plays a much less important role. In these countries, North America is most important, followed by Asia.

Table 12. Most important regions of origin for firms with predominately or exclusively non-EU highly qualified employees
Percentage

	Eastern Europe	North America	Asia	Africa
Germany	55.8	23.5	14.7	5.9
France, United Kingdom, Netherlands	10.0	45.0	35.0	10.0
Total	38.9	31.4	22.2	7.4

Note: The responses for France, United Kingdom and the Netherlands were too few for separate listing and were pooled.
Source: Author's calculations based on IZA International Employer Survey 2000.

In conclusion, it is evident that an examination of the country of origin alone is not sufficient for gaining additional knowledge of the reasons for hiring highly qualified foreign employees. The empirical findings regarding the countries of origin from which firms recruit point to arguments relating to the employees' personal competencies (know-how in key technologies, international competence) as well as to domestic shortages of skilled labour.

Fields of study

The survey investigated fields of study separately for domestic and foreign HQE. All possible fields were summarised in six broad categories. These data are collected only for firms with HQFE. The procedure is analogous to the variable "country of origin". It was first asked if certain fields of study occurred, and, in the case of multiple answers, the quantitatively most important field of study was specified.

Table 13. Subject in which domestic and foreign HQE in German firms employing HQFE took their degree
Percentages

	Domestic		Foreign	
	Any HQE with degree in	Most HQE with degree in	Any HQFE with degree in	Most HQFE with degree in
Engineering	56.25	36.07	45.24	36.07
Mathematics, natural sciences	56.25	13.11	38.89	14.75
Computer science	64.84	15.57	47.62	22.95
Law	21.88	1.64	4.76	n.a.
Business studies	69.53	22.13	40.48	15.57
Medicine	11.72	3.28	7.14	3.28
Others	14.84	8.20	9.52	7.38

Source: Author's calculations based on IZA International Employer Survey 2000.

As Table 13 shows, business studies are most frequently named in German firms, with 70% for domestic HQE, followed by computer sciences with 65%. This relates to all possible nominations. The ranking changes if one considers the field of study in which most HQE are recruited. Here, engineering leads with a share of 36% of all firms. The last two columns of Table 13 offer a comparison with HQFE. Naturally, the responses are fewer since HQFE, as a rule, constitute only a fraction of domestic highly qualified workers and it thus is likely that certain fields of study are not represented. Apart from that, it appears that the distribution of domestic and foreign HQE deviates surprisingly little.

In terms of the most popular fields of study, the main difference is a switch from business studies, the most frequent field for domestic HQE in 22% of firms (and most frequent for HQFE in 16% of firms) and computer science, which is the most frequent field for HQFE in 23% of firms. Patterns are clearer if one differentiates according to the region of origin of HQFE. This information is not directly available, but an approximate indication can be obtained by calculating the last column of Table 13 separately for firms that recruit predominantly or exclusively from EU countries and for firms that recruit predominantly or exclusively from non-EU countries. The results are shown in Table 14.

The differences are now more pronounced. Computer science, for example, is the predominant field of study for firms that mostly employ HQFE from non-EU countries, as 32% of all firms in this group give computer science as the quantitatively most important field of study among the HQFE. Engineering is the most important field of study for 42% of all firms that recruit mostly from EU countries. As Table 10 has shown, a large share of non-EU employees come from eastern Europe. The results thus show clearly that computer specialists are recruited from eastern Europe.

Table 14. Most frequent subject of HQFE classified by region of origin
Percentages

	Predominately or exclusively HQFE from	
	EU countries	Non-EU countries
Engineering	41.54	23.68
Mathematics and natural sciences	18.46	13.16
Computer science	13.85	31.58
Business studies	16.92	15.79
Medicine	1.54	7.89
Others	7.69	7.89
Total	100.0	100.0

Source: Author's calculations based on IZA International Employer Survey 2000.

Functions within the firm

Functions within a firm are naturally closely connected with employees' field of study. Thus, it does not come as a surprise that a close look at these functions generally supports the previous results.

The distribution of domestic and highly qualified foreign workers among the six functions examined is quite similar, especially in terms of the most frequent occupation (Table 15). The only exception is a concentration of HQFE in functions that are related to information technologies.

However, new aspects appear when the functions are differentiated according to region of origin (Table 16). HQFE are strongly concentrated in marketing and distribution in firms that predominantly or exclusively employ HQFE from EU countries. This is an indication that the knowledge of foreign markets plays a major role, especially when recruiting within Europe. This function plays a subordinate role in firms employing HQFE from non-EU countries. In these firms, R&D is most important, together with "other", a category that may include menial tasks unconnected with the employee's original training or subject of study.

Table 15. Functions of domestic and foreign highly qualified employees in German firms with HQFE
Percentages

	Domestic HQE		Foreign HQE	
	All responses	Most frequent response	All responses	Most frequent response
R&D	59.84	42.06	52.34	40.50
Information technology	32.28	10.32	25.00	14.05
Production	22.83	7.14	14.06	7.44
Marketing, distribution	39.37	19.84	35.94	17.36
Administration	29.92	6.35	18.75	7.44
Other	14.96	14.29	15.62	13.22

Source: Author's calculations based on IZA International Employer Survey 2000.

Table 16. Most frequent function of HQFE classified by region of origin
Percentages

	Predominantly or exclusively HQFE from	
	EU countries	Non-EU countries
R&D	38.71	43.59
Information technology	12.90	12.82
Production	8.06	5.13
Marketing, distribution	29.03	5.13
Administration	4.84	12.82
Other	6.45	20.51
Total	100.0	100.0

Source: Author's calculations based on IZA International Employer Survey 2000.

Reasons for lack of demand

So far it has been assumed that the number of HQFE corresponds to demand. However, it can be argued that something like "potential demand" differs from "realised demand". Consequently, there is the question of the reason for this difference, which can be called "reasons for non-recruitment". Statements were made to which the interviewees could respond by "yes" or "no". A largely identical set of statements was presented to firms with and without HQFE. For the first group, the relevant question was: "If you hire foreign employees with a university degree, in which of the following areas do you see potential problems?" For the second group of firms, the same statements were given, introduced by the question: "What are your reasons for not hiring foreign employees with a university degree?"

Table 17 shows the results for German firms. Language difficulties, for example, were identified as a potential problem by 47% of all firms employing HQFE. These, as well as socio-cultural differences, are the most commonly named personality-related problem for these firms. Problems related to discrimination, such as a lack of acceptance by superiors, subordinates or customers play a minor role. Around a quarter of all firms named a lack of knowledge of foreign education systems and careers.

Table 17. Reasons for non-recruiting
Percentages

	Firms without HQFE	Firms with HQFE	t-value
Language problems	12.9	46.8	6.444
Socio-cultural differences such as mentality and habits	9.8	52.1	8.439
Acceptance by superiors	1.2	8.5	2.934
Acceptance by subordinates	2.4	14.8	3.840
Acceptance by customers	4.9	14.8	2.770
Difficulties in judging foreign professional careers	3.7	24.4	5.305
Lacking knowledge of foreign educational systems and qualifications	4.9	27.6	5.434
High recruiting costs	1.8	19.1	5.083
Difficulties in obtaining work permits	60.9	65.2	0.741
No applicants	54.3	n.a.	
No demand, jobs are filled with German applicants	19.1	n.a.	

Source: Author's calculations based on IZA International Employer Survey 2000.

Interestingly, firms that do not employ HQFE do not attach special importance to such problems. For these firms, a lack of applicants or a lack of demand for HQFE plays the decisive role. These firms are not even conscious of the problems that might arise because they do not encounter them in their daily business routines. These problems only gain importance if the firm actually starts to recruit internationally.

For both kinds of firms, however, it is true that difficulties in obtaining a work permit for non-EU foreigners are a reason for non-recruitment. Among the firms that do not employ HQFE and that identify difficulties in obtaining a work permit, 89% state that they would recruit internationally if the regulations were simplified. Among the firms that employ HQFE and identify difficulties in obtaining a work permit, 71% state that they would recruit even more international applicants if the regulations were simplified. This opens up a large range of possible policy actions.

Summary and conclusion

This study offers insight into the demand for internationally mobile, highly qualified foreign employees from the point of view of firms. How high is the demand? In Germany, about 39% of all surveyed firms employ HQFE. In these firms, their average share is about 9%. The average share in all the German firms surveyed is 3.5%. Thus, in practice, international mobility is not very high, but it is far from negligible. Especially for R&D and IT, whether as an industry or a function within a firm, highly qualified foreign workers are important. If one measures greater international orientation by the number of highly qualified foreign employees, then the United Kingdom tends to be more internationally oriented than the other countries studied. Regarding the regions of origin of HQFE, there are clear differences in recruiting countries' characteristics. German firms put a relatively greater weight on recruitment of eastern Europeans than firms in the other countries.

Starting from this stocktaking, the question was, "Why do German firms recruit highly qualified workers in foreign labour markets and what factors determine demand?" The investigation addressed two hypotheses. According to the first, firms recruit internationally to gain access to knowledge that is not available nationally. The lack of availability may result from the fact that the knowledge is not yet available nationally as it concerns advanced technologies with a promising future. Employees' mobility is then part of the international process of the diffusion of knowledge. Alternatively, the demand may concern knowledge of foreign markets, foreign languages, etc., in short, international competence. In both cases, firms gain access to skills that are complementary to those of the domestic HQE. The second hypothesis is based on a possible shortage of skilled labour. In this case, HQFE are sought as a substitute for insufficient domestic personnel.

The difference is not only academic. It is also of major practical relevance for policy. In one case, the shortage of skilled labour has to be identified accurately and, if possible, well in advance. In the other, the major challenge is to make one's country attractive to highly qualified workers in the long term. Especially with regard to the second hypothesis and the increasing degree of globalisation, there is likely to be a steady increase in the demand for international mobility. In this case, it is important to reduce institutional obstacles to international mobility.

To be able to distinguish empirically between these two hypotheses, three kinds of evidence were evaluated. First, the firms were asked directly for their subjective reasons for recruiting internationally. Then, multivariate regressions were used to examine whether the patterns of demand can be explained by characteristics of the firm. Finally, conclusions regarding the reasons for demand were derived by investigating the characteristics of HQFE themselves, such as their subject of study or function within the firm.

As can be expected, the conclusions are not unambiguous. The empirical evidence does not allow for excluding either hypothesis. The different reasons adduced all contribute to demand and overlap. A rational immigration policy should thus not rely on a single reason for the international mobility of labour.

Among the subjective reasons for recruiting, international competence plays an important role. Among the characteristics of the firm, the share of foreign business and the general share of HQE are the most important determinants of demand. While the first of these two factors once again speaks for the importance international competence, it is difficult to interpret what the share of HQE means. This factor may be an indicator for the degree of technology orientation within the firm and thus support the argument for transfer of know-how. On the other hand, it could mean that firms with high demand for highly qualified workers are more likely to be affected by a shortage of skilled labour. This part of the analysis underlined the complexity of the processes of corporate decision making, since the explanatory power of the models used was rather low.

The same complexity was evident in the characteristics of HQFE. A comparison with their domestic colleagues' subjects of study and functions within the firm showed that the similarities outweighed the differences. There is, however, a certain concentration among IT-related subjects and IT-related functions, especially with firms that mostly recruit from non-EU countries and that predominantly recruit from eastern Europe. This could be interpreted as evidence of a reaction to a shortage of skilled labour in this area.

The study dealt with the situation of firms in the autumn of 2000. It does, however, also allow for some limited statements on how demand for HQFE is likely to develop in the future. There are a number of starting points for those predictions. On the one hand, the study identifies the effects of globalisation on the demand for HQFE, for instance by calculating the share of foreign business or the share of HQFE. Assuming that the globalisation trend continues, a further increase in demand is likely. A second starting point derives from a subjective assessment by the firms, which was directly included in the questionnaire. Among the German firms questioned, 69% felt that the number of HQE in their firms would increase during the next two years, and 60% felt that the share of HQFE among all HQE would increase in the next two years. Taking these factors into account, the relevance of research into international mobility of the highly skilled will increase. It is hoped that this study, while providing initial answers, will also encourage further research on the international personnel policy of firms, a topic that has previously been neglected.

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Chapter 8

RETURN MIGRATION OF HIGHLY-SKILLED IRISH INTO IRELAND AND THEIR IMPACT ON GNP AND EARNINGS INEQUALITY

by

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Introduction

For most of its modern history, Ireland has had net outward migration. Until the 1960s, net outflow tended to exceed the natural increase so that the population decreased. From a level of 6.5 million in 1841, the population fell to 3.2 million at the turn of the century and to a low of 2.8 million in 1961 (these figures refer to what is now the Republic of Ireland). In the 1960s, natural increase exceeded outflow, resulting in population growth. In the 1970s, owing to improved economic performance, a net inflow occurred for the first time since independence (Barrett, 1999).

While the inflow of the 1970s might have generated research into the nature and effects of inward migration, this did not happen. The main reason was the resumption of large-scale outflows in the 1980s. However, with the vastly improved economic conditions of the 1990s, net inflows again appeared, and research into the nature and effects of the inflow was undertaken.

This chapter reviews some of this research and outlines what the research has shown about the nature of return migration into Ireland and its effects. Three main issues reflect the content of three papers. The first concerns the characteristics of returning migrants (Barrett and Trace, 1998), who were relatively more highly skilled than the domestic population. The second is the effect of this skilled inflow on GNP and earnings inequality (Barrett *et al*., 2000). Given the skilled nature of the inflow, one would expect a positive effect on GNP and a lessening in earnings inequality due to increased competition at the upper end of the distribution. Evidence for both of these effects is provided. The third issue concerns how the earnings of returning migrants compare to the earnings of those who have not migrated, holding constant a range of factors that influence earnings (Barrett and O'Connell, forthcoming). It appears that men who return earn more than male non-migrants. This suggests a possible additional benefit to the Irish economy from return migration.

Characteristics of returning migrants

In order to gain an understanding of the characteristics of returning migrants in the mid-1990s, it is helpful to look first at those who left Ireland in the 1980s. Table 1 shows the percentage of different educational-level groups who emigrated each year between 1980 and 1990.

Table 1. Percentage of emigrating secondary - and tertiary-level education leavers

Year of leaving	Secondary level	Tertiary level	
		Primary degree	Higher degree
1980	1.7	8.0	17.0
1981	1.1	7.6	21.9
1982	1.8	8.1	18.8
1983	3.5	9.4	15.3
1984	4.1	14.3	19.4
1985	5.7	16.2	27.1
1986	6.1	19.5	24.4
1987	10.5	25.6	28.9
1988	14.7	26.1	27.6
1989	9.9	24.9	30.8
1990	8.1	19.0	24.1

Source: O'Gráda and Walsh (1994).

As Table 1 shows, emigration in the 1980s was not evenly distributed across education groups. More highly educated people were more likely to emigrate, an indication that a "brain drain" was taking place. This led to concerns over the loss to the state in terms of its investment in education.

Table 2. Educational profile of return migrants and non-migrants by age category
Percentages

Age		No qualifications	Primary	Junior/inter	Leaving	Tertiary level/non-university	Tertiary level/ university	Higher university
20-24	R	0.5	4.0	11.0	36.5	22.5	22.5	3.0
	N-M	0.4	5.6	20.1	50.4	15.0	7.8	0.7
25-29	R	0.0	4.5	13.3	24.7	28.9	21.6	7.1
	N-M	0.5	7.5	25.8	37.1	16.3	10.7	2.1
30-39	R	0.2	8.6	19.8	21.8	23.7	20.9	5.0
	N-M	0.6	14.9	19.9	38.8	14.1	9.7	1.9
40-49	R	2.2	18.3	19.7	27.6	12.7	11.9	7.5
	N-M	0.6	29.4	28.4	24.0	8.9	7.1	1.5
50-59	R	1.2	32.5	20.0	17.8	13.6	10.4	4.5
	N-M	0.8	43.9	23.4	18.6	6.8	5.3	1.2
60-69	R	0.0	34.0	18.3	20.0	12.2	8.6	7.0
	N-M	1.2	58.9	17.3	14.2	4.2	3.4	0.7
70+	R	0.0	38.8	27.0	11.8	7.8	14.5	0.0
	N-M	2.2	70.8	12.1	9.3	2.8	2.4	0.4

R = returnees, defined as Irish nationals who were born in Ireland but who were not resident in Ireland 12 months previously; N-M = non-migrants, defined as Irish nationals who were born in Ireland who were resident in Ireland 12 months previously. The percentages are based on 1 400 return migrants and 265 655 non-migrants.
No qualifications = no educational qualifications.
Primary = completed primary.
Junior/inter = a state exam taken approximately half-way through second level schooling.
Leaving = state exam taken at the end of second level schooling.
Tertiary level/non-university = typically diploma and certificate courses in Regional Technical Colleges and the Institutes of Technology.
Tertiary level/university and higher university are self-explanatory.
Source: Barrett and Trace (1998), based on Labour Force Surveys 1994, 1995 and 1996.

Given those who left in the 1980s, it would be expected that the returnees of the 1990s would also be relatively more educated than the domestic population. Based on data from the Labour Force Surveys of 1994 to 1996, Table 2 shows the percentage of returnees and non-migrants with different levels of education, by age group. Returnees have significantly higher levels of educational attainment.

Barrett and Trace (1998) make two additional relevant points. First, not only were returning migrants relatively more educated than the domestic population, so were non-Irish immigrants. Second, evidence is presented to suggest that returning migrants had higher levels of education on average than the emigrants of the 1980s as a whole. These two findings suggest that Ireland in the 1990s was particularly attractive to high-earning people.

Effects on GNP and earnings inequality

These findings prompted Barrett *et al*. (2000) to look at the effects of such an inflow. Their particular interest was the effects on earnings inequality and the returns to education.

Between 1987 and 1994, Ireland experienced a substantial increase in earnings inequality. As Table 3 shows, the ratio of hourly earnings of the top decile to the bottom decile increased from 4.16 to 4.77. However, between 1994 and 1997, this ratio was largely unchanged.

Table 3. Distribution of hourly earnings in 1987, 1994 and 1997

As a proportion of the median for all employees	1987	1994	1997
Bottom decile	0.47	0.47	0.48
Bottom quartile	0.73	0.68	0.69
Top quartile	1.37	1.50	1.53
Top decile	1.96	2.24	2.33
Top decile/bottom decile	4.16	4.77	4.81

Source: Barrett *et al*., 2000.

This pattern is largely reflected in the returns to education, with the returns to university education (as measured by the coefficient of a university dummy variable in a standard Mincer-type wage equation) increasing between 1987 and 1994 and remaining stable between 1994 and 1997.

In terms of the returns to education by age group, the picture is somewhat more complicated. The returns to university degrees for middle-aged people (aged 33-49) followed the pattern observed for the entire group, *i.e.* an increase in the earlier period followed by stability. However, for the younger group (aged 15-32), the returns were stable over the full ten-year period.

The pattern observed across age groups required some clarification. Barrett *et al*. (2000) suggest a role for immigration, arguing as follows. Consider a situation in which the market for skilled employees is actually made up of two separate markets, one for young skilled employees, the other for older skilled employees. Young skilled employees are not substitutes for he older skilled employees and so do not compete with them. In Ireland for most of the period under discussion, the expansion in tertiary-level education was such that there was a large increase in the supply of young skilled employees to the labour market. Ireland, like everywhere else, appeared to experience an increase in the demand for skilled labour at that time. From the observation of stability in the returns to university degrees for younger people, it would appear that the supply increase matched the increase in demand.

The situation in the older skilled market was different. If the assumption of two separate markets is correct, the increase in supply coming from the expanded tertiary-level sector would not affect the older skilled market. This explains why the return to university degrees could increase between 1987 and 1994. In order to explain the stability in the return to degrees for this age group between 1994 and 1997, Barrett *et al.* turn to immigration.

Between 1994 and 1997, there was a net inflow of 16 400 into Ireland, made up of returning migrants and non-Irish immigrants in roughly equal proportions. However, this aggregate figure hides very large differences across age groups. For those aged 15-25, there was a net outflow of 44 100. For those aged 25-44, there was a net inflow of 27 000, about 3% of the population of that age. When one recalls that this inflow was made up of relatively highly skilled people, it is clear that the inflow represents a higher percentage of the relevant age/skill population. Such an inflow may have acted in a manner similar to the inflow from the expanded education sector into the younger skilled labour market. In particular, the increase in the supply of skilled, middle-aged workers may have reduced wage pressures, thereby halting the increase in the return to university degrees that was observed between 1987 and 1994.

To test this hypothesis, Barrett *et al.* follow the approach of Borjas *et al*. (1997). Previously, the impact of immigration on wages had typically been estimated by relating changes in immigrant concentrations across regions to the changes in wages for native workers. Borjas *et al.* criticised this approach by arguing that some of the adjustment to an inflow might take the form of natives moving out of certain areas, or not moving into them. By employing an approach based on area comparisons, economy-wide effects might be missed. They overcome the difficulty by estimating a model of the economy-wide labour market and simulating the effects of immigration.

Barrett *et al.* developed a structural model of the Irish labour market. They set out a set of equations in which a range of variables, such as output, employment and the wages of skilled employees, are determined (the wages of unskilled employees are assumed to be determined by social welfare payments). Using data from 1970 to 1996, the parameters of the model are estimated. The estimated model is then used to compare outcomes with and without the level of immigration that occurred from 1994 to 1997 to see how a range of variables react, in particular output and the wages of the highly skilled. The results of the exercise are summarised in Table 4.

Table 4. Simulated effects of immigration
Percentage points

Skilled labour supply	3.2
Skilled wage rates	-4.7
GNP	1.5
Total employment	3.2
Unemployment rate	-0.7

Source: Barrett *et al.*, 2000.

As Table 4 shows, immigration increased among the skilled labour force by 3.2%. As a result of competition at the upper end of the earnings distribution, the wages of skilled workers were 4.7% lower than they would have been in the absence of immigration. GNP was 1.5% higher than it would have been and unemployment was 0.7 percentage points lower.

This simulation exercise provides evidence in support of the hypothesis that immigration helped to reduce earnings inequality in Ireland and also that it increased GNP. The result for inequality provides an interesting contrast to the work of Borjas *et al.* (1997) for the United States, which

suggests that the recent immigrant inflow is less skilled than the domestic population and that the resulting competition at the lower end of the earnings distribution has contributed to an increase in earnings inequality.

Earnings of returning migrants relative to non-migrants

Finally, there is the issue of how the earnings of returning Irish migrants compare to Irish people who remained in Ireland. Co *et al*. (2000) develop a hypothesis in which migration is part of the process of human capital formation. In particular, individuals may decide to work away from home and acquire skills and competencies that are rewarded on their return to their home country. Co *et al.* test the hypothesis using data on Hungarians and find that returning migrants earn more than those who remained in Hungary, thereby providing evidence in support of the hypothesis.

Barrett and O'Connell (forthcoming) use data on graduates from Irish tertiary-level colleges to further explore this issue. While a focus on graduates might ordinarily appear restrictive, it should be remembered that much of the Irish migratory population is relatively well educated, so that this group is of particular interest. The data set is made up of people who graduated in 1992 and were interviewed in 1998. Only Irish nationals who working for payment are included. Returning migrants are defined as people who said they had lived outside of Ireland for at least six months since graduation, but who were currently resident in Ireland. Non-migrants are defined as people who did not live outside of Ireland for more than six months since graduation.

Mincer-type wage equations are estimated for the full sample (approximately 800 individuals with about 150 returnees and 650 non-migrants). Separate equations are also run for men and women. The results of one set of regressions are shown in Table 5. The usual control variables such as education and experience are included and most of the coefficients have the expected sign. The one exception is the partner variable whose coefficient, being negative, is unlike other studies. For present purposes, the variable of most interest is the returnee; this is a dummy variable that is equal to one if the person is a returnee and zero otherwise. For the full sample, the coefficient is positive but insignificant. But for men, the coefficient is both positive and significant and suggests that male returnees earn 10% more than comparable male non-migrants.

Table 5. Wage equations with returnee dummy variable
Dependent variable: log of monthly wage

	All; N = 828		Men; N = 412		Women; N = 416	
	B	t-stat	B	t-stat	B	t-stat
Experience	0.07	8.24	0.08	6.07	0.06	5.08
Bachelor's degree	0.28	8.13	0.26	5.08	0.31	6.62
Masters degree or equivalent	0.30	9.33	0.28	5.26	0.32	8.42
Doctorate	0.51	7.55	0.46	4.65	0.56	6.04
Dublin	0.10	3.96	0.06	1.32	0.15	4.73
Male	0.16	6.23				
Partner	-0.05	-1.79	-0.08	-1.75	-0.03	-0.82
Returnee	0.05	1.48	0.10	1.98	-0.01	-0.31
Constant	6.71	115.90	6.88	78.76	6.73	94.27
	Adj- R^2 = 0.22		Adj- R^2 = 0.18		Adj- R^2 = 0.23	

Source: Barrett and O'Connell (forthcoming).

Barrett and O'Connell extend the analysis by considering the reasons given by individuals for migrating. A large proportion (42%) of returning migrants stated that they originally left for "an adventure" or "to see the world". Barrett and O'Connell contrast this group with those who left for labour-market reasons (*e.g.* to get a job or a better job) or to pursue further education. When the returning migrant group is broken up along these lines, they find that men who left for labour market reasons earn 15% more than non-migrants, whereas there is no wage advantage for those who left for adventure-related reasons.

No wage advantage is found for female returnees. Upon investigation, Barrett and O'Connell find some weak evidence to suggest that women are more likely to return for family-related reasons so that the timing of their return may not allow them to derive the full benefit from their time away. This is an example of women acting as tied migrants, in the sense developed by Mincer (1978).

Conclusions

The research on former emigrants returning to Ireland makes the following three broad points.

- First, those who returned in the mid-1990s were relatively more educated than the domestic population. This is not entirely surprising since those who left in the 1980s were also relatively more educated. However, there is evidence to suggest that the returnees had higher levels of educational attainment on average, relative to the group of emigrants as a whole.

- Second, the inflow increased the level of GNP. Again, this is not entirely surprising since immigration is generally expected to increase GNP. What is perhaps more interesting is that the inflow, because of its skilled nature, reduced the wages of skilled workers relative to what they would have been in the absence of immigration. This contributed to a reduction in earnings inequality.

- Finally, the earnings of returning migrants exceeded those of comparable non-migrants, at least for men. To the extent that the findings on men indicate increased human capital for returning migrants, the positive contribution to the Irish economy of this group may be even stronger than suggested by the analysis of Barrett *et al.* (2000).

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PART III

TRENDS AND ECONOMIC IMPACT IN NON-OECD COUNTRIES

Chapter 9

MASS MIGRATION OF HIGHLY SKILLED WORKERS: ISRAEL IN THE 1990s

by

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Introduction

The following discussion has two main parts. The first outlines the characteristics of Israel's migration system and the attributes, advantages and disadvantages of the data sources available to portray it. The extent to which movements of highly qualified professional workers, especially scientists, engineers and researchers, can be identified will be described.

The second part attempts, with the aid of these sources, to analyse the impact of the mass migration of these occupational groups on Israel and its economy in the 1990s.

Israel's migration system: data and policy context

The demographic context of Israel's migration system

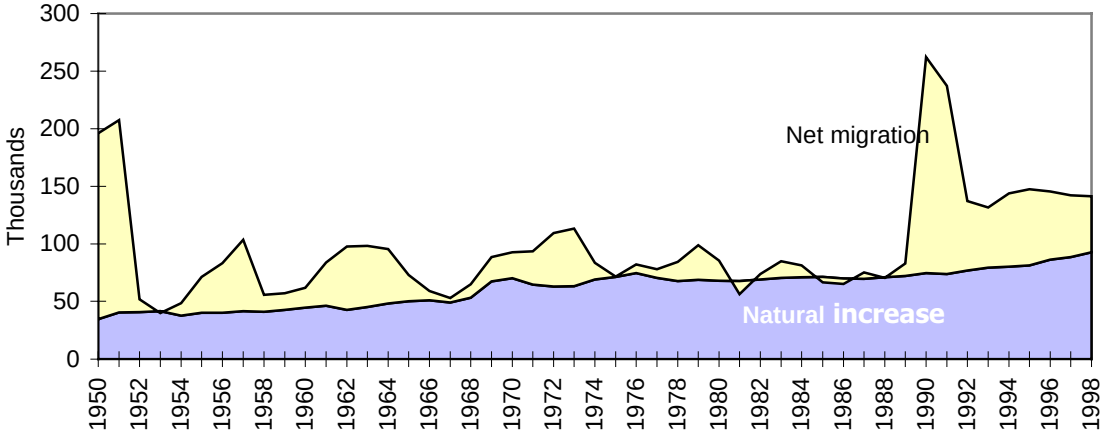
At the end of 2000, Israel's population numbered 6.4 million persons, 31% of whom were born abroad (38% of the Jewish population) and 14% having arrived in Israel since 1990. Over the 53 years of its history, Israel's annual population growth has averaged 4% a year. However, this rate has been subject to significant fluctuations (Figure 1). After the first great wave of immigration following independence, which doubled the population within five years, the intensity of immigration gradually declined. By the 1980s, immigration had reached a very low level (averaging 15 000 persons a year) and yearly population growth rates fell to 1.8%.

In the 1990s, growth rates rose to 5-6% in 1990-91 and then fell to 2.5-2.7% in 1992-99 (nearly 45% of which was due to net migration), still a much higher rate than that of other developed countries.

The wave of immigration in the 1990s was the largest since the early 1950s. It was brought about by the break-up of the former Soviet Union and the closure of alternative destinations for Jewish emigration (principally the United States). In 1990 alone, more than 199 000 persons arrived. By the end of 1999, more than 956 000 immigrants had entered the country. Although the principal country of origin was the former Soviet Union (with 822 000), a substantial number (nearly 40 000) arrived from

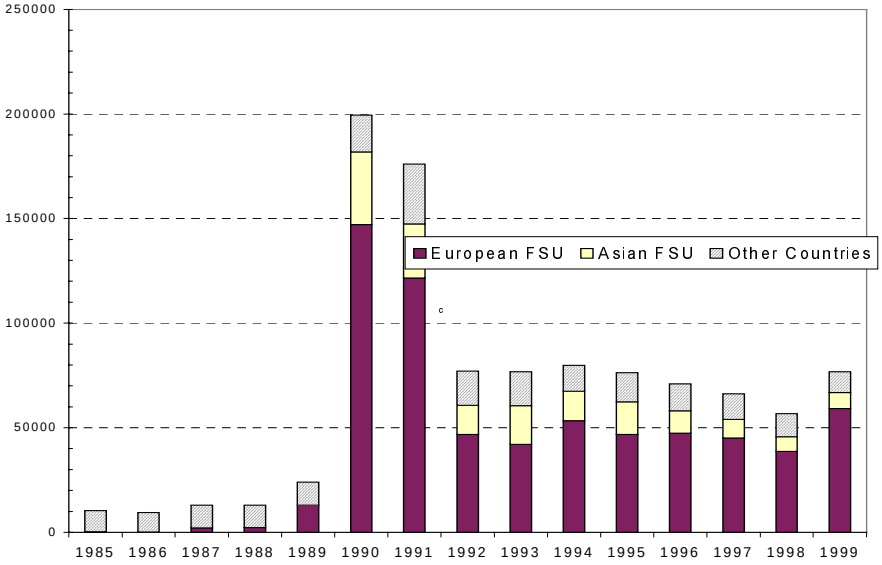
Ethiopia (Figure 2). After 1991, immigration levels gradually declined but remain substantially higher than in the 1970s and 1980s. The movement was large, both in absolute terms and in relation to the size of Israel's population. In every sphere – social, economic, political, cultural – it has had a transforming effect on Israel.

Figure 1. Population growth 1948-98: net migration and natural increase



Source: *Statistical Abstract 2000*.

Figure 2. Immigration to Israel by country of origin



Source: CBS, *Immigration to Israel 1998*, *Statistical Abstract 2000*.

Immigration and emigration policy

Israel's history is intimately linked to migratory events. Its establishment was associated with substantial refugee movements, both to and from the country. The core of its Zionist ethos, its very *raison d'être*, has been to gather Jewish immigrants from around the world and create a new nation.

Immigration has therefore been central to public policy. The term for immigration in Hebrew, *Aliyah*, expresses this symbolic significance, through its connotation of "ascent", or "pilgrimage". The term for emigration, *Yeridah*, connotes descent and is pejorative. Immigration is valued for its nation-building character and is not subject to restrictions based on the state of the labour market. In this spirit, the mass influx of immigrants in the early 1990s was widely viewed as a positive public challenge, an historic opportunity, even when it became clear that its extent would require structural change in the economy (Flug *et al*., 1997). As a corollary, the retention of immigrants and the discouragement of emigration has always been an important constraint on economic policy (Ben-Porath, 1986, p. 2).

The legal basis for immigration in Israel rests on two laws. One is the Law of Return, which establishes the right of Jews and members of their immediate families to settle in Israel and acquire citizenship immediately. The second is the Law of Entry, which governs the entry into Israel of foreigners who do not fall under the Law of Return and the conditions of their stay. Jewish immigrants to Israel (*olim*) are not regarded as "candidates" for citizenship but as "returning nationals" who are entitled to free entry and immediate citizenship. As will be seen, this has important consequences for the types of migration data available.

A variety of public agencies are engaged in promoting immigration, chief among them the Jewish Agency. Others, principally the Ministry of Immigrant Absorption, are charged with promoting the social and economic assimilation of immigrants. That ministry is also responsible for the implementation of policies to promote and ease the return of Israelis living abroad. Absorption of immigrants and returning residents by the labour market is a central component of these policies. A wide variety of programmes is made available to immigrants. While some existed prior to the crisis created by the sheer size and skill composition of the immigration wave of the early 1990s, many were developed specifically to deal with that crisis. Among them are vocational training and retraining courses, licensing courses for physicians, aid to immigrant entrepreneurs, programmes for musicians and artists, tax rebates to employers, etc. Salient among them with respect to this study are direct and indirect salary subsidies for immigrant university teachers, scientists, and researchers (see below).

Immigration is, of course, only one component of the migration balance. The other element, emigration, has fluctuated as substantially as immigration, in response both to immigration waves and to cyclical economic factors, which in turn have been linked to immigration waves. The volume of emigration has exceeded that of immigration only in 1953, 1981, 1985-86 and 1988. Although a considerable portion of emigration flows has been made up of return migration of recently arrived immigrants, public concern with levels of emigration has been greatest in periods when immigration was low. This was especially true in the late 1970s and in the 1980s. In the early 1980s, public concern with emigration rose sufficiently for a unit to be established in the Ministry of Immigrant Absorption that was devoted to implementing policies to encourage the return of Israeli emigrants. One of its primary targets is highly skilled native Israelis (or those who immigrated at a young enough age to have acquired their education in Israel), especially those in North America, the principal destination of Israeli emigrants.

In the 1990s, a new element in Israel's migration system emerged: documented and undocumented foreign workers. Unlike *olim*, foreign workers are not considered permanent or temporary residents under Israeli law, but as visitors with permission to work. This too has consequences for the data system. The small number of foreigners with work permits began to grow in the late 1980s, but tens of thousands of such permits were granted by the government in the early 1990s. This was a result of lobbying by employers, against a background of security-based restrictions on the entry of Palestinian labourers and a rise in demand for the construction workers required by the building boom sparked by mass immigration from the former Soviet Union. Providing housing for the

immigrants as rapidly as possible was a policy priority. By the late 1990s, the number of documented foreign labourers stood at approximately 80 000. Most are still employed as manual semi-skilled workers in the construction industry and in agriculture, while several thousand women, principally from the Philippines, are employed in the nursing professions and personal services. The Central Bureau of Statistics has estimated the number of undocumented migrants (visa overstayers) at approximately 100 000. Most are employed in the services sector. No micro-data are available for either group on their educational qualifications or occupations abroad.

Hitherto, the "foreign worker" sector has not included more than a handful of foreign "experts". However, owing to the international shortage of skilled professionals, and before the technology bubble burst in late 2000, lobbyists for Israel's burgeoning high-technology companies tried to persuade the government to permit extensive importation of foreign computer programmers and engineers as "foreign workers" or face curtailment of the growth of this sector. This proposal, which aroused some public controversy, quietly lapsed when high-technology firms began to dismiss employees. However, it is likely to re-emerge if the sector's growth picks up again.

Data sources

A comprehensive system of data collection on the movement of highly skilled labour requires micro-data on occupation, educational attainment, migratory movements and demographic variables. Israel's system for monitoring migration *flows* is essentially register-based. Data on country of birth and year of immigration are present in most registers, as well as in sample surveys. However, the identification of migratory movements depends on how the concept of "changing country of usual residence" (in the short or long term) is made operational (United Nations, 1998, p. 25). Country of birth is often not an adequate proxy for country of usual residence. Moreover, Israel's concept of "immigration" covers only certain types of international movements. Thus, the considerations behind the administrative system that produces the data for monitoring flows do not always make it possible to capture data on the movement of highly skilled workers. Moreover, the system lacks labour force or educational variables. Data regarding *stocks* are richer in educational and occupational variables: however, certain types of migrants (especially returning emigrants) cannot be adequately identified. These questions are returned to below.

Israel's statistics on migration flows are based on two interconnected data registration systems, which are administered by the Population Administration of the Ministry of Interior: the Population Register (PR), and the Border Control database. All citizens and permanent and temporary residents of Israel have a personal record in the PR, which is indexed by a unique personal identity number (PIN). The PIN is widely used in administrative procedures in Israel and therefore provides the basis on which record linkages can be made between various administrative data registers.

The PR includes, among other variables, date of immigration, country of birth and parents' countries of birth. In addition, all entries and departures by Israelis and foreigners are recorded and archived in the Border Control database. The PIN links records of Israelis in the PR with the Border Control database: the border police at airports and land borders record the PIN as part of passport control, thereby creating a record of date of departure and return. Records for foreigners in the Border Control database were based, until 2000, on batch keypunching of data contained on a border card filled out at arrival and departure which included name, visa status and passport number, country of residence and birth, date of birth and sex. They do not carry a PIN.

Israel's census (most recently in 1995**)** covers the *de jure* population, collects stock data by date of immigration, country of birth and father and mother's country of birth, as well as sample (20%)

data on education (years of schooling by type of establishment and highest degree or certificate acquired); occupation and industry; and permanent place of residence five years earlier. The question on residence five years before the census is the only direct means of identifying returning emigrants. The data available are generally comparable to data from other countries: Israel's national classifications of occupations and of economic activity are broadly compatible with ISCO and ISIC (CBS, 1994a; 1993a). The presence of the PIN in the census file facilitates links to other surveys and register-based data files.

Annual population estimates are calculated by demographic accounting methods, based on annual files received from the PR. These estimates provide updated data on the population by demographic variables at the level of detailed statistical areas. They include year of immigration for recent years and period of immigration for the more distant past for each of approximately 20 countries of birth, or otherwise continent of birth. However, no attempt is made to update population stocks by educational attainment or occupation. As in other countries, such estimates are based on the Labour Force Survey (LFS).

The LFS is a rotating panel survey, with approximately 12 000 households per panel, which samples approximately 2% of the labour force. It collects data on occupations, economic branch and educational qualifications. It includes items on year of immigration and country of birth (but not on citizenship or place of residence one year before the survey). The size of the sample is sufficient to provide estimates of the occupations and economic branches of the immigrant labour force (*olim*), although, as in other countries, there are limits to the level of detail that such a survey can provide. Moreover, it does not allow for identifying returning Israeli emigrants or persons returning after temporary absences to acquire education or training abroad (CBS, 2000).

Special surveys: The extraordinary nature of the immigration wave of the 1990s prompted the launching of a variety of surveys on immigrant employment (For an overview, see Sicron *et al*., 1996; Sicron, 1998). They required more detailed data than were provided by the LFS. The CBS conducted several panel surveys from 1990 to 1996, gathering detailed data on education and occupation abroad, employment and training in Israel, language acquisition and other variables (CBS 1991, 1993b, 1994b, 1995, 1996, 1997). The Brookdale Institute in Jerusalem conducted a variety of surveys, among them a panel survey of immigrants aged 25-64 who were interviewed in mid-1992 and late 1994 (Naveh *et al*., 1994); a panel survey of older immigrants aged 55 and over, interviewed in 1994 and 1995 (Lithwick and Naveh, 1995), a survey of 1 500 immigrant engineers aged 25-54, conducted in 1995 (Naveh, 1997); a panel survey of immigrant physicians, conducted in 1994 and 1998 (Nirel, 1999).

Record linkage: a rich potential source. As mentioned above, the widespread use of the PIN in Israeli administrative records, and from 2000 in the LFS as well, holds the promise of developing much richer data on migratory movements. Linkage of immigration records with the Border Control database (already accomplished) will provide estimates by education and occupation abroad of emigration of immigrants. Examples of potential projects of this kind are linkage of census records (with their educational and occupational data) with records in the Border Control database containing information on long-term and short-term movements abroad, before and after the census. Similarly, a linkage with administrative files received from universities would make it possible to track long-term and short-term movements abroad of university faculty and of recipients of advanced degrees.

Coverage and shortcomings of the data

As in many other countries, the richness of administrative data on migratory flows roughly corresponds to the degree of elaboration of administrative procedures governing the flow of given

types of migrants and reflects the underlying interests of such procedures. Thus, the data on *olim* are much richer than data on Israeli emigrants and other long-term and short-term migratory movements.

Israel's immigration statistics refer, principally, to persons entering Israel under the Law of Return, or to persons who, although they entered under another status, have received the right to settle under the Law of Return. Such persons fill out a registration form, the content of which is entered into in the PR. This form provides the basis for monthly and annual immigration statistics. In certain cases, accompanying family members who are not eligible under the Law of Return are granted permanent resident status under the Law of Entry, and they, too, are included in immigration files. The registration form contains information on occupation and years of education abroad, and although these items are not stored in the Population Register, they are passed on to the CBS and the Ministry of Immigrant Absorption. Unfortunately, the immigration authorities still use the 1972 Classification of Occupations, which is not equivalent to the revised classification used in the census and the LFS. Moreover, the occupational categories in that classification are not very detailed: engineers, for instance, are not generally coded by sub-speciality and data on highest educational level attained are not included.

A further problem is that the concept of residence on which the PR is based is "legal residence" and not "usual residence". Consequently, most international movements are not reflected in the PR. Although persons registered in the PR are required to inform the authorities if they have decided to settle abroad permanently, few do so in practice. Moreover, persons residing abroad even for prolonged periods may legitimately regard themselves as not having "settled" abroad. For this reason, the PR cannot be used directly as a source for emigration data. The PR contains records for all permanent residents and citizens, but only for certain categories of temporary residents, principally those who are candidates for citizenship or permanent residence and thus "legally resident" in Israel. Other categories of temporary residents – among them students, "foreign workers" and visiting faculty, all of which may include highly skilled workers – are not recorded in the PR.

Inbound and outbound flows of Israelis

Because the Population Register does not reflect usual residence, inbound and outgoing migration of Israelis can only be calculated on the basis of movement and duration of stay, as recorded in the Border Control database. To estimate emigration and return migration, special annual data files are prepared with a segment of the border movement history of all persons who were abroad continuously for over 90 days. Operationally, emigrants are defined as persons who departed Israel in a given year and were abroad continuously for 365 days. They are defined as "usually resident" in Israel if before departure they resided in Israel continuously for 90 days. Similarly, a returning resident is defined as one who was abroad continuously for 365 days and, after returning, remained in Israel for 90 continuous days.

Although data series based on these approximations have provided a reliable proxy for inbound and outbound migration of Israelis, they are clearly far from perfect. In an age when frequent visits to Israel by Israelis residing abroad is cheap and common, one can no longer rely on the time limits involved in the operational definitions used. However, until some measure of usual residence is adopted by the Ministry of Interior, it will be difficult to identify categories of migrants unambiguously.

Non-immigrant inflows

Olim are not, of course, the only foreign migrants to Israel. In 2000, around 4 000 refugees entered Israel from Lebanon. Occupational data are not available for any of them. Likewise, no data are available on foreign students and trainees. In the 1990s, the most substantial movements of migrants (in order of size, with an estimate of the number entering in recent years) have involved: temporary foreign workers holding valid work permits (50 000-90 000); visa-overstayers who entered legally but overstayed their visas and/or are working without a permit (15 000-25 000); citizens and permanent residents returning after one year or more abroad (8 000-12 000); immigrating citizens (persons born abroad to Israeli citizens and entering the country in order to settle, 4 000-5 000); family reunification (principally marriage partners of Arab residents of east Jerusalem and other regions of the country, 1 000).

Since none of these groups is captured by the statistical system governing immigrants, data on their occupations and education are lacking. Both immigrating citizens and family reunification migrants are entered in the Population Register, and this event is recorded by the statistical system. However, while the PR records their country of birth, it does not record the country from which they arrived. Moreover, since in Israeli terminology they are not "immigrants" (*olim*), their date of immigration is not recorded in the Population Register. The CBS has recently obtained the agreement of the Population Administration to retain their date of entry in their records.

Foreign workers are not considered permanent or temporary residents under Israeli law but visitors with permission to work. Therefore, they are not entered in the Population Register. A Register of Foreigners has been established, but until recently, most of its content has consisted in data obtained from the border cards; for foreign workers, data on their employer are also obtained. From this source, the number of entries and exits of persons holding work permits can be extracted, as well as some data regarding the economic branch in which they work.

It would be possible to enumerate visa overstayers reliably if the border control data were reliable. In practice, since a substantial number of exit cards cannot be matched to entry cards, statistical methods have to be used to estimate the number of overstayers. This has been done for the years 1995-99, in which time the number of overstayers apparently in the Israeli workforce rose from around 60 000 to over 100 000.

Immigration of the highly skilled in the 1990s

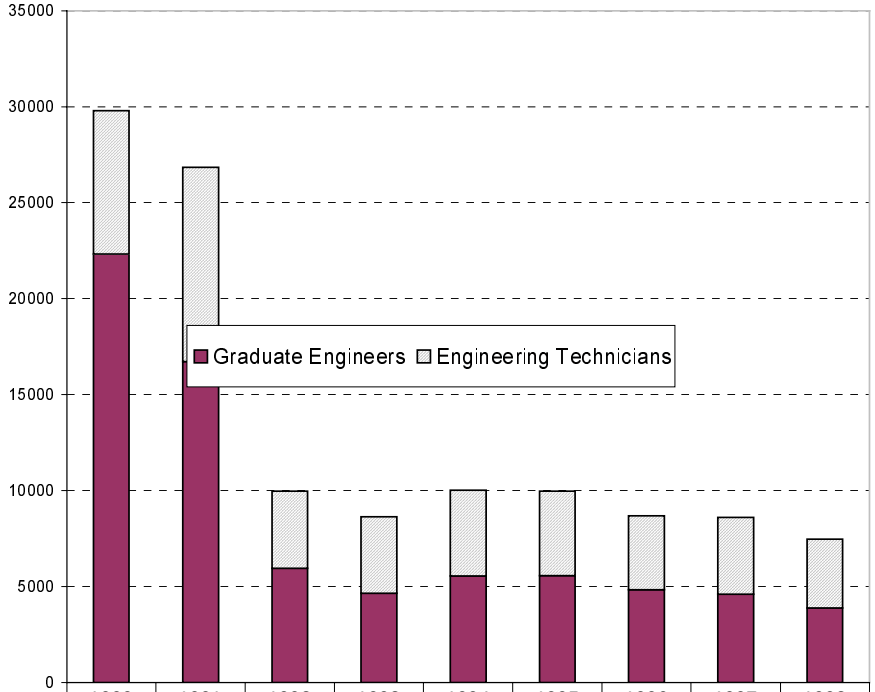
The scale of the immigration wave

The 1990s wave of immigrations was weighted towards the highly skilled and out of all proportion to the economy that received it. Between 1990 and 1999, over 490 000 immigrants who had worked abroad entered Israel, *i.e.* one-third the size of Israel's labour force in 1989. Over 307 000 reported having been employed as academic or associate professionals and technicians (the Israeli equivalent of ISCO groups 2 and 3), as compared to 356 000 employed in these occupations in Israel in 1989 (Statistical Abstracts, 1990-2000). In particular, nearly 91 000 (38% of whom were women) were employed as engineers or architects before immigration, over three times the 27 000 Israelis employed in these professions in 1989. Nearly 20 000 had been physicians or dentists, as compared to 14 000 in these professions in Israel in 1989. Unlike most migratory movements, the immigrant population was not younger than the receiving one: in fact, its median age was more than six years older (33-34). Thus, a considerable proportion of the arriving immigrants were nearing retirement age

(over 20% of those aged 15-64 were over 55), which exacerbated employment problems (Paltiel *et al*., 1997; Lithwick and Naveh, 1995)

Not only was the wave huge, it was concentrated, both numerically and as regards skills, in the years 1990-91. Figure 3 depicts the situation for professionals in the engineering professions (ISCO groups 2 and 3) aged 20-54 at immigration. Over 50% of graduate engineers arrived in 1990-91.

Figure 3. Immigrants in the engineering professions aged 20-54 at immigration



	1990	1991	1992	1993	1994	1995	1996	1997	1998
Engineering Technicians	7471	10125	4016	3990	4461	4402	3848	4006	3582
Graduate Engineers	22322	16719	5944	4639	5555	5564	4837	4593	3889

Source: CBS Immigration data, special tabulations.

Immigration data sources do not provide information on educational levels. Data from the 1995 census, however, show that 32% of immigrants aged 15 and over who arrived in 1990-95 had university degrees (as compared to 13% of the rest of the population) and 2.3% had a PhD degree or equivalent (as compared to 1.1% of the rest of the population) (CBS, 1999).

Incorporating this highly skilled population into the Israeli economy was not made any easier by the state of the Israeli economy in 1989: per capita GNP declined that year, unemployment rose to 9% and inflation reached 20%. Yet, contrary to some pessimistic predictions, the immigration wave helped stimulate an economic boom, and per capita GNP rose by an annual average of 2.4% between 1990 and 1997. Unemployment, which rose in the first three years of the wave, eventually fell to the levels of the mid-1980s (Statistical Abstract, 2000). Thus, the problem of finding work for the immigrants was eventually solved by the economic expansion that they themselves helped to stimulate. At what cost or benefit, however, for the immigrants and for the economy as a whole, in terms of the retention of their original occupations and skills?

Exploitation of these skills and experience was the challenge faced by both the economy and the immigrants themselves. A variety of surveys and studies based on data from the first five or six years of the immigration wave documented high labour force participation rates and gradual declines in unemployment (except for persons over age 55), along with considerable occupational downgrading (Sicron, 1998). This was no less true of engineers than of other professions.

Absorption of engineers

A survey of 1 500 engineers aged 20-54 at immigration found that only a quarter had found work as engineers with another 9% in related occupations, while 44% were working as skilled and 25% as unskilled labourers. The situation of women in this field was worse than that of men: only 18% were employed as engineers. Clearly, the chance of finding employment was higher when the structure of demand in the Israeli labour market was favourable: 40% of immigrants who had been employed in electrical, electronic or computer engineering were employed in their profession in Israel, as were 41% of civil engineers. The first group met the demands of the fastest-growing sector of Israeli industry, while the second found employment in a sector whose growth was stimulated by immigration itself (Naveh, 1997). But problems in finding employment were not all due to limited demand: conversion of engineering skills acquired in the Soviet Union also posed a problem. In certain cases, the classification "engineer" was not equivalent to its Western counterpart (the case of the 12% who were "economic engineers"). In other cases, lack of skills in Hebrew and English (the language of most technical manuals and the professional literature) and in computing techniques served as a barrier to employment.

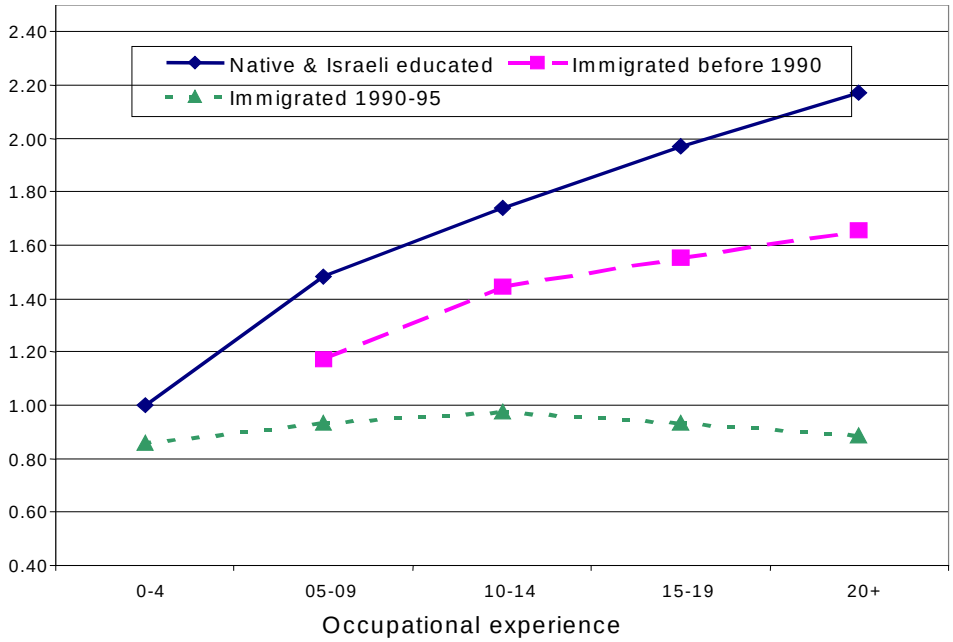
Economic analysis using various models has shown large gaps in the short-term "rate of return" of professional education between immigrants and native Israelis in the 1990s. Weiss and Gotlibowski (1995) found that the adjustments and compromises made by immigrants were equivalent to a loss of about two years of education and 10% of the wages they would expect to receive under current market conditions if they could find employment in their original occupation. Eckstein and Weiss (1998) found that, based on present trends, the occupational distribution of immigrants was likely to coincide over a period of 15 years with that of comparable native Israelis. However, although wage growth of high-skilled immigrants in their initial years in the country is high (8% a year), the price that immigrants receive for their years of schooling is initially zero and later remains below that for native Israelis (4% and 7%, respectively, for each year of schooling).

Figure 4, based on cross-sectional data from the 1995 census, illustrates this situation. Wages of Israelis in scientific and technological occupations (engineers and scientists) are plotted against years of occupational experience (measured as the difference between current age and estimated age at completion of education). It is clear that whereas the difference between the wages of immigrants and native Israelis with little or no occupational experience is small, immigrants are essentially not rewarded for occupational experience abroad. Another interpretation of this is that immigrants with considerable experience are willing to accept relatively low wages as the price for working in their profession.

Balancing the rather negative picture presented by the evidence for occupational downgrading and low wage rates is the evidence for the positive macroeconomic effects of immigrants' skills on the Israeli economy. The wave of immigration seems to have contributed to the changing structure of the Israeli economy and its shift toward high-technology industries. At least one study has found that the wave of immigration was the most important factor behind the shift of output in the 1990s towards skill-intensive products (Gandal, 1999). Moreover, some of the negative picture may reflect the fact that most of the studies on which this survey is based were conducted in the early 1990s. Since then,

the picture may have changed somewhat. An investigation of the growth of labour in the high-technology sector in the late 1990s has shown that the growth of the immigrant labour force in high-technology occupations (defined as engineers and scientists in electronic computing and biotechnology occupations) outstripped that of overall growth in these occupations. Between 1995 and 1999, overall labour in high-technology occupations in Israel grew by 39%, whereas the number of immigrants in these occupations rose by 69% (Caplan and Goldman, 2001).

Figure 4. **Income growth in high-skill occupations relative to natives with 0-4 years of experience**
Census data



Source: 1995 Census, special tabulations.

Absorption of scientists

Whereas absorption of engineers was left to market forces, the government intervened to facilitate the absorption of workers regarded as "scientists". Over 13 000 of the immigrants in 1989-98 were classified by the absorption authorities as "scientists". Approximately 40% arrived in 1990-91. They were:

- Persons with a PhD degree or equivalent, who had at least three published papers to their credit and who had been engaged in research in three of the five years preceding immigration.
- Persons with a master's degree or equivalent who had at least three published papers to their credit and who had been engaged in research in four of the six years preceding immigration.
- R&D engineers with a master's degree, with four years of industrial research experience in the six years preceding immigration.

Assistance programmes were considered necessary for this group, not only because this windfall to the Israeli economy was considered to be a unique opportunity to stimulate research (the number of

persons employed in R&D in Israel in 1989 was estimated at about 15 000), but because it was believed that scientists from the former Soviet Union faced particular difficulties in adapting to a Western research environment. They lacked simple prerequisites such as a working knowledge of English or familiarity with procedures for submitting research proposals and seeking sources of funding. A number of assistance programmes were developed which entailed short-term (up to three years) subsidies to salaries and research funds in universities and other research institutions. "Research incubators" were established where researchers could develop innovative ideas in a protected environment before attempting to offer them on the market.

Approximately half of the researchers had backgrounds in mathematics and physics – fields in which the Soviet Union was particularly advanced – and about a quarter were in the life sciences. Most had been employed in governmental research institutes, a minority in universities.

According to a 1998 report of the Ministry of Immigrant Absorption, of these 13 000 scientists, 74% had found employment in their field and of these, over 80% had done so through assistance programmes, about equally in the public and the private sector. Slightly over one-quarter were placed in universities (Ministry of Immigrant Absorption, 1999).

Although the programmes were meant to provide funding only for a bridging period during the scientists' adaptation, about half still required assistance after three or four years. New programmes were introduced to continue support. A 1995 study of the Ministry of Science showed that those who were employed in basic or theoretical research seem to have been absorbed more successfully, whereas differences between Western and Soviet technology seemed to explain why those in applied fields fared worse. Even after four years, problems remained in language skills and in the ability to prepare attractive research proposals. The narrow scope of their collegial networks in the Western scientific world also appeared to be a handicap (Sicron, 1998).

General absorption of the highly skilled

The overall result of the mutual adaptation of the Israeli economy and the immigration wave of the 1990s can be summarised in the data presented in Tables 1 and 2. The occupational distribution of highly skilled immigrants in Israel demonstrates that only about a third have been able to retain their former occupational category; those who arrived in 1990-91 are more likely to have obtained highly skilled employment than those who arrived later. Overall, Israel's occupational distribution is only slightly more concentrated in ISCO categories 2 and 3 than it was before the immigration wave, and the distribution of immigrant occupations generally corresponds to the distribution for all Israelis. In the decade of the immigration wave (1989-99) the number of persons employed as academic or associate professionals and technicians rose considerably, by about 60%. Although a substantial proportion of this increase is explained by the contribution of the immigration wave (about 40%), it contributed less to these occupational categories than to the growth of the labour force as a whole (52%).

The role of emigration

Immigrants are only half of the net migration equation, and the question arises whether emigration (of both native Israelis and immigrants) or the return of former emigrants are significant components of the circulation of highly skilled labour in Israel in the 1990s. As in other countries, these questions are more easily posed than answered. Even though current estimates of the demographic characteristics of outgoing and returning emigrants are available, their occupational and

educational characteristics are, by and large, unknown. Nevertheless some partial information can be extracted from record linkage, from the 1995 census and from foreign data.

Table 1. Occupational distribution of total employees and immigrants in Israel, 1999

Israeli labour force 1999	Total employed	Employed immigrants by year of immigration			Immigrants of 1990-99
		Total	Arrived 1990-91	Arrived 1992-99	Occupation before Immigration
Total (thousands)	2 136.6	352.6	154.1	198.5	490.6
Academic professionals (ISCO 2)	12.5%	11.7%	16.4%	9.2%	31.6%
Associate professionals and technicians (ISCO 3)	14.7%	13.0%	15.5%	9.7%	33.4%
Other occupations	72.8%	75.4%	68.1%	81.1%	35.0%

Source: Statistical Abstract 2000, Israel Labour Force Survey 1999, special tabulations.

Table 2. Contribution of immigration to growth of the labour force by occupational category, 1999

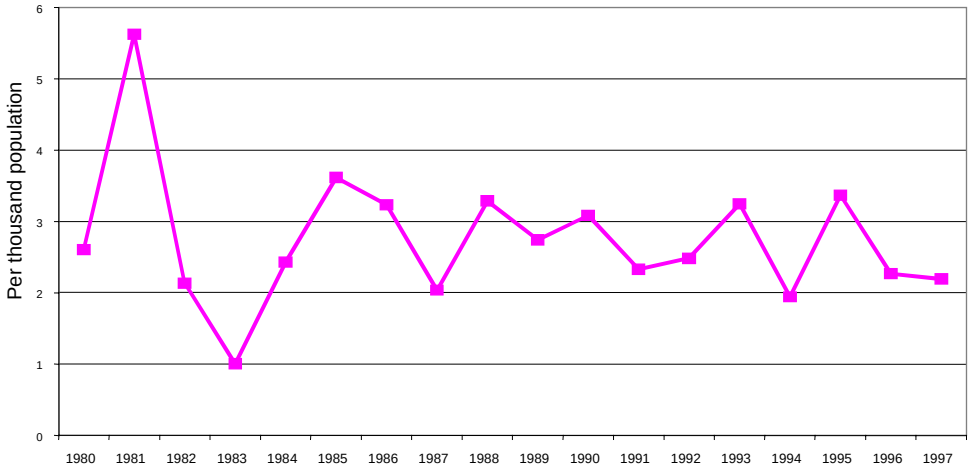
	Total employed (thousands)	Immigrants 1990-99 (thousands)	Net growth 1990-99 (%)	Proportion of growth explained by immigration (%)
Total	2 136.6	352.6	46%	52%
Academic professionals (ISCO 2)	267.1	40.9	60%	41%
Associate professionals and technicians (ISCO 3)	314.1	45.4	59%	39%
Other occupations	1 555.4	264.1	42%	58%

Source: Statistical Abstract 2000, Israel Labour Force Survey 1999, special tabulations.

In the past, immigration waves to Israel were often followed by emigration waves (Lamdany, 1982). Yet data on the demographic characteristics of emigration flows from the Border Control database show that emigration rates from Israel in the 1990s were, if anything, slightly lower than those of the 1980s (Figure 5). This stability, however, conceals a profound change in emigration patterns. Over half of the emigrants in the 1990s were recent immigrants, whereas in the 1980s over 80% were native or veteran Israelis. This overall stability conceals a dramatic decline in emigration of native Israelis in the 1990s. This is confirmed by US Immigration and Naturalization Service (INS) data (the principal destination of Israeli emigrants) on the receipt of immigration visas by persons who reported Israel as their last country of permanent residence. The data show a steep decline in immigration rates in the 1990s (Figure 6). Data from Canada, not shown here, also show that rates of receipt of landed immigrant status for native Israelis declined sharply in the 1990s.

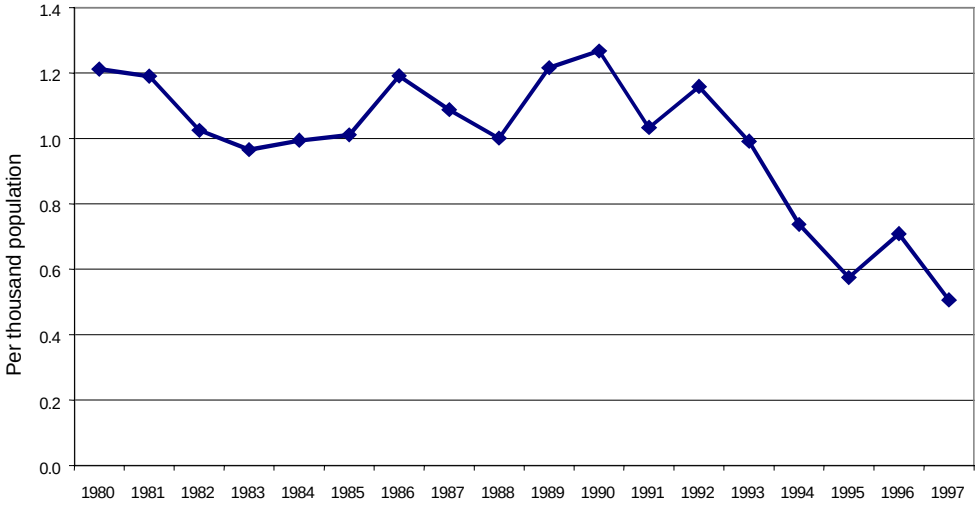
What are the implications for movements of highly skilled labour? Based on American census data, it has been shown that emigrants from Israel in the 1970s and 1980s were highly skilled, both in comparison to other immigration groups and to the Israeli population (Cohen and Haberfeld, 2001). Thus, a downturn in emigration implies that fewer highly skilled workers were leaving Israel permanently. It may be that the rapid growth of the high-technology sector in Israel in the 1990s, partly stimulated by the immigration wave, led to a greater retention of the highly skilled in Israel. As for the emigration of highly skilled immigrants, record linkage of immigration files with Border Control files showed that in the years 1990-92 at least, emigration rates for immigrants who had worked in professional occupations abroad (ISCO category 2) were actually lower than overall emigration rates (CBS, unpublished data). In absolute numbers, they were no more than 600 annually.

Figure 5. Net emigration rates from Israel (new emigrants minus returning emigrants)
Per thousand of the average Israeli population



Source: CBS – unpublished data.

Figure 6. Immigrants to the United States whose last country of permanent residence was Israel
Per thousand of the average Israeli population



Source: INS Statistical Yearbook, various years.

It may be that whereas "permanent" emigration of native Israelis had declined, short-to-medium-term movements of the highly skilled were continuing or even increasing. At present, no long-term trend data for these movements are available. The only indication that this might be so comes from INS data on the issuance of H-1B visas (temporary workers with speciality occupations) by country of citizenship. In 1996 and 1998, the number of such visas issued to Israelis (2 000 and 3 200, respectively) was considerable, given the size of Israel's population. The equivalent figures for such countries as France or Germany were only three times larger.

Data from the 1995 census give some indication of the contribution to Israel's labour force of returning emigrants in the 1990s. Table 3 shows that although this contribution was not large as

compared to that of immigrants, it was disproportionately concentrated in scientific and engineering occupations.

Table 3. Contribution of highly skilled immigrants and returning emigrants to Israel's labour force, 1995

Occupational category	Total	Immigrated 1990-95	Born or educated in Israel: returning emigrants	Total net migration
Scientists and engineers	100%	20.0%	2.1%	22.1%
Physicians	100%	23.0%	2.5%	25.6%
Other academic professionals	100%	5.5%	1.9%	7.4%
Other occupations	100%	12.2%	1.5%	13.7%
All	100%	12.5%	1.6%	14.1%

Source: 1995 Census, special tabulation.

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Chapter 10

INTERNATIONAL MIGRATION OF SCIENTISTS AND ENGINEERS IN RUSSIA

by

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Introduction

At the start of the 1990s, the scale of emigration drastically increased in Russia to reach a total annual outflow that exceeded 100 000 persons. Measuring this emigration and analysing the driving forces became the task of the day. Since organisation of data collection at border control posts required much funding and time, the available sources of information were simply adapted to new requirements. This resulted in an imperfect system of statistical observation of emigration from Russia.

With respect to scientists and engineers, the problem was even greater. Neither national statistical authorities nor migration-related agencies were interested in describing this category of migrants. Specific efforts were therefore required from the Centre for Science Research and Statistics (CSRS) to provide a quantitative assessment of the scale of migrating scientists and engineers.

With the warmer international political climate, Russian researchers had the possibility of obtaining contract jobs abroad owing to the stronger interest in Russia at the end of the 1980s, which contributed to the closer integration of Russian science into the world S&T community. The increased openness of the Russian S&T system and new forms of international co-operation played a significant role. Another crucial factor in this regard was the 1991 Law on Employment, which stipulated the right of Russian citizens to take employment abroad. Consequently, the scale of temporary engagement of Russian research scholars in other countries has significantly exceeded the emigration of R&D personnel *per se*.

Given that the departure of researchers abroad was not part of any clear-cut government policies and that no statistical data were collected, CSRS had to undertake special statistical studies to analyse the population of scientists and engineers employed internationally on a temporary basis.

This chapter describes the sources of data for measuring the international mobility of Russian researchers and the collection methods used. An assessment of emigration of scientists and engineers from Russia is provided. Particular attention is devoted to the methodology and results of an *ad hoc* survey of employment of Russian researchers abroad.

Emigration of Russian scientists and engineers: data sources and analysis

Overall data on citizens leaving Russia for permanent residence abroad are provided by the Ministry of Internal Affairs of the Russian Federation (MVD) and the State Committee on Statistics of the Russian Federation (Goskomstat). Though these data sources are not free from certain shortcomings, they may serve as a starting point for estimating the scale of qualified professionals' emigration from Russia.

MVD records contain data on persons who receive permission to leave Russia for permanent residence in other countries. They enable analysts to make a rough evaluation of the professional structure of those going abroad for permanent residence on the basis of the sector in which they were employed in Russia. The data also make it possible to distribute emigrating individuals by region of Russia and recipient country from 1992. Unfortunately, this source of information does not provide information on highly qualified personnel, since it does not include the educational level of emigrants. Gender and age variables are available only with regard to the total emigrating population, but not for particular professional groups. Moreover, it is impossible to single out R&D personnel, because the classification of economic sectors used by MVD merges the R&D and education sectors. This disadvantage seems, however, to be surmountable owing to the method of assessing the scale of emigration of R&D professionals developed by CSRS.

The Goskomstat data on the emigration of Russian citizens were obtained from processing, performed by regional statistical offices, of primary records of arrivals and departures that are filed by local units of the Ministry of Internal Affairs which surveys the population at their places of residence. It is intended to cover not only citizens departing for permanent residence (which is as a rule connected with a change in citizenship), but also those who leave the country for a long period to study or work abroad. It should be stressed, however, that registration is not obligatory so that the data are far from complete.

Nevertheless, on that basis, Goskomstat has produced since 1994 figures on the qualifications of emigrants, their gender and age characteristics, nationality, occupation and region of residence in Russia, as well as country of destination. Unfortunately, data collection on migrants' qualifications and sector of employment was discontinued in 1997. This has decreased the analytical value of this data source and discouraged its use.

For a better understanding of emigration data for Russia, two specific features of Russian statistics should be mentioned, which are different from those of most other countries. First, in the Russian Federation, emigrants are defined as persons going abroad for permanent residence, not as those who leave the country for over one year. Second, nationality is understood as the ethnic group to which an individual belongs, not the country of birth or citizenship. For example, a person can be a Russian citizen but at the same time belong to a specific "nationality": Russian, Jewish, Tatar, German, Ukrainian, etc. Hence, the nationality record reflects an ethnic group, not citizenship.

Table 1 presents the overall scale of emigration from Russia in 1990-2000 by country of destination.

Table 1. Emigration from Russia by recipient country
Number of persons who received permission to go abroad for permanent residence

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Aggregate total for 1990-2000
Total	103 614	88 281	102 910	114 133	106 076	111 012	97 548	85 828	84 658	106 837	78 399	1 079 296
Germany	33 753	33 697	62 690	73 093	69 900	79 912	64 841	52 491	49 558	53 221	45 574	618 730
Israel	61 022	38 742	21 975	20 558	17 107	15 368	14 488	14 613	17 005	33 699	16 480	271 057
United States	2 317	11 016	13 200	14 919	13 813	10 705	12 355	12 507	10 797	11 108	9 552	122 289
Australia	79	304	803	531	690	486	375	210	167	161	127	3 933
Greece	4 177	2 088	1 855	1 798	1 052	1 309	1 334	1 002	832	938	601	16 986
Canada	179	164	292	663	874	763	1 010	1 309	1 463	1 885	971	9 573
Other countries	2 087	2 270	2 095	2 571	2 640	2 469	3 145	3 696	4 836	5 825	5 094	36 728

Source: Calculated by CSRS on the basis of data collected by the Ministry of Internal Affairs.

According to long-term observations, children under 18 years old account for approximately 30% (29.7% in 2000) of emigrants. About three-quarters of all adult emigrants (72% in 2000) are employed. Thus, about half of people leaving the country (50.6% in 2000) are part of the economically active population. Among those over 18 years old, there is a slightly greater share of women (57.2%).

The bulk of the flow of emigrants is directed towards Germany and Israel. The third recipient country for Russian emigrants is the United States (12.2% in 2000); all other countries account for only 8.6% of the total number of emigrants from Russia (Table 2).

Table 2. Distribution of Russian emigrants by recipient country
Percentages

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Germany	32.6	38.2	60.9	64.0	65.9	72.0	66.5	61.2	58.5	49.8	58.1
Israel	58.9	43.9	21.4	18.0	16.1	13.8	14.8	17.0	20.1	31.5	21.0
United States	2.2	12.5	12.8	13.1	13.0	9.6	12.7	14.6	12.8	10.4	12.2
Australia	0.1	0.3	0.8	0.5	0.7	0.4	0.4	0.2	0.2	0.2	0.2
Greece	4.0	2.4	1.8	1.6	1.0	1.2	1.4	1.2	1.0	0.9	0.8
Canada	0.2	0.2	0.3	0.6	0.8	0.7	1.0	1.5	1.7	1.8	1.2
Other countries	2.0	2.6	2.0	2.2	2.5	2.2	3.2	4.3	5.7	5.4	6.5

Source: Calculated by CSRS on the basis of data collected by the Ministry of Internal Affairs.

The occupational structure of emigrants from Russia can be assessed with the help of data from the Ministry of Internal Affairs on the distribution of those who received permission to leave the country, by sector of the national economy (Table 3).

Table 3. Distribution of emigrants from Russia by sector of the national economy[1]
Percentages

	1992	1993	1994	1995	1996	1997	1998	1999	2000
Total	100	100	100	100	100	100	100	100	100
Industry, electricity, transport, communications, material and technical supply, construction	27.5	29.0	25.8	26.5	25.8	23.7	21.5	19.5	18.3
Agriculture and forestry, purchasing	14.9	14.5	14.6	14.3	12.0	10.9	11.7	10.2	10.5
Trade, public catering, housing and communal services, finance, insurance, administration	7.9	7.0	7.3	8.5	9.0	8.6	7.7	7.7	6.7
Science and education	7.8	8.7	8.9	9.9	9.9	9.0	9.1	8.5	8.7
Health, social security, physical training	7.0	6.2	5.9	5.9	6.7	6.5	6.8	6.6	6.0
Culture and arts	1.8	1.7	1.4	1.4	1.6	1.5	1.6	1.4	1.4
Others	33.1	32.9	36.1	33.5	35.0	39.7	41.6	46.1	48.4

1. Only employed emigrants over 18 years of age were included.
Source: Ministry of Internal Affairs.

During the 1990s, the number of persons employed in the sector "Science and Scientific Services" who emigrated from Russia ranged from 1 000 to 2 000 a year. This included not only research scientists but other categories employed in this sector as well (Table 4).

Table 4. Number of employees of the sector "Science and Scientific Services" who emigrated from Russia
Thousands

1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Aggregate 1989-2000
0.9	2.1	1.8	2.1	2.3	2.1	2.2	1.9	1.2	1.1	1.4	1.1	20.2

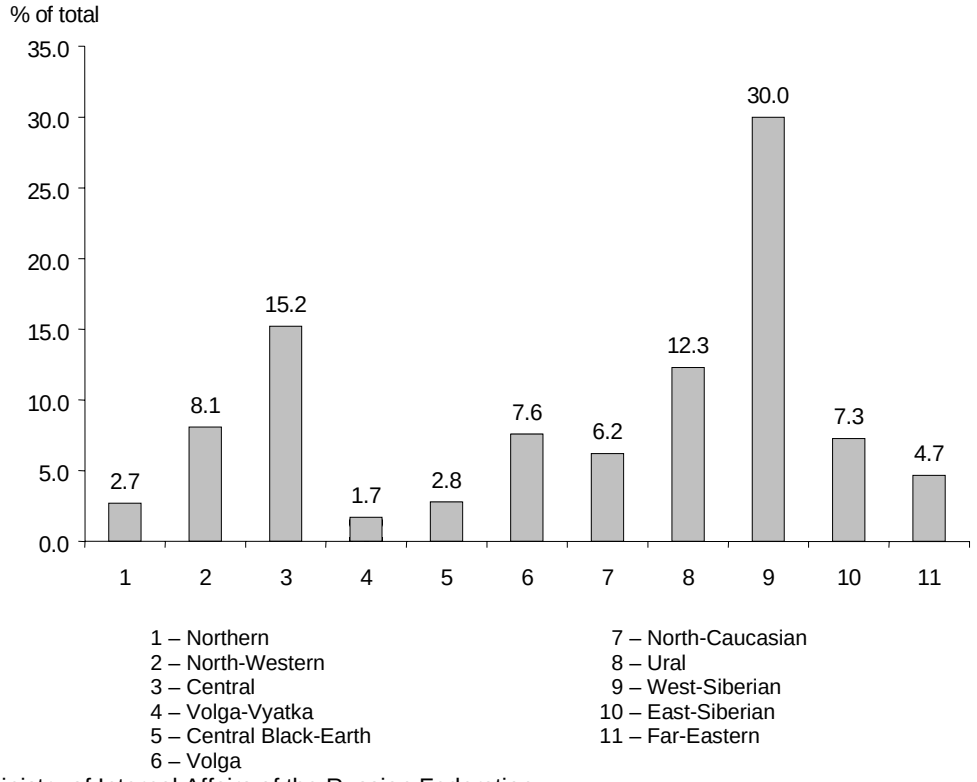
Source: Estimated by CSRS.

The majority of emigrants employed in the S&T and education sectors[1] have gone to Germany and Israel. These two countries accounted for 86% of the emigrants in this category who left Russia in 2000. At the same time, relative indicators reflecting the proportion of S&T and education employees in the total number of emigrants by recipient countries are the highest for Canada (13.8%), the United States (11.9%) and Israel (10.9%).

Analysis of the distribution of emigrants employed in the S&T and education sectors by region of the Russian Federation shows that half originate from West Siberia and the Central Economic Region (Figure 1). The contribution of these two regions to the overall migration flow from Russia is significant as well.

In addition, Goskomstat data make it possible to assess the ethnic and educational patterns of emigrants. In particular, in 1999, ethnic Germans accounted for 32.9% of all emigrants, Russians, 40.4% and Jews, 10.5%. According to 1996 data, one in five emigrants from Russia held a university degree and 27.7% had secondary vocational education degrees. Among those with university education only 0.17% had advanced scientific degrees.

Figure 1. Employees of the science and education sectors who emigrated from Russia, by economic region



Source: Ministry of Internal Affairs of the Russian Federation.

The last few years have seen a reduction in the outflow of manpower from the S&T sector. CSRS studies show that emigrants represent 1–2% of total S&T manpower. Emigration of S&T employees for permanent residence abroad is usually ethnically determined. As a rule, it does not affect the most highly qualified professionals, who are mainly involved in scientifically driven migration.

Employment of Russian researchers abroad

As mentioned, the improved international climate at the beginning of the 1990s greatly contributed to the large-scale outflow of Russian scientists. This outflow was also due in part to the worsening condition of the domestic R&D sector in the transition period, which resulted in a drastic reduction of R&D financing, declining employment and salaries and falling prestige of S&T occupations. All these factors led Russian scientists and engineers, especially those with higher professional qualifications, to seek jobs abroad.

The initial CSRS attempts to measure the employment-driven outflow of researchers from Russia date back to 1992-93. The primary focus was on the Russian Academy of Sciences, as the major centre for state-of-the-art basic research. At that early stage, it become evident that temporary outflows exceeded permanent emigration in both scale and quality.

Then, in 1997-98, CSRS conducted a survey to obtain information on researchers temporarily employed abroad. It drew on the fact that scientists leaving the country for a contract or allied arrangements abroad generally stayed on the payroll of their mother organisations.

Only those who had spent more than three months abroad were considered. The duration of temporary work abroad for persons who had returned home prior to the survey was defined as the actual period of time spent abroad. For those still working abroad, the respective term was identified on the basis of their contracts or declared intentions, as known to personnel officers at responding units.

The survey targeted academy and industry R&D institutes, universities and other equivalent higher education institutions located throughout Russia in order to answer the following questions:

- Who goes for temporary work abroad and where do they go?
- For how long are Russian researchers employed abroad?
- What are the objectives and channels for Russian researchers to obtain jobs abroad?
- What is the nature of their work there?
- What fields of S&T are most affected by such arrangements?

Through the survey, detailed information was obtained on the population of researchers temporarily engaged abroad and their distribution by age, position, qualification, field of S&T, etc.

The survey showed that 169 Academy research institutes (21.5% of the total), 58 branch R&D institutes (5.3%) and 53 universities (13%) had researchers temporarily employed abroad. The total number of such researchers was 4 084, or 2.6% of the total number of the researchers of these institutions.

Table 5 shows that Academy institutes accounted for 2 727 researchers in this category (7.6% of all researchers employed by these institutes). The respective number for industry R&D institutes was 501 (2.7%), and for universities, 856 (9.9%). Therefore, while Academy institutes led in terms of the absolute number of researchers employed abroad, they are somewhat behind higher education institutions in terms of intensity of international mobility of researchers.

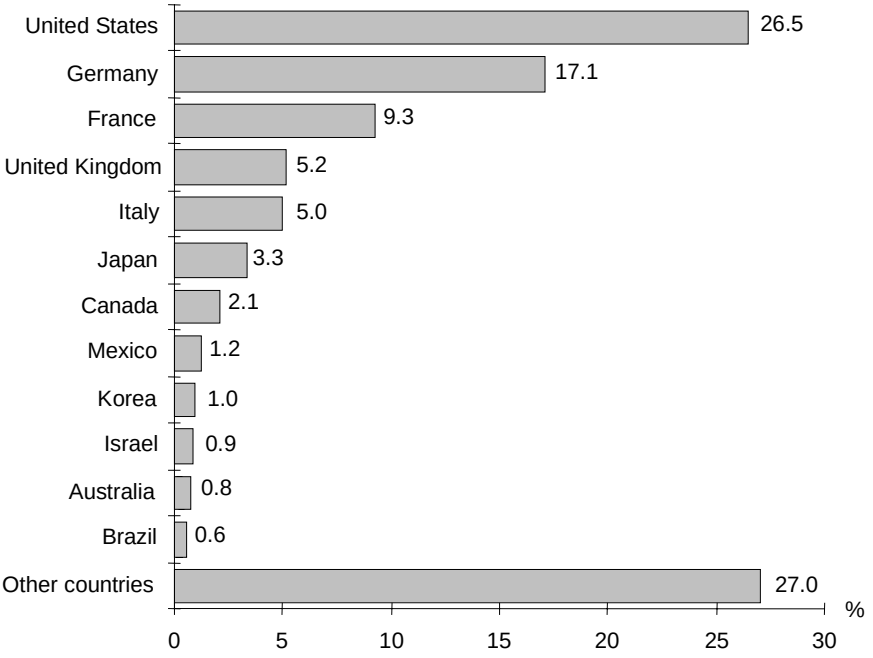
Table 5. Researchers employed abroad by type of institution

	Researchers employed abroad	Percentage of the total number of researchers
Total	4 084	6.5
Academy research institutes	2 727	7.6
Branch R&D institutes	501	2.7
Higher education institutions	856	9.9

Source: Centre for Science Research and Statistics.

The majority of Russian researchers working abroad were employed in the major OECD economies (Figure 2). Slightly over half (62.9%) were employed in the United States, Germany, and France, followed by the United Kingdom, Italy and Japan (with a total of 13.5%). In all, these countries accounted for two-thirds of the Russian researchers employed abroad.

Figure 2. Researchers employed abroad by recipient country



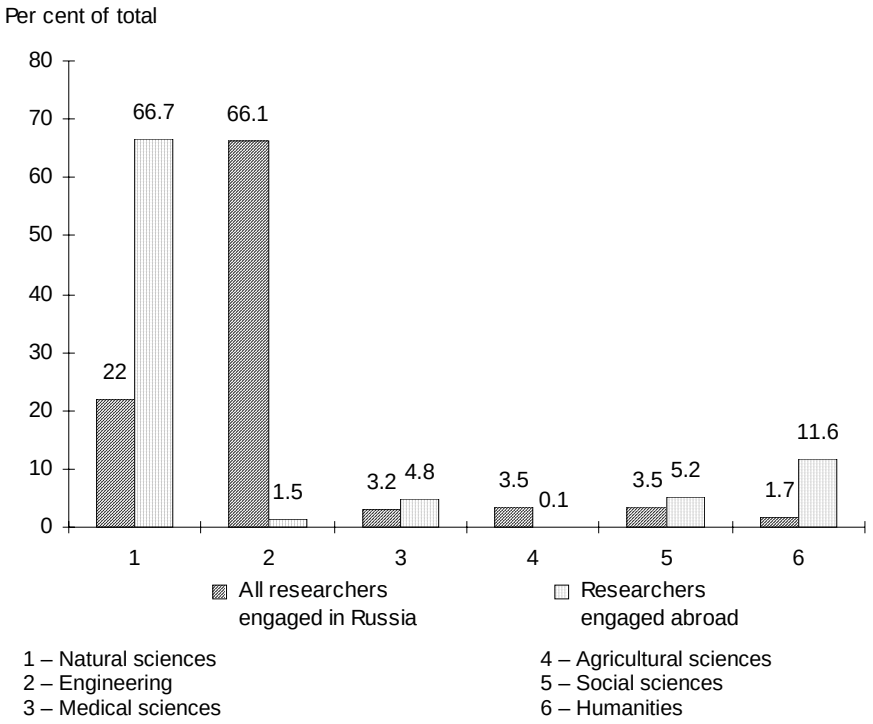
Source: Centre for Science Research and Statistics.

The researchers who obtained temporary positions in foreign countries are largely natural scientists, especially physicists and biologists (Figure 3). Their proportion among migrants is three times their proportion in the overall stock of researchers. Engineers, who represent the bulk of the domestic stock of researchers, played a minor role in terms of international migration. The shares of social and medical scientists among those employed outside Russia were 5.2% and 4.8%, respectively, slightly above their shares in the total stock of researchers in Russia. In terms of the intensity of research scholars' migration, expressed as the ratio of such employees to the total stock of researchers in a given S&T field, the humanities occupy the first place, with almost 6% temporarily employed abroad. For researchers in the natural sciences, this indicator did not exceed 2.5%. In other S&T fields, the levels were even lower: 1% for social sciences and medicine, 0.2% for engineering and 0.04% for agriculture.

Russian scientists obtained positions abroad on the basis of invitations from foreign partners (38.8%), through contracts negotiated independently (18%) or via official Russian institutions (15.2%). S&T exchange was the basis of temporary employment for 10.5% of researchers (Table 6).

Half of Russian scientists sought employment abroad in order to conduct joint research projects and one in four sought to perform non-collaborative research at a foreign institution (Table 7). Approximately equal shares (slightly above 10%) concerned those going to lecture or for training.

Figure 3. Researchers by field of science and technology



Source: Centre for Science Research and Statistics.

Table 6. Researchers employed abroad by cause of departure

	Researchers employed abroad	By invitation	Under contract signed through Russian organisations	Under independent contract	By exchange	Other
Total	4 084	1 584	621	736	427	716
Academy research institutes	2 727	1 213	384	502	112	516
Branch R&D institutes	501	145	131	80	29	116
Higher education institutions	856	226	106	154	286	84

Source: Centre for Science Research and Statistics.

Table 7. Researchers employed abroad by aim
Percentages

	Researchers employed abroad	Lecturing, consulting	Joint research projects	Scientific work in foreign organisations	Education, training	Other
Total	100.0	12.4	41.7	24.6	11.1	10.2
Academy research institutes	100.0	12.5	42.5	27.3	6.1	11.7
Branch R&D institutes	100.0	2.0	62.5	17.2	10.6	6.8
Higher education institutions	100.0	18.2	26.1	20.6	27.5	7.7

Source: Centre for Science Research and Statistics.

Somewhat over half of the scientists (57.4%) stayed abroad for less than a year, 20.2% from one to two years and 22.4% for more than two years (Table 8).

Table 8. Researchers employed abroad by duration of work

	Researchers employed abroad	From 3 months to one year	1-2 years	More than 2 years
Total	4 084	2 345	824	915
Academy research institutes	2 727	1 380	616	731
Branch R&D institutes	501	295	112	94
Higher education institutions	856	670	96	90

Source: Centre for Science Research and Statistics.

Most researchers employed abroad (63.9%) were 30-49 years old (Table 9). Although the share of younger scholars (under 29 years) was somewhat higher among those employed outside Russia than in the structure of domestic R&D personnel, other indicators show that foreign partners prefer to collaborate with scientists who have already achieved a certain level of expertise. The coefficient of mobility (the proportion of those going abroad in a certain age group to total R&D personnel belonging to that age group) is highest among those aged 30-39. Despite the high share of women in Russia's R&D personnel (57%), they represent less than a quarter of the scientists employed abroad.

Table 9. Researchers employed abroad by age and gender
Percentages

	Researchers employed abroad	Under 29 years	30–39 years	40–49 years	50–59 years	60–69 years	70 years and over
Total	100.0	11.8	32.5	31.4	17.0	6.3	1.0
Women	100.0	17.7	38.0	27.6	12.6	3.4	0.7

Source: Centre for Science Research and Statistics.

The qualifications of researchers going to other countries for temporary work exceeds by all parameters the respective indicators for the Russian R&D personnel in general. Candidates of science represent 19.7% of researchers employed in Russia but 50.3% of those engaged abroad. For doctors of science, these percentages are 4.4% and 19.9%, respectively. Within the latter category, 10% had the status of a professor, whereas corresponding and full members of the Russian Academy of Sciences represented 1% each (Table 10).

Table 10. Researchers employed abroad by qualification
Percentages

	Scientific degree		Academic status		
	Candidate	Doctorate	Professor	Corresponding member	Academician
Researchers employed abroad	50.3	19.9	9.6	1.2	1.0
Of whom women	51.8	10.3	4.1	0.7	0.2

Source: Centre for Science Research and Statistics.

These are, in brief, the major findings of the survey described above. However, to understand fully the phenomenon of temporary international migration of scientists and engineers, national

surveys in the countries of origin should be complemented by analysis of the situation in recipient countries. For instance, there is no information about Russian researchers who went abroad for temporary work and never returned. Their professional and social status in host countries as well as how they have adapted to their new environment remains unclear.

Given Russia's role in the global process of international mobility of scientists and engineers, as well as the deterioration of the national S&T potential during the transition to a market economy, there has been in Russia a certain bias towards restraining the migratory outflow highly skilled professionals. This involves not only government policies but also public perception of scientific migration. Thus, CSRS public opinion studies have highlighted that 51% of the population believe that by leaving the country in the current difficult times, researchers inflict losses on Russia in general and its science base in particular. Only 29% think that going abroad allows researchers to improve their skills, with a promise of returning enriched by their new experiences.

Although both the outflow of researchers from the domestic R&D sector and permanent emigration from Russia have been declining in recent years, many questions concerning temporary professional mobility of highly skilled scientists and engineers remain. Long-term trends and the impact on national R&D capacities need to be considered. Is the international mobility of Russian scientists to be treated as a necessary element of their scientific work or simply as the result of seeking better living conditions? What role does it play as an implicit form of technology transfer beyond the borders of the Russian Federation? Or, vice versa, is temporary work abroad an alternative to "brain drain"? All these issues are subjects of future investigations.

NOTE

1. Since the records of the Ministry of Internal Affairs do not distinguish between S&T and education occupations, separate estimates for emigrants earlier employed in the S&T sector are not available.

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Chapter 11

INTERNATIONAL MOBILITY OF CHINA'S RESOURCES IN SCIENCE AND TECHNOLOGY AND ITS IMPACT

by

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Introduction

Following China's opening in 1978, the fields in which it engages in exchanges and relationships with other countries have broadened and deepened. A prominent feature is the increasing international mobility of human resources in science and technology (HRST). Data on the international mobility of HRST need to be collected and the impacts on China and OECD countries need to be assessed.

Because China's market economy is at an early stage and its statistical system still incomplete, statistics on the international mobility of HRST are not fully available. This chapter presents some data that will help to address this issue. Following a general description of data sources, a data set for outflows of China's HRST is established, some related indicators are presented and the impacts of China's "brain drain" on China and receiving countries are analysed. The situation of foreign experts, and their contribution to China's economy, is addressed. Finally, suggestions are made for the establishment of a system of statistical indicators and its application to China.

Data availability: a general description

As a developing country, China's level of economic development is relatively low and returns on human capital are limited. As a result, outflows exceed inflows. Generally speaking, China's "brain drain" has three main aspects: study, foreign labour co-operation and technological migration. A large majority of outflows are for study; students are sent by the government or institutions (schools, research institutions, enterprises, etc.) or are self-supported. The number of Chinese citizens engaged in study abroad can be obtained from the Statistical Yearbook and the Statistical Yearbook for Education. The data, which are provided by the Ministry of Education, are incomplete and inconsistent. Before 1990, data on self-supported study, which was marginal, were not included. Since then, the number of self-supported persons who study abroad has grown regularly, as exchanges and incomes have increased. However, the statistics do not fully capture their numbers. Moreover, the published statistics do not present detailed indicators, such as country or course of study. In recent years, the share of government-supported students has declined. For these students, countries and fields of study are strictly defined. This information is available for 1996 from the committee that is

responsible for selecting students to be sent abroad by the government. The aggregate database can be roughly broken down on that basis.

The Bureau of Entry-Exit Management (BEEM) of the Ministry of Public Security (MPS) is the government body charged with checking the qualifications of those going to study abroad and with issuing passports. Therefore, this body has more complete data on study abroad and technical migration. However, MPS data are restricted. Moreover, since BEEM does not collect statistics, the authors have only obtained rough statistics on the number of citizens abroad in 1997-2000. The MPS data simply reflect the number of persons who applied successfully for passports in order to study abroad. However, some have their visas rejected by foreign embassies and some give reasons other than study abroad when applying for passports. As a result, the data are somewhat inaccurate.

The Ministry of Personnel (MP) is responsible for managing the staff of state-owned units, including government institutions, colleges and universities, large-scale enterprises, etc. When persons who study abroad return home and work in a state-owned unit, the relevant department of the MP receives them and takes charge of them. However, the relevant data are not collected and processed completely and carefully. Recently the MP, in conjunction with local personnel departments and large-scale state-owned units, initiated a survey of the working conditions of persons who returned after having studied abroad. This investigation will provide valuable data, but it will only be completed in June of 2001, or later.

The Ministry of Foreign Trade and Economic Co-operation (MOFTEC) has as one important function the management of international labour co-operation. China generally exports labour services at a low technical level. Since 1996, however, labour services in foreign countries for contracted project design and consultation have also been included; they involve educated personnel undertaking highly technical work abroad. While these new labour services represent a very small part of either international labour services or outflows of HRST, they are expected to grow quickly in the future.

The technical migrant is a person with higher education who responds to a request from a foreign country and gives up a domestic job to work and settle abroad. This type of brain drain has developed rapidly in China. The relevant information is only in the hands of BEEM of MPS and is not in the public domain, so that it is not possible to know the extent and the characteristics of the brain drain.

Inflows of HRST can be classified as follows: foreign experts introduced by international exchange agreements; specialists, such as technical experts, managers and engineers, sent to China by other countries; technicians working in China for a long period and sent by foreign investors; foreigners who studied in China and stay to work in China. The first three are discussed here. The last category is very small, because of government restrictions. For the first category, more detailed data can be obtained from the State Bureau of Foreign Experts (SBFE), which is in charge of the management of foreign experts. In the second and third cases, there are no specific statistics, so that the data can only be estimated roughly on the basis of the level of inflows of technology and foreign investment. Recently, SBFE and the State Statistical Bureau (SSB) initiated a survey of foreign experts working in China. The result of the survey will give more detailed data when it has been completed.

China's outflows of HRST: data and analysis

Aggregate and classified data on overseas study

Table 1 shows numbers of students studying abroad and returning home over the period 1978-99, based on the statistics of Ministry of Education (ME), which are not comprehensive. It indicates that, over the period, the total number of students who studied abroad and returned home are 171 636 and 60 788, respectively. The table does not include data for 1979 and for 1981-84, and, even if estimated data are added for the missing five years, the total number of students studying abroad is smaller than the figure (400 000) obtained from BEEM of MPS.

Table 1. Chinese students studying abroad and returning, 1978-99

Year	No. of students studying abroad	No. of students returning
1978	860	248
1980	2 124	162
1985	4 888	1 424
1986	4 676	1 388
1987	4 703	1 605
1988	3 786	3 000
1989	3 329	1 753
1990	2 950	1 593
1991	2 900	2 069
1992	6 540	3 611
1993	10 742	5 128
1994	19 071	4 230
1995	20 381	5 750
1996	20 905	6 570
1997	22 410	7 130
1998	17 622	7 379
1999	23 749	7 748

Source: *Statistical Yearbook*, 2000.

Table 2 presents the number of students who studied abroad in 1997-2000 according to the statistics of BEEM of MPS. The numbers are higher by 56.5%, 212.1%, and 257.9%, respectively, than those in Table 1. In absolute value, the differences are even more noteworthy: 12 669, 37 378 and 61 251, respectively. This indicates that the recently published official figures are quite different from the real ones. The most important reason is the recent dramatic increase in self-supported students, who are not controlled by the Ministry of Education.

Table 2. Numbers of students studying abroad, 1997-2000

Year	Total	Self-supported	Sent by government	Sent by units
1997	35 079	30 731	1 906	2 442
1998	55 000	50 000	2 000	3 000
1999	85 000	80 000	2 000	3 000
2000	85 000	80 000	2 228	2 724

Note: Data for 1998,1999, total and self-supported are estimates.
Source: MPS.

Table 3 represents the cumulative total of students having studied abroad, calculated by adding up numbers from 1978 to the years in Table 2.

Table 3. Total number of those studying abroad in certain years

Year	Cumulative total of students having studied abroad	Self-supported	Sent by government	Sent by units	Total having returned
1983	25 500	7 000			7 000
1987	65 000	20 000			20 000
1989	96 101	22 677	29 994	43 430	39 183
1992	170 000				
1998	320 000				100 000

Note: Figures for dates prior to 1987 only include total publicly supported overseas study.
Source: Based on Ministry of Education data.

Based on Ministry of Education data, using the figures in Table 3 as marginal total of control, and referring to data in Table 2, the data in Table 1 are adjusted and disaggregated into three categories: self-supported, state-supported, unit-supported (Table 4).

Table 4. Numbers of students studying abroad and returning (adjusted values)

Year	Number of students studying abroad				Number returning
	Total	Self-supported	Sent by government	Sent by units	
1978	1 187		860		248
1979	2 415		1 750		200
1980	2 931		2 124		162
1981	4 714		3 416		1 090
1982	6 129		4 441		2 500
1983	8 154		5 909		2 800
1984	8 092		5 500		3 684
1985	9 843		4 888		3 497
1986	9 546		4 676		3 409
1987	11 989		4 703	6 596	3 941
1988	14 496		3 786	3 535	7 367
1989	16 605		2 987	5 390	4 188
1990	24 656		2 244	5 403	6 063
1991	28 156		2 495		2 536
1992	21 087		2 574		4 426
1993	11 924	9 167	2 166	591	6 286
1994	21 169	18 754	1 962	453	5 184
1995	22 623		1 616		7 054
1996	23 205	15 900	1 905	5 400	8 054
1997	35 079	27 389	2 110	5 580	8 740
1998	36 000	29 821	2 639	3 540	9 046
1999	80 000	75 080	2 228	2 724	9 526

Note: Data for 1999 are estimated based on data of MPS and other public materials.
Source: Authors' calculations.

Among students sent abroad by the government or by a unit, few take an undergraduate course of study, but this has changed with the dramatic increase in self-supported study abroad. In terms of regional distribution, 75% go to Europe, North America and Oceania and 25% to the rest of the world. A large majority of self-supported students go to countries in Europe and America and also to Japan, Singapore, Australia and New Zealand. Among students sent by government and units, 70-80% study natural sciences, engineering and technology, medical sciences, agricultural sciences, forestry and animal husbandry, etc.; the rest study humanities and social sciences (Table 5).

Table 5. Breakdown of students studying abroad by area of study and country, 1978-99

	Cumulative total of students having studied abroad	Proportion (%)	Total returning	Share of students having returned (%)
Total	400 000		100 000	
Classified by subject				
Science and engineering	300 000	75		
Liberal arts	100 000	25		
Classified by country of study				
United States	213 200	53.3	30 021	14.1
Japan	66 800	16.7	25 016	37.4
Canada	26 800	6.7	10 036	37.4
German	26 800	6.7	10 036	37.4
United Kingdom	21 200	5.3	9 924	46.8
France	14 800	3.7	7 050	47.6
Australia	13 200	3.3	5 932	44.9
Others	17 200	4.3	1 984	11.5

Source: Based on Ministry of Education data.

For the aggregate, the following calculation is used: the rate of return = stock of returned/(stock of study abroad minus the numbers of students studying abroad). Up to 1999, the stock of returned is 100 000, the stock for overseas study is 400 000 and the number of students studying abroad is 100 000. So the rate of return is 100 000/(400 000 – 100 000), which is 33.3%.

For specific countries, since numbers of students who were studying abroad cannot be obtained, the following calculation is used: the rate of return = total of those who returned/total of those studying abroad. The rates of students returning from different countries vary because of differing conditions and employment policies for foreign students.

Based on the above, China's HRST working in OECD countries appear to amount to 186 000. This does not include the students who are studying in these countries (87 000 in the United States, 7 000 in Canada, 16 000 in Japan and 76 000 in the European Union).

Foreign labour services for contracted project design and consultation

According to MOFTEC, since 1995 China has actively developed foreign labour services for contracted project design and consultation. So far, the scale of such services is very small: the total number of persons involved was 250 in 1995 and 451 in 1999, and only a small minority went to OECD countries (Table 6). However, the export of high-level labour services is increasing and will generate a return of foreign currency to China.

Table 6. Numbers of HRST working abroad for project design and consultation

	1995	1996	1997	1998	1999
Total	250	349	425	277	451
To					
Japan	4		5		
United States	11		40	25	
Germany	23	21			
France			42		
Italy			12		
Netherlands				5	
Austria			6		

Source: *Yearbook 1999 for Foreign Trade and Economy* and others.

Strictly speaking, HRST working abroad also include foreign labour service and undertaking contracted projects, but the relevant data are not available.

Impact of China's brain drain

The figures given above show that outflows of HRST are a noteworthy phenomenon in China's opening to the world. There has been an increase in technical migration and self-supported study abroad. In terms of China's huge population, the scale of the brain drain may appear insignificant, but its impact cannot be ignored, as these are well-educated and talented human resources. This is particularly true for students sent by government to study overseas.

China's outflows of HRST affect both China and receiving countries, both positively and negatively, but the extent and scope of the effects are very different.

Impact on China

There are two kinds of brain drain, with very different impacts on China's economy. There are temporary outflows of students who study overseas, earn degrees or complete courses and return home either immediately or after working abroad for a period of time. Most students sent to study abroad by the government are of this type, as are workers who go abroad to provide labour services for contracted project design and consultation or for other reasons. The permanent outflows concern those who study abroad and then settle and work abroad or those who settle abroad as technical migrants. These represent real outflows of talent.

These outflows are outflows of human capital. In the past, China's educational system was state-supported, and education cost the individuals very little. In the 1990s, China's higher education system was gradually reformed and fees began to be collected from students, although these fees did not cover the cost of the government's expenditure on education. Some specialists estimate that training a college student represents a total cost of RMB 200 000, which includes the costs of basic, middle and higher education. So far, China has permanently lost at least 200 000 HRST, which represents a loss of over RMB 40 billion invested in human capital, or the equivalent of about 20% of total financial education fund in 1998.

Self-supported students who study overseas pay tuition fees that are much higher than at home. The outflow of domestic capital is becoming more serious with the recent growth of self-supported study abroad. Assuming that the annual cost of study abroad per student is USD 20 000 and that Chinese self-supported students studying abroad are some 80 000 in number in 2000, China lost the equivalent of USD 1.6 billion. This figure does not include students' costs in previous years, nor does it take account of foreign financial support. The above figures simply represent a loss of investment in human capital in terms of input. If individual and social opportunity costs are included, the losses represented by HRST outflows will be much higher.

Outflows of both human capital and foreign currency are drains on resources. In terms of size, China's HRST are the equivalent of those of the United States, Japan, the European Union and Russia taken together. However, the quality is at a lower level and is aggravated by brain drain. This restricts China's economic development. Most of China's outward flows of HRST concern the best and brightest of its high-skilled human resources. In the knowledge-based economy, the core of competition is for talent, and brain drain reduces competitiveness. China's outflows of high-skilled human resources, including those who play a leading role in some academic subjects and fields, definitely hinder China's scientific and technological progress and reduce its international competitiveness. According to the Report on International Competitiveness (2000) of the Lausanne International Management School (Switzerland), China is in last place for the indicator "availability of qualified engineers" and in second-to-last place for the indicator "availability of qualified information technicians". This means that China is short of key technical talent owing in part to the outflows of high-skilled human resources. Moreover, in the 1990s, the fact that a number of excellent students who graduated from well-known Chinese universities went abroad will have a far-reaching impact on China's potential for future scientific and technological development. For example, at Beijing University, over 600 students in Departments of Physics, Chemistry and Biology went abroad as self-supported students. This means that almost 40% of graduated college students at the three departments went abroad, and it was suggested that the university was run for the benefit of foreign countries. Currently, outflows of excellent young researchers from the best universities and research institutions in China are a very serious problem. Universities and institutions are finding it difficult to keep excellent young talent.

However, outflows of HRST can also have positive effects. First, labour market pressures may be somewhat reduced, so that the second tier of excellent talent have the opportunity to show their potential and develop their capacities. Second, for the HRST who leave permanently, some choose China as the first region for investment when they succeed abroad and take their business to international level. This can have a very positive impact on China's development in terms of capital, technology and management.

The overall effect of the permanent brain drain on China's economy is the balance of the above positive and negative effects. At present, the negative effect is larger than positive one.

Temporary outflows of HRST should not be viewed as brain drain. There may be some negative effects, but in the long term, the advantages are greater than the disadvantages. For example, the temporary outflow of foreign labour service for contracted project design and consultation produces wealth for China (Table 7). When Table 7 is compared with the numbers of persons in Table 6, it is evident that the per capita income produced (around USD 200 000 in 1999) is much higher than domestic per capita (around USD 800 in 1999).

Table 7. Income from foreign labour service for project design and consultation, 1995-99
USD thousands

	1995	1996	1997	1998	1999
Income	13 323	16 368	18 152	89 000	89 580

Source: MOFTEC.

As globalisation has strengthened, the international mobility of HRST has increased. For China, which is a net outflow country, international mobility of HRST is significant.

First, international mobility promotes international academic exchanges, which allow Chinese schools quickly to be informed about the scientific and technological frontier. This is very important for raising China's scientific and technological level.

Second, those who study abroad not only learn about advanced technology, management, trade, etc., but also broaden their horizons, accumulate advanced work experience and greatly increase their stock of human capital. Assume conservatively that each overseas student receives an annual scholarship or assistantship of USD 10 000 for four years and that there are 10 000 persons who return home, they bring home a stock of human capital USD 4 billion. The amount of the human capital stock is calculated in terms of input costs.

Those who return with their added human capital and start a business at home bring not only advanced knowledge of business, trade, science and technology, but also precious information resources that can help the development of China's economy. What they can offer far exceeds the investment implied by their period of study or work abroad.

Third, outflows of HRST lead to changes in the system of personnel management in sending countries like China. Over time, China will see more clearly the importance of talent/expertise and will seek to attract back those who have gone abroad. The personnel management system is gradually moving towards policies that are advantageous to returning talent and to making full use of that talent. Recently, a number of regions in China have set up incubators for those returning from study abroad, and some have policies to help such persons to start an undertaking. This will speed the return of talented persons and promote scientific and technological progress in China.

Fourth, property rights need to be well defined and protected, so that those who return and invent or innovate can profit from their work. If people are deprived because such protection is lacking, the result will be a "tragedy of the commons" and an acceleration of the brain drain.

Impact on receiving countries

It is evident that receiving countries benefit from an increase in the stock of human capital. Most of those who go abroad to study are well educated, so that receiving countries simply need to build on that base in order to acquire high-skilled HRST. For receiving countries with plentiful resources, the inflow of many foreign students means that they can make fuller and more efficient use of their educational resources.

In the past few years, with the rise of the knowledge-based economy and the development of information technologies in Western countries, there is strong demand for information technology workers, and countries have implemented policies to recruit HRST in developing countries. As a

leading industry in the knowledge-based economy, development of the information industry will surely promote scientific and technological progress and raise a nation's competitiveness in the world.

However, talent inflows do not only have beneficial effects on receiving countries. Foreign workers intensify competition for jobs and increase unemployment pressures on domestic workers. Receiving countries are likely to take measures to protect domestic workers.

To sum up, the win/lose impacts of international mobility of HRST on the sending and receiving countries are not symmetric, but win/win relationships exist to a certain extent. The international mobility of HRST results in international movement of technology, capital, knowledge, information, etc. It promotes international trade, academic and cultural exchange. This can increase the social welfare of both sending and receiving countries.

Inflows of HRST into China and their impacts

Since the reform and opening to the world, the Chinese government has actively encouraged the recruitment of foreign experts to take part in constructing modern China. Thanks to the efforts made by the SBFE, China has achieved remarkable success in attracting foreign experts. This has played an important role in the economic development and the modernisation of China.

According to SBFE, over the period 1978-99, a total of 824 000 foreign experts (full-time equivalent – FTE) were engaged, including long-term and short-term personnel. At present, more detailed data than the time series in Table 8 are not available. The table shows that a total of 613 820 foreign experts (FTE) worked in China during the period 1992-99, many more than the 210 180 during the period 1978-91. As the table also shows, inflows of experts are increasing, with an annual average growth rate of 4.3%.

Table 8. Foreign experts sent to China, 1992-99

Year	Total (FTE)	Management experts and those sent on contracts		Experts sent by foreign investors		Experts in education, science, culture and public health	
		FTE	%	FTE	%	FTE	%
Total 1978-91	210 180						
1992	62 500						
1993	71 820						
1994	74 500						
1995	76 000						
1996	80 000	31 200	39.0	34 400	43.0	14 400	18.0
1997	82 000	30 800	37.6	37 000	45.1	14 200	17.3
1998	83 000	37 018	44.6	32 370	39.0	13 612	16.4
1999	84 000	36 540	43.5	33 096	39.4	14 364	17.1

Source: Based on SBFE annual reports for 1996-99.

The foreign experts engaged by China can be classified as follows: experts engaged on the basis of agreements between the Chinese government and foreign governments or international organisations; economics and management experts engaged via academic exchanges with foreign countries; cultural and teaching experts; senior managers and technicians in enterprises with foreign investors. The experts work in industry, agriculture, major projects, science and technology, finance and banking, commercial law, logistics, culture and education, press, public health, sports, etc. Table 8 shows the share of experts in the following three main categories: experts in enterprises with foreign

investors; management experts sent as a result of trade contracts; experts in education, science, culture and public health.

In terms of regions, 49.7% of foreign experts were in the eastern region in 1996, 33% in the middle region, 17.3% in the western region. This corresponds to differences in regional economic development; where the economy is better developed, one finds more frequent exchange, more foreign capital and more experts.

The SBFE statistics do not fully reflect reality. With the development associated with China's opening, inflows of foreign experts have greatly increased, but it is hard to know the number of foreign experts sent by foreign investors. A situation in which many foreign HRST reside permanently in China, as has happened in developed countries, has not occurred.

For universities and colleges, which receive foreign experts and engage foreign teachers, time series data are slightly more detailed (Table 9). Numbers of foreign experts in Chinese schools of higher education grew rapidly in 1978-99. Compared to the data in Table 8, the annual average growth rate is 14% between 1992-99, much higher than the growth rate for all foreign experts sent to China. In terms of long-term and short-term employees, there was a much smaller share of long-term experts in the 1990s than in early 1980s. This indicates that numbers of short-term cultural and educational experts increased faster than numbers of long-term experts in the1990s.

Table 9. Foreign experts in institutions of higher education, 1978-99

Year	Total (FTE)	Long-term stays		Short-term stays	
		FTE	%	FTE	%
1978		100			
1979	830	335	40.36	495	59.64
1980	1 255	545	43.43	710	56.57
1981	1 290	560	43.41	730	56.59
1987	2 145	645	30.07	1 500	69.93
1990/91	3 683	1 305	35.43	2 377	64.57
1992	5 600	1 680	30.00	3 920	70.00
1993	7 800	1 800	23.08	6 000	76.92
1994	13 000	2 800	21.54	10 200	78.46
1995	14 798	4 708	31.82	10 090	68.18
1996	14 053	4 605	32.77	9 448	67.23
1997	14 046	4 317	30.73	9 729	69.27
1998	13 538	3 607	26.64	9 931	73.36
1999	14 020				

Source: Based on *China Yearbook of Education* and other materials.

The presence of foreign experts in China is significance in many respects. While it is difficult to analyse this quantitatively, since the factors involved are complex and detailed data are not available, a qualitative description is possible.

First, because China is a developing country, the development of science, technology and the economy lags behind developed countries. The presence of foreign experts can help China to learn and use advanced science, technology, and management techniques of other countries, including developed nations, to modernise more efficiently, to grow faster and to improve its international competitiveness.

Second, foreign experts in technical management and those who carry out trade contracts play a key role in the smooth implementation of trade between China and foreign countries. They promote the absorption of technology, the mastery of advanced equipment and the development of technical talent. This helps to encourage the renewal of equipment in enterprises, technological progress and management innovation.

Third, the presence of foreign experts in educational fields helps to promote cultural and education development, to establish important subjects in major laboratories, to carry out major research projects and to develop talent of high level.

Fourth, for key projects that attract worldwide attention, such as the Three Gorge Dam project, foreign experts in technology, contract management, business and finance facilitate the smooth implementation of the projects. Foreign experts contribute significantly to large projects in basic industries, such as construction projects or agriculture. They promote technical innovation and diffusion and help to transform traditional industries and develop of hi-technology industries.

Fifth, foreign experts take part in consultations on important programmes of reform, where they play an important role in fostering the absorption of advanced management techniques, sharing their experience and learning and drawing on their efficient legal systems, thereby helping to advance China's reform through effective programmes.

In a word, to meet the demands of the times, China will have to speed up the international exchange of talent and attract more foreign experts. China's possible accession to the WTO in the near future will provide a good opportunity for development in China and bring conditions and opportunities for absorbing more foreign capital, learning advanced technology and gaining management experience. In this situation, foreign experts are likely to help ensure China's success. The Chinese government needs to make further efforts to formulate related policy and adjust the security system.

Problems for the study and direction of future work

International competition in terms of the knowledge economy mainly involves competition for skills, especially high-level skills. Developed countries, especially their high-technology industries, make efforts to enlist foreign talent that meets their needs in order to maintain their lead position.

Developing countries instead invite foreign experts, seek to develop domestic talent and implement policies to encourage domestic talent that has gone abroad to return so as to develop their economies. Therefore, many aspects of international mobility need to be examined, the mechanisms that promote mobility need to be studied and the effects of international mobility on economic growth and social progress in various countries need to be understood in order to formulate effective policy. To do so, however, it is necessary to address a certain number of problems.

First, the international mobility of HRST involves multiple countries and its impact is complex. Acquisition of basic data is essential. Governments need to realise their importance, make clear the management and statistical functions of relevant government institutions and engage in international co-operation and exchanges on the design of statistical indicators and the improvement of statistical methods and practices.

In China, it is very difficult to acquire basic data. China has not established comprehensive statistics on the international mobility of HRST. The available data are rough and related information

is incomplete so that it is difficult to acquire the desired statistics. That is the biggest problem for the study of international mobility. In fact, data on talent outflows and inflows can be used to create a database conveniently and at relatively low cost. Full statistics on talent outflows could be obtained by creating proper statistical indicators and giving a clear statistical mandate to MPS. For OECD countries, more accurate information on Chinese talent flows into OECD countries can be obtained with the co-operation of embassies in China. The management function of SBFE, combined with the statistics of MP and MPS, needs to be clarified in order to obtain more complete data.

Second, the comparative analysis of international mobility of HRST depends on statistical indicators and a database cross-classified according to various characteristics. The register of mobile talent should cover: individual characteristics, such as destination country, purposes of going abroad (work, study abroad, etc.), field of activity or study, education, age, sex, number of years of the stay, etc. It should also cover economic characteristics such as amount of scholarship or assistantship fund earned, compensation, expenditure for study abroad, etc. This indicates the following indicators:

Indicators of flow:

- Annual numbers of study abroad students, overseas workers and migrants to each country.
- Annual numbers of study abroad students, overseas workers and migrants by educational level to each country.
- Annual numbers of study abroad students, overseas workers and migrants by field of activity/study to each country.
- Annual numbers of study abroad students, overseas workers and migrants by age to each country.
- Annual numbers of fully self-supported students for study abroad to each country.

Cumulative indicator:

- The cumulative total of the above indicators over the period of study.

Indicators for outflows who return home are similar. The annual net outflows of HRST of each category for each country can be found by combining the statistical data on entries and exits from that country. The scale, speed, category and effect of international mobility of HRST can then be quantified and analysed. These data can be used for planning and forecasting the development of skills and become a basis for evaluating the economic effectiveness of policy for the international mobility of China's talent.

As the effect of international mobility of human resources is complex and variegated, its analysis should be conducted in a general equilibrium framework. It should be compared, in particular, to the effects of changes in the quality and quantity of domestic human resources. The general equilibrium approach would also be relevant for analysing the effect of the mobility of human resources at an international level, comparing in particular sending and receiving countries.

Case studies can be of help in understanding the impact of international mobility of HRST. Surveys can give specific information that can help to clarify aspects of the issue. In China, the survey of well-known universities like Qinghua University or Beijing University, with many students who go abroad, can give further depth to an analysis of the scale and effect of outflows of China's HRST. Surveys of large construction projects or undertaken in some coastal cities can show the circumstances and effect of inflows of foreign experts. Of course, financial support is needed to carry out such surveys.

Chapter 12

RETHINKING HIGH-SKILLED INTERNATIONAL MIGRATION: RESEARCH AND POLICY ISSUES FOR INDIA'S INFORMATION ECONOMY

by

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Introduction

In the 1990s, migration has been affected by a qualitatively different organisation of capital and labour. For most of the 20th century, immigrant labour was largely employed in economies dominated by agricultural and manufacturing. By the late 1990s, the transformation of many manufacturing activities by information technology brought the services sector to the fore. The change from an industrial to a post-industrial economy has been characterised by high employment in service industries and in the rapidly growing information economy. In the context of migration, this transformation has meant that, in contrast to earlier parts of the 20th century when the labour flow was in the main unskilled, migration policies and debates in both developing and developed countries have increasingly had to contend with inflows and outflows of highly skilled and professional labour.

The expansion of the information economy has resulted in extensive global linkages. In their attempt to position themselves in the new world order, countries have begun to rely increasingly on the global labour supply. The policies of developed countries, particularly in North America and western Europe, reflect the changes in the type and kind of migrant labour. Many receiving countries have reduced the importance of national origin as a criterion of admissibility, allowing immigration from non-European countries when either the criterion of economic contribution or of family reunification is met (Boyd, 2000). This has resulted in a disproportionate rise of immigrants, especially to North America, from Asian countries, and in particular from India to the United States, the United Kingdom and Canada. In other words, the transformation of the economy has effected major changes in the types of labour flows for both sending and receiving countries.

This chapter explores the rapidly growing phenomenon of migration of highly skilled labour, especially in the information technology sector, and the impact that this has had on India's labour flows to the developed countries, where the information economy is concentrated.

While Asian-born information technology workers appear to form a substantial proportion of foreign-born workers in the developed countries, particularly in North America, the popular media and some research also indicate that a significant share return to their countries of origin after a period of time. Are such findings justified for India? This chapter addresses this question by first examining the

stock of immigrants at different points of time in the receiving countries and then reviewing the literature and research on immigrant Indian information technology workers, as they concern changes in India's economy and labour profile. The chapter attempts to put into perspective the multitude of issues arising from the return migration of information technology workers, as this form of migration adds a new dimension to the international division of labour in particular and the economies of developing countries in general. The chapter is structured as follows. First, it explores the magnitude of migration of highly skilled information technology workers from India to developed countries. Second, it examines cases of migration of skilled labour from India to a few main recipient OECD countries by placing the extent of migration in the context of the debate on economic loss and gain to the Indian and receiving economies. Finally, it analyses the available data on net private transfers to India to estimate the trend and magnitude of immigration to the industrialised countries.

Trends in international migration from India

Given that India has very little systematic data on international migration, the issue has not received much attention from economists and policy makers in post-independent India. However, it is widely accepted that there has been a constant outflow of skilled labour from the country. In a first phase, which began in the early 1950s and continued until the mid-1970s, a substantial number of technically skilled and professionally qualified persons migrated to industrialised countries, in sharp contrast to previous centuries when most labour outflow consisted of unskilled and very often indentured workers. The popular destinations were the United Kingdom, the United States, Canada and to a lesser extent western Europe and Australia. Unfortunately, there are no data on the numbers, destinations or skills of those who emigrated (Nayyar, 1994).

The second phase began in the mid-1970s and peaked in the early 1980s, and the destination was largely the oil-exporting Middle East. The nature of this migration was strikingly different, in that the migrants were overwhelmingly either unskilled or semi-skilled workers. The few who were skilled worked in manufacturing or clerical occupations. The share of migrants from the professional and technical category fell from 88% in 1971 to 57% in 1975 (Chakravarthy, 2000). However, although emigration in this period largely concerned unskilled workers, emigration to developed countries, particularly the United States, continued to involve professionals with technical qualifications. According to Deepak Nayyar (1994), although India's share of total immigration to the United States was a mere 3.6% in the period 1981-90, India represented 13.4% of the admissions of professional, highly skilled migrants.

While the Middle East continues to be the destination for a large number of Indians, the 1990s have seen a resurgence of international migration of skilled workers from India, especially in the information technology sector. Noticeable of late has been the movement of software professionals to the United States, the United Kingdom, Canada, Germany, Australia and Singapore and to a lesser extent, in the latter part of the 1990s, to a few western European nations such as the Netherlands, Norway, Sweden and Ireland. The migration to western European countries, which is comparatively new, has been attributed to the dramatic changes in the world economy caused by changes in production techniques due to the large-scale introduction of information technology in manufacturing as well as service industries.

The primary source of data on the dimensions and the composition of labour outflows in India is the Ministry of Labour, which provides emigration clearance for workers who intend to take up employment abroad. However, professionals or persons with postgraduate educational qualifications are exempted from the statute on emigration clearance. Therefore, it is not possible to analyse labour outflow trends with any degree of accuracy.

Given this caveat, annual outflows were a mere 4 000 in 1976, reached a high of 275 000 in 1981, declined after 1984 and rose again in the 1990s. The data on distribution of labour emigration by country of destination show that the Middle East still receives the greatest number, absorbing about three-fifths of Indian emigrants. The available information on the skill composition of migrants shows that highly skilled workers are less than 5% of emigrants (Nayyar, 1989). However, it must be recalled that this result does not include the migration of professionals such as engineers, doctors, architects, etc.

General observations

Given the lack of a systematic database at the macroeconomic level, it is obviously not possible to provide an exhaustive analysis of issues relating to international migration of information technology workers or software professionals. However, there are some estimates of the Indian migrant population in the major OECD labour-importing countries. The available evidence for a few OECD countries is outlined in Table 1. These statistics and other available evidence about the increase or decrease of stocks, migration motives and, where available, skill levels and average earnings of Indian immigrants in receiving countries make it possible to draw some conclusions about Indian migration. However, caution needs to be exercised when making comparisons, as some OECD countries define the immigrant population as those of foreign nationality (European countries, Japan, Korea) while others estimate the number of foreign-born persons (United States, Canada, Australia).

Table 1. Temporary migrants with speciality occupations (H-1B visa holders) 1994

Country of origin	Number	Percentage
India	16 948	16.0
United Kingdom	13 696	12.9
Japan	7 317	6.9
Philippines	5 098	4.8
France	4 548	4.3
Germany	4 042	3.8
Canada	3 527	3.3
Mexico	3 256	3.1
China	2 721	2.6
Australia	2 676	2.5
Brazil	2 354	2.2
Italy	2 107	2.0
Soviet Union	2 104	2.0
Netherlands	2 068	2.0
Israel	1 897	1.8
Other countries	31 540	29.8
Total	105 899	100.0

Source: US Immigration and Naturalization Service, 1994, in Alarcon, 2000.

Keeping in mind these differences, the following inferences can be drawn with respect to migration of the highly skilled:

- The United Kingdom and the United States have been and continue to be the largest recipient of Indian migrants in the technically qualified and professional category. For the United States, the share of Indian immigrants has tended to be small relative to total migrants (the greatest number of immigrants come from Mexico).

- In most OECD countries, immigration is largely due either to family reunification (United States, France, Norway, Sweden, United Kingdom) or asylum seekers (Germany, Australia, Sweden), but there has been a substantial increase in the volume of immigrants seeking work in these countries. It is in this last category that India features as a sending or source country.
- According to the popular media, the characteristics of the Indian population have been changing in many OECD countries, particularly in the United States, the United Kingdom, Canada, Australia and Germany, where there is increased emphasis on migration of skilled workers.

With the rise of the information technology sector in the 1990s, the inflow of Indian migrants, especially of software professionals, substantially increased in the United Kingdom, Germany, the Netherlands and, most recently, the Nordic countries. In other words, the number of receiving countries has increased dramatically in the last decade.

Indian immigration to the United States

For the past 30 years, India has been one of the largest sending countries to the United States, with the Indian population rising from 50 000 in 1970 to 722 000 in 1998. Indians account for 2.8% of the total immigrant population. The professional characteristics of Indian immigrants may be assumed from the fact that in 1998 only 6% of Indians lived in conditions of poverty, compared to 31% of Mexican and 38% of Dominican immigrants. Moreover, Indians do not make use of welfare benefits (Camarota, 1999). The United States has had more liberal immigration rules for work or residence than most other developed countries. The Immigration Act of 1990 raised the number of employment visas from 54 000 to 140 000 a year, and the number has been steadily increasing. Before 1990, less than 10% of the immigrants entered the United States each year on the basis of their job skills, while after that year, approximately 21% of new immigrants have done so. Taking advantage of this situation, highly skilled and professional Indians have increasingly emigrated to the United States.

While it is well known that the participation of skilled migrants in the US labour market is less restricted than that of unskilled migrants, there has recently been a substantial rise in the proportion of foreign-born scientists and engineers working in the United States. Micro studies have now established that these highly skilled workers, especially engineers, are employed in the expanding, high-growth information technology industry (Thaw, 2000; Alarcon, 2000; Chakravarthy, 2000).

The impact of the rapidly expanding IT economy in the United States was first felt in the new Immigration Act and then in the proportion of Indians in the immigrant population. In 1994, Indians constituted 38.5% of total immigrants admitted to the United States in previous years who became permanent residents. The United States also has an entry category known as H-1B non-immigrant, which is designed for temporary workers employed in “speciality occupations”. Indians feature among the largest number of persons entering the United States under this category (Table 1). In 1994, India was the largest sending country, with a contribution of 16% to the total H-1B category.

Indian immigration to Australia

The history of Indian migration to Australia dates back to the early 19th century (Bureau of Immigration, Multicultural and Population Research, 1995) when a substantial proportion of Punjabi Sikhs and Punjabi Muslims went there as agricultural labourers and traders. The next main period of immigration began in the post World War II and post-independence period with the migration of India-born British citizens and Anglo-Indians. The relaxation of the restrictive immigration policy in 1966 resulted in a massive rise in the immigration figures. The India-born population has since risen

steadily, from 15 754 in 1966 to 41 675 in 1981 and to 77 689 in 1996 (Table 2). However, although the number of the India-born rose substantially in the 1980s and 1990s, with estimated annual arrivals of 1 500-3 100 (Aswathi and Chandra, 1994), very high levels of migration from other Asian countries (Vietnam, Malaysia, China, the Philippines) meant that India has been one of the less significant source countries. According to the 1996 census, out of a total of 1 008 327 persons born in Asia, 145 498 were born in southern Asia.

Table 2. India-born population in Australia, 1901-96

Census year	India-born
1901	7 637
1911	6 644
1921	6 918
1933	6 774
1947	8 160
1954	11 955
1961	14 166
1966	15 754
1971	29 211
1976	37 586
1981	41 816
1986	47 816
1991	60 958
1996	77 689

Source: Jayaraman, 1998.

For permanent entry into Australia, people may qualify under a number of eligibility criteria. However, Indians have consistently used either the family reunion or skilled categories. Until the 1990s, a majority of Indians migrated under the former category, but in the 1990s the number of skilled Indian migrants was a little over double the number of family migrants. The high skill level of these migrants can be deduced from the fact that in the 1990s the census records that a third of Indians hold a tertiary-level degree and the median weekly income of Indians was AUD 375, 28% higher than that of the overall Australian population (Jayaraman, 1998).

Two interesting inferences can be drawn from the available data on Indian migrants to Australia. First, there has been a quantum increase in those reporting themselves as IT staff. In fact, according to the Australian government, at the end of June 2000, 17% of all businesses in Australia employed their own IT staff (including Web design staff). The percentage of businesses with IT staff ranged from 10% in both the construction and the personal and other services industries to 46% in the electricity, gas and water supply industry. In terms of revenue, exports of information industries exceeded AUD 4 billion in 1995, placing them among Australia's top export earners. Australia's information and communication technology exports now exceed its wool and wheat exports and are double its automotive and crude petroleum exports. Against this background, the census evidence that most Indian immigrants in the last decade are highly skilled persons with tertiary-level education who earn high wages, it may be deduced that the expanding Australian IT sector is absorbing a majority of the Indian migrants. Second, given the constant rise in the stock of skilled Indian migrants, including a substantial rise in recent arrivals of Indian migrants in Australia, it is safe to deduce that there is very little return migration from Australia.

Indian immigration to the United Kingdom

The United Kingdom has traditionally been an important destination for immigrants from its former colonies and the Commonwealth. In particular, there has consistently been significant immigration from South Asia, especially Pakistan, India, Bangladesh and Sri Lanka. In 1991, non-British persons represented nearly 7.4% of the total population and 5.5% belonged to ethnic minorities. According to Hatton and Price (1998), a majority of this population was born outside the United Kingdom.

Some interesting observations and deductions can be drawn from the pooled Quarterly Labour Force Surveys of 1997. Zorlu (2000) pooled the data and compared four important immigrant communities (black, Indian, Pakistani/Bangladeshi and mixed/other origin) with the employment characteristics of natives of the British Isles. This data set (Table 3) indicates that:

- A relatively high share of India-born men and women are employed. In the case of Indian men, the share in full-time employment is second only to that of white men. Although the share of Indian women in full-time employment is somewhat lower, it is substantially higher than that of the Pakistani/Bangladeshi and mixed /other communities.
- Indians are among the top two groups, after the Pakistani/Bangladeshi who work mainly in the private sector. Indian employees have the highest share in non-manual activities and have the highest mean net weekly earnings.
- Among the five sampled communities, a relatively large share of the Indian population falls into the high-skill category

Table 3. Distribution of main UK immigrant communities by skills, sector, occupation and social class
Percentages

Characteristics	White	Black	Indian	Pakistani/ Bangladeshi	Mixed/other
Mean net weekly pay	206.60	183.89	231.80	154.28	212.88
Skill distribution					
Low-skill	52	53	59	74	58
Medium-skill	32	29	20	16	22
High-skill	16	18	21	10	20
Sector					
Private sector	77	67	81	84	77
Public sector	23	33	19	15	23
Occupation					
Manual	40	43	34	51	32
Non-manual	59	56	66	49	67
Armed forces	0.45	0.12	0	0	0.07
Social class					
Professional	6	5	12	6	9
Intermediate	30	28	29	17	28
Skilled (non-manual)	23	24	24	25	30
Skilled (manual)	20	18	13	23	14
Partly skilled	16	17	19	25	15
Unskilled	5	7	3	4	5
Armed forces	0.45	0.12	0	0	0.07

Source: Pooled data of the British Quarterly Labour Survey, 1997, in Zorlu, 2000.

Indian immigration to Canada

Although the United States, the United Kingdom and Europe have historically been the major sources of immigrants in Canada, immigration from Asia has substantially increased since the legislative changes of the 1970s. This is clear from the fact that by 1991, India-born persons constituted 16% of the total population (Jayaraman, 1998). The Canadian Census provides information about immigrant populations with a bachelor's degree or higher. According to *The Daily* (Statistics Canada, 2000), permanent immigrants in knowledge-based occupations increased significantly from the mid-1980s to 1997, the most recent year for which data are available. During this period, there was a 15-fold increase of permanent immigrants among computer scientists and a ten-fold increase among engineers. Further, between 1991 and 1996, employment of computer engineers, system analysts and computer programmers grew from 124 000 to 163 000. Recent immigrants, *i.e.* those who arrived after 1990, accounted for almost one-third of the increase. The 1996 census reveals that between 1991 and 1996, Indians accounted for 6.9% of total immigrants and that India was the third largest sending country after Hong Kong, China, and mainland China (Table 4). The 1996 census data further confirm that most permanent residents with engineering as a major field of study are recent immigrants (Table 5).

Table 4**. Top ten places of birth of recent immigrants to Canada, 1996**

Country	Number	Percentage
Hong Kong, China	108 915	10.5
China	87 875	8.5
India	71 335	6.9
Philippines	71 325	6.9
Sri Lanka	44 235	4.3
Poland	36 965	3.6
Chinese Taipei	32 140	3.1
Vietnam	32 060	3.1
United States	29 020	2.8
United Kingdom	25 425	2.4
Top ten among total immigrants	539 295	51.9
Total recent immigrants	1 038 995	100.0

Note: Recent Immigrants are those who immigrated between 1991 and 1996.
Source: *The Daily*, Statistics Canada, 1997.

Indians account for about 17% of recent Asian immigrants in Canada and largely arrive in Toronto and Vancouver. They account for 7.5% and 8.5% of recent immigrants living in Toronto and Vancouver, respectively. Considering that these cities have large concentrations of IT-related employment, it is safe to deduce that Indian immigrants are important contributors to Canada's IT sector.

Immigration to the Netherlands, Germany and Japan

The expansion of the IT sector to other industrialised countries and the severe shortage of the requisite skilled labour have led many other countries to look for labour from other countries. India, which is able to supply a highly skilled IT workforce, has naturally begun to emerge as an important source. This trend is visible in the Netherlands, where the number of IT workers granted work permits reached an all-time high of 450 in 1999 (Nicolaas and Sprangers, 2001). In Germany and Japan, the

cap on the number of persons eligible to enter using the employment category substantially increased in the period 1999-2001.

Table 5. **Selected characteristics of permanent resident immigrant men arriving in Canada at age 28 or more, 1996**

Characteristics	Canadian-born	Asian-born	All other sources
Highest degree			
Bachelor's degree	82.2	68.1	58.3
Master's degree	15.4	20.7	33.8
PhD degree	2.4	11.2	8.0
Occupational group			
Manager	28.6	17.2	18.3
Engineer	41.3	29.2	33.4
Technician	11.6	16.4	16.5
Other	18.6	37.2	31.9
Years in Canada			
2-4		34.2	35.9
5-9		37.6	32.7
10-14		9.1	14.7
15-19		8.7	10.5
20 or more		10.4	6.2

Source: Statistics Canada, Census 2B database.

India's IT industry: remittances and migration

Although, India has no systematic data on levels of movement in terms of emigration and return migration of highly skilled professionals, especially in the IT sector, it is possible to deduce from the available data on IT exports the dimensions of highly skilled labour flows from and to India. This section first provides a general overview of the growth and dimensions of the Indian IT industry and then considers the compound annual growth rate (CAGR) of net private transfers to India from different regions.

The IT industry was estimated to have earned revenues of USD 8.67 billion, a rise of almost 50% over 1998-99 (USD 6.05 billion). Further, in the last five years (1995-2000), the Indian IT industry has recorded a CAGR of more than 42.4%, almost double the growth rate of IT industries in many developed countries.

According to NASSOM (2001), the IT manufacturing sector has been growing at an average rate of 30-35% annually over the past decade. The industry has over 150 major hardware players, supported by over 800 ancillary units and small vendors engaged in sub-assembly and equipment manufacturing. Software continues to contribute a major portion of the Indian IT industry's revenues (over 65% of the annual revenue in 1999-2000). India's software industry grew by 53% in 1999-2000 with revenues jumping from INR 15 890 crore in 1998-99 to INR 24 350 crore in 1999-2000. More than 185 of the Fortune 500 companies outsourced their software requirements to Indian software houses.

Much of India's export work in developing custom software is actually carried out at the client's site overseas ("on site") rather than offshore in India. In 1988, an average of 65% of export contracts were carried out wholly at the client's site, while 35% contained some offshore elements (Heeks,

1998). This translated into just under 75% of Indian software export development taking place overseas and only 25% in India. This was even true of work in India's export processing zones, which were intended to be bases for offshore work (Heeks, 1998). In other words, in the IT sector, especially in the case of software, export is largely synonymous with the relocation of "bodies" from India. Given that in terms of major trade partners, there is a heavy reliance on the United States and some other OECD country markets, especially in the software sector (Table 6), it is natural that most IT migrants immigrate to these countries.

Table 6. **Indian software exports by destination, 1997/98**

Destination	Proportion of total exports
United States	65%
United Kingdom	10%
Other Europe	10%
Japan	5%
Other	10%

Source: Dataquest, 1998, in Heeks, 1998.

According to Deepak Nayyar (1994), deductions can be made about the region of emigration from the type of financial inflows to India. Table 7 outlines the trends in net private transfer payments from different currency regions. In the two decades from 1974-75 to 1994-95, there was an overall increase in net private transfers, although the regions from which they originate vary. In the first of these decades, the increase was greatest in the rest of the non-sterling area, while in the second, the dollar area and OECD countries contributed most of the increase while flows from the rest of the non-sterling area saw a substantial drop. While caution needs to be exercised in interpreting net private transfers, it seems reasonable to assume that the relative rise or fall is due to the extent of Indian emigration to the different countries. By juxtaposing the stock of immigrants in the countries with the largest stocks of Indians, against the regions in which transfers or remittances rose or dropped, it is possible to draw certain conclusions.

Table 7. **Net private transfers**
INR millions

Year	Sterling area	Dollar area	OECD area	Rest of non-sterling area	International institutional area
1974-75	1 107	1 267	349	76	-5
1984-85	15 297	5 932	2 220	7 713	-
1994-95	135 312	73 228	23 851	21 775	-
1995-96	152 472	225 393	30 943	30 873	-

Source: Government of India Reports on Currency and Finance, 1976 and 1986.

At this point it is important to explain how these currency areas may be equated to countries. Nayyar (1989) estimates the composition of remittances to India using certain assumptions. Using these assumptions and cross-tabulating them with available stock and immigration data from developed countries, the following inferences are drawn:

- The dollar area comprises the United States, Canada, Central America countries and a few Latin American countries. Given that Indian emigration is almost solely to the United States and Canada, it is safe to assume that the dollar area accounts for remittances from North America. As is clear from Table 8, this area contributed most of the increase in net private transfers in the period 1984-85 to 1994-95. Recalling that immigration of highly skilled IT

professionals to North America was very high in 1990-96, it is reasonable to conclude that the remittances are from these immigrants.

For India's balance of payment statistics, the OECD area is constituted by western Europe, excluding the United Kingdom and including Turkey. Given the stock of immigrants in these countries, it is reasonable to assume that Germany, the Netherlands and the Scandinavian countries accounted for most of the increase in remittances between the mid-1980s and the mid-1990s

- The sterling area comprises the commonwealth countries – the United Kingdom, Ireland, the Caribbean Islands, some countries in West and East Africa, the Persian Gulf states, the Middle East, parts of Southeast Asia, South Asia, Australia and New Zealand. Given the number of countries, disaggregation is difficult. However, certain trends can be deduced from the extent of emigration to these countries. The earlier increase and the later fall can be traced to changes in labour demand in the oil-exporting Persian Gulf and Middle East. However, the mild drop of 0.6% in private transfers from this region may be attributed to the rise in demand for highly skilled labour in the United Kingdom, Australia and to a lesser extent New Zealand, which has in effect offset the fall in demand for unskilled labour in the oil-exporting countries.

- The region described as the rest of the non-sterling area covers the remaining countries of the world, including the socialist countries of Europe, most of Latin America and Africa and Asian countries outside the sterling area, particularly Saudi Arabia, Iran, Iraq and Libya. The phenomenal increase in the first period and the fall in the second may be traced to trends in emigration to the oil-exporting countries. The comparison of a fall of almost 4% in this region to the fall of 0.6% in the sterling area substantiates the thesis that there has been a rise in emigration from India to the industrialised countries, especially to the United Kingdom and Australia, in the period from the mid-1980s to mid-1990s.

Table 8. **Estimated compound annual growth rate of net private transfers**

Year	Sterling area	Dollar area	OECD area	Rest of non-sterling area
1974-75 to 1984-85	3.0	1.7	2.0	5.9
1984-85 to 1994-95	2.4	2.8	2.7	1.1

Source: Government of India Reports on Currency and Finance, 1976 and 1986.

General conclusions

For India, the size and composition of labour outflows have been determined by the receiving countries. While India has a surplus of labour which spans the entire spectrum of skills, the data on remittances indicate labour outflow is increasingly directed to the industrialised world. Further, from the available data on skill composition, educational level, mean earnings and percentage living in poverty in the industrialised countries, it is evident that in these countries Indian immigrants belong to the highly skilled group. As a developing country, India is unable to provide satisfactory and competitive earnings and employment for its highly skilled labour. However, it may be time for India to adopt a more proactive policy position and monitor the actual working conditions of its workers as well as introduce measures to reduce the depletion of certain skills which are necessary for the nation's future economic prosperity. In conclusion, the total lack of information on both emigration and return migration is a serious gap, as it prevents the country from embarking on systematic planning for manpower and the development of human resources.

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Chapter 13

MIGRATION OF SKILLED AND HIGHLY SKILLED WORKERS SOUTH AFRICA: A CASE STUDY

by

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Introduction

South Africa has recently produced detailed data on measuring the emigration of skilled and highly skilled workers, assessing the impact and effects of this emigration and implementing appropriate policies.

Measuring the emigration of skilled workers

Finding the relevant data

The study of the emigration of skilled labour since the 1960s has been hampered by problems of statistical evaluation. International organisations have in fact considered this to be a basic obstacle to finding a political and technical solution (OECD, 1970; Briborg and Goran, 1975; UNCTAD, 1982). They have recommended sustained co-operation to achieve uniform, reliable and comparable data (UNCTAD, 1982, 1984a, 1984b, 1984c, 1985). Today there is a tendency to give greater emphasis to flow data (border crossings) than to stock data (censuses) to measure migration and follow trends (Domenach and Picouet, 1985).

There is also agreement that it is preferable to use data from receiving, rather than sending, countries in order to evaluate real flows. This is because migrants, especially highly skilled workers, the vast majority of whom migrate legally, are far less likely to declare their migrant status at their point of departure than at their arrival point (Chrissanthaki, 1996; OECD, 1998, Statistical Annex, pp. 214-215). However, receiving country data can only be used effectively if they are available across the wide range of host countries (Blayo, 1989) and if they can be compared with the data of countries of origin (Bilsborrow *et al*., 1997, p. 12).

These conditions were met in a recent study of the migration of highly skilled workers from South Africa. Data from the statistical agencies of the five countries that receive more than three-quarters of the skilled migrants from the Republic of South Africa, *i.e.* the United Kingdom, the United States, Australia, Canada and New Zealand, were systematically collected, processed and compared with the South African data. The reliability of the latter data has been the subject of

increasing debate in recent years, which has intensified discussion of the issue and its solutions both in South Africa and elsewhere.

Finding a rational basis for debate on an emotional subject

The "brain drain" is a highly sensitive issue in contemporary South African society. The socio-political changes of the 1990s are seen as directly responsible for emigration among its white population. Under apartheid, skills of all kinds were concentrated precisely in this segment of the population. The "colour bar" restricted the access of non-whites to skilled jobs and the Bantu Education Act prevented them from gaining access to high-standard education. The impact of this historical legacy is still felt, even though the skills deficit among the black population is gradually diminishing. This problem is particularly acute today since the country has chosen, with the end of apartheid and the introduction of a policy of openness, to face international competition and produce, for export in particular, goods and services that are highly knowledge-intensive. In a situation in which technological innovation constitutes a strategic pillar of national development, skilled labour plays a key role.

The threat of a mass departure of the financial and human resources represented by the white population has always been a source of great concern. This is borne out by the intense media coverage of this issue throughout the 1990s. A review of South Africa's daily and weekly press shows that coverage of the "brain drain", which was already widespread at the beginning of the 1990s, has steadily increased over the past decade. There has been endless controversy over its causes, effects and extent. Some have stressed that skilled blacks are also tending to leave, while others have argued that the affirmative action policy is depriving whites of jobs for which they would be qualified. According to some partial surveys, growing insecurity seems to be a major cause of departures. The ending of privileged education and the lack of prospects, the depreciation of the national currency, the rand, and a sluggish economic situation are just some of the reasons given.

Although opinions vary as to the causes, there is general agreement about the nature of the trend. No one contests the fact that skilled labour is leaving the country, and everyone sees the phenomenon as being more or less directly due to changes that occurred in the mid-1990s. Official South African statistics show a change in trend starting in 1994, the year when a democratically elected government came to power. Before that, net migration had been positive, but it became negative in that year and has remained so ever since, with lower immigration and higher emigration both in general and in particular among skilled labour. Nevertheless, the validity of these official data was soon questioned. Empirical and anecdotal evidence, in particular from foreign embassies, international removal companies and sectoral professional associations, suggested that the official figures considerably underestimated the trend, thus leading to growing concern over its real scale. The new data coming mostly from host countries, which are varied and more reliable, have been used to measure the magnitude of the trend more accurately and to help define a new policy.

A question of method

Outside data is useful, but it requires a degree of uniformity in countries' methods of collecting and recording data if they are to be comparable. Fortunately, this is the case for the countries considered here, as their statistical systems belong to the same tradition.

The highly skilled category covers "professionals, semi-professionals and technical professions" (including architects, engineers, technicians, researchers, scientists, and professionals in the health and

dental sectors, education, science and the arts, sports and entertainment), as well as "managers, supervisors and senior officials" (public and private sector). Unfortunately, the statistical series provided are not complete for the same years and the same countries over the entire period. The smoothing and estimates carried out to complete the series were conducted using two methods that produce slightly different results. Both differ sharply from the official figures provided by South Africa's statistical agency.

The present study is concerned solely with permanent migrants from South Africa to the five receiving countries. It does not take account of temporary migrants or those who are admitted under a temporary status that is subsequently modified. H-1B visas in the United States and the "study and work" visas granted by the United Kingdom for a two-year period for nationals of Commonwealth countries are not counted. Consequently, the data in Table 1 are a low estimate, since they are confined to declarations of permanent immigration (which is however reversible).

Table 1. Permanent emigration of "professionals" according to South African data and data from the five main host countries[1], 1989-97

	1989	1990	1991	1992	1993	1994	1995	1996	1997
Australia (S. Africa data)	312	291	198	189	*356*	274	308	420	310
Australia (new data)	*558*	*479*	295	213	353	610	765	696	1 122
New Zealand (S. Africa data)	25	24	12	49	*93*	349	209	297	286
New Zealand (new data)	60	59	63	104	551	656	462	628	631
Canada (S. Africa data)	94	85	63	69	*136*	224	173	170	118
Canada (new data)	327	*227*	*213*	243	407	677	421	315	421
United States (S. Africa data)	56	68	89	81	*153*	216	235	254	258
United States (new data)	*399*	*418*	*389*	*528*	*461*	*450*	*538*	618	*538*
United Kingdom (S. Africa data)	275	331	296	349	*661*	450	368	422	444
United Kingdom (new data)	*2 574*	*1 408*	*1 760*	*1 518*	*2 068*	*1 782*	*924*	*2 508*	*2 417*

1. Estimates in italics.
Source: Meyer *et al*., 2000.

Results that are both expected and surprising

The first observation is that the level of migration recorded by the host countries is much higher than that indicated by the South African data. Table 2 gives the aggregate figures for the entire period.

Table 2. Comparison of overall emigration-immigration figures

	All categories 1987-97	"Professionals" 1989-97
Immigration (South Africa figures)	95 983	11 464
Emigration (South Africa figures)	82 811	12 949
Emigration (host countries)	233 609	41 496

Source: Meyer *et al*., 2000.

These figures confirm that emigration of skilled labour is 3.2 times greater than recorded by the South African authorities. They consequently bear out fears about the rising scale of flows of skilled emigration from South Africa. However, the position is less clear-cut when the data for the periods before and after the change of regime – supposedly the determinant of the trend reversal and the growing brain drain – are examined.

The data in Table 3 show that the emigration of highly skilled workers preceded the political changes that took place in 1994. An analysis based on longer time series shows in fact that the net migration trend probably reversed in 1985 and has since remained negative. There was a rise in emigration in 1994, but it was smaller (between 20% and 50%, depending on the method of calculation used) than the official sources indicate (an increase of over 100%). On the other hand, the sharp decline in immigration seems much more clearly the outcome of the new political situation.

Table 3. Comparison of the migration of "professionals", 1989-92 and 1994-97

	1989-92	1994-97
Immigration (South Africa data)	6 714	3 295
Emigration (Souh Africa data)	3 721	7 534
Emigration (new data)	16 447	19 890

Source: Meyer *et al*., 2000.

The effects of migration

A considerable financial and human cost

Efforts to determine the economic and financial costs of the resources lost due to the outflow of skills have been controversial ever since attempts were made to calculate them from the standpoint of taxation in the 1970s. The calculation methods (historical cost or discounted value) used to evaluate the "human capital" lost are based on premises that are obviously open to question. However, there can be no doubt that emigration is costly to South Africa in a number of ways.

A recent study indicated that the loss of human capital since 1997 may have amounted to ZAR 67.8 billion (approximately USD 10 billion) (Fourie and Joubert, 1998), which would be equivalent to an annual drop in GDP of 0.37%. Other research points out that a further ZAR 11 billion must be added to this sum, representing the amount that each emigrant may take out of the country (*i.e.* ZAR 100 000 per person) (Kaplan *et al*., 1999). Finally, the same study mentions the costs borne by the South African economy (ZAR 2.5 billion) owing to the higher turnover among this category of labour and the costs of finding and recruiting workers to fill the high-skilled jobs left vacant.

Shortages on the local labour market

It is easier to calculate the costs of migration than to evaluate its impact on the country's economic fabric and labour market structure. This can only be done by making assumptions and using incomplete data. One hypothesis concerns the state of the high-skilled labour market in South Africa. The Presidential Commission responsible for reviewing labour market policy (Lewis and Ngoasheng, 1996) pointed out the institutional rigidities, corporatist interests and restrictions on sectors and categories that keep the cost of highly skilled labour artificially high in some professions. It is obvious that the growing emigration and the diminishing immigration tend to increase the pressure on the labour market and explain the rise in salaries in these categories, making it that much more difficult to achieve a new socio-occupational balance and to narrow the gap in pay scales in the new South Africa, which hopes to reduce inequalities.

An examination of the available statistical data shows first that, according to the corrected data, there is net emigration of some 4 600 "professionals" per year, or 0.3 % of the total stock of this category of persons resident in the country, which stood at 1 428 737 at the 1996 census. Clearly, in

absolute terms, there is little danger that this pool of skilled labour will disappear overnight. In terms of the inflows and outflows in this segment of the labour market, if the number of new entrants replacing departures (turnover) is calculated at 36 000, net emigration amounts to 13% of the total, a figure close to those given by the surveys conducted by business consultants (Kaplan *et al*., 1999). The results differ widely, depending on the professions examined. Some (in particular accountants, computer specialists and engineers) seem to be more affected by emigration than others. Nevertheless, these differences are difficult to measure on the basis of general statistical data and the figures provided by professional associations, as it is not easy to assess to what extent the latter data are representative and comparable.

Barriers to investment and innovation

South Africa has set a course of transforming its society by relying heavily on the development of knowledge, making education, training and the expansion of scientific and technical knowledge the pillars of reconstruction. The introduction of a national innovation system and the choice of an economic policy promoting the development of exports, especially high value-added and high knowledge-intensive exports, go hand in hand. It is clear that since 1993, in contrast to previous decades, the expansion of foreign trade has benefited highly skilled categories far more than others (Bhorat, 2000). Recent studies and short-term projections also show that the vast majority of jobs that are to be created in the formal sector will go to those with high qualifications, at the expense of other categories, on an increasingly selective labour market.

This being the case, the negative net migration of highly skilled labour and its impact on structural skill shortages in the South African economy is a problem. It acts as a constraint on any significant economic recovery. South African economists and businessmen wonder whether the country's economy will be able to take advantage of growth, attract capital and meet global demand if it will soon be experiencing labour shortages. Consequently, managers are concerned about the growing emigration of skilled labour, but nevertheless believe, when asked to assess its practical impact on their staff in particular, that this effect is negligible or nil (Rogerson and Rogerson, 2001).

The brain drain, without doubt, is one of a series of negative factors, such as insecurity and the development of the AIDS epidemic, that tend to discourage foreign direct investment in South Africa.

Policy aspects

A welcome change in migration policy

South Africa is currently making in-depth changes to its approach to the migration of skilled workers. In the wake of various policy documents (Green Paper on International Migration, 1997; White Paper on International Migration, 2000), there is a growing awareness of the contradiction between the skills shortage and the restrictive immigration policy regarding skilled labour. It is clear that the skills gap is as much due to declining immigration as to increased emigration. Consequently, the Home Affairs Department has prepared a bill aimed at facilitating the recruitment of highly skilled foreigners. Nevertheless, the bill has been much criticised, to the effect that the law would favour a bureaucratic, formalistic and therefore slow processing of applications of skilled workers and that a more flexible system should be implemented so as not to slow the rapid allocation of labour required by a dynamic and competitive knowledge-based economy.

As a result, President Thabo Mbeki decided to assign this issue to members of his office's Investment and Employment Committee. Consequently, it is now probable that the change in immigration conditions will result in increased admission of highly skilled workers. This change is likely to lessen the incentive to emigrate and contribute to attracting foreign investment or to reducing disinvestment. However, the impact on diplomatic relations with neighbouring countries is uncertain.

The first countries from which South Africa might attract skilled labour are its African neighbours. What everyone had expected, and sometimes feared, with the end of apartheid might now occur, *i.e.* a "north-south brain drain" in southern Africa or the continent as a whole. Research and industrial and technological capacity are incomparably more developed in South Africa than in other African countries. This kind of development gap can have repercussions such as those already occurring in many other regions of the world (Meyer *et al.*, 2001), with intermediate countries offsetting their losses of skilled labour to highly industrialised countries through an influx of skilled labour from less advanced countries. South Africa is not unaware of this problem, but considers that the country's development will ultimately be favourable to all of Africa and that the benefits would therefore be redistributed.

Role of intermediaries in the market

South African migration policy focuses more on immigration than on emigration. This is shown by the fact that no steps have been taken to curtail emigration (other than limited measures such as requiring new doctors to practice locally for several years after obtaining their medical degree). It is simply assumed that the improvement of general conditions and growing employment opportunities will encourage young professionals to remain in the country. It is true that, in the context of a very open international marketplace and high demand, any regulatory measures taken by South Africa would certainly have a limited effect.

Nevertheless, it must be borne in mind that a number of actors are involved in the functioning of the marketplace. The circulation of skilled labour is organised by agents who facilitate it and make it more flexible and more rapid. Many other actors are involved in creating and disseminating information, making legal arrangements and providing other services that facilitate migration (departments in embassies, the press and professional associations, recruitment agencies, etc.). These actors shape the migration of highly skilled labour. In this context, it would be desirable for a policy and co-ordination body to play a role, so that there might be public monitoring of the workings of the market. The case of South Africa is interesting in this respect, for despite a strong increase in the outflow of skilled labour, neither the government nor the opposition has proved capable of designing measures that would make it possible to monitor the many agencies that recruit South African jobholders to work abroad. Yet there has been scathing criticism from those who deplore the mass exodus of nurses and schoolteachers to northern Europe, for example (*Pretoria News*, 30 March 2001).

The diaspora, a new factor?

The mass emigration of highly skilled nationals from developing countries to a number of OECD countries has gradually led to the emergence of intellectual diasporas. This "skills drain" reduces proportionately the development opportunities of their countries of origin, which suffer from a severe lack of skilled labour, among their other problems. Today, many "diaspora" networks seek to strengthen ties between expatriate intellectuals and their country of birth so that they can participate in their country's development from abroad. Some 35 countries now use such networks, with varying

degrees of success (Meyer and Brown, 1999). They are based on the idea that expatriates, far from being a loss, can be an asset, as they represent human capital formed using the resources of host countries which countries of origin might mobilise to their advantage.

For example, South Africa has created a network, the South African Network of Skills Abroad (SANSA), with over 2 000 members in some 65 countries. The potential impact of such networks is enormous. They can help to provide the human resources lacking in their countries of origin and have a multiplier effect due to the fact that they are connected with expatriates' own socio-occupational networks. However, these networks are not necessarily easy to mobilise. A survey is currently being organised by France's *Institut de Recherche pour le Développement* (IRD) to assess the conditions that foster their development and optimisation. They have the advantage that they deprive neither the country of origin nor the host country of their skills. On the contrary, they contribute to the development of both and to relations between them. However, because of their intermediate position, they are also highly dependent on the support that they receive from both countries. The idea of taking advantage of these "diaspora networks" is admittedly promising, but primarily depends on the mutual determination of the countries concerned to strengthen their co-operation in this field.

Conclusion

South Africa is a special case. Although its highly skilled diaspora can be estimated as being in the tens of thousands, it accounts for only 2-5% of this category of the population resident in the country. By comparison, the diaspora of developing countries as a whole is far larger, both proportionately and in absolute terms; according to some estimates it is equal to at least one-third of the skilled labour in countries of origin (Meyer and Brown, 1999). Despite its specificity, the example of South Africa shows the importance of the role that co-operation in the field of highly skilled labour migration might play. It is only through a form of co-operation with the main countries concerned, at all stages of migration, that a sending country can solve its brain drain problem. First, it must try to improve data collection in partnership with the host country or countries so that it can better assess the scale of the problem. Second, and without waiting for an exhaustive evaluation of the costs generated by the problem, the sending countries must take measures to try to stem the brain drain. Third, co-ordination seems to be necessary to monitor the systems of intermediaries through which labour migration actually takes place on the international skills market. Fourth, the South African example shows the possibility of greater co-operation between countries of origin and host countries so that both can benefit from the skilled workers located abroad.

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PART IV

POLICY ISSUES

Chapter 14

THE MOBILITY OF HUMAN RESOURCES IN SCIENCE AND TECHNOLOGY IN SWEDEN

by

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Introduction

In Sweden, as in many European countries, the fear of losing part of its economic and scientific potential through the departure of skilled workers (the "brain drain") has been a recurrent theme for many years. Yet a glance at the overall economic indicators reveals a fairly healthy picture: the government budget is in balance, the labour market is very dynamic, the country is well in the lead among industrialised countries in terms of its technological development and its communication and information industries, foreign investors are flowing in, domestic investment in research and development (R&D) is among the highest in the OECD area as a percentage of GNP – in short, the economy is doing well. There is widespread concern, however, because the population is ageing, because young people, with their increasing levels of education, are curious to see what is happening beyond their borders, because local industries, large and small alike, are reacting to globalisation by selling off whole segments of their activities to foreign companies or are relocating their headquarters or laboratories outside Sweden. It is primarily these social indicators that feed the fear of a brain drain, which is associated in the public mind with a weakening or even a loss of the country's economic and industrial potential, and are seen as a threat to its competitiveness and its future place in the world economy.

Yet beyond the glowing reports and the fears described in the press, many government agencies, labour unions and public and private institutions, reflecting the pragmatic spirit that characterises the decision-making process in Sweden, are today trying to come to grips with this question. Their attention has focused recently on how the country can meet its short-term needs for human resources in science and technology (HRST) in order to address the challenges of economic, industrial and technological development. To examine this question, a number of studies have recently been undertaken in all sectors concerned: education, migration, labour market development, professional mobility, taxation issues, etc. Drawing upon this work (some of which is still under way), and with the use of official statistics,[1] this chapter examines the migration patterns of HRST, and the relative importance of those resources in the current economic and social context.

Immigration policies in Sweden[2]

In the aftermath of World War II, Sweden's labour market was unable to meet the growing demands of its burgeoning economy. One of the first steps taken by the Swedish authorities to facilitate the entry of foreign workers was to do away with work permits for Danes and Norwegians (1943) and later for Finns (1946). At the same time, visa requirements were abolished for visitors from European countries. Consequently, many foreigners settled in Sweden, with those from the Nordic countries enjoying automatic working rights and those from other European countries transforming their status (and their permits) from tourist to worker if, having been able to find a job, they wanted to stay in the country.

Agreements were signed among the Nordic countries in 1954, creating an area within which labour could move freely and abolishing passport requirements between these countries. Citizens of Nordic countries could thus travel, settle and live in any Nordic country, and successive agreements gradually gave them the same social rights as nationals of the country they were in.

It was in the early 1960s that immigration flows from beyond the Nordic countries began, primarily from the former Yugoslavia, Greece and Turkey. At the same time, European immigration continued. Faced with growing immigration and union concerns about the labour market, however, the government and Parliament took a series of measures, between 1966 and 1968, to regulate the inflow of foreign workers. Henceforth, a work permit could no longer be obtained on Swedish soil: application had to be made at a consulate in the worker's home country. These restrictions were accompanied by a series of social measures that gave all immigrants access to the national social security system.

Since that time, the granting of work permits has been the responsibility of the labour services and is directly linked to labour market requirements. The only legal justification for granting a work permit to a foreigner is the lack of a local job seeker to fill the position. Consequently, since the early 1970s, a very small number of work permits has been issued to nationals of non-Nordic countries (and, since 1995, to persons from beyond the European Economic Area), and only a few hundred people per year have qualified. These have been highly skilled workers, specialists and employees of multinationals. However, also since 1995, the requirement for a work permit has been abolished for nationals of countries within the European Economic Area, who now have the right to travel, settle and work in Sweden. They must obtain a residence permit.

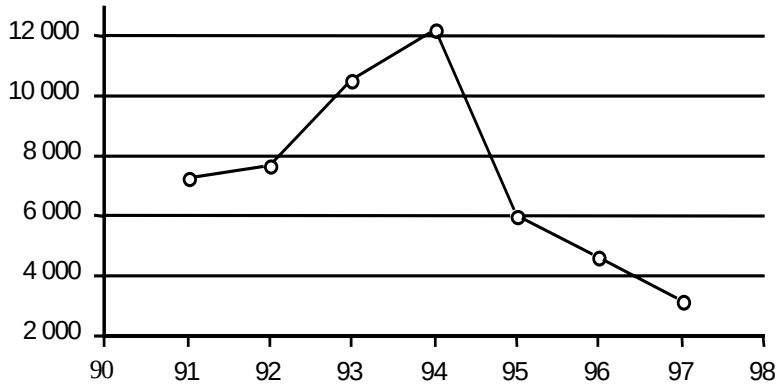
The HRST component of immigration flows

Since the early 1980s, immigration to Sweden has been dominated by family members of earlier immigrants, and above all by the arrival of asylum seekers, who now constitute the main component of the immigration flow. During the past decade, asylum seekers came primarily from the countries of eastern Europe, but also from Africa and the Middle East. Apart from 1993 and 1994, when Sweden granted considerable numbers of residence permits (refugee status) to nationals of the former Yugoslavia (rising from barely 2 000 in 1992 to 20 000 in 1993 and to 40 000 in 1994),[3] immigration flows (as reflected in the issuance of residence permits) have remained fairly stable, ranging between 30 000 and 44 000 individuals per year, about half of whom were asylum seekers in the last two years.[4] Only a small proportion of this population (16-19%, depending on the year, with a notable decline to 9% in 1997) have been HRST.

The proportion of highly skilled workers is known to be relatively higher among asylum seekers than among so-called economic migrants.[5] Figure 1 shows significant growth in the number of foreign

HRST arrivals in 1993 and 1994, years that saw a massive influx of nationals of the former Yugoslavia.

Figure 1. Inflows of foreign HRST, 1990-98

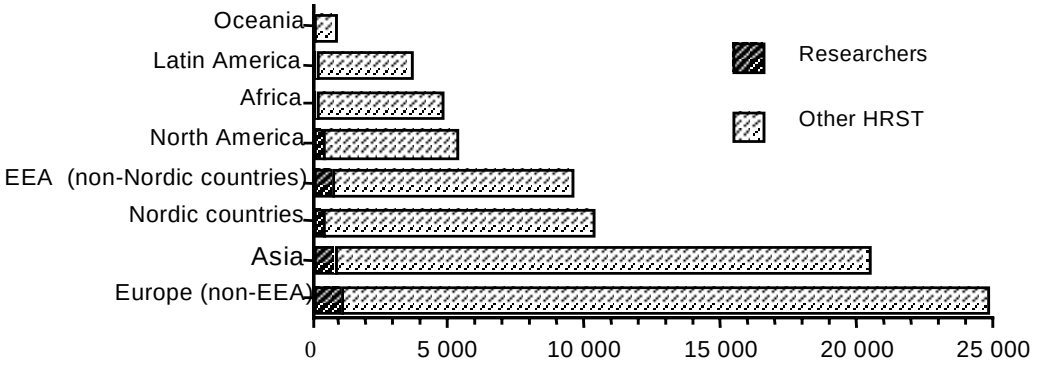


Source: Statistics Sweden, 1999b.

Origin of HRST born outside Sweden

The European area beyond the European Economic Area (EEA) has been the source for the greatest number of HRST entering Sweden during the past decade (Figure 2). Apart from HRST coming from the countries of former Yugoslavia (primarily asylum seekers), there has also been an inflow from the former communist block, particularly Poland.[6] The noteworthy proportion of Asian immigrants is apparently due to the fact that Sweden has accepted major flows of refugees or asylum seekers from the Middle East in the last decades.

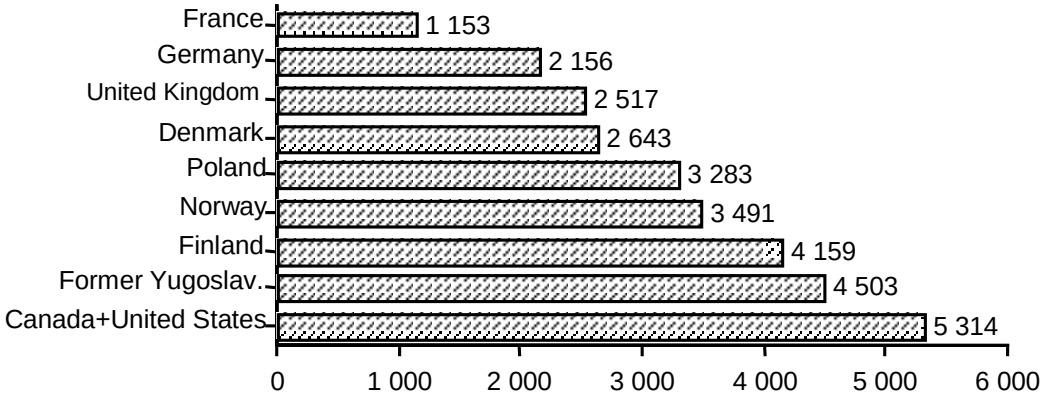
Figure 2. Inflows of foreign HRST between 1987 and 1989, by region of origin



Source: Statistics Sweden, 1999b.

An analysis by country of origin (Figure 3) shows the United States in first place, followed by the former Yugoslavia and then the three Nordic countries (with Poland in between) and certain European Union countries.

Figure 3. **Largest foreign contingents of HRST entering Sweden between 1987 and 1998, by country or group of countries**
Cumulative figures



Source: Statistics Sweden. 1999b.

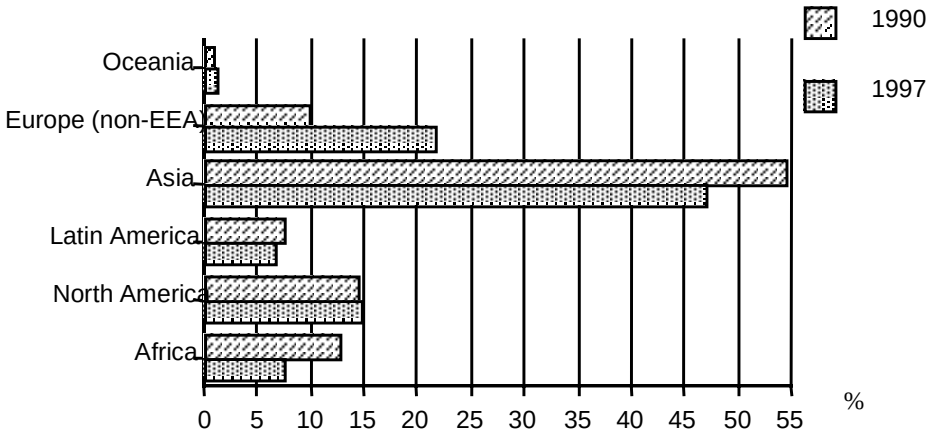
Foreign students in Sweden

According to Swedish statistics, the country received about 13 000 foreign students[7] in 1998, or roughly half the number of Swedish students studying abroad (25 000). One-third (4 500) of the students came from other Nordic countries, another third (4 900) from the rest of Europe (in the geographic sense of the term) and the remaining third from the rest of the world, with a heavy contingent from Asia (2 000), primarily from China (650) and Iran (610).[8] More than 50% of foreign students, or 6 400, were taking part in exchange programmes, for the most part (77%) under official European or Nordic sponsorship (in particular, Erasmus and Nordplus).

The number of foreign students pursuing doctoral studies has grown steadily over the last decade, from 1 864 in 1990-91 to 2 357 in 1996-97, an increase of more than 25%.[9] On the other hand, in terms of total doctoral studies enrolment (which is itself rising), the proportion of foreign students rose by barely one percentage point, from 19.6% in 1990 to 20.4% in 1997.

Figure 4 highlights the relative (although declining) importance of doctoral candidates of Asian origin. This is due above all to the Chinese students who, at 30%, constitute the largest foreign contingent among the non-EEA foreign doctoral student body. There has also been a significant increase in non-EEA Europeans, whose representation rose from 12% to 22%, reflecting primarily a greater influx of doctoral students from the Baltic countries and from Russia. After China, the most heavily represented countries are the United States (12% of students), followed by the Baltic countries, Iran and Russia. Medicine is the most popular discipline among foreign doctoral students[10] (especially Chinese, Americans and Russians), followed by technological sciences (which attract the most Iranian and Baltic students) (Högskoleverket, 1998).

Figure 4. Foreign doctoral candidates (non-EEA) by continent, 1990 and 1997
Percentages



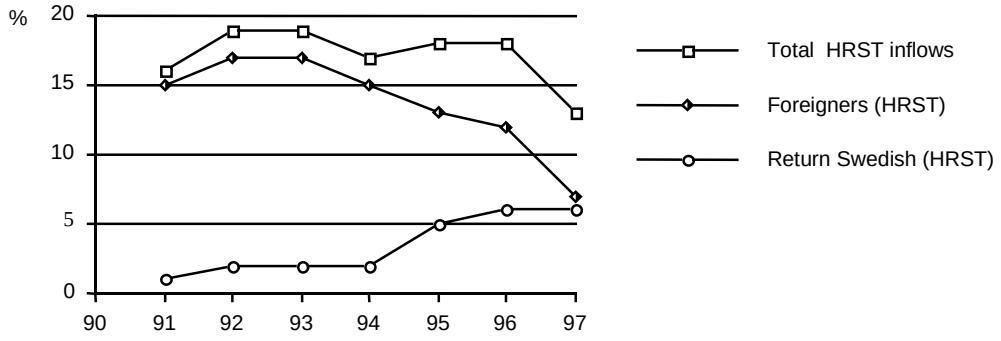
Source: Högskoleverket (1998).

Despite legislation that does little to encourage foreign students to remain in Sweden (they are not allowed to change their immigration status unless they marry a Swedish national or a person authorised to reside in Sweden), two-thirds of graduates stay in the country after receiving their diploma. Having a job in public or private research is probably the main reason for remaining in Sweden. Indeed, foreign graduates of Swedish academic institutions are likely to be known and integrated into a local research team by the time they have defended their thesis. This fact has gone some way towards dispelling the often-expressed fear that the high proportion of foreigners (20%) in doctoral programmes represents a costly national investment from which the country does not profit.[11]

Foreigners as a share of highly skilled workers

It is impossible to assess the share of foreigners in Sweden's HRST population on the basis of their professional occupation, because of the lack of any method of direct observation. What can be observed is the share they represent at the time of their arrival in terms of their education level. Data on the entry of highly skilled workers reveal not only a sharp decline in numbers (Figure 1) but a downward trend in HRST entrants of foreign origin compared to returning Swedish HRST (Figure 5).

Figure 5. HRST inflows to Sweden by nationality as a share of total annual entries

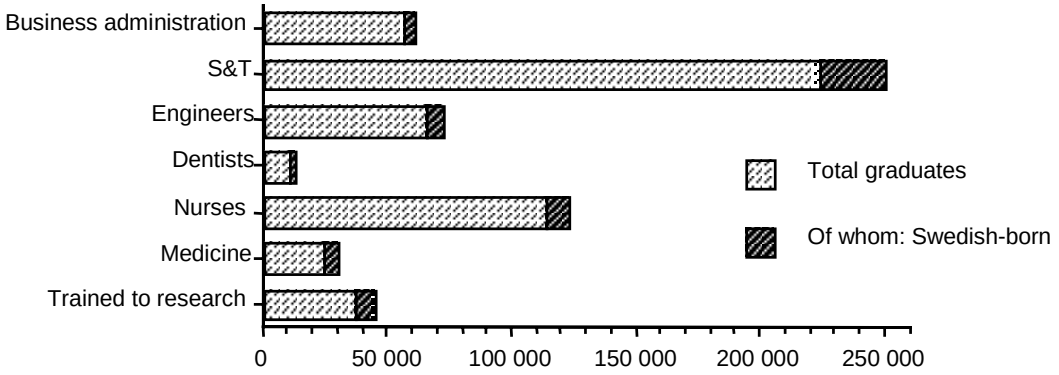


Source: Statistics Sweden, 1999b.

It is also difficult to derive an accurate estimate of HRST as a proportion of the resident immigrant population or of the country's total population, given the mobility of HRST and the difficulties of gathering data. Studies on this topic[12] show, however, that highly skilled individuals are proportionately more numerous in the immigrant community than in the population of Swedish origin. The survey also showed that, while there has been net growth over the decade, the stock of foreign HRST varied significantly over that period. For example, it stood at between 1% and 2% (or between 4 500 and 9 700 persons) in 1998. In 1999, estimates ranged between 0.4% and -0.2% (*i.e.* between + 3 800 and -2 100).

Another study, again conducted by Statistics Sweden, for the year 1997 (Figure 6) offers a cross-section of HRST as a share of the total Swedish labour force (16-74 years). It found that foreign HRST accounted for 9% of graduates in business administration and management, 12% of graduates in science and technology, 10% of engineers (including architects), 16% of dentists, 9% of nurses, 20% of medical doctors and 21% of researchers. This does not necessarily mean, however, that these highly skilled individuals occupied positions consistent with their qualifications. This issue will be addressed later, in the context of the Swedish labour market.

Figure 6. Share of foreigners among the stock of graduates, 1997



Source: Statistics Sweden, 1999b.

The proportion of EEA nationals in migration flows

Table 1 shows that the inflow of EEA nationals has not grown as fast as might have been expected after Sweden joined the European Union in 1995.

Table 1. Issuance of residence permits to citizens of the European Economic Area, 1994-99

Reason for issuance	1994	1995	1996	1997	1998	1999
Employment	2 020	1 659	1 768	1 583	1 938	1 856
Entrepreneurs	97	63	91	90	105	95
Business	201	163	250	302	484	526
Students	1 148	1 102	1 558	1 272	1 700	1 986
Other – not in the labour force	2 574	1 661	1 497	1 309	1 508	1 611
Total of the above categories	6 040	4 648	5 164	4 556	5 735	6 074
Total permits issued	78 987	32 486	31 664	36 565	39 433	37 376
Share	7.4%	14.3%	16.3%	12.4%	14.5%	16.2%

Source: Migrationsverket, 2000.

While it is impossible to separate out the high skill categories from the distribution of professions, it may be said that the share of students (at all levels) has risen sharply (by 73%), from 1 148 to 1 986.[13] It will also be seen that the number of residence permits granted to business professionals (temporary stay permits) rose by a factor of 2.5, reflecting the growth of trade.

International mobility of HRST

Imobility of Swedish-born HRST

Mobility of Swedish students

Far more than the departure of foreign HRST trained in Sweden, it is the outflow of skilled workers of Swedish origin that is generally regarded as the greatest loss for the country's S&T potential. Studies consistently show that young Swedish graduates are increasingly interested in going abroad. This trend is already apparent at the high-school level; in a 1999 survey conducted by Statistics Sweden, more than half of graduating students going on to higher education replied "yes" and 25% replied "maybe" to the question, "Are you thinking of pursuing part of your higher education abroad?" Thus, 80% of high-school students were actively thinking about the possibility of leaving Sweden to study. In 1993-94, the same survey (which is conducted annually) produced results about 10% lower. There has thus been a sharp increase in the desire for mobility (Utbildningsdepartementet, 2000a).

Between desire and realisation, however, there is a line that many students do not cross. During the university year 1999/00, some 27 300 young Swedes (8% of the total)[14] pursued their studies abroad. This is far from the 80% who said they wanted to do so, and yet it shows a significant increase over the pattern of the 1980s. Moreover, the number of students supported abroad by Swedish scholarships[15] rose sharply in recent years, *i.e.* from 9% of the total student body in 1995/96 to 12% in 1997/98. In 1998 and 1999, however, the number of students expressing a wish to leave at several of Sweden's leading schools contracted, although this may have been due to economic conditions at the time.

According to official statistics for 1999, emigration rates are highest among holders of doctoral degrees (30% in 1995-96). For the most part, they leave to pursue postdoctoral university studies or research, and their stays abroad are usually relatively short. Thus, one-half of young graduates returned to Sweden the year after they left, and at the time of the survey (Spring 1998, two years after departure), only one-third had not yet returned. Moreover, not all of the remaining third had notified the authorities of a change in their permanent address, which suggests that the rate of return will be even higher over the longer term.

After postdoctoral students, the most highly mobile contingent is students graduating from secondary school. Of these, 15% left in 1995-96, and nearly all had returned by the time of the survey (only 5% remained abroad two years later). The main reason for travel was to gain language experience, to work as an *au pair* or to pursue other non-scholastic activities. The idea of a sabbatical year before going on to university has become increasingly common.

International mobility of Swedish-born professionals[16]

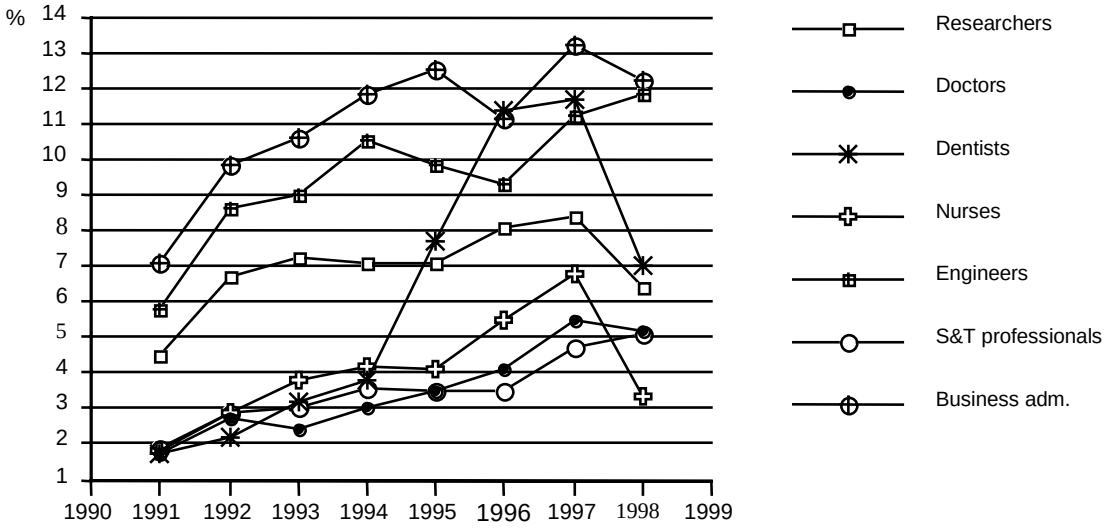
Since the beginning of the decade, the annual number of highly skilled S&T professionals leaving the country has tripled, in both absolute and relative terms. It is estimated today that between 2% and

3% of new graduates go abroad,[17] and the rate is as high as 5-6% for graduates in business administration and management. This may reflect the fact that these schools offer a portion of their courses abroad, thereby allowing students to forge ties that will encourage them to emigrate once they have completed their studies.

Yet while it is steadily increasing, this emigration has not resulted in any major net loss of numbers in the various professional contingents, in a context where the overall number of graduates continues to grow. The profession that has seen the sharpest increase in departures during the past decade is dentistry, where departures tripled between 1994 and 1996, from 35 individuals to 104. Yet even this latter figure represented barely 1.2% of the profession's membership in 1996.[18]

Moreover, this group shows a high tendency to return, and the number of returns has grown in parallel with the rising rate of departures. Statistics indicate that, for all disciplines, at least half of Swedish-born HRST expatriates return to the country after a stay of some years abroad (the latest data suggest that more than 65% of engineers[19] and 55% of business and management professionals[20] return to Sweden within eight years after their departure) (Figure 7).[21] In fact, the return rate is probably even higher, since it is too early to forecast how many recent emigrants will return.

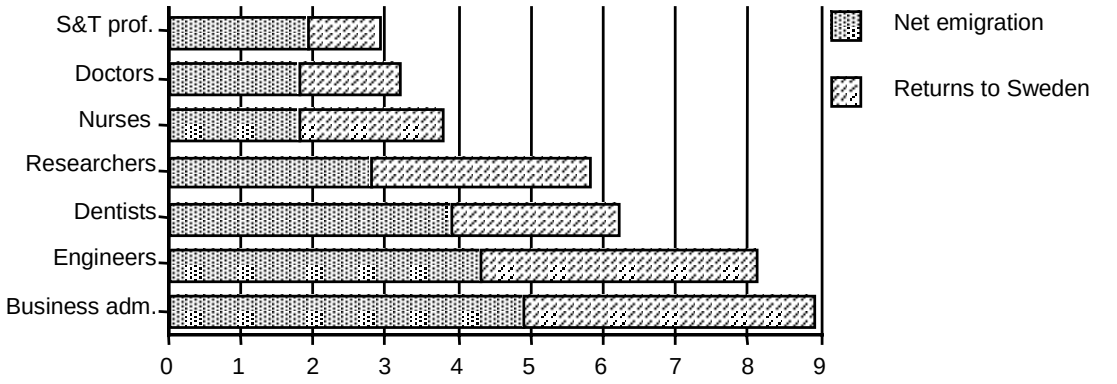
Figure 7. Swedish-born emigrants per 1 000 professionals, by profession



Source: Statistics Sweden, 1999a, p. 2.

The professions with the highest emigration as a percentage of the professional body are business and management, followed by engineering, dentistry and research. These four professions also have the highest net emigration numbers. In the nursing profession, despite the high number of expatriates (3 975), only 3.8% of its members have left, and only 1.8% had not returned (Figure 8).

Figure 8. Share of emigrants and returns (11-year cumulative figures) among Swedish-born persons, by field (1987-98)



Source: Statistics Sweden, 1999b.

A qualitative survey conducted in Spring 2000 for the Ministry of Education to determine why highly skilled Swedes returned between 1987 and 1998 provides some valuable information on migration. HRST migrants, for the most part, were found to have occupied a job in their area of qualification before, during and after migration.[22] Engineers and business and management professionals often worked in firms, groups or organisations by which they were already employed in Sweden. Reasons for moving abroad (45% go to a European country) are primarily of three kinds (apart from family considerations): *i)* to acquire international experience and come back more competitive; *ii)* to earn more money; and *iii)* to pursue a cultural interest (learning a foreign language, exploring new lifestyles). Moreover, many take advantage of a stay abroad to continue their education and training (40% of women and 25% of men).

That survey also reveals that the great majority of those who leave in fact come back according to their original schedule. This suggests that they resisted the temptation to remain abroad beyond their work contract. The reasons given to explain this behaviour involve purely positive considerations: it is Sweden's attractiveness that makes them return, rather than conditions abroad that drive them out. They come back to Sweden mainly because they find it easier to combine working life with family life, studies and leisure activities. There may also be an element of homesickness, but above all, they come back because the economic situation is favourable and the labour market is dynamic.

Thus, mobility of highly skilled nationals is relatively low. On the one hand, it reflects common professional practices, such as researchers pursuing postdoctoral studies abroad, or engineers working in foreign affiliates of their company. On the other hand, it responds to labour market demands, as in the case of nurses. Mobility is part of the internationalisation of education and training, for example for business and management professionals who find jobs abroad because of the international focus of their training programme and the globalisation of trade. This mobility, moreover, has a strong two-way element, since more than half of emigrants return to Sweden at the end of their stay, and in fact between a quarter and a third of these people have already lived abroad one or more times, and many plan to leave again in the relatively near future (a tendency that is particularly noticeable among researchers and engineers).

The mobility of foreign-born HRST

Highly skilled individuals of foreign origin are particularly mobile, and many have left or are leaving Sweden. Between 1987 and 1998, no fewer than 26 714 highly skilled foreign workers left (including more than 4 000 researchers, 1 500 medical doctors, 3 400 S&T professionals and 1 300 nurses) (Migrationsgruppen, 2000).

The reasons for these departures are many, but some have to do with the fact that many of these HRST came originally as refugees or asylum seekers. In principle, these people did not intend to settle permanently, and many return home as soon as they can. This is the pattern followed by a large portion of HRST who came from the former Yugoslavia. The employment problems facing people who apply for asylum and are unable to return home often have to do with the loss of their skills during the lengthy asylum determination procedures (which can take two years), when it is impossible for them to integrate themselves, even linguistically. By the time the procedure is completed, these people find that, in approaching the labour market at last, they have lost their skills, they can hardly speak Swedish and they may not be in a position to take supplementary training that would equip them for employment in Sweden. Many of these people therefore try to leave the country.

Another category with great mobility consists of recent graduates who, having completed their studies, are no longer authorised to reside legally in Sweden.

The Swedish labour market and HRST mobility

The general economic context[23] and the labour market

A number of indicators show that Sweden today enjoys a healthy and strong economy. Unemployment affects only 4% of the labour force, the government budget is in balance, the inflation rate is below the European average, interest rates have been declining steadily for several years, industrial investment is rising along with output, foreign investment is maintaining its pace and the spirit of entrepreneurship is strong.[24]

In contrast to this positive picture, another series of indicators, relating to employment and demographics, could in time jeopardise the country's economic performance. The last decade has in fact witnessed a decline of 4% in the labour force participation rate. Moreover, the demographic outlook is troubling: after 2030, the population will begin to decline, and the elderly will be growing in numbers while the economically active (25-64 years) will shrink from 58% to 54%. According to current projections, if the participation rate among persons aged 25-64 remains steady, 40% of the population will be supporting the remaining 60% by 2030. A further problem is that the labour market has for some years now suffered a shortage of highly skilled manpower in certain sectors of the economy (a phenomenon affecting most Western countries). All of these considerations pose a challenge that the country is seeking to address, and the question of human resources, and in particular that of the international mobility of HRST, is now at the heart of public debate.

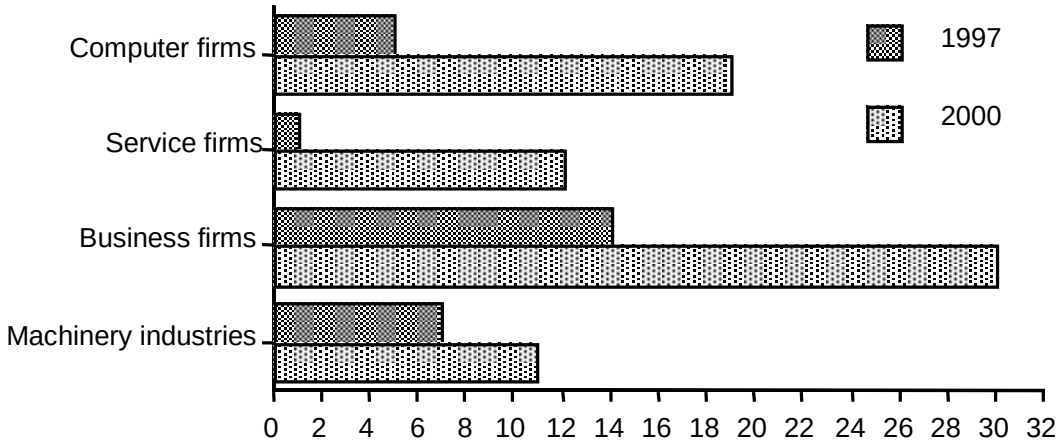
Business mobility in the globalised market

The impact of market globalisation has been felt with great force in Sweden. Many Swedish firms have been taken over by foreign companies since the beginning of the 1990s. Such mergers nearly doubled between 1988 and 1999, placing Sweden in third position internationally among countries whose domestic enterprises have been acquired by foreign concerns.[25] These establishments number

some 4 000 today and employ 400 000 people (or 17% of the country's labour force). At the same time, Swedish companies have been buying up foreign firms. Between 1993 and 1998, the number of such acquisitions reached 851, far exceeding the number of take-overs of Swedish firms (545) during the same period, although in financial terms the two processes were roughly in balance. Between 75% and 80% of these mergers and acquisitions occurred outside the industrial sector, a fact most likely explained by the deregulation that has taken place in the services sector.

These mergers are often of a strategic nature. Their primary aim is to internationalise the client base, raise R&D budgets and concentrate activities. One direct consequence of these mergers has been the relocation of many corporate headquarters. Thus, during the 1990s, nine of the 50 biggest Swedish concerns relocated their headquarters or a significant portion of head-office activities abroad. In seven of these cases,[26] this move followed the merger of the business with a foreign company. Yet this trend is even more pronounced among small and medium-sized enterprises, primarily those that are taken over by foreigners. In 1997, 12% the head offices of Swedish firms (or a portion thereof) were based abroad, while in 2000 the comparable figure was 30% (Figure 9).

Figure 9. Percentage increase in relocation abroad of headquarters between 1997 and 2000 in the most affected sectors



Source: NUTEK, 2000b.

This mobility has been made possible through the development of information and communication technologies (ICT) which, while facilitating new institutional configurations, have also had an impact on the mobility (or lack of mobility) of HRST. An example is the delinking of R&D activity from corporate headquarters. Given the key role of ICT in current mobility trends (for businesses and people alike) and their particularly advanced state of development in Sweden, it is useful to review this sector of activity briefly.

The emergence of ICT clusters

The development of ICT in Sweden is based on an engineering tradition that dates back more than 100 years in traditional industries such as pharmaceuticals, chemicals, metallurgy, mining, automotive manufacture and household appliances. The constant demand from large businesses for state-of-the-art technology has sparked many innovations and given rise to perhaps 20 000 ICT firms which today employ more than 200 000 people (or slightly more than 5% of the working population).

Other factors that have contributed to this development include the presence of a telecommunications giant (Ericsson, which devotes 14% of revenues to R&D) in the local market, the popular acceptance of ICT (thanks in large part to political determination to promote information technologies), a major national R&D effort,[27] a true climate of innovation[28] and the emergence of clusters or concentrations of firms from the same sector in technology clusters.[29]

These factors have combined to make Sweden the most advanced country in Europe in the move to an information society. Penetration rates for the Internet, cellular telephones and home computers are the highest in the world. Broadband fixed or mobile telephone services will soon cover most of the country. All of the conditions are in place for making this country one of the principal reservoirs of ICT businesses: a strong industrial base, demanding multinational clients, the growing adoption of information technology by both the public and the private sectors, state-of-the-art infrastructure and a dynamic spirit of entrepreneurship.

These circumstances help to restrain the desire for personal mobility on the part of HRST working in this sector. It would appear that, , young ICT graduates in Sweden have no particular desire to leave the country, unlike many in other S&T sectors. There are several reasons for this: they see Sweden as one of the most attractive places in the world from the professional viewpoint, the existence of clusters has an emulation effect that stimulates creativity and innovation, salaries in the sector are high and many firms (because they are small) have a business culture that is participatory and motivating (Pensionsforum, Industriförbundet and SACO, 2000).

Yet even when they are grouped together in clusters where there are strategic facilities for fostering co-operation between education, research and industry and for facilitating international collaboration in ICT, these firms, mostly of modest size (the average has ten employees, although several international giants have also set up in Sweden), are particularly vulnerable in the current context of globalisation. In fact, having turned to international markets (above all the United States) to establish their credibility, they find that to survive they must invest constantly in further innovation, and this makes them permanently susceptible to take-over or expatriation.

What Sweden has, then, is an extremely dynamic economic sector which is, paradoxically, vulnerable in terms of economic growth. Moreover, no one can predict today what effect this technological development will have on HRST mobility over the short and medium term. The way in which Sweden responds to the shortage of skilled labour in this area will provide part of the answer, in terms of whether the businesses or the human resources are going to move. Above all, the more general question is whether the advanced development of ICT in Sweden will accelerate HRST mobility or help to keep those resources rooted at home.

How mergers and acquisitions effect HRST mobility

Curiously, the internationalisation of business seems to induce little personal mobility.[30] Over the period 1996-99, and for a population of some 650 000 employees of Swedish multinationals, it appears that mobility between corporate headquarters in Sweden and affiliates abroad (numbering 82) was extremely limited. The average number of relocations from headquarters to affiliates, while twice the level of movement in the other direction, was nonetheless limited to 0.15 persons per affiliate, for both the executive and middle management ranks (or, all told, something over ten individuals for each of these two categories) and 0.32 persons among engineers and technicians (or slightly more than 25 individuals). Thus, there have been barely 50 moves[31] involving the expatriation of highly skilled Swedish personnel. On the basis of this finding, the authors of the survey suggest that “the specific technical skills required for work are more important than institutional knowledge, and this encourages

recruitment abroad. Another possible explanation for the situation is the role of ICT which, by facilitating communication among the various components of the business, has greatly reduced the need to move people around."

The results of this study are quite surprising. One might have thought that relocation abroad would produce a significant flow of expatriates since, as the survey demonstrated, one reason for such a move was the desire of management personnel to escape heavy taxation. Yet we also know that one of the objectives of relocation is also to be able, by offering competitive salaries, to attract highly skilled workers who would hesitate to work in Sweden because of the lower salary scale and the sharply progressive nature of personal taxation. It would seem, then, that relocations do not entail any significant brain drain, but rather an impoverishment of the local labour market, through the loss of highly skilled jobs.

These corporate headquarters are making such moves in a context where the structure of businesses is changing. Production and R&D activities, which historically were located very close to headquarters, have become increasingly separate. The development of ICT has probably had much to do with this, but the result has been to decentralise responsibilities in affiliates scattered abroad.[32] Consequently, when a headquarters moves, this does not necessarily have an impact on operational HRST in production or R&D, since these divisions most likely are not moved at the same time as the head office.[33]

On the basis of available data, it is difficult to say whether these relocations have an impact on the international mobility of people who are affected by them locally. While we may safely say that they do not entail any massive brain drain, we also know that they can lead to a net loss of jobs on the local market. This loss affects not only those employees who are left behind by the headquarters move, but all sectors of related activity, *i.e.* local firms that used to work directly with the relocated head office: consulting services, maintenance, security, hotels and restaurants, etc. According to the study cited above (ISA, 1999), the businesses surveyed were at that time buying more than SEK 9 billion of services from outside firms (of which SEK 6.4 billion from Swedish firms). This represented 5 300 jobs in Sweden. If the study estimates are confirmed (*i.e.* if the businesses that were planning in 1999 to move headquarters abroad actually do so[34]), the country would risk losing 25 000 jobs over three years or 8 000 jobs a year.

What does the situation mean for the international mobility of HRST? It is impossible to say on the basis of current knowledge. Mobility is rarely examined as such in the context of economic studies, and the available national statistics on migrations are too general to identify the reasons for departure among the various professional categories, which are usually grouped under headings that cover a broad set of fields and professions.[35] There is no information to hand, then, for drawing any conclusions about these job losses in terms of mobility.

Matching HRST supply and demand

The shortage of Swedish-born skilled labour

In Sweden, as in many other countries, an emerging shortage of skilled manpower is blamed on a mismatch in the labour market between job offers and available skills. Without questioning the existence of this shortage, which has been established by a number of professional and labour organisations, two recent studies have cast doubt on its importance by highlighting a tendency among employers to exaggerate skills requirements in the recruiting process.

The first study, conducted by NUTEK in 1999 (NUTEK, 2000a) and covering 200 Swedish firms throughout the country, confirms this view by showing that, while in 43% of the 4 000 job offers examined the employers encountered difficulty in recruiting people with the required skills, the skills stipulated in fact went well beyond technical requirements. The personnel profile that was so difficult to match included the following features: professional experience, social skills, capacity to motivate and a sense of commitment, as well as adequate training and a sound command of the Swedish language. The second study, conducted by the Ministry of Labour (Edholm and Hägglund, 1999), found that, for the 35% of companies interviewed that indicated recruitment problems, only 12% had had to abandon recruitment or accept a candidate with lower qualifications. For the others, the study concluded, recruitment difficulties could be attributed to an overstatement of real needs.

The NUTEK study also shows that while nationality is not an important recruitment criterion (although it appears in 45% of cases),[36] a knowledge of the Swedish language is in fact first on the list of criteria (along with social skills). This means that some foreigners who may have the required technical and professional qualifications are left out of the running. Moreover, the study shows that "insufficient command of Swedish" was cited by 5% of employers as a factor for rejecting candidates. This is a relatively low proportion but, considering that foreigners represent only 6% of Swedish residents, it is not insignificant.

The high skills and qualifications demanded by employers must not be allowed to hide a very real shortage caused by the fact that, despite the demand, some candidates simply do not apply. According to the NUTEK study, "few or no candidates" is the first reason given by 85% of businesses. This shortage of skilled manpower is much more acute for jobs that require advanced training in professions where high-level technical skills are required, particularly those involving new technologies. Both the public and private sectors today face a shortage of specialists in electronics and in ICT.

Employment of foreign-born HRST

This has become a sensitive point on the Swedish labour market. Sweden today receives many foreigners who are unable to find work commensurate with their training and qualifications. This is officially regarded as a serious waste of human resources (Utbildningsdepartementet, 2000a, p. 9). The share of immigrants in the unemployment figures is significant and nearly three times their share of the labour force (OECD, 2000a). The reasons for this underemployment are many. First, there is an observed tendency among business executives to hire nationals in preference to persons born abroad, particularly when it comes to younger candidates. This applies even to people educated in Sweden. Many foreigners are handicapped by their poor command of the language. Their education diplomas may be illegible, and they may have trouble winning recognition of their qualifications in an environment where they lack cultural references.

The situation is changing, however. During the 1990s, professions that traditionally recruited the greatest numbers of HRST gradually increased their hiring of foreign-born HRST and reduced their hiring of foreigners without higher education. A similar trend could be seen in industries that traditionally have little demand for highly skilled manpower (services, commerce, hotels and restaurants, processing industries, agriculture and construction, for example).

Although the economic recovery has helped to open the labour market to skilled foreign workers, they are far from enjoying full employment. The figures show, for example, that between 70 000 and 80 000 were unemployed in 1998, including 2 500-3 000 scientific researchers, 1 500-1 700 engineers, 500-800 dentists, 1 500-2 500 nurses, 600-1 100 highly skilled S&T professionals.

The sector that stands out in particular for its employment of foreigners (perhaps because of labour shortages) is information technologies, where the share of foreign workers has risen fastest in recent years. At the end of the 1980s, large numbers of highly skilled workers were recruited abroad by IT firms, and by 1990 they accounted for slightly more than 6.5% of the industry labour force. Between 1990 and 1993, such hiring was cut back but then recovered. In 1997, at least 7% of highly skilled workers (some 4 000) in this industry were of foreign origin.[37]

Increasing the supply of HRST

The previous sections clearly show that, while Sweden may not be facing a severe brain drain, it will have to adopt a suitable policy for resolving the shortage of highly skilled workers if it is to maintain its growth rate. Combined with demographic projections, this problem might in time jeopardise the country's economic development. Among the available options, two have to do with HRST mobility: increasing the return rate for expatriates[38] and attracting foreign workers (starting with better utilisation of foreign-born skills already in the country). This is this option that the country appears to have adopted.

This option, however, carries its own complications. A policy of selectively attracting highly skilled immigrants has a number of social and economic implications (education, taxation, housing, regulation, etc.). With this in mind, some policy directions that may be contributing to the current situation but will also provide a basis for future decisions are examined below.

Measures affecting higher education

Internationalisation and flexibility

International mobility has long been viewed as an essential feature of the Swedish higher education system and is strongly encouraged by official directives.[39] The university reform of 1993, which gave institutions greater independence and flexibility in designing their programmes and selecting their local partners, has also given them greater leeway to internationalise their study programmes and to expand their research networks. Since that time, students at the undergraduate and graduate level have enjoyed greater mobility, both within and outside officially sponsored exchange programmes. In fact, the majority of students who received Swedish funding for study abroad in 1999-2000 did so on their own.

Flexibility is another basic value of the higher education system. It is seen as making education more effective and more competitive, helping institutions to keep pace with local industries and sponsoring stimulating interaction. Study programmes have been decentralised and are now designed at the local level. Only the length of the programme and the resulting certificate are still controlled at the national level. Local co-operation has also grown in the research field[40] and is moving in two directions: *i)* meeting the needs of local industries; and *ii)* sponsoring international research projects.

The first aspect of this science policy has involved instituting specific doctoral programmes to meet the needs of industry and increasing the local supply of doctoral graduates specifically trained to those requirements. The second aspect – internationalisation – has involved financial incentives[41] and the establishment of "centres of excellence" funded by NUTEK within universities.

Thus, through autonomy and pluralism, flexibility and internationalisation, Sweden has been able to establish a creative environment for research and the advancement of knowledge. Nowhere is the success of this policy more apparent than in the ICT sector.

Towards an "information society"

The fact that 75% of the Swedish population between the ages of 16 and 64 have access to a computer, and more than 60% have access to the Internet,[42] is primarily the result of a deliberate, long-term and general national policy, starting with education.[43] This policy has relied on the outstanding quality of the technical education offered in the country's technology institutes (Stockholm, Gothenburg, Lund and Linköping are the best known) which have responded very promptly to new technology needs.

Since then, the effort has been continuous. Several major research foundations have invested in research projects, both in universities and in industry. The country's universities and training institutions are, as noted earlier, well adapted to the needs of industry and are undertaking initiatives that are increasingly oriented towards the use of ICT.[44] As a result, the number of graduates in electronics and computer sciences, while still insufficient, has grown in the late 1990s (especially in 1998 and 1999, with about 500 graduates each year).

This is part of a long-term strategy on the part of the national authorities to ensure that Sweden remains an international leader in ICT and can attract international skills and foreign capital. To encourage thinking about the new paths that the country should pursue in the 21st century, a hundred or so experts from the world of research, industry and public services met in eight working groups during 1999 and mapped out a number of strategies to safeguard the country's position of strength in the international market. The strategies include the following: promoting interaction between biological and IT sciences, developing strategies and programmes for applying IT in health and social services, developing software to support long-term and intermediate training in the closer interface between education and the workplace, and developing ways of making ICT exchanges secure (NUTEK, 1999 and 2000b). These are but a few of the areas in which the country hopes to promote innovation.

Producing more graduates – a challenge for tomorrow

With more than 10% of its GDP devoted to education, Sweden takes first place among OECD countries, yet this financial effort is not reflected in the proportion of the Swedish population enrolled in higher education. In fact, while many people go on to advanced studies, they are less likely to pursue them beyond three years. Consequently, at 23%, the rate of graduates among the 25-64 age group at the ISCED 5 level and beyond, Sweden lags behind that of many other OECD countries (OECD, 2000b). The factors influencing length of study are many. Among the most obvious are a narrow salary range, highly progressive personal taxation, education financing in the form of loans, new approaches to studies that combine mobility with time out and ready access to continuing education.

Narrow salary scales and high tax rates may explain in part why young Swedes do not undertake long study programmes. A recent survey shows, for example, that four professions at the ISCED 5 level and beyond (high-school teachers, physical therapists, occupational therapists, social workers) had gross incomes lower than those of industrial workers in 1988 (SACO, FöreningsSparbanken, 2000). The study also indicated a significant compression during the last three decades in the

differential between disposable incomes (*i.e.* income left after personal taxes and repayment of student loans) for professionals who have pursued lengthy university training and for those without higher education.

Another factor turning people away from pursuing a university education is the method of student financing through government loans, the burden of which increases with the length of studies. Added to this is the fact that young Swedes are increasingly mobile and, as noted at the outset of this chapter, inclined to take one or several years off after high school. It is clear, as well, that increasing numbers of students interrupt their studies for a period of time. These new forms of behaviour inevitably delay entry into the workforce. Students may make up for this by opting for shorter programmes of study. Such a choice may also be encouraged by the strong awareness among young Swedes today that they will need continuing education throughout their professional careers. Knowing that they will have ready access to on-the-job training[45] may also induce them to opt initially for shorter programmes.

Whatever the reasons for this shortage of advanced university degree holders, it poses a real problem for maintaining the country's pace of economic and industrial growth in the near future. Several solutions are being proposed, all with the same objective: to create economic incentives that compensate those who pursue longer studies. The first idea is to broaden the salary scale, with the view that this would serve three related objectives: encouraging young Swedes to earn advanced degrees, attracting foreigners and highly skilled workers to Swedish university programmes and motivating companies to remain in Sweden.[46] There is also a call for the political authorities to recognise the impact of personal taxation and to take appropriate decisions.[47]

The internationalisation of higher education

Another proposed solution is to bring in foreign students with university potential. This possibility was examined last year by an official commission set up to study ways of recruiting larger numbers of foreign students from beyond the European Economic Area (Utbildningsdepartementet, 2000b).

Along with this interest in opening Sweden to young foreigners seeking an education, and who might remain in the country after their studies and offset the shortage of local skilled labour, the presence of foreign students has become an issue in itself. Not only are universities in Europe today being assigned a primary role in international economic competition, but the number of foreign students in universities is taken as an indicator of their international stature and their powers of attraction on the international market for higher education. In many northern countries, this market is extremely lucrative, and in fact the commission was also asked to examine the notion of tuition fees for non-EEA students.[48]

Taking its cue from countries that earn substantial revenues from this activity[49] and undertake promotional marketing to recruit foreign students from around the world, the commission drew up this list of Sweden's comparative advantages:

- An extensive system of universities of high quality in both teaching and research.
- Internationally respected research (Sweden is the home of the Nobel Prize).
- A population with a solid mastery of English.
- A highly multicultural society.

- A well-functioning system of student support and extracurricular services.
- A highly advanced ICT sector.
- Solid economic growth.

The goal would be to recruit 5 000 new students from beyond the EEA over the next five years. To this end, the commission proposes to:

- Expand teaching in English.
- Introduce the means for recognising foreign degrees at the ISCED 5 level by creating an "international master's degree" that would allow foreign students to enter university programmes at the proper level after two three-month preparatory sessions.
- Strengthen the teaching of Swedish.
- Expand the supply of university housing (an acute problem in the larger cities, particularly in Stockholm[50]).
- Amend immigration regulations so that non-EEA students may work during vacations and remain in Sweden after completing their studies.
- Increase the number of foreign teachers.
- Increase the number of scholarships available for foreign students.
- Authorise universities to negotiate goal-oriented agreements with foreign governments, agencies and institutions.
- Introduce international marketing strategies to promote study in Sweden (through the Swedish Institute).

In this context, "education is seen as a strategic investment for developing and reinforcing future bonds between individuals, institutions and businesses in foreign countries. The health of Swedish businesses is more than ever dependent on recruiting well-trained workers with know-how and an understanding of foreign markets and conditions in those markets." (Utbildningsdepartementet, 2000b)

Attracting foreign-born HRST

Located at the heart of the Nordic and Hanseatic worlds, Sweden is particularly well placed to pursue international industrial and business activities in northern Europe. Its membership in the European Union since 1995 has reinforced its position in this respect, by opening it to countries further south. As noted previously, the result is that a great many foreign businesses have set up facilities in Sweden or have taken over existing Swedish firms during the past decade. Yet this has not meant any significant displacement of workers, either into or out of Sweden. The question now is to consider why highly skilled foreigners are not more interested in coming to Sweden. This issue is currently being addressed by the Economic Council of ISA, which, under the Ministry of Foreign Affairs, has a mission to promote Sweden's image abroad and to examine how social and economic conditions in Sweden can be used to attract foreign investment, including human resources.[51]

While Sweden offers many advantages for students and investors, it also has some drawbacks, of a geographic, climatic, administrative or cultural kind, for people who might want to settle there. First among them is the difficulty for anyone who is not an EEA national to enter the country.

Immigration regulations

It is very difficult to obtain a work permit for Sweden unless one is from the Nordic Union or the European Union. Work permits are issued only to a candidate for a job that cannot be filled by a Swede, by a foreign resident in Sweden or by a Nordic or European national (between 250 and 300 permits are issued each year). Permits are granted for the period required for the job, up to one year, and are renewable when necessary. Work is limited to the occupation and to the employer identified in the permit. Only individuals at the executive level can have this kind of permit transformed to permanent residence. The applicant must, of course, demonstrate that she/he has a job and declare what his/her income will be, but must also have a place to live, and this, given the acute housing shortage in many urban areas, is an additional hurdle that only those businesses seeking foreigners for highly specialised jobs can overcome.

There are other kinds of permits, of course. There is one for temporary labour shortage (which is dependent on labour market conditions, and is granted for 18 months at most), another for work experience under international exchanges and yet another for seasonal work. All of these permits are specific to certain situations. There is another, much more flexible, permit which is widely used for bringing in highly skilled workers, known as the "international exchange" permit. During the first ten months of last year, more than 15 000 foreigners entered Sweden with this permit. This permit is open to many professions, and is used by academics, artists and cultural professionals, researchers and highly skilled workers from industry and other economic sectors. It is granted for the period of work required (which may be as little as one day or up to 48 months) and is renewable. Clearly, it is potentially very attractive if it is used flexibly.[52]

Measures to lighten the tax burden on temporary residents

Personal taxation is the subject of much political and social debate in Sweden and is an issue that lies at the heart of mobility for highly skilled workers. For nearly 70 years, with few exceptions, Sweden has been governed by the Social Democratic Party or by a coalition of the left. Although economic policy has in fact been quite liberal, the principle of solidarity underlying national institutions is firmly entrenched in society. A key feature of this solidarity is an approach to personal taxation that seeks to reduce income gaps between individuals and to pay for social policies of benefit to all.

Starting from the principle that highly skilled workers who come to Sweden for short periods of time have only limited need for the social services available to Swedes and permanent residents, a new law came into effect in early 2001 that will alleviate, for up to three years, the tax burden on foreign experts and highly skilled workers who live in Sweden for fewer than five years. Thus, 25% of income will be exempt from taxation and social charges, as will certain fringe benefits that are normally taxable.[53] Sweden has thereby brought itself into line with legislation in other European countries (*e.g.* Denmark, the Netherlands, Belgium) that have adopted such policies to encourage the recruitment of specialised foreign personnel and to stimulate investment by foreign firms.

Promoting the employment of skilled foreign workers

Social diversity

In Sweden today, one in every four individuals is of foreign origin.[54] The resulting cultural diversity is something new in a society that until fairly recently was relatively homogeneous (and remains so in some rural areas). The arrival during the last 25 years of large foreign communities of diverse backgrounds, which came for the most part to seek asylum and have settled in the suburbs of the major cities, has led to social friction, as in many European countries, and has evoked defensive and sometimes hostile reactions among the local population. It is clear that, quite apart from the illegible diplomas and unverifiable skills that many foreigners, however qualified, bring to the Swedish labour market, part of the problem lies in the reluctance of some employers to put their confidence in foreign workers, even if they are skilled and even if they have graduated from top Swedish schools.

Action is thus called for among the population as a whole. Such efforts will become more urgent if the shortage of highly skilled manpower is to be made up through foreign workers. The "diversity" policy that was adopted in 1998 should be able to meet this need. Originally developed to respond to the new cultural reality of Sweden, this policy is now no longer targeted specifically at foreigners, but at an entire population that is now regarded as segmented, of diverse origins and ethnic makeup, and with varied know-how and skills, which should be able to express itself within society and contribute to economic growth.

This new legislation is based on "democratic principles, whereby the cultural and ethnic diversity of Swedish immigrants should be reflected in the way policies are formulated and applied. The objective is to achieve equality of rights, duties and opportunities for all, regardless of ethnic or cultural origins"[55]. There is no longer to be any specific policy for integrating foreigners, apart from the measures that are indispensable at the beginning of their stay. This means that social measures will no longer focus on immigrants as such, but on the development of society as a whole. An Integration Service was created on 1 June 1998 to apply this policy in all its social dimensions.

This law is already being applied in various areas, and a number of measures are now in place with alternative means for taking foreigners' qualifications into consideration and making it easier for them to gain recognition for their qualifications in the labour market. This approach involves a provision for evaluating and validating academic diplomas and work experience acquired abroad, and for offering foreigners access to skills-upgrading programmes. Major efforts are being made to raise the level of knowledge among adults through continuous training (including the learning of Swedish). Foreigners can participate either directly at their place of work or by taking higher education courses. There are also provisions for enhancing "diversity" in higher education institutions and reducing social and ethnic bias in recruitment. It is not possible here to discuss all of these measures, but the fact that they are being taken shows a public willingness to confront the barriers facing foreigners (many of whom, it should be stressed, are highly qualified) in a labour market that has been prone to discrimination.

The anti-discrimination law

Another move in the same direction was the introduction in May 1999 of new legislation to combat ethnic discrimination, with a particular focus on occupational aspects. This new law applies to all kinds of discrimination, direct or indirect, deliberate or not, on the part of employers. Its scope is not limited to the hiring process itself, but covers recruitment procedures and campaigns (which must

not contain any ethnic bias) and extends, indeed, to all aspects of corporate life. Employers are held responsible for establishing a climate favourable to "ethnic diversity" within the company, and for avoiding any form of ethnic harassment in the workplace. It is up to the employer to investigate and take the necessary measures where such problems exist. By making employers responsible in this way, the intention is to sensitise management personnel to Sweden's multicultural reality and help integrate foreigners into the workplace.

While the main objective of these measures is to move towards a more democratic society by reinforcing rights, duties and opportunities for all, it can be expected that in time, and provided the intended changes are actually implemented,[56] they will help to make Sweden more attractive for highly skilled foreign workers. Indeed, such an outcome is likely to be essential if economic growth is to be maintained.

Conclusion

The recent studies cited in this chapter show not only that Sweden is not suffering a brain drain but that the emigration of its HRST is relatively modest and involves only a small proportion of its graduates. Also, this mobility is part of a two-way movement and is offset by a significant return flow among people who, having lived abroad, return home. It is primarily young people with high-level scientific and technical skills who leave, and their behaviour follows recognised patterns: international training, postdoctoral residencies, temporary relocation as members of a consortium, etc.

On the immigration front, Sweden receives many highly skilled foreign workers whose abilities are not put to full use. The flow of asylum seekers (the main category of immigrants to Sweden for the last 25 years) has been an important source of HRST, but during the two years it takes to process their application they do not have the right to work. When they finally receive authorisation, they encounter problems in winning recognition of their abilities in a labour market that, while dynamic enough, is mistrustful of their qualifications. Faced with such difficulties, many leave Sweden. Despite this, net migration of foreign-born HRST has been largely positive over the past decade.

Paradoxically, Sweden suffers a deficit of national graduates, and this has produced a notable shortage of highly skilled S&T workers. This deficit, combined with an inverted age pyramid, could have a significant impact on the country's medium-term economic growth. At the same time, located as it is at the heart of a major trading zone (northern Europe and the Baltic), Sweden is seeing its companies relocating abroad or being taken over by foreign capital in the context of ongoing globalisation. The economic impact of these relocations and mergers, both at national level and on the local employment scene, is not fully understood, but there has been no significant shift of personnel either into or out of Sweden.

To ensure the country's technological progress and cope with the challenges of globalisation, the Swedish government has for several decades been promoting the development of communication and information sciences and technologies. By encouraging and supporting co-ordinated research, manufacturing and education efforts, it has hoped (and continues to hope) to attract foreign experts and investors. The sector today is extremely dynamic and growing rapidly, but Swedish firms, while highly innovative, are often small and thus vulnerable to take-over or expatriation. Still, Swedish policy has paid off, and the country has become a world centre for ICT. The fact remains that, while foreigners are showing an interest in investment, there has been to date no observable migration of professionals on any great scale among. Indeed, with internationally competitive opportunities available in Sweden, Swedish-born specialists have no urge to leave, and this is probably a positive sign. On the other hand, the foreign inflow is relatively modest. Nevertheless, with 4 000 foreign-born

workers (many of whom are Swedish residents), this sector has the most significant contingent of non-Swedish HRST (even if they represent only 2% of workers in this sector).

Debate is increasingly focused on how Sweden can attract highly specialised foreign workers. However, it is first necessary to address the issue of employing foreigners already in Sweden. In an effort to come to terms with what the Swedish authorities themselves call "a waste of human resources", the country has followed since 1998 a very deliberate policy of "diversity", expressed in legislation that seeks to bring all the country's minorities into the evolving social fabric and give them their appropriate place within it. Foreigners, as a component of society, are thus specifically targeted by the provisions of the law in all its fields of application and particularly in education and employment. These legislative provisions were supplemented by a law against ethnic discrimination that came into effect in 1999.

With the legal basis of its policy now in place, Sweden is committed to the further internationalisation of its society. This is an officially declared objective that is reflected as much in measures to open the higher education system to students from beyond the EEA as in efforts to enhance the mobility of Sweden's elite who, in the eyes of the authorities, are still too limited in their outlook. It would seem, then, that despite the cries of alarm heard here and there, the mobility of the country's brightest minds is regarded as something to be encouraged. On the other hand, ways will have to be found to overcome the shortage of S&T graduates and technicians. One solution is to make the country more attractive for foreign HRST. In any case, Sweden's economic growth over the medium term will depend in part on its success in meeting this challenge in the coming years.

NOTES

1. Sweden's official statistics are prepared in part on the basis of four sets of records (population, education, occupation, migration), which are updated regularly in conjunction with the authorities involved and are periodically adjusted with data from the population census and from category-specific and thematic surveys.

2. This section draws heavily on Edgren and Sahlin, 1999.

3. By the narrow definition of inflows, the dramatic surge in asylum seekers from the former Yugoslavia occurred in 1992, rising from 13 000 in 1991 to nearly 70 000 in 1992. Arrivals declined gradually to 28 000 and then to 10 000 in the following years and have since stabilised at between 1 000 and 5 000 a year.

4. These migrants do not all remain in Sweden, because not all are officially recognised as refugees. Sweden applies the 1951 Geneva Convention, but it fills the gaps in that instrument through two other, special categories that take into account asylum seekers who are at risk in their own country because of war or lack of protection from the national authorities.

5. These are mainly people from the South who are fleeing endemic underemployment and have no particular qualifications to offer the host country. This profile is by no means characteristic of most migrant workers today.

6. A programme to bring in Polish physicians was introduced during the decade to alleviate the shortage of Swedish doctors.

7. Foreigners enrolled in higher education institutions (the statistics do not differentiate between students who have come specifically to pursue their studies and the children of foreigners already resident in Sweden). This group accounts for 4.4% of the student body. By way of comparison, foreign students represent 3.2% of the student body in the United States, 5.1% in Denmark, 6.2% in France and in Norway, 7.8% in Germany, 9.9% in Belgium and 10.5% in the United Kingdom.

8. The high share of Iranians reflects the presence of the large community of Iranian exiles in Sweden.

9. The number of students from the European Union, despite an increasee of 57%, remained relatively low, while the number of Nordic doctoral candidates has remained stable.

10. The Karoliska Institute, widely renowned as a medical research centre, received the greatest number of foreign doctoral students (13% of all students enrolled) in 1996-97.

11. This study (Högskoleverket, 1998), also highlighted the fact that there were proportionately more doctorate holders among foreigners than among Swedes.

12. Statistics Sweden conducted a survey on this topic in 1999 in order to update its education records.

13. This figure includes only students requiring a residence permit. Those arriving under an exchange programme who do not need such a permit (nationals of Nordic countries, those coming for less than three months, etc.) are not included.

14. Most students who leave do so on their own, rather than under an exchange programme.

15. What is referred to here as a Swedish scholarship is a publicly funded student loan for which all students are eligible (subject to certain performance conditions) and which must be repaid during subsequent working life. In Sweden, students need not rely on financial support from their families, even if they are wealthy, provided they makes normal progress in their studies.

16. There is a fine distinction between student and recent graduate. This is why the "professional" category also includes doctorate holders working in research. If they are also included in the "student" category as recent graduates, that is because of the temporary nature of their post doctorate position. Like medical doctors, nurses, engineers or any other category of HRST, they are treated as trained professionals leaving the country.

17. This is a total figure covering all graduates of Swedish institutions, of whatever nationality.

18. Dentistry schools accept more foreign candidates than any other Swedish academic institutions (about 25%, whereas the average for all institutions is around 4%) (Utbildningsdepartementet, 1998).

19. This label relates to the professional category of « civilinjeniör » and covers engineering graduates from the major Swedish technology institutes.

20. This label relates to the professional category of « civilekonom » which designates graduates of the major business schools working in various branches of economics, finance and business: management, business administration, financial administration, etc.

21. Utbildningsdepartementet, 2000a. The overall share of returnees was between 30% and 40% during the 1980s.

22. With the added information that engineers are more likely to work in information and communication technologies after their return to Sweden.

23. This section is largely based on NUTEK, 2000b.

24. Among EU countries, Sweden attracted the highest level of foreign investment during the 1990s (ISA, 2000).

25. Relative to population size, Sweden now has more multinational firms than any other country.

26. ASEA, Stora, Procordia, Nobel, Aga, Pharmacia and Astra. The two firms that decided to relocate for their own reasons were Ericsson and Esselte.

27. According to the OECD, Sweden is the country that devotes the highest share (4%) of GDP to R&D.

28. Sweden ranks fourth after Japan, the United States and Finland in the number of patents per capita in telephone engineering, and fifth in other information technology patents after Japan, the United States, the Netherlands and Germany.

29. The most important of these clusters is the Kista Science Park, north of Stockholm, with more than 650 firms (including some international giants) employing 27 000 workers. The Kista region is a world leader in ICT (ISA, 1999).

30. The only available information on the subject comes from a 1999 survey on the economic impact of the relocation of Swedish company headquarters (ISA, 1999). Given the scant research interest in this economic phenomenon, the Swedish Investment Promotion Agency (ISA) commissioned the study, which involved mailing a questionnaire to 35 company headquarters and 255 affiliates (of which 32% had set up outside Sweden). The average response rate was 60%. Telephone interviews were also conducted with firms that had relocated all or part of their headquarters abroad.

31. The question was posed in the following terms: "Indicate the number of employees who were relocated within your company over the last three years". The question thus related to permanent moves. The international nature of these firms apparently meant that there were many temporary

assignments abroad (some for extended periods of time), but these did not represent permanent relocation and hence did not appear in the survey. This interpretation may be confirmed by a survey conducted by the Swedish Statistics Institute (cited in Utbildningsdepartementet, 2000a) where it is clear that, of the nearly 4 000 engineers and business and management personnel who returned to Sweden between 1987 and 1998, many had worked while they were abroad for the same firm, group or organisation by which they had previously been engaged in Sweden.

32. The survey (ISA, 1999) found that mobility within Sweden was greater than internationally but was still very low.

33. Note however that firms with head offices abroad are less likely to perform their R&D work in Sweden than those with Sweden-based headquarters (NUTEK, 2000b).

34. The latest surveys on this subject (NUTEK, 2000b) point to a decelerating trend in the departure of Swedish firms, especially in the ICT sector.

35. Thus, the heading "naturvetare" (translated as "other S&T professions" in earlier sections) covers graduates in biology, physics, mathematics, computer sciences, etc., who have had three years or more of university and are not engineers or researchers. This is the largest HRST group in Sweden.

36 A law banning ethnic discrimination was passed in 1999. If employers consider nationality a recruitment criterion, they face legal sanctions. Only firms working for national defence may use this criterion.

37. This is likely to be an underestimate, since the education level of foreign workers in this sector is not always known.

38. This route has not even been explored, given the strongly "round trip" nature of Swedish HRST mobility.

39. Introducing the recent study on international mobility of highly skilled workers (Utbildningsdepartementet, 2000a), the minister of national education regretted that graduates were not opting to spend more time abroad. In the interests of social development and coping with the challenges of globalisation, he said, international experience is essential today.

40. The bulk of government research spending goes to the universities and not to the research institutes.

41. SEK 10 billion have been earmarked over a 15-year period for internationally competitive research projects (60% for engineering, scientific and medical research, 25% for environmental research and 15% for the humanities and social sciences).

42. Dagens Nyheter, 30/1, Nytt n° 5.

43. Since this chapter concerns highly skilled workers, the issue of IT teaching at secondary school level is not discussed, although it is obviously important to the development of an "information society".

44. For example, KTH (Royal Institute of Technology) in Stockholm is opening a specialised IT annex in the Kista Science Park that will take 10 000 students within ten years, a new ICT-focused university is opening in Gothenburg in 2001, the Linnaeus Center for Bioinformatics has opened at Uppsala (a new discipline combining biology, mathematics, medicine and computer science). The objective is to integrate ICT into all disciplines taught. At Uppsala, Scandinavia's oldest university, a virtual ICT faculty has been established, bringing all faculties together to promote the interdisciplinary use of these new technologies.

45. With the other Scandinavian countries, Sweden is in the lead in terms of the number of people in continuing education (OECD, 2000c).

46. Some fear that Swedish firms will continue to relocate in order to meet their growing needs for highly skilled workers. If higher salaries must be offered to attract them, the argument goes, and if salary

scales remain as they are today, this will mean a major jump in payroll costs, which could lead firms to relocate abroad.

47. Debate over these two points is nothing new, of course, and is unlikely to produce any quick and simple solutions. It involves, in fact, one of the cornerstones of the egalitarianism inherent in the country's social-democratic politics of the last 75 years, whereby all institutions are committed to equality of opportunity and national solidarity.

48. The commission's report (currently out for public discussion) proposes several approaches to sharing the funding burden between foreign students and the government. These are not looked at here, since they may be partially invalidated by political considerations.

49. According to the non-governmental organisation Education International (EI), the United States earns USD 7 billion a year, the United Kingdom about USD 2 billion, Australia nearly USD 750 million and Canada USD 730 million.

50. According to SSSB (the university housing agency in Stockholm), the waiting list for student housing currently stands at 14 000.

51. The current study asks the question, "How can we attract highly skilled people to Sweden?" (see ISA, 2001).

52. Obtaining this permit requires a job promise, an assured before-tax income of SEK 13 000 and guaranteed housing. The acute housing crisis in the larger cities, where accommodation is both scarce and expensive, is a definite obstacle to attracting foreigners to the country.

53. Moving expenses, two home-country visits per year for workers and their family and education allowances for children.

54. Pensionsforum, Industriförbundet, SACO, 2000. Data on this subject do not distinguish between first-, second- and third-generation immigrants, and it is therefore impossible to confirm Swedish claims to be the most multicultural country today. In France, for example, one person in three is of foreign origin, if one goes back to the grandparents' generation.

55. *Sverige, framtiden och mångfalden-från invqndrarpolitik till integrationspolitik*, (prop. 1997/1998, p. 16).

56. Sweden has a tradition of adopting very deliberate and ambitious social policies which succeed in changing the prevailing mentality over time. The best example is the policy that has been applied on all fronts for the last 30 years to promote equal opportunities for men and women and has had an observable impact on public attitudes and behaviour in this area.

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Chapter 15

HIGH-SKILL MIGRATION AND CHINESE TAIPEI'S INDUSTRIAL DEVELOPMENT

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Introduction

Owing to rapid technological change and global economic competition, the labour market for skilled professional personnel is becoming increasing globalised in terms of both supply and the demand. The mobility of highly qualified human resources, particularly in the fields of science and technology, has increased strongly because many countries seek to increase their ability to embrace new technology. Reports of shortages of certain types of S&T personnel, in particular IT workers, suggest an imbalance in the labour market of many industrialised countries. International sources of human resources in science and technology (HRST) are therefore becoming more important for meeting specific skill requirements.

Recruitment from abroad does not only concern local shortages of certain types of expertise. International movements of HRST are also a feature of the internationalisation of higher education systems. Many industrialised countries have made S&T education and training policies more responsive to demand from abroad. Their universities have large proportions of foreign students and offer various international faculty exchange schemes. This has stimulated the interest of foreign scientists in working abroad and has also helped to give domestic graduates a more international perspective. For instance, the United States has opened higher education and research systems and used temporary immigration of qualified S&T professionals to improve flexibility in adjusting to demand. Since the 1960s, the United States has started to attract large numbers of highly skilled immigrants and students and accounts for 32% of all foreign students in OECD countries (OECD, 2000). About 5% of foreign-born science and engineering degree holders in the United States are from Chinese Taipei (NSB, 2000).

International movements of HRST have grown both in numbers and in complexity in the last two decades. Highly skilled workers now move either temporarily or permanently to take advantage of higher wages, more exciting opportunities and changes in life style. However, increased demand for highly skilled personnel in the labour market worldwide and a broad range of international education opportunities will inevitably exert pressure on the knowledge stock of many countries. Today, governments in both developed and less developed countries are concerned about the loss of their highly qualified workers. The "brain drain" has for many years been an important issue on the policy agenda.

A growing number of studies focus on the mobility of highly skilled workers in general and the likely effects of this type of flow. Many have studied individual professions within highly skilled categories such as medical practitioners, bankers, scientists and academics (Miller *et al*., 1998; Beaverstock, 1994; North, 1995; Gaillard and Gaillard, 1998; Johnson and Regets, 1998; Mahroum, 1999). Others have dealt with the international movements of highly skilled personnel in general and looked into inflows and outflows for countries (Salt and Clarke, 1998; Carrington and Detragiache, 1998). The impact of scientists' emigration on sending countries and receiving countries has also been studied (Mountford, 1994; North, 1995; Gover and Huray, 1998).

However, there are many problems associated with obtaining data on the mobility of HRST. Earlier research was often hampered by a lack of internationally comparable statistics. For this reason, the OECD and the European Commission encourage the monitoring of HRST on the labour market. The OECD and Eurostat have adopted a methodological manual (the "Canberra Manual") for measuring human resources for science and technology. Measurement of the stock of S&T personnel uses qualification-based data on education level and field of study. HRST can also be categorised by sector of employment and occupational categories. The "Canberra Manual" definitions have been re-investigated several times in response to problems in fitting situations to those definitions. The most difficult issues involve who to count in specific occupational or industrial categories and the limitations on the existing data (Mahroum, 1999; OECD 2000).

The "Canberra Manual's" concepts and definitions have been further developed by Eurostat into a system of indicators for measuring stocks and flows of HRST. The OECD launched a programme in 1998, under the general theme of developing new indicators for a knowledge-based economy. Three Nordic countries (Finland, Sweden and Norway) co-operated in a pilot study in the same year and developed mobility indicators based on a register-based statistical system. Later, in research projects conducted by Statistics Sweden and Statistics Finland in 1999, issues related to the development of internationally comparable mobility indicators were discussed. Much effort could be seen in constructing indicators from international resources and national resources (OECD, 1999).

High-skill migration: impacts on Chinese Taipei's economic growth

Return migration (whether temporary or permanent) of highly skilled science and technology workers is judged an important factor in Chinese Taipei's economic miracle. The growth of Chinese Taipei's high-technology industries in the late 1980s was closely associated with the boom in the global electronic industry, the specialisation of the electronics manufacturing process and the internationalisation of the division of labour in the electronic industry, as designing companies (mainly US companies) looked for better and cheaper manufacturers globally. However, it is also argued that social agents (professionals, entrepreneurs, politicians, venture capitalists) also played an important role in this transformation. Returned migrants, in particular, were the source of transfer of information and know-how as well as the development of business networks, which are seen as crucial for creating high-technology companies. This study investigates the links between movements of highly skilled workers and the development of high-technology industries in Chinese Taipei based on a very limited statistical survey. Existing statistical resources are reviewed and several issues are raised for the coming National Mobility Survey.

The "brain drain" period

Like many Asian countries, Chinese Taipei began to experience an outflow of highly skilled personnel in the 1960s, especially after the relaxation of Asian immigration restrictions by Canada, the

United States, Australia and New Zealand. The 1965 Hart-Celler Act, in particular, had a clear impact on the inflow of Chinese Taipei talent to the United States. The Act allows immigration on the basis of possession of scarce skills and on family ties to citizens or permanent residents. As a result, the number of scientists and engineers emigrating from Chinese Taipei increased drastically. During the 1970s and the 1980s, it became very common for Chinese Taipei graduates to go the United States for higher degrees and possibly professional opportunities. Chen's (1995) research shows that 20% of Chinese Taipei undergraduates in the field of science and technology went abroad for higher education during that period. In 1977, only 16.2% of students studying abroad returned after the successful completion of their study. The return rate even dropped to 8.2% in 1979 (Su, 1995) (Table 1). For the major receiving country, the United States, the inflow of foreign talent matched the demand for technical skills in new high-technology industries in Silicon Valley. Foreign-born scientists and engineers accounted for one-third of the total employees in Silicon Valley's high-technology industries. Among this population, almost two-thirds were of Asian origin, of which 51% were from Chinese Taipei (Saxenian, 1999).

Table 1. Number of students studying abroad and returning, by year

Year	Number of students studying abroad	Number of students returning	Return rate
1977	3 852	624	16.2%
1978	4 756	580	12.2%
1979	5 801	478	8.2%
1980	5 933	640	10.8%
1981	5 363	937	17.5%
1982	5 925	1 106	18.7%
1983	5 690	1 257	22.1%
1984	5 410	1 329	24.6%
1985	5 979	1 350	22.6%
1986	7 016	1 583	22.7%
1987	6 599	1 920	29.1%
1988	7 122	2 296	32.2%
1989	-	2 464	-
1990	-	2 863	-
1991	-	3 264	-
1992	-	5 157	-
1993	-	6 172	-
1994	-	6 510	-

Source: Su, 1995.

The loss of talent and the negative effect on economic development attracted nation-wide attention in Chinese Taipei. Given that many expatriates were working in science and technology and the emergent industries of the Silicon Valley, the government decided to emulate the "Silicon Valley" experience. This led to the establishment of the Hsinchu Science-based Industrial Park (HSIP) and other initiatives for the creation of high-technology industries. HSIP was established in 1980 as an incubator for new technology-based firms. It started out with 17 companies on land totalling 605 hectares. With the government's careful planning and incentives, the park provided returnees from abroad with good commercial opportunities and services, as well as access to a high-quality living environment resembling that overseas. Along with Chinese Taipei's top research institute (ITRI) and

two leading universities, Tsing-Hua and Chiao-Tung universities, HSIP offers returnees sufficient resources and a wide range of choices for career investment.

In addition to developing infrastructure, the government reacted to the "brain drain" by making an effort to build a transnational community to help to recruit highly skilled workers in the United States to return home. Scientists and engineers based in the United States and Chinese Taipei were deliberately brought together in government-sponsored meetings and conferences. These events helped to build personal and professional relationships between engineers, entrepreneurs, executives and bureaucrats on both sides of the Pacific. US-based scientists and engineers enthusiastically gave advice on the formulation of industrial policies. They were also willing to bring new technologies and industries to Chinese Taipei and offer opportunities in the then emerging sectors of microelectronics and computer hardware development. By the end of the 1980s, HSIP was home to 121 high-technology companies, many of which were set up by returnees. A reversal of the "brain drain" occurred as the result of active government intervention.

The reverse brain drain

The late 1980s witnessed a return of former emigrants (Chang, 1992; San and Su, 1999). It is estimated that 33% of students studying abroad returned after the successful completion of their study, a return rate three times higher than that in 1980 (Su, 1995) (Figure 1). A survey based on the Chinese Taipei 1990 population census (Table 2) suggests that around 50 000 emigrants returned during the period 1985-90. About 43% of returnees have at least a college education and more than 30% are employed as professionals and managers. Hsinchu Science-based Industrial Park, already the largest concentration of Chinese Taipei's high-technology industries, absorbed the best-educated returnees, in particular those with graduate education (Tsai and Lim, 2001) (Tables 3 and 4). This is particularly true for the holders of the PhD employed in the six largest industries in HSIP, who were mostly educated abroad (Figure 2).

The 1990s witnessed a growing number of US-educated students returned to Chinese Taipei. As an example, it is estimated that more than 30% of the engineers who studied in the United States returned to Chinese Taipei, three times the 1970s return rate (Su, 1995). HSIP became the destination for hundreds of returnees who started new companies or took positions in existing companies. The number of returnees working in HSIP was 27 in 1983, 223 in 1989, but 3 265 in 1999 and 4 108 in 2000. The park housed 289 companies in 2000, of which 113 (39%) were started by mainly US-educated engineers, often with professional experience in Silicon Valley. These returnees also actively recruited friends from Silicon Valley to return to Chinese Taipei (Figure 3 and Table 5).

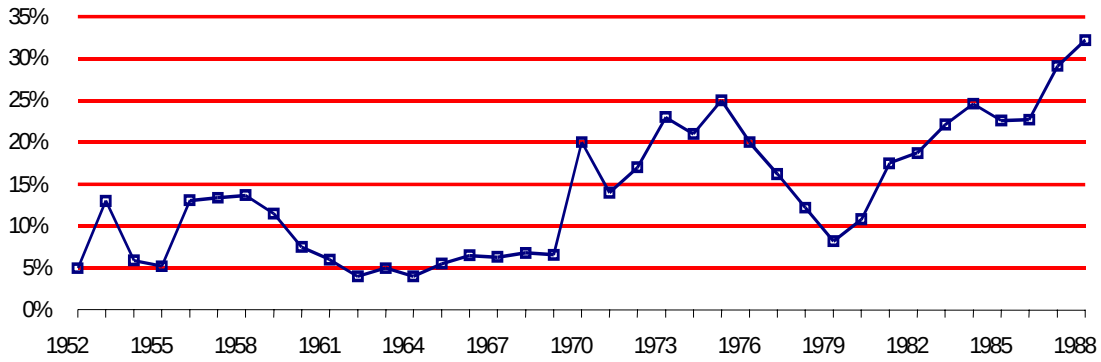
Another group of returnees, generally characterised as "temporary returnees" or "transnational workers", work on both sides of the Pacific. This group mainly consists of managers, engineers, angel investors and venture capitalists, who often travel between Silicon Valley and Hsinchu. Their families are mostly based in the United States. They play a role as middlemen, linking businesses in the two regions through their personal networks and their technological and market know-how. A total of 70 HSIP companies now have offices in Silicon Valley, with executives and managers who work both locally and in the main office. These companies often make decisions and obtain new sources of knowledge, technology, capital and business opportunities through their CEO's personal network and their connection to industrial networks in Silicon Valley. This connection also allows many distant producers to collaborate to upgrade their technological capabilities.

Table 2. Returnees (from other than China) in the labour force aged 20+ by type of internal migration

Personal characteristics	Returned immigrants		Type of internal migration		
	Volume (persons)	Composition (%)	Return (%)	Onward (%)	Return/ Onward
Total	7 246	100.0	43.0	57.0	0.7550
1. Sex					
Male	4 785	66.0	43.5	56.5	0.7696
Female	2 461	34.0	42.1	57.9	0.7271
2. Age					
20-24	302	4.2	53.6	46.4	1.1570
25-29	855	11.8	50.3	49.7	1.0117
30-34	2 144	29.6	39.5	60.5	0.6532
35-39	2 013	27.8	37.5	62.5	0.5990
40-44	910	12.6	44.5	55.5	0.8021
45-49	442	6.1	50.2	49.8	1.0092
50-54	319	4.4	50.2	49.8	1.0064
55-59	130	1.8	50.0	50.0	1.0000
60-64	66	0.9	53.0	47.0	1.1290
65+	65	0.9	56.9	43.1	1.3213
3. Marital status					
Single	1 812	25.0	50.7	49.3	1.0292
Married	5 601	69.9	39.8	60.2	0.6620
Div/Sep	316	4.4	48.1	51.9	0.9268
Widowed	57	0.8	52.6	47.4	1.1110
4. Education					
Primary	597	8.2	62.8	37.2	1.6889
Junior High	470	6.5	59.4	40.6	1.4606
Senior High	1 172	16.2	50.2	49.8	1.0068
College	796	11.0	40.7	59.3	0.6863
University	2 083	28.8	43.8	56.2	0.7803
Graduate	2 128	19.4	30.0	70.0	0.4282
5. Employment status					
Employed	6 909	95.4	42.5	57.5	0.7385
Unemployed	337	4.7	54.0	46.0	1.1744
6. Industry					
Primary	316	4.5	84.8	15.2	5.5833
Secondary	1 807	25.7	47.3	52.7	0.8983
Tertiary	4 912	69.8	38.2	61.8	0.6173
7. Occupation					
Professional	2 529	36.0	33.9	66.1	0.5126
Managerial	332	4.7	45.2	54.8	0.8242
Clerk/sales	3 221	45.8	42.5	57.5	0.7382
Agricultural	305	4.3	86.2	13.8	6.2622
Blue collar	648	9.2	55.6	44.4	1.2502

Source: Original Records of the 1990 Chinese Taipei Population Census.

Figure 1. Return rate



Source: Su, 1995.

Table 3. R&D researchers in HSIP by industry and qualification, 1999

Industry	Qualification									
	Total		PhD		Master's		Bachelor's		Junior college or below	
	No.	%	No.	%	No.	%	No.	%	No.	%
Total	10 770	100.0	3 579	5.4	4 849	45.0	3 549	33.0	1 793	16.6
Integrated circuits	5 646	100.0	354	6.3	3 034	53.7	1 622	28.7	636	11.3
Computers and peripherals	2 505	100.0	69	2.8	805	32.1	1 064	42.5	567	22.6
Telecommunications	1 091	100.0	36	3.3	367	33.6	409	37.5	279	25.6
Opto-electronics	1 310	100.0	89	6.8	569	43.4	388	29.6	264	20.2
Precision machinery	90	100.0	6	6.7	24	26.7	30	33.3	30	33.3
Biotechnology	128	100.0	25	19.5	50	39.1	36	28.1	17	13.3

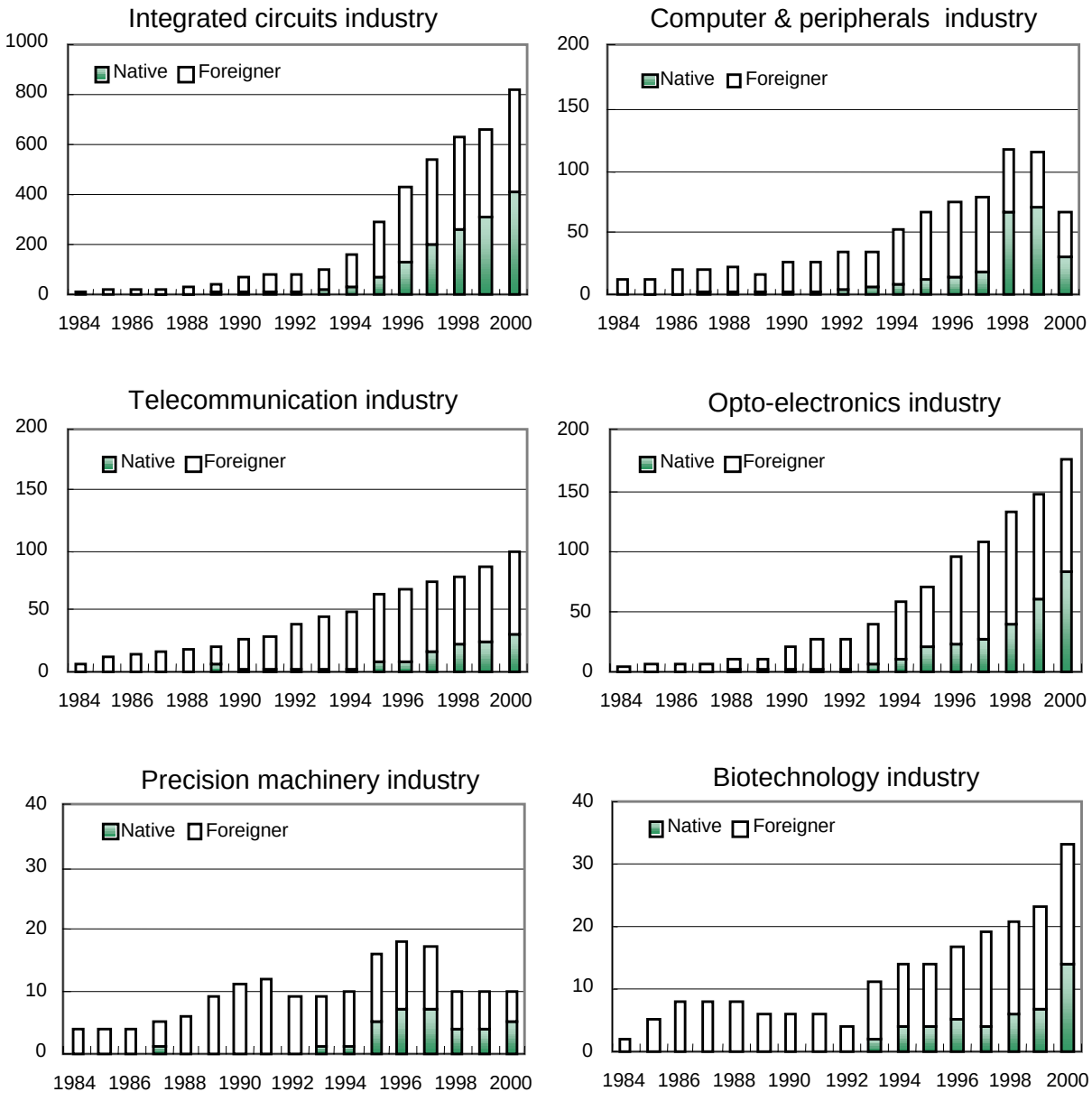
Source: Indicators of Science and Technology, National Science Council, 2000.

Table 4. R&D manpower in HSIP by industry, 1999

Industry	Total R&D manpower	Researchers	Technicians	Supporting personnel	No. of employees	Researchers as % of employees
Total	14 685	10 770	2 525	1 390	82 822	13.0
Integrated circuits	7 816	5 646	1 314	856	48 284	11.7
Computers and peripherals	3 418	2 505	626	287	16 529	15.2
Telecommunications	1 334	1 091	187	56	5 299	20.6
Opto-electronics	1 799	1 310	346	143	11 110	11.8
Precision machinery	123	90	20	13	1 165	7.7
Biotechnology	195	128	32	35	435	29.4

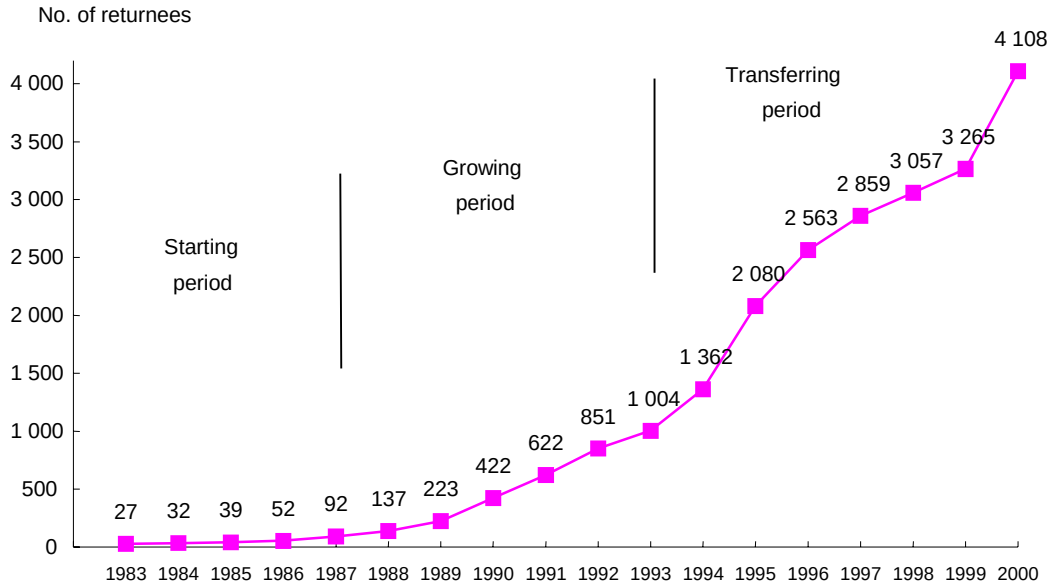
Source: Indicators of Science and Technology, National Science Council, 2000.

Figure 2. Foreign and native PhD hiring in six industries



Source: Science-Based Industrial Park Administration.

Figure 3. Number of returnees in HSIP



Source: Science-Based Industrial Park Administration.

Table 5. Companies in HSIP, 2000
NTD millions

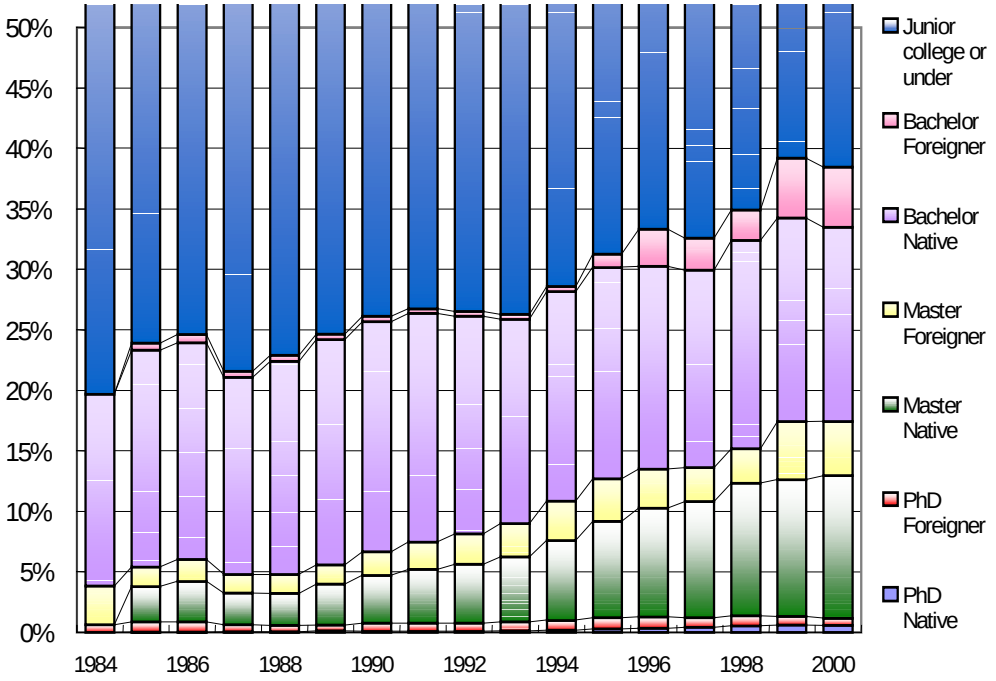
Category	Companies already in the park					Approved but not yet entered		
	Number of companies	Approval capital	Percentage (%)	Actual capital	Percentage (%)	Number of companies	Approval capital	Percentage (%)
Domestic company	239	909 781.60	95.75	669 094.26	96.34	23	43 017.00	95.44
Returnee	97	260 802.22	27.45	192 458.80	27.71	6	3 300.00	7.32
General	142	648 979.38	68.3	476 635.46	68.63	17	39 717.00	88.12
Foreign company	50	40 277.24	4.25	25 390.01	3.66	3	2 050.00	4.56
Returnee	16	9 812.30	1.03	5 821.84	0.83	2	1 800.00	3.99
General	34	30 464.94	3.22	19 568.17	2.83	1	250.00	0.57
Total	289	950 058.84	100	694 484.27	100	26	45 067.00	100

Note: There were a total of 121 new companies set up, including returnees, which were approved to enter the park; 113 companies had entered by the end of 2000.
Source: Science-Based Industrial Park Administration.

The growing number of returnees has changed the structure of human capital in HSIP (Figure 4). Earlier, employees with a PhD degree were mainly foreigners. For instance, in 1984 (the fourth year of HSIP), all employees with a PhD degree were foreigners. As the number of employees (as well as the percentage of total employees) with a PhD degree grew over time (from 0.6% in 1984 to 1% in 1994), the number of PhDs who were Chinese Taipei nationals grew as well. By the end of 2000, they numbered 478, compared to 550 foreigners (Figure 5). This indicates that nationals with PhDs more and more meet HSIP companies' needs in terms of technological know-how and R&D capability. As more and more people with master's degrees awarded abroad have returned to Chinese Taipei in

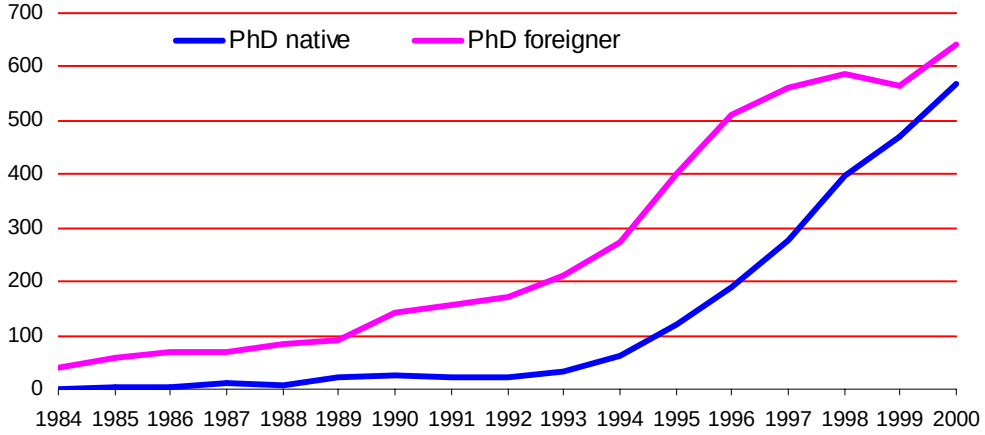
recent years, the number of Chinese Taipei nationals with a master's degree has grown dramatically. By the end of 2000, there were three times as many as foreign employees with a master's degree (Figure 6). Undoubtedly, HSIP's competence today owes to its large reserve of highly qualified personnel. In 2000, among the 102 775 people employed in the park, 38.5% hold bachelor's degree or higher. Among them, 1 208 hold a PhD degree, or the equivalent of 1.2% of total employees of HSIP companies; 16 724 hold a master's degree, or the equivalent of 16.3% of total employees. Finally, 61.5% of total employees hold only a junior college degree or less (Figure 7).

Figure 4. Trends in the distribution of human resources, by education



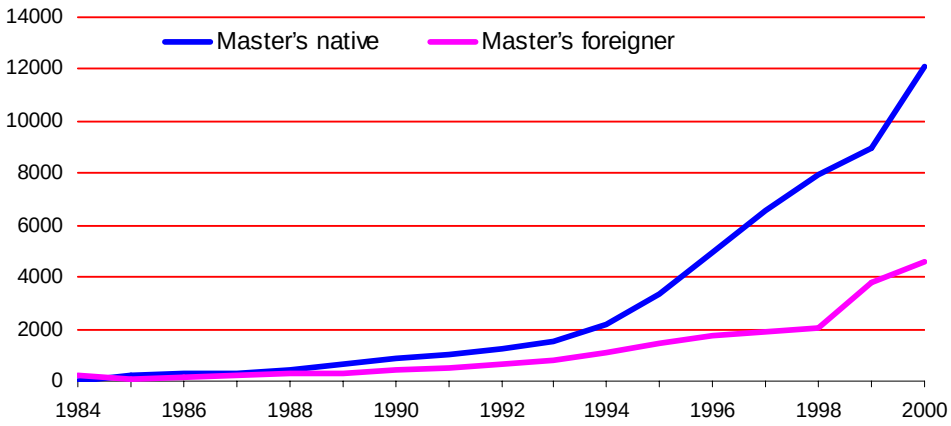
Source: Science-Based Industrial Park Administration.

Figure 5. Trends in PhD hiring



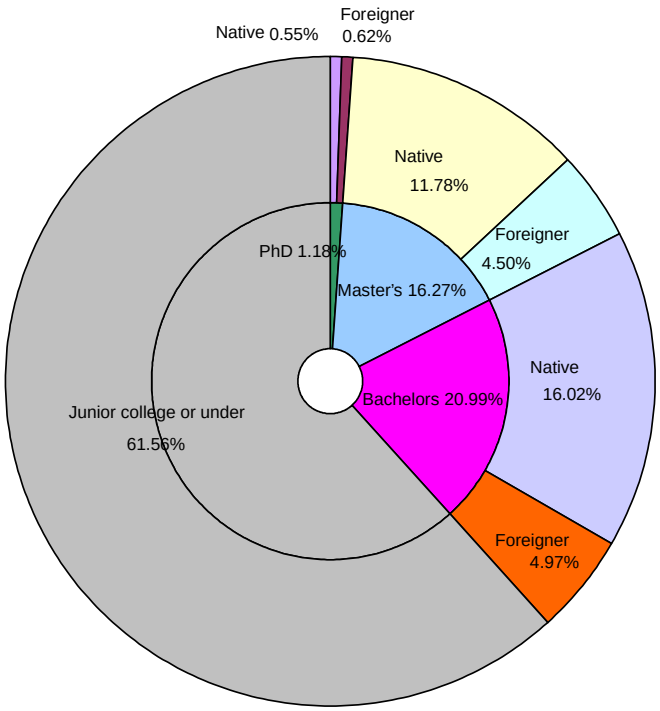
Source: Science-Based Industrial Park Administration.

Figure 6. Trends in master's degree hiring



Source: Science-Based Industrial Park Administration.

Figure 7. HSIP human resources by education, 2000



Source: Science-Based Industrial Park Administration.

HSIP has functioned well since its inception and had made a tremendous contribution to Chinese Taipei's industrial economy. Chinese Taipei now sees itself as one of the leading economies in Asia with real GDP growth averaging about 8% a year for the last three decades. Over the period 1996-2000, the trade surplus ranged from USD 5 billion to USD 13.6 billion. Over 98% of exports are

industrial products. Today HSIP is home to 289 of Chinese Taipei's top high-technology companies, with total employment of 102 775 (Table 6) and a combined investment of USD 34 billion in 2000. According to the latest statistics on detailed R&D manpower in HSIP, 14 685 employees participate in R&D activities in 1999, and a total of 10 770 were categorised as R&D researchers. Most R&D researchers (5 646) work in the semiconductor industry (Table 4). To date, the park has received a total of USD 1.1 billion in investment. Annual sales in 2000 amount to NTD 930 billion (about USD 28 billion) (Figure 8). HSIP is becoming a major site for Chinese Taipei's most productive companies in electronics and information technology. More than 90% of the companies are in the information and communication sector and have average growth of 29-63% a year. In terms of R&D expenditure, NTD 22.5 billion are for integrated circuits, NTD 7.2 billion for computers and peripherals, NTD 3.17 billion for opto-electronics, NTD 2.16 billion for telecommunications, and the 18 biotechnology companies spend a total of NTD 230 million (Table 7).

Table 6. Number of firms and employees in HSIP by industry, 2000

Industry	No. of firms	No. of employees
Total	289	102 775
Integrated circuits	116	61 223
Computers and peripherals	49	16 064
Telecommunications	50	7 334
Opto-electronics	44	16 167
Precision machinery	12	1 351
Biotechnology	18	636

Source: Science-Based Industrial Park Administration.

Table 7. R&D expenditures by industry and type of work, 1999
NTD millions

	Type of work							
	Total		Basic research		Applied research		Technological development	
Industry	No.	%	No.	%	No.	%	No.	%
Total	35 454	100.0	159	0.4	8 420	23.8	26 874	75.8
Integrated circuits	22 537	100.0	13	0.1	4 515	20.0	18 009	79.9
Computers and peripherals	7 257	100.0	126	1.7	2 592	35.7	4 539	62.5
Telecommunications	2 163	100.0	10	0.5	440	20.3	1 713	79.2
Opto-electronics	3 170	100.0	5	0.2	741	23.4	2 424	76.5
Precision machinery	96	100.0	0	0.0	46	47.7	50	52.3
Biotechnology	230	100.0	4	1.8	86	37.4	140	60.7

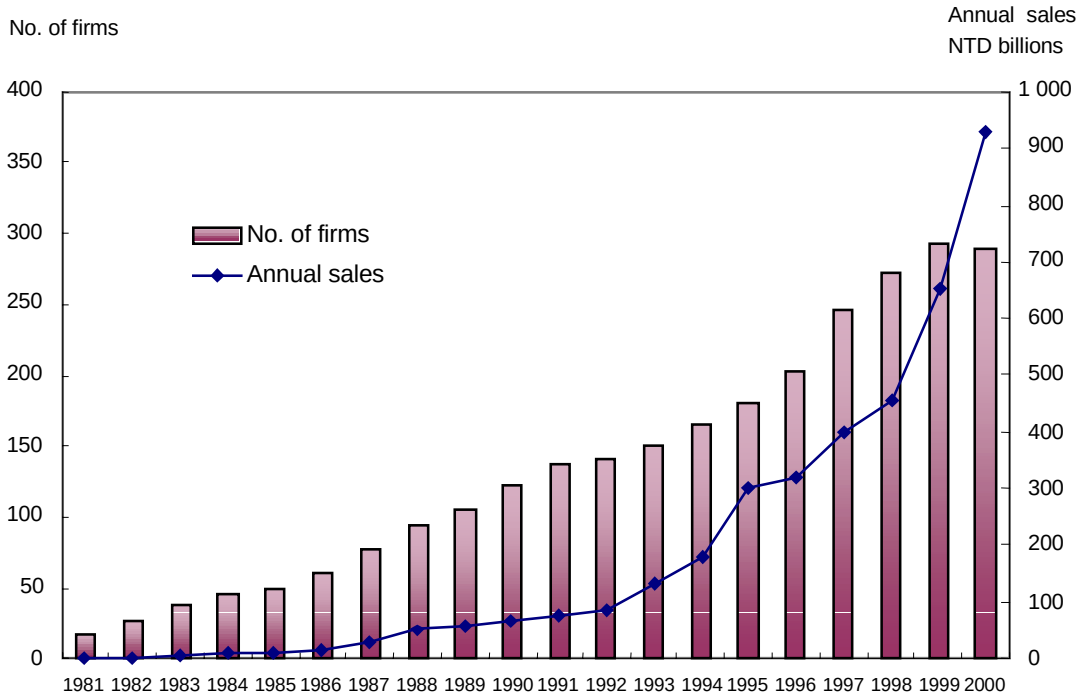
Note: Data of both Hsinchu and Tainan Science-Based Industrial Park are included.
Source: Indicators of Science and Technology, National Science Council, 2000.

Planning for a national survey on HRST

From the above information, it is clear that the loss of highly skilled workers to the United States has given way in the 1990s to more two-way flows of skills, technology and capital. The reversal of the "brain drain" in Chinese Taipei constitutes a unique experience and demands a well-defined investigation. The pilot study on Hsinchu Science-based Industrial Park reveals the importance of

overseas returnees, especially those who are highly qualified workers in science and technology fields, in the development of high-technology industries in the HSIP. But an overall picture of HRST in the park is still lacking owing to the limitations of existing statistics. The pilot study also raises a number of problems related to the statistical data. The data available on HRST stocks and flows are extremely limited and inconsistent. Statistical tools for counting HRST at national level are yet to be defined. The most available data at the national level are mainly from the population census by DGBAS (Directorate-General of Budget, Accounting and Statistics). This data set records five-year residential information and covers the total population. It provides sufficient information on nationality, individual demographics, human capital and socio-economic characteristics. But it fails to indicate the previous country of residence of returning emigrants. Other frequently used sources are data from Ministry of Education and the National Youth Commission. Both official data sets focus primarily on returned students and professionals, and are appropriate for studying the motivation to return. But the records cease in 1990 and do not capture the return of former business emigrants.

Figure 8. Growth of firms and annual sales



Source: Science-Based Industrial Park Administration.

International movements of highly skilled workers in the science and technology field today are far more complicated than before. The issue is of specific interest to policy makers in Chinese Taipei, but very limited statistical information is available at present to help the policy maker make policy decisions. To gain a better understanding of the stock and the mobility of highly skilled S&T personnel, the National Science Council plans to explore other official statistics and to conduct a survey specifically designed for this purpose. To make the statistical result comparable, the survey will be conducted on the basis of the 1993 OECD Frascati Manual (*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". The survey planned is described below:

The definition of HRST

As defined in the Anberra Manual", HRST are those who successfully completed education at the tertiary level in an S&T field of study and those who are not qualified in this way but are employed in an S&T occupation where the above qualification are normally required.

Major data sources

National sources of data are:

- Registers of educational attainment.
- 2000 Population Censuses (release in June 2001).
- Specific surveys: National Youth Commission, household surveys, annual labour force survey, migration statistics, annual education statistics (Ministry of Education), national earnings surveys, R&D surveys (National Science Council), Survey of Research Personnel (National Science Council), Database for Government-funded Research (National Science Council).
- Other sources: *Ad hoc* survey.

Methodology of this study

A questionnaire will be used to survey the targeted group in order to obtain specific data for this study. Also, face-to-face interviews with a randomly selected sample of the target group will be conducted to identify and flesh out the main factors influencing decisions about moving or changing.

First part of the survey: HRST stock

The stock will be categorised by personal characteristics (gender, age, national origin, ethnicity), education, occupation and sector of employment.

- Education: those with a university degree or the equivalent; those with advanced qualification, such as a master's or doctoral degree.
- Fields of study: natural sciences, engineering and technology, medical sciences, agricultural sciences, social sciences, humanities, other field.
- Occupation (ISCO-88 groups of occupations):
  - A. Managers: production and operation department managers, other department managers general managers.
  - B. Professionals: physical, mathematical and engineering science professionals, life science and health professionals, teaching professionals, other professionals, physical, mathematical and engineering science associate professionals, life science and health associate professionals, teaching associate professionals, other associate professionals

Second part two of the survey: HRST mobility

This part of the survey aims to identify the status and trends of international and intra-sectoral mobility of HRST in Chinese Taipei since 1990. Science and technology fields will be classified in accordance with the "Canberra Manual". The study will focus on three dimensions: *i)* international mobility of the target group after graduation from foreign countries to Chinese Taipei; *ii)* intra-sectoral mobility of the target groups among government, academia, research institutes and industries after returning to Chinese Taipei; *iii)* identification of indicators influencing international and intra-sectoral mobility based on the target group's perception or experience.

The following is the list of proposed indicators:

- Mobility indicators: Indicators on mobility between firms and other organisations for specific industries to determine the share of employees changing employer or employment status from year t-1 to t.
- Indicators on mobility between research-producing sectors and research-using sectors.
- Indicators on international mobility, defined as persons employed in year t who go abroad either temporarily or permanently for employment in another country and persons employed in year t who come from abroad.

The data will be broken down by qualification (field and study) and occupation and country of origin/destination.

Expected results

It is expected that the study will make available the following information:

- Total stock of highly qualified employees.
- Stock of highly qualified employees broken down by qualification and occupation.
- Total mobility rate: share of highly qualified personnel, defined on the basis of qualification or occupation and occupied as professionals who change jobs, with respect to total stocks of employees.
- Mobility rate by sector, gender, age group, educational level and establishment size.
- Foreign-born highly qualified employees.
- Share of foreign citizens in the stock of highly qualified employees.

Conclusion

Although in Chinese Taipei, none of the statistical sources was set up in the 1980s to provide information about the stock and mobility of HRST, government officials' understanding of the issue was quite extensive and their observation led to important improvements in policy design. The reversal of flows of HRST in the 1990s was clearly affected by a variety of policy factors. today, however, the pattern of HRST mobility is becoming more complex and diverse. Highly skilled workers are attracted or discouraged by different circumstances and provisions, such as taxation, study

abroad, quality of work, openness of communication, business expansion overseas, labour market supply and demand signals. All these factors interact to determine the pattern of flows. Addressing the statistical issues is just the very beginning. Science and technology policies have to work together with broader labour market and education policies in order to address policy challenges such as skill shortages or barriers to mobility.

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Chapter 16

POLICIES FOR ADMITTING HIGHLY SKILLED WORKERS INTO THE UNITED STATES

by

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Introduction

This chapter reviews recent developments in the admission of foreigners with professional, technical and kindred skills (PTK) as immigrants and non-immigrants. In FY98, the most recent data available, the United States admitted 77 500 immigrants (workers and their families) for economic-employment reasons, well under the 140 000 annual quota. In FY2000, all of the 115 000 H-1B visas for foreign speciality workers were issued. The quota was raised to 195 000 for FY2001, but it appears that this limit will not be reached because of the high-tech slowdown (Table 1).[1]

Table 1. Employment-based immigration and H-1Bs, 1992-98

	1992	1993	1994	1995	1996	1997	1998
Employment-based immigration ceiling	140 000	140 000	140 000	140 000	140 000	140 000	140 000
Employment-based immigration	116 198	147 012	123 291	85 336	117 499	90 607	77 517
H-1B visa ceiling	65 000	65 000	65 000	65 000	65 000	65 000	65 000
H-1B admissions (double count)	110 223	92 795	105 899	117 574	114 458	200 000	240 947

Note: 1997 admissions are estimated; the Immigration and Naturalization Service (INS) has no data. In 1999-2000, the H-1B ceiling is 115 000; in 2001, the ceiling is 195 000.
Source: INS and author's estimates.

The US admissions system is unbalanced: the certification process for admitting immigrants to fill vacant jobs is slow and costly, while the attestation process for admitting highly skilled temporary workers is fast and relatively cheap. The result is that number of highly skilled immigrants admitted has been declining, while the number of temporary visas granted for highly skilled workers has been increasing. Many of the highly skilled workers want to become immigrants, leading to long queues for immigration visas and frustration as highly skilled migrants wait, generally staying employed by the sponsoring employer, until an immigration visa becomes available. Once they receive the immigration visa, they often quit, giving lie to the certification that the foreigner was needed to fill the vacant job.

The major policy recommendation is to change the certification process for immigrants, making it more like the attestation process for skilled workers. Governmental control over employers seeking foreign workers as well as funds to close the demand-supply gap that sets temporary and permanent immigration in motion would arise from a new "significant fee", perhaps USD 10 000 per visa, that employers would pay into a training fund in exchange for quicker government approval of employer requests to grant immigration visas to the foreigners that employers believe are best qualified to fill vacant jobs.

The chapter looks at recent trends in two major US migration programmes. The immigration programme admits permanent residents with green cards (and their families) who can generally live and work anywhere in the United States, *i.e.* they do not have to work for the employer who sponsored their admission after receiving a green card. The other programme admits non-immigrants with H-1B visas who can later adjust their status to immigrant. The process for obtaining an immigrant visa may require certification, which means the US employer must convince the US Department of Labour (DOL) that US workers are not available to fill the vacant job. The H-1B admission process, by contrast, relies on attestation, which means that the employer opens the border gate, and DOL enforcement occurs only after the foreign worker is in the United States. Both programmes are numerically limited:

- There are five immigrant visa categories that admit up to 140 000 permanent immigrants (including family members) a year because of their personal characteristics or because US employers requested them by name (sponsored them) to fill vacant jobs. The check on admissions in this programme is certification – convincing the US Department of Labour that US workers are not available to fill the vacant job in a process that generally costs USD 10 000-20 000 and lasts two to four years. The immigration quota was not fully used in the 1990s.

- The H-1B programme admits up to 195 000 temporary professional and speciality workers a year to fill jobs for up to six years after an US employer attests that US workers are not available at the prevailing wage. The check on admissions in this programme has been the quota – it was 65 000 a year between 1991 and 1998, 115 000 a year in 1999-2000, and is currently 195 000 a year. If a foreigner with an H-1B visa finds an employer to "sponsor" him or her for an immigration visa, *i.e.* to apply for certification, the H-1B foreigner can become a US immigrant.

Programmes to hire foreign workers

The United States, like most other industrial democracies, has programmes under which employers may request permission to hire foreign professionals temporarily or permanently, for three major reasons:

- To fill labour demand-supply gaps caused by lengthy training periods in cyclical (nursing, engineering) or fast-growing (information technology – IT) industries. Foreigners who are already trained and willing to migrate can fill vacant jobs until the domestic education system catches up with the increased demand by training additional professionals.

- To enable employers to hire the "best and brightest" from the global pool of professional, technical and kindred (PTK) workers, or to enable multinationals to move PTK workers easily among countries to build stronger and more diverse management teams.

- To increase the nation's stock of human capital and thereby spur economic growth by allowing foreigners who graduate from US universities and find jobs to remain, or to admit foreigners with higher-than-average levels of education. The employment of such workers should have positive multiplier and public finance effects, as some of the foreigners develop scientific or business ideas that expand employment, and as a result of higher than average earnings, the taxes they pay generally exceed the costs of the public services highly skilled foreigners consume.

While aiming to achieve these human capital and economic goals, US immigration and labour laws also aim to protect US workers from the "adverse effects" of foreign workers. The policy challenge is to balance the competing goals or goods of:

- Providing easy access to skilled foreigners whose presence can increase economic growth.
- Protecting US workers from the adverse effects of the availability and presence of these foreigners.

The United States admits most immigrants for family, humanitarian and diversity reasons. In FY98, some 660 000 immigrants were admitted, including 78 000 (12%) under economic or employment preferences (both numbers include dependants of immigrants). Within these 78 000 "employment immigrants", 15 000 had more than a Bachelor of Arts (BA) degree and were admitted without a test of the US labour market. These were aliens with extraordinary ability, outstanding professors and researchers and multinational executives, as well as professionals with advanced degrees. There were another 15 000 so-called third-preference immigrants admitted after US employers were certified as needing the foreigner to fill a vacant job. These workers ranged from maids to persons with a BA degree. The maximum number of immigrants admitted for economic/employment reasons is 140 000 per year, including spouses and dependants.

In addition to immigrants, the United States admits non-immigrant foreigners for employment with 19 different visas that range from range from A for ambassadors to TN for NAFTA professionals. Some 293 000 foreign workers were admitted in FY98 under the three major temporary worker visa categories (*INS Statistical Yearbook*, 1998, pp. 140-141):

- H-1B (speciality workers): 240 900 admissions (admissions double count the same individual entering the United States several times in one year).
- H-2A (agricultural workers): 27 300 admissions.
- H-2B (non-farm unskilled workers): 24 900 admissions.

Another 80 000 foreigners were admitted with visas reflecting special skills or needs:

- O1 (extraordinary ability/achievement) 12 200 admissions.
- P1 (athletes/entertainers): 34 500 admissions.
- R1 (religious workers): 10 900 admissions.

These 372 000 temporary foreign workers and trainees were accompanied by admissions of 86 000 spouses and children. There were also 59 000 professional Canadians and Mexicans (BA or more) admitted in FY98 with TN visas under NAFTA; they were accompanied by 17 800 spouses and children.

Some foreigners are admitted for other reasons, such as treaty traders, foreign students, exchange visitors and intra-company transferees, and work in the United States. Admissions in FY98 were 144 600 treaty traders (including family members), 553 900 foreign students, 215 000 exchange visitors, and 203 300 intra-company transferees (these three without family members), for a total 1.1 million.[2]

These data suggest that a total of about 30 000 immigrants were admitted for economic-employment reasons and 430 000 to 1 million temporary foreign workers. The US labour force rose from 126 million in 1990 to 138 million in 1998, or by 1.5 million a year, suggesting that immigration contributes importantly to labour force growth. Admissions of temporary foreign workers doubled between 1995 and 1998, when US employment averaged 131 million, but even 1 million newcomers represent less than 1% of employment. Nonetheless, the sharp rise in admissions of non-immigrants who come to the United States to work, or who come to the United States to study or visit but often work as well, has prompted a debate over the best way to manage the competing goals of facilitating the entry of needed workers while protecting US workers.

Permanent: immigrants

Since 1965, US employers have usually been required to obtain certification from the US Department of Labour that US workers are unavailable for each vacancy that they want to fill with an immigrant and to show that the presence of the immigrant in the vacant job will not adversely affect US workers.[3] The Immigration Act of 1990 (IMMACT) more than doubled the number of visas available for permanent immigrants entering the United States for economic or employment reasons, from 54 000 to 140 000 (including family members).[4]

The rationale for this increase was expressed as follows in 1990: "The United States labour market is now faced with two problems that immigration policy can help to correct. The first is the need of American business for highly skilled, specially trained personnel to fill increasingly sophisticated jobs for which domestic workers cannot be found... The second problem concerns the skills gap in the current and projected United States labour pool...it is unlikely that enough United States workers will be trained quickly enough to meet legitimate employment needs...immigration can and should be incorporated into an overall strategy that promotes the creation of the type of work force needed in an increasingly competitive global economy without adversely impacting on the wages and working conditions of American workers."

Permanent: employment-based immigration

The United States admits immigrants for economic and employment reasons under five preferences, each of which is numerically limited:

- First, priority workers, maximum 40 040 per year (including families), are foreigners with extraordinary ability, outstanding professors and researchers and multinational executives and managers.[5]
- Second, professionals with advanced degrees or persons of exceptional ability, maximum 40 040 per year plus visas not used in higher preferences (including families).

- Third, skilled and other workers, maximum 40 040 per year plus visas not used in higher preferences (including families, but with an annual limit of 10 000 visas for unskilled workers).

- Fourth, special immigrants, maximum 9 940 per year (including families, with a maximum of 5 000 religious workers).

- Fifth, employment-creation investors, maximum 9 940 per year (including families).

The availability of these immigrant visas is updated monthly in the US Department of State's Visa Bulletin (http://travel.state.gov/visa_bulletin.html). In April 2001, there was no wait for visas in three of the five categories, meaning that foreigners with extraordinary ability or multinational executives could obtain immigration visas as soon as their applications could be processed. There were 5-7 month waits for second-preference visas for Chinese and Indians, but third-preference foreigners with a BA or more, and unskilled workers, had to wait 3.5 years for an immigration visa to become available.

It is important to emphasise that first- and second-preference immigrants can be admitted without a test of the US labour market to determine if US workers are available, *i.e.* these immigrants are admitted on the basis of their personal characteristics (an advanced degree or a job as a multinational executive). By contrast, third-preference immigrants, persons with a BA degree as well as skilled and unskilled workers without college degrees, can be admitted only after a US employer "sponsors" the foreigner for an immigrant visa.

Sponsoring a foreigner for an immigrant visa means that a US employer must obtain certification or written confirmation from the US Department of Labour (DOL) that: *i)* US workers are not available to fill the vacant job and *ii)* the presence of the foreigner in the job will not adversely affect US workers.[6] DOL sends written notice of its certification decision (Notice of Findings) to the US employer who applied, and US employers can appeal negative decisions to the Board of Alien Labour Certification Appeals (http://www.oalj.dol.gov/index.htm). In the mid-1990s, DOL was spending about USD 60 million a year on labour certification activities.

There are three important points about immigrants admitted for economic and employment reasons:

- The number of immigrants admitted, including family members, is less than the maximum 140 000 a year and declined in the 1990s: 77 517 in FY98, 90 607 in FY97, 117 500 in FY96, 85 336 in FY95, 123 291 in FY94.

- Most immigrants admitted for economic and employment reasons are already in the United States and adjust their status from illegal or non-immigrant foreigner to immigrant. In FY96, about 90% of the principals (the workers being sponsored) "admitted" under economic and employment preferences were already in the United States and adjusted their status.

- Certification is a time-consuming process. The US employer must advertise the job, keep a log of applicants and the reasons why they were not hired and then obtain DOL certification before moving into the queue for immigration visas. In March 1999, there was a backlog of employer requests for the certification of about 144 000 foreigners (110 000 in state employment offices and 34 000 at regional DOL offices). About 300 staff in state employment services (ES) offices are responsible for monitoring employer recruitment, and there is a delay of one to three years between the filing of a request for certification and a decision by DOL that the immigrant is or is not needed.

The US DOL approved about 11 300 petitions for immigrants in 1997, down from 14 900 in 1992 (Table 2). There appears to be no correlation between changes in annual earnings and the number of employer petitions for immigrants, which suggests that: *i)* any "labour shortages" are highly localised; or *ii)* that hiring foreigners is a network process, and that employer preferences and network recruitment, not labour market conditions, determine petition flows. Network-driven hiring means, for example, that a US hospital develops a relationship with a particular training institution in Canada or the Philippines, finds the graduates to be very useful, and returns to that school to recruit every year, rather than looking outside its local area in the United States. Some US school districts follow this policy in recruiting bilingual teachers from particular educational institutions in Mexico.

It is clear that petitions for immigrants represent a very small fraction of employment in each of the occupations for which immigrants are requested. Requests for 11 300 immigrants in 1997 in occupations that included 40 million workers means that immigrant petitions were a very small fraction of current employment. It is also clear that there is no consistent relationship between petitions and wage changes. In some occupations, annual earnings rose and in others they fell, but it should be emphasised that the annual earnings in occupations in which foreigners play significant roles may include unusual employment arrangements, such as significant self-employment.[7]

Table 2. Annual earnings and approved employer petitions for immigrant visas, 1992-97

Permanent labour certifications	Annual earnings			Approved employer petitions			Employment petitions	
	1992	1997	Change	1992	1997	Change	1997	
Occupational category	USD	USD	%	USD	USD	%	(000)	%
Computer-related occupations	40 894	48 811	19	1 065	5 313	399	1 236	0.43
Art	33 678	36 932	10	110	103	-6	251	0.04
Managers and officials	51 954	53 557	3	1 214	1 112	-8	18 440	0.01
Medicine and health	63 406	66 301	5	745	611	-18	2 886	0.02
Administrative occupations	38 093	42 848	12	950	753	-21	4 604	0.02
Entertainment and recreation	58 026	32 301	-44	97	71	-27	136	0.05
Writing	34 567	33 635	-3	91	65	-29	61	0.11
Social sciences	36 362	39 034	7	261	166	-36	441	0.04
Professional, technical, and managerial	30 061	29 901	-1	124	56	-55	4 604	0.00
Religion and theology	24 299	26 494	9	29	13	-55	350	0.00
Museum, library, and archival sciences	36 833	31 730	-14	97	38	-61	188	0.02
Architecture, engineering and surveying	40 395	45 008	11	4 703	1 830	-61	169	1.08
Law and jurisprudence	59 681	62 701	5	93	31	-67	885	0.00
Education	34 934	40 681	16	2 772	736	-73	4 798	0.02
Life sciences	32 029	34 111	7	933	153	-84	106	0.14
Mathematics and physical sciences	39 842	40 928	3	1 585	254	-84	144	0.18
Total	40 717	47 724	17	14 869	11 305	-24	39 299	0.03

Source: Lindsay, 1999, from Department of Labour, Administrative Data 1992, 1997 and Bureau of Labor Statistics (BLS).

Permanent: evaluation and policy suggestions

There are three major criticisms of the US certification system for US employers seeking immigrants: sham recruitment, no guarantees and filling jobs with immigrants that are not in the national interest. The most common policy suggestion is to substitute an employer-paid fee for certification: the US Commission on Immigration Reform (CIR) recommended in 1995 that US employers pay a significant fee, say USD 10 000, to sponsor an immigrant to fill a vacant job, and that the fees collected from employers be put into a fund that would support training US workers for the jobs for which immigrants are being sponsored.

The problem most frequently mentioned in evaluations of the certification process is sham recruitment. Most of the immigrants sponsored by US employers are already working for the employer when the employer requests certification. This means that the employer is "seeking US workers" to fill a "vacant job" when the foreigner is in fact already filling the job. Under these circumstances, the employer simply wants an immigrant visa for the foreigner in the job, not a US worker to fill the job. Thus, US workers who seek the job that the employer is required to advertise are rarely hired.

DOL's inspector general, for example, found that 99% of the 24 000 foreigners sponsored by US employers for economic/employment visas in FY93 were already working for the employer who requested them, including about 4 000 who were unauthorised foreign workers. When the US employers examined advertised the 24 000 jobs, they attracted 165 000 applications from US workers – about seven US applicants per job – but in virtually every case, the US workers were not hired, and the employer was certified to hire the foreigner.

However, once the foreigner gets an immigration visa, there is no legal requirement that the immigrant remain on the job, *i.e.* there is no guarantee that the foreigner will remain in the job. Immigrants may live and work almost anywhere, and there are many reports that IT professionals and other foreigners who get immigrant visas immediately leave the employer who sponsored them.

A third criticism is that it is difficult to consider as being in the national interest the admission of many immigrants who are admitted to fill jobs. Between 1988 and 1996, the United States admitted as economic/employment immigrants some 40 000 housekeepers, nannies and domestic workers, 15 000 cooks and chefs, 3 000 auto repair workers, 252 fast-food workers, 199 poultry dressers, 173 choral directors, 156 landscape labourers, 122 short-order cooks, 77 plumbers, 68 doughnut makers, 53 baker's helpers, and 38 hospital janitors. In many of these cases, employers sponsored immigrants to reward them for their personal services in their homes or they sponsored their relatives for admission as needed workers.

Most reform proposals call for employers to pay fees as a substitute for DOL certification. Under the CIR's reform recommendations, instead of applying to DOL for labour certification, employers wanting to sponsor foreign workers for admission would pay a fee of USD 7 000-10 000 per immigrant into a private fund that would train US workers to fill vacant jobs identified by employer requests for immigrants. Employers willing to pay these fees would be presumed to have searched and failed to find US workers, and thus save the up to USD 10 000 they currently pay lawyers to complete the labour certification process. Ex-Senator Alan K. Simpson (Republican of Wyoming) introduced a bill in 1996 that would have reduced the number of immigrants admitted for economic/employment reasons from 140 000 to 75 000 a year, required US employers to pay immigrants admitted to fill vacant US jobs at least 10% more than the prevailing wage and to pay a fee equivalent to 30% of the immigrant's first year salary into a US fund that trained workers for the jobs being filled by immigrants. Simpson's proposal was not fully debated or acted on in Congress.

A second reform proposal is to change the labour certification process, moving it from DOL's Employment and Training Administration to the Employment Standards Administration (ESA). The proposed new system, known as the Program Electronic Review Management or PERM system, would substitute an attestation process for labour certification, reducing the time between application and certification. An employer's application would be scanned into a computer, and the data submitted by the employer would be compared to pre-established thresholds. Only suspect applications would be audited, and the others would be approved. PERM was blocked by immigration lawyers who opposed the consolidation of services and enforcement in one DOL agency, ESA.

Temporary: non-immigrant H-1Bs

Non-immigrants are foreigners in the United States for a specific purpose; foreign workers are those who fill US jobs. The United States in the 1990s developed a number of new foreign worker programmes, each targeted on a narrow segment of the labour market, and each having distinct rules of admission and terms for workers. There are 14 non-immigrant visas for foreign workers.

There are three important background facts about non-immigrant or foreign workers:

- First, US immigration law assumes that foreigners applying for non-immigrant visas are intending to become immigrants and places the burden on the foreigner to prove that he or she will in fact leave the United States at the end of the visa.
- Second, there are usually no limits or quotas on the number of non-immigrant visas available; the major exceptions are for H-1B workers (annual quota of 195 000) and H-2B workers (annual quota of 66 000). Most non-immigrants may bring family members with them to the United States.[8]
- Third, even though non-immigrants must show that they have ties to their country of origin and plan to return in order to get a non-immigrant visa, most non-immigrants are permitted to adjust to permanent resident or immigrant status while in the United States. This adjustment-of-status concept makes many foreign workers in fact "probationary immigrants"; if they can prove to their employers that they are good workers, they are likely to be sponsored by the employer for immigrant status, which means that, once in the United States as a non-immigrant, the foreigner can stay as an immigrant.

The H-1B programme

The major programme admitting highly skilled foreign workers is the H-1B programme, established under the Immigration Act of 1990.[9] The H-1B programme allows US employers to have admitted to the United States foreigners with at least a BA degree who are filling US jobs that require at least a BA degree. The admissions procedure relies on attestations by employers, who file a Labour Condition Attestation (Form ETA 9035)[10] that makes assurances about three factors:

- The employer asserts that he/she is offering the H-1B worker the prevailing wage.
- The employer asserts that the working conditions offered to the H-1B worker do not adversely affect US employees' working conditions.
- The employer asserts that there is no strike or lockout for the position being filled by the H-1B.

The LCAs do not have to include the name of the H-1B worker the employer wishes to employ, and the DOL generally cannot investigate employers who request or employ H-1B workers unless a complaint is lodged. H-1B visas are valid for up to three years and can be renewed once for another three years. After six years, the H-1B must: *i)* adjust status, *e.g.* to immigrant; or *ii)* return home for at least one year. Spouses and children of an H-1B visa holder are granted H-4 visas, which permit them to attend school in the United States but not to work.

The major H-1B story of the late 1990s was the rapid growth in employer requests for H-1B workers, which led to more than 65 000 requests in the late 1990s (Table 3). About half of H-1B workers are employed in the computer industry, and that industry took the lead in efforts to raise the annual limit, to 115 000 in 1999 and 2000, and to 195 000 in 2001.[11] The H-1B programme was modified in 1998 when the cap was raised to 115 000 a year, primarily by defining so-called "body shops", firms whose workforces include 15% or more H-1B workers as "H-1B-dependent" employers.[12] These 100-200 US employers, and only these employers, must *i)* document their efforts to recruit US workers and *ii)* certify that US workers were not laid off to make room for the H-1Bs in the previous 90 days, and that US workers will not be laid off for 90 days after the arrival of the H-1Bs. Other employers do not have to search for US workers before hiring H-1B foreigners, and can lay off US workers to create vacant jobs that are filled with H-1Bs.

Table 3. H-1B visas issued by country of origin, 1990-99

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
People's Republic of China	610	1 145	894	1 031	1 256	1 887	2 330	3 214	3 883	5 779
India	2 697	4 102	5 552	7 606	11 301	15 528	19 203	31 686	40 247	55 047
Japan	3 791	5 167	2 767	2 152	2 217	2 070	2 411	2 929	2 878	3 339
Philippines	7 302	7 221	7 550	7 596	8 753	10 026	4 601	2 685	2 758	3 065
France	2 293	2 413	1 686	870	1 003	1 216	1 463	1 894	2 110	2 633
Germany	1 637	1 888	1 501	1 012	1 092	1 484	1 518	2 088	2 242	2 451
United Kingdom	7 174	8 794	6 726	3 993	4 230	4 771	5 601	6 928	6 343	6 665
Russia	3 709	3 942	1 651	1 892	1 245	1 196	1 255	1 357	1 395	1 619
Mexico	3 727	3 227	2 488	1 307	1 147	1 451	1 909	2 785	2 320	2 419
Australia	827	1 102	990	863	1 050	1 042	1 123	1 438	1 666	1 651
Subtotal	33 767	39 001	31 805	28 322	33 294	40 671	41 414	57 004	65 842	84 668
Ceiling	65 000	65 000	65 000	65 000	65 000	65 000	65 000	65 000	65 000	115 000

Source: US Department of State, Visa Office.

The other major change introduced with the raising of the annual limit was an annual fee of USD 1 000 per petition (request for H-1B worker) to be used to provide scholarships to encourage Americans to study in computer-related fields (universities and some research institutes do not have to pay this fee). The theory behind this fee is that "labour shortages" represent gaps between demand and supply. In the case of US IT workers, the argument was that demand is rising faster than supply because of the explosive growth of high-tech industries, and that there was a lag before US students could get the required training. Thus, the short-run goal of filling vacant jobs is to be solved in the long run in part with employer-paid fees that lower the cost of training and thus should encourage more US students to go into fields with labour shortages such as IT.

The H-1B programme expanded during a boom in the IT industry, when employment was rising sharply. In 2001, there were widespread layoffs, which highlighted several issues in the H-1B programme. An H-1B visa attaches to the employer, not the worker; a laid-off H-1B worker is to

return to his country of origin as soon as he is laid off and at the employer's expense; however, there is widespread discussion of a 10-day "grace period" during which the H-1B worker can try to find another US employer to hire him. The number of H-1B visas issued in the first six months of FY2001 was 72 000, versus 100 000 a year earlier.

H-1B evaluation

The H-1B programme can be evaluated at several levels:

- How many H-1B foreign workers are in the national interest?
- Can employers be trusted to pay prevailing wages and not adversely affect similar US workers?
- Are enforcement and penalties on employers dependent on H-1B workers effective?
- Will employer-paid fees that fund scholarships close the supply-demand gap?

As for the permanent immigrant programme, many critics of the H-1B programme argue that it is used by US employers to hire foreign students who graduate from US universities and other foreigners already in the United States to undercut wages, not to fill jobs for which US workers are unavailable. The evidence in support of this criticism is two-fold, government audits and hiring practices in the computer industry. In May 1996, the US Department of Labor's inspector general concluded that the H-1B programme "serves as a probationary try-out employment programme for illegal aliens, foreign students and foreign visitors to determine if they will be sponsored for permanent status". Labor Secretary Robert B. Reich in 1995 testified: "We have seen numerous instances in which American businesses have brought in foreign skilled workers after having laid off skilled American workers, simply because they can get the foreign workers more cheaply. [The H-1B programme] has become a major means of circumventing the costs of paying skilled American workers or the costs of training them." (Migration News, 1996; DOL Reports on Temporary Workers, May)

The hiring criticism emphasises that most IT employers hire fewer than 5% of the applicants for jobs, including very few applicants over age 40. Most US high-tech firms require applicants to apply by computer and screen applicants for age and skills. Why, critics argue, do US firms find US workers with 20-30 years experience unqualified to fill a vacant job, while they find a newcomer from China or India qualified? Critics assert that the reason is that the foreigners with H-1B visas will work "hard and scared" because: *i)* they know that they must leave the United States if they lose their jobs; and *ii)* they want to impress the US employer so as to be sponsored for an immigrant visa.

The hard and scared criticism is linked to wages: are foreigners hired because they are the best qualified to fill a job or because they are cheaper? Critics argue that H-1Bs hoping to be sponsored by their employers for immigrant visas are not likely to complain, even if they are not paid prevailing wages, or if they are asked to work long hours. DOL, critics say, often accepts employer attestations that offer wages that are below prevailing levels, and does not police US employers to ensure that they pay the promised wages to H-1B workers.

The third criticism relates to enforcement of programme rules. There appears to be significant fraud by both employers and foreign workers. The most common types of fraud involve: *i)* US employers attesting that they need H-1B workers even though they do not have a specific job for a worker to fill; and *ii)* employers or workers falsifying their educational qualifications. Some US "employers" who request H-1B workers turn out to be only mail drops, but they nonetheless are

allowed to have foreigners admitted to the United States legally for six years. Many of these bogus employers are employment agencies, and some advertise in India and China, promising six-year US work permits in exchange for fees of USD 5 000-15 000. Some of the foreigners getting H-1B visas from such agents may not have BA degrees, or they arrive in the United States but do not have jobs. During Congressional hearings in May 1999, the American consulate in Chennai, India, which processed applications for 20 000 H-1B workers in 1998, reported that 21% of a sample of 3 200 H-1B visa applications were fraudulent (the workers did not have the qualifications they claimed), and that for another 25%, the consulate could not verify the worker's level of education and training.

The fourth criticism is that, in light of the desire of many foreigners to immigrate to the United States and the formation of networks linking Indian computer schools to US computer firms, for example, even employer-paid fees will not close the demand-supply gap. Ex-President Clinton reflected this fear in a speech of 30 March 1999 to the Electronic Industries Alliance: "Over the long run, the answer to this problem of the lack of skilled workers cannot simply be to look beyond our borders – surely a part of it has to be to better train people within our borders to do this work."

The computer industry has been at the centre of the debate over the H-1B programme, largely because about half of the H-1B workers are employed in the IT industry broadly defined. A comparison of changes in annual earnings of workers by occupation and employer petitions for H-1B workers filed in 1992 and 1997 found the largest increase in employer petitions was in computer-related occupations.[13] However, there was no apparent correlation between annual earnings changes and approved employer petitions for H-1B workers. Petitions for H-1B workers increased in every occupation faster than annual earnings (Table 4).

Table 4. Average annual earnings and approved employer petitions for H-1B workers, 1992-97

Labour condition attestations	Annual earnings			Approved employer petitions		
Occupational category	1992	1997	Change	1992	1997	Change
	USD	USD	%	USD	USD	%
Computer-related occupations	39 750	49 178	24	5 732	63 468	1 007
Art	35 479	39 535	11	336	1 876	458
Administrative occupations	38 514	42 508	10	2 132	11 225	427
Writing	37 212	37 613	1	235	1 092	365
Professional, technical, and managerial	49 910	52 563	5	895	3 741	318
Architecture, engineering and surveying	42 188	49 643	18	4 520	18 279	304
Social sciences	42 449	42 826	1	808	3 153	290
Managers and officials	62 706	59 072	-6	1 919	6 613	245
Medicine and health	43 891	55 903	27	4 114	12 569	206
Fashion models	134 583	115 000	-15	4	11	175
Museum, library, and archival sciences	29 309	36 562	25	98	255	160
Entertainment and recreation	37 953	39 637	4	135	348	158
Law and jurisprudence	64 605	67 499	4	342	818	139
Education	33 945	36 302	7	4 878	8 226	69
Life sciences	33 673	35 678	6	2 120	3 482	64
Religion and theology	25 980	32 090	24	50	77	54
Mathematics and physical sciences	40 217	46 189	15	2 093	3 178	52
All these occupations	41 244	48 390	17	30 411	138 411	355

Note: Data are for full time work, annual earnings, and approved employer petitions for H-1B workers.
Source: Lowell, 1999, from Department of Labor, Administrative Data 1992, 1997.

A 2000 study concluded that sharply higher H-1B admissions were one reason why average earnings in high-demand occupations do not increase even faster. It has been suggested that many H-1B foreign workers want to find a US employer to "sponsor" them for a permanent immigration visa, so as H-1B workers they are more willing to work long hours for lower pay than US workers would. In FY94, it was estimated that about 40% of H-1B workers were able to obtain some type of permanent immigration visa, versus 17% for F-1 students, suggesting that adjustments to immigrant status are more common for H-1Bs than for other non-immigrants.[14]

Most US data are collected by foreign-born versus native-born and do not distinguish the foreign born by type of visa. The core US IT workforce – about 2.5 million in 2000 – is about 20% foreign born, and about half of these foreign-born IT workers are believed to be H-1Bs. One wage indicator – average weekly earnings by type of IT employer – suggests that some H-1Bs may be earning lower-than-average wages. In the IT industry in 2000, average weekly earnings of workers hired directly by IT firms was USD 570, but IT workers hired by intermediaries (agents that place IT workers with firms that need them, making the workers "contingent employees") were 46% lower at USD 389 a week. About 5% of US IT workers, and 15% of H-1B workers, were contingent employees.

The high-tech industry slowed suddenly in 2000-01; there were 500 000 H-1B foreign professionals in the United States in June 2001, including 250 000 from India. However, it appeared that the 195 000 H-1B visas available for FY2001 would not be used up. Only 16 000 new H-1B workers came to the United States in February 2001, half the 32 000 who arrived in the same month of 2000.

Most reports on the H-1B programme in summer 2001 focused on problems with the programme, a sharp change from the late 1990s when the focus was on how H-1Bs were helping the United States to be the world's IT leader. A typical story was the profile of an Indian H-1B who arrived in November 2000 to work for ChristAm, a Texas "body shop" that recruited H-1B foreigners for jobs at US companies that need temporary computer support staff. In this case, ChristAm did not abide by the contract it made with the Indian worker, and went out of business without paying him the promised wages. The worker did not complain for fear that he would be ordered out of the United States because he did not have a job (Silverman, 2001).

The relation between body shops, usually operated by immigrants from the country from which H-1Bs are brought, and the workers they bring into the United States with H-1B visas, has become the focus of several court cases. Many body shops require H-1Bs to sign contracts that include penalties if the H-1B worker leaves the body shop that brought him into the United States, for example for a job with the US firm to which he is assigned temporarily. One body shop, Compubahn, sued to collect a USD 25 000 penalty from an H-1B worker who was hired by the company to which Compubahn assigned him. However, a San Mateo County court in April 2001 ruled that this penalty was unlawful, and ordered Compubahn to pay the affected Indian H-1B USD 215 050 in legal fees and other expenses. In FY00, DOL received 140 complaints from H-1B workers, up from 48 in FY97.

Policy implications

The United States is a nation of immigrants that has been and continues to be enriched by the arrival of newcomers. Supporters of immigration have traditionally opposed guest worker programmes, arguing that the United States welcomed newcomers as new Americans, not as foreigners who would have to depart. There was far more rapid growth in the 1990s in non-immigrant than in immigration visas, especially for highly skilled workers, leading to efforts to issue more green

cards instead of having more guest workers. These efforts failed, and Congress was persuaded, largely by the high-tech industry, to raise the number of H-1B visas available without making any major changes in employment-based immigration policy.

Immigration generally adds workers in a shotgun fashion across the labour market. Guest worker programmes, by contrast, often aim in rifle fashion to fill a narrow range of labour market vacancies. This shift from shotgun to rifle guest worker policies means, for example, that changes in macroeconomic policies have less effect on employer demands for guest workers, since only a small share of all employers participate in any particular guest worker programme. The combination of narrowly targeted programmes, a few hundred participating employers, and a reduced capacity of government to assess the labour market and to enforce programme rules sets the stage for conflict over: *i)* an employer's real "need" for foreign workers; and *ii)* the effect of foreign workers on US workers as well as the trajectory of the affected sector in both the short and the long term which might occur if the presence of foreign workers in some labour market segments discouraged Americans from being trained in certain fields.

The link between guest workers and immigration, between the H-1B programme and the employment-based immigration system remains unresolved. The major issues include:

- *Delays and costs involved in certification*. US employers estimate that it takes two to four years and costs USD 10 000-20 000 to obtain certification that an immigration visa should be issued to fill a vacant job. These delays and costs are expected to worsen as the number of H-1B workers increases without any increase in the number of employment-based visas, so that some H-1B workers seeking immigration visas may not be able to obtain one before their six-year work visas expire (legislation approved in 2000 allows such workers to remain in the United States)

- *Fraud in both programmes*. The certification procedure in the immigration programme is supposed to ensure an honest employer effort to find US workers. However, in many cases, the foreigner being sponsored for an immigration visa is already employed, so the employer has no interest in finding a US worker. The H-1B's attestation procedure enables so-called body brokers to charge fees to foreign workers, and make them sign contracts that restrict their mobility in the United States; both workers and their US employers may inflate the foreigner's education and skills.

- *The national interest balance*. The goal is to enable US employers to get the skills they need from the global labour market quickly and easily while avoiding adverse effects on US workers and maintaining the interest of US business in training and retraining US workers. The US Commission on Immigration Reform recommended in 1995 that the best way to achieve this balance is to have employers pay "significant fees" for the privilege of hiring foreign workers temporarily or as immigrants. These employer-paid fees would be available to speed up the administration of the programme, enforce programme rules and encourage the training of US workers.

The fee system relies on economic incentives to balance the competing goods involved in importing foreign human capital. Good one is easy access to foreign workers for employers to maintain their profits, and good two is protection for US workers as well as policies to maintain the competitive edge of industries. Under a fee system, employers would prove that they made a good-faith effort to recruit foreign workers by paying fees. The fees collected from employers could be used to cover the cost of enforcement of labour laws in affected industries, to train and retrain US workers and to develop productivity-increasing technologies. A fee system combined with a minimum

wage and enforcement that prevents the employer from requiring the foreign worker to pay the fee, would encourage employers to look to the US labour market, since hiring a US worker would enable the employer to avoid the fee.

These recommendations echo those of a 2001 policy report released by a business group, the Committee for Economic Development (CED). It recommended that the H-1B system be restored to a "temporary" programme by reducing the duration of the visa from six to three years and that H-1B visas be auctioned to the highest bidder when demand for them exceeds supply. The CED also recommended replacing certification for employment-based immigrants by attestation, with employers subject to audits and fines.

NOTES

1. The speed of the high-tech slowdown in April-May 2001 was faster than expected. In addition to layoffs, many high-tech firms have rescinded the job offers made to new graduates and offered them bonuses NOT to take the jobs they were offered. Cisco, for example, rescinded about 25% of the job offers to college students, and offered a consolation package consisting of 12 weeks' salary. Jonathan D. Glater, "Dear New Employee: Welcome, and Goodbye", *New York Times*, 4 May 2001

2. In FY95, admissions in these categories were 132 000, 356 600, 201 000, and 112 000, for a total of 802 000..

3. "An alien seeking to immigrate to the United States on the basis of employment must obtain an offer of permanent full-time employment from an employer in the United States. The alien cannot be admitted as a permanent resident unless, among other things, the employer obtains a labour certification from the Department that qualified US workers are not available for the employment offered to the alien, and that the wages and working conditions offered will not adversely affect those of similarly employed US workers.

   The labour certification process requires the employer to recruit US workers at prevailing wages and working conditions through the State Employment Service, by advertising, posting notice of the job opportunity and by other appropriate means. A Departmental regional certifying officer makes a decision to grant or deny the labour certification based on the results of the employer's recruitment efforts and compliance with Departmental regulations." (http://workforcesecurity.doleta.gov/foreign/dflc.asp#perm)

4. IMMACT also changed the H-1B programme, easing employer access to professional foreign non-immigrants and simultaneously imposing a cap of 65 000 visas a year, and created the non-capped O, P, Q, and R visa programmes for foreign entertainers and athletes, among others.

5. First priority workers seeking EB-1 visas do not have to have a US job offer, but must indicate that they will continue to work in their field of extraordinary ability, which is defined as a "level of expertise indicating that the individual is one of those few who have risen to the top of the field of endeavour". Extraordinary ability is demonstrated by showing: *i)* receipt of a major, internationally recognised award such as a Nobel Prize or an Academy Award; or *ii)* at least three types of evidence, such as lesser national or international prizes or awards for excellence, membership in selective associations that require outstanding achievements of their members, published materials about the alien and his work in professional journals, original scientific, scholarly or artistic contributions of major significance, or commanding a high salary compared to others in the field. Many petitions for EB-1 visas include letters attesting to the alien's important contributions and ability.

6. US employers seeking labour certification to sponsor a foreigner for immigration must apply by submitting ETA Form 750, Application for Alien Employment Certification: a statement of the qualifications of the alien, signed by the alien; a description of the job to be filled by the alien, including the wage offered and the steps taken to recruit US workers, including a copy of recruitment ads, the number of US applicants, and the reasons they were not hired.

7. For example, there were 61 000 technical writers, and many are self-employed persons who work by the job, so that it can be very hard to interpret annual earnings and changes in annual earnings.

8. The spouses of temporary foreign workers are generally not permitted to work in the United States, a rule that several organisations are trying to change. Australia, Argentina, Hong Kong (China), and the United Kingdom reportedly permit the spouses of foreign PTK workers to work. In 1998, Canada launched a pilot programme to permit spouses of PTKs to work.

9. The H-1 programme was established in 1952 and, although there was no ceiling, no more than 15 000 foreigners a year were ever admitted until the 1980s; there were 47 000 admissions in 1985.

10. Employers fax LCA Form ETA 9035 to (215) 596-1052 or (415) 975-4964 and receive approval or reasons for rejection within 3-4 days.

11. The 1998 legislation was the American Competitiveness and Workforce Improvement Act; the 2000 legislation was the American Competitiveness in the Twenty-first Century Act.

12. H-1B workers with a Master's degree or more or earning USD 60 000 or more are not included in calculating dependency.

13. The United States had 1.5 million computer scientists in 1997.

14. F-1 students are most likely to become immigrants in the United States through marriage; H-1B workers are more likely to become immigrants by finding a US employer to sponsor them. A survey of H-1B visa holders in 1999 found that 23% had adjusted from F1 student to H-1B visas.

ANNEX 1. NON-IMMIGRANT ADMISSIONS 1990-96

There are three major sources of data especially on non-immigrant visas that permit employment in the United States: DOL data on the number of employers requesting workers and the number of workers they request; INS data on admissions, with double counting for foreigners who enter three or four times within a year, *e.g.* on an H-1B visa; and DOS data on the number of each type of visa issued. The DOS data are an undercount because: *i)* some foreigners adjust their status with the INS while in the United States; and *ii)* some foreigners extend their stay in the United States with the INS. There are no non-immigrant data for FY97.

Table A1. INS non-immigrant admissions to the United States, FY1990-96

Category/fiscal year ending 30 September	1990	1991	1992	1993	1994	1995	1996	Dist: 96 (%)	Change: 92-96 (%)
All	17 574 055	18 920 045	20 910 880	21 566 404	22 118 706	22 871 209	24 852 503	100	19
Temporary visitors	16 079 666	17 234 400	19 229 066	19 879 443	20 318 933	20 887 329	22 880 270	92	19
B1 business	2 661 338	2 616 335	2 788 069	2 961 092	3 164 099	3 275 796	3 770 326	15	35
Visa waiver			294 065	640 397	786 739	942 538	1 370 452	6	
B2 pleasure	13 418 328	14 618 065	16 440 997	16 918 351	17 154 834	17 611 533	19 109 944	77	16
Visa waiver			4 528 112	8 624 006	8 969 404	9 407 254	11 192 978	45	
Transit aliens (C1 to C4)	306 156	364 456	345 930	331 208	330 936	320 333	325 538		-6
Treaty traders(includes families)	147 536	155 049	152 385	144 644	141 030	131 777	138 568		-9
E1 Traders	78 658	76 952	71 796	65 362	60 196	53 557	54 289		-24
E2 Investors	68 878	78 097	80 589	79 282	80 834	78 220	84 279		5
Students and dependants	355 207	374 420	401 287	403 272	427 721	395 120	426 903	100	6
F1 Academic students	319 467	335 623	360 964	362 700	386 157	356 585	418 117	98	16
M1 Vocational students	6 797	7 615	7 722	7 920	7 844	7 635	8 786	2	14
F2 Spouses/families	28 490	30 499	31 988	32 103	33 071	30 489	32 485		2
M2 Spouses/families	453	683	613	549	649	411	507		-17
Reps of international orgs. G1 to G5)	61 449	64 451	69 947	72 755	74 722	71 982	79 528		14
G4 International org. employees	43 104	46 913	50 674	52 856	53 768	51 410	53 656		6
G5 Attendants/servants	1 603	1 638	1 524	1 543	1 596	1 466	1 447	0	-5
Temporary workers and trainees	139 587	159 714	163 262	162 976	185 988	220 664	227 440	100	39
H-A Registered nurses		2 130	7 176	6 506	6 106	6 512	2 046	1	-71
H-B Specialty occupations	100 446	114 467	110 223	92 795	105 899	117 574	144 458	64	31
H2 Unskilled	35 973	39 882	34 442	29 475	28 872	25 587	23 980	11	-30
H-A Agricultural	18 219	18 440	16 390	14 268	13 185	11 394	9 635	4	-41

Table A1 (cont'd.)

Category/fiscal year ending 30 September	1990	1991	1992	1993	1994	1995	1996	Dist: 96 (%)	Change: 92-96 (%)
H-B Non-farm workers	17 754	21 442	18 052	14 847	15 687	14 193	14 345	6	-21
H3 Industrial trainees	3 168	3 235	3 352	3 126	3 075	2 787	2 986	1	-11
O1 Extraordinary ability workers			456	3 105	5 029	5 974	7 177	3	1 474
O2 Assistants of O1			258	964	1 455	1 813	2 112	1	719
P1 Int'l recog. athletes and entertainers			3 548	17 109	22 500	22 397	25 968	11	632
P2 Other artists/entertainers-reciprocal			90	422	613	660	1 727	1	1 819
P3 Artists/entertainers-unique culture			1 131	4 036	4 942	5 315	5 938	3	425
Q1 Int'l culture exchange programmes			9	994	1 546	1 399	2 056	1	
R1 Religious workers			2 577	4 444	5 951	6 742	8 992	4	249
Spouses and children of temp. workers/trainees	28 687	34 803	40 009	39 704	43 207	53 582	53 572		34
H4: families of H1, H2, H3 workers	28 687	34 803	39 155	37 833	40 490	43 247	50 106		28
O3: families of O1, O2			1	322	549	751	877		
P4: families of P1, P2, P3			152	498	562	592	667		339
R2: families of R1			701	1 051	1 606	1 790	1 922		174
I1 Foreign media reps (incl. families)	20 252	21 073	21 695	21 032	27 691	24 220	33 596		55
J1 Exchange visitors	174 247	182 693	189 485	196 782	216 610	201 095	215 475		14
J2: Exchange visitor families	40 397	40 737	41 807	42 623	42 561	39 269	41 250		-1
L1 Intra-company transfers	63 810	70 505	73 315	82 606	98 189	112 124	140 457		92
L2: families of Intra-company transfers	39 375	42 529	45 464	49 537	56 048	61 621	41 250		-9
TC NAFTA professionals	5 293	8 123	12 531	16 610	5 031	121			
TN NAFTA professionals					19 806	23 783	26 987		
TD: families of TN					5 535	7 202	7 694		
Others (unknown)	189	51 576	1 354	446	878	779	310		
Subtotal: Foreign workers: H, L, TC/TN	208 690	238 342	249 108	262 192	309 014	356 692	394 884		59
Subtotal: Foreign students, exchange visitors	500 511	525 931	558 171	567 402	610 611	565 315	642 378		15

Source: INS Statistical Yearbook, 1996. Persons admitted several times are double counted.

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Chapter 17

MIGRATION POLICIES DESIGNED TO FACILITATE THE RECRUITMENT OF SKILLED WORKERS IN AUSTRALIA

by

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Introduction

Australia differs from some other OECD countries in having had a sustained official programme of attracting migrants to settle in Australia for over two centuries. The level, composition and policy drivers of the immigration programme have undergone many shifts over the period, but, as a result, Australia is more affected by migration than almost all other countries. In 2000, 24% of its resident population was born overseas (24.9% of its workforce in 1996) and a further 19.2% of residents were Australian-born but had at least one parent born overseas. The scale of post-war immigration in Australia can be gauged from the fact that it has been estimated that immigration (including subsequent fertility) accounted for 59% of the growth of 11.8 million in the total Australian population between 1945 and 2000 (Kippen and McDonald, 2000). These numbers, impressive as they are, are only the tip of the iceberg in terms of the changes that have been brought about by immigrants. One of the truisms about all migration is that migrants are *never* representative of the populations at either their place of origin or at their place of destination. This chapter examines the extent to which immigration to Australia has been selective of skilled workers and the policies that have been developed to recruit skilled workers. Although the national immigration programme only specifically focused on attracting skilled immigrants in the 1970s, in 1996 immigrants made up 29.8% of all qualified workers but only 24.9% of the entire workforce.

The chapter begins by a brief review of post-war immigration and settlement. It then examines the settlement element of the immigration programme and focuses on current policies for recruiting skilled workers. The next section is concerned with a relatively new element, the recruitment of skilled workers via temporary entry programmes, followed by a discussion of recruitment of skilled workers in one area of current labour shortage, information technology. The following section addresses a relatively new area of government concern in Australia, the emigration of highly skilled Australian workers and the extent of Australia's brain drain. Finally, some major policy issues and areas of debate concerning skilled migration in Australia are briefly discussed.

Background

The post-World War II period saw major changes in Australian immigration. The level of immigration reached and then remained at levels unprecedented before the war. The post-war period

saw the gradual dismantling of the "White Australia" policy, and immigrant intake after the war included, for the first time, large numbers of non-British Europeans and, by the 1970s, substantial numbers of non-Europeans, especially Asians.

Immediately after World War II, the imperatives of immigration policy were both demographic and economic. On the one hand, there were massive labour shortages in the post-war boom period and labour – skilled, semi-skilled and unskilled – was needed for the massive growth in manufacturing. Also, there was a "populate or perish" argument in the aftermath of the near-invasion by Japan during the war. With the end of the "long boom" in the 1970s, the reduction in manufacturing employment and increases in unemployment, immigration policy was redefined to include a planned numerical intake with a number of policy components:

- *Refugee and humanitarian movement*: to resettle refugees.
- *Family migration*: to enable family members to join earlier generations of immigrants.
- *Economic migration*: to recruit people with skills in short supply.
- *Special categories*: New Zealanders (who had previously moved freely across the Tasman Sea), people with special talents, etc.

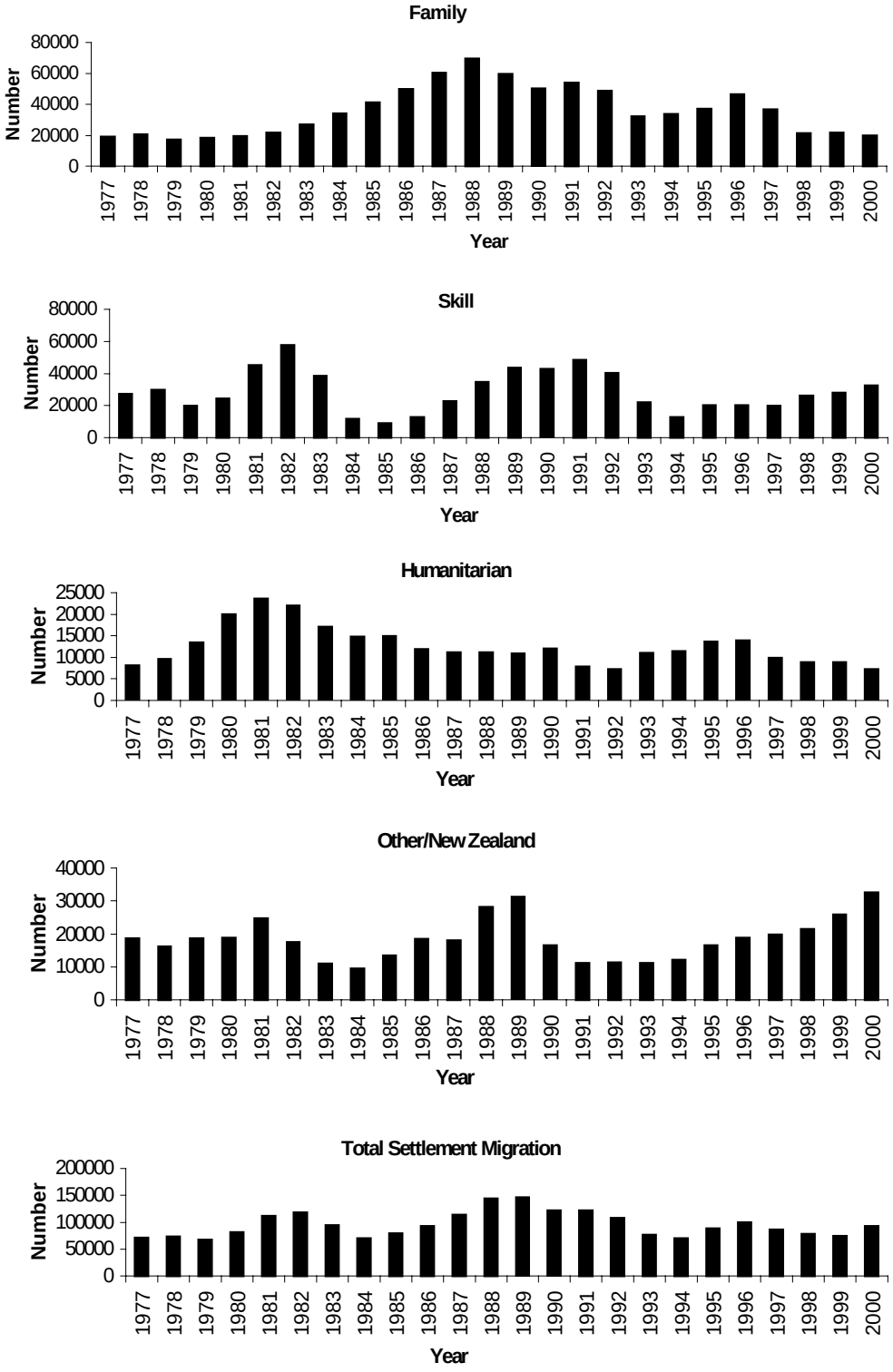
The following period has seen the relative significance of the major components vary (Figure 1). However, until recently, an abiding feature of immigration policy was an overwhelming emphasis upon the recruitment and permanent settlement of immigrant families in Australia. The "guest worker" migration schemes that were developed in Europe in the 1950s in response to labour shortages were explicitly eschewed. In recent years, however, there has been a reversal of this policy, at least with respect to skilled workers.

Settlement immigration and skilled workers

While recruitment of workers has been a consistent part of post-war immigration policy in Australia, recruitment of skilled workers only became an explicit part of immigration policy in the 1970s and has since received greater emphasis. As Table 1 shows, the skill profile of all migrants is higher than that of the Australian-born population, and it is even higher when only settlers arriving in Australia in the five years prior to the census are examined.

The current Australian migration programme operates within set planning levels and has humanitarian and non-humanitarian components. The skilled migration programme is part of the latter, the various elements of which summarised in Table 2. Within the programme, some components, *i.e.* business skills, the employer-nominated scheme (ENS), distinguished talents, spouses and dependent children are demand-driven and not subject to capping. The programme has three main eligibility migration categories: family, skilled and special eligibility. Family migration consists of a number of categories under which the potential migrant can be sponsored by a relative who is an Australian citizen or permanent resident of Australia.

Figure 1. Trends in intake of different types of settlers, 1977-2000



Source: DIMA *Immigration Update* and *Australian Immigration Consolidated Statistics*, various issues.

Table 1. Australian-born and overseas-born population: workforce characteristics, occupation and education, 1996

	Australian-born	Overseas-born	
Characteristic	%	%	Resident < 5 years %
Workforce characteristics			
Percent not in workforce	35.8	42.5	41.6
Percent of workforce unemployed	8.6	10.7	10.0
Occupation			
Manager, professional	27.2	27.5	28.3
Technician, paraprofessional	11.5	11.9	10.4
High skill trade	17.9	17.5	16.3
Intermediate skill	25.4	25.1	20.2
Low skill	18.0	18.0	24.8
Educational qualification			
Degree/diploma	16.2	19.2	29.6
Skilled/basic vocational	14.1	13.1	9.8

Source: Hugo, 1999a.

Table 2. Programme management structure (2000-01) migration (non-humanitarian) programme

Skill	Family	Special eligibility
*Skilled independent & skilled-Australian sponsored**	*Parents and preferential family*	Can be capped
	Can be capped subject to demand in	
Points tested	All other family categories	
Planning level adjusted subject to demand in business skills and ENS	*Fiancés & Interdependents*	
	Can be capped subject to demand for spouse and dependant child places	
Business skills, ENS & distinguished talent		
Demand-driven	*Spouses & dependent children*	
	Demand-driven	
Contingency reserve	Exempt from capping	
To be utilised if States and Territories, business employers and regional authorities generate additional demand	*Contingency reserve*	
	Legislation defeated in Senate October 2000	

* Until July 1999, independent and skilled Australian-linked.
Source: DIMA, 2000a.

As Figures 1 and 2 show, there has been a significant shift in recent years away from the family towards the skilled category. Skilled migration consists of a number of categories of prospective migrants with particular occupational skills, outstanding talents or business skills. These categories are:

- Independent migrants: These are not sponsored by an employer or relative in Australia. They must pass a points test which includes skills, age and English language ability (16 419 visas in 1999-2000).
- *Skilled/Australian-linked*: Introduced 1 July 1997 (replacing the concessional family category). Applicants must pass a points test on skills, age and English ability; they receive

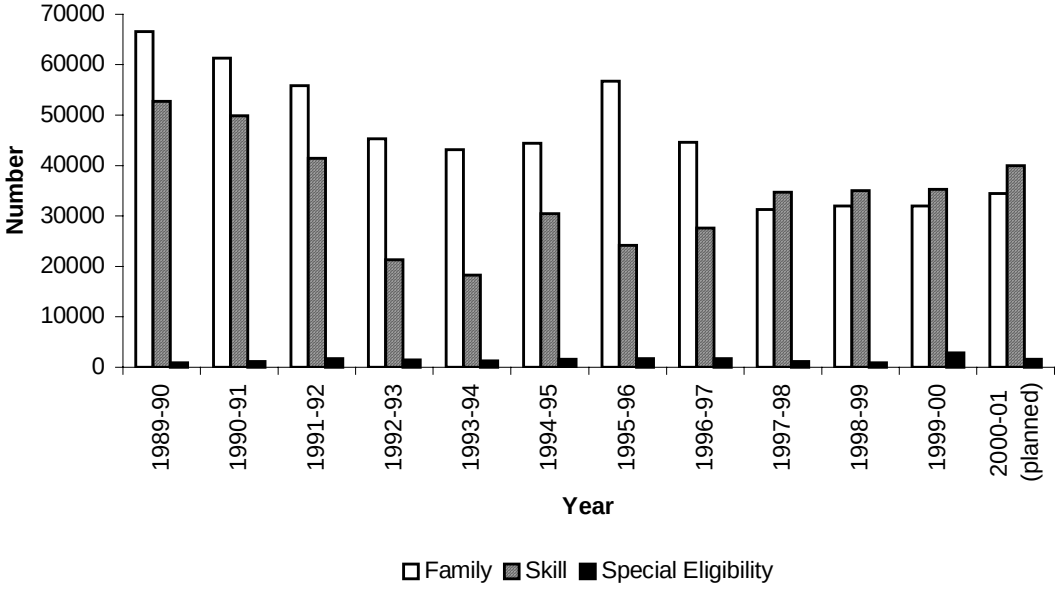
additional points for sponsorship by relatives in Australia (8 882 visas in 1999-2000). Also includes regional-linked for those sponsored by relatives in regional areas (not points tested).

- *Employer-sponsored*: employers may nominate (or sponsor) personnel from overseas through the ENS, the regional sponsored migration scheme (RSMS) and labour agreements. These visas enable Australian employers to fill skilled permanent vacancies with overseas personnel if they cannot find suitably qualified workers in Australia. A total of 1 212 visas were granted in 1999-2000.

- *Business skills*: encourages successful business people to settle permanently in Australia and develop new business opportunities (5 631 visas in 1999-2000).

- *Distinguished talent*: for distinguished individuals with special or unique talents of benefit to Australia (67 visas in 1999-2000).

Figure 2. Migration programme outcomes by stream



Source: DIMA, *Population Flows: Immigration Aspects*, various issues.

Figure 3 presents the breakdown of the numbers in each category for the year 1999-2000. In recent times, there has been greater government intervention to shape the intake of immigrants to contribute better to national economic development goals. This is evident in the greater emphasis on skills and in the development of business migration programmes to attract entrepreneurs with substantial sums to invest in Australia. Australia, like Canada, has micro-managed the qualifications of their migrant intake since the 1970s and the introduction of points assessment schemes. Recent years have seen a substantial shift towards skills/business migration and away from family migration (Table 3 and Figure 2). Mid-1997 saw the removal of the concessional family category and the introduction of the skilled/Australian-linked category; the family category has been reduced by capping the migration of parents.

Table 3. Migration programme visas granted, 1990-91 to 2000-01 (planned)

Migration category/ component	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000	2000-01
Family											
Spouses/fiancés	24 500	26 300	27 800	25 100	26 100	33 550	25 130	25 790	24 740	26 330	28 250
Parents	10 300	7 200	5 300	4 500	5 100	8 890	7 580	1 080	3 120	1 900	2 100[5]
Dependent children	2 000	2 000	2 700	2 500	2 500	2 830	2 200	2 190	2 070	2 160	2 770
Other	2 000	2 000	1 700	1 700	3 100	3 450	2 330	2 250	2 100	1 600	1 280
Concessional family[1]	22 500	18 100	7 700	9 400	7 700	8 000	7 340	-	-	-	-
Total family	61 300	55 900	45 300	43 200	44 500	56 700	44 580	31 310	32 040	32 000	34 400
% of total programme	54.6	56.5	66.7	68.8	58.2	68.7	60.3	46.7	47.2	45.6	45.3
Skill											
Employer nominations[2]	7 500	5 600	4 800	4 000	3 300	4 640	5 560	5 950	5 650	5 390	5 800
Business skills[3]	7 000	6 200	3 300	1 900	2 400	4 900	5 820	5 360	6 080	6 260	6 700
Distinguished talents	100	200	200	200	100	200	190	180	210	110	170
Skilled-independent[4]	35 100	29 400	13 000	11 800	15 000	10 600	15 000	13 270	13 640	15 610	21 350
Skilled-Australian sponsored[1]	-	-	-	-	-	-	-	9 540	9 240	7 900	5 950
1 November onshore	-	-	-	500	9 600	3 800	980	370	180	60	30
Total skill	49 800	41 400	21 300	18 300	30 400	24 100	27 550	34 670	35 000	35 330	40 000[6]
% of total programme	44.4	41.9	31.4	29.1	39.7	29.2	37.3	51.7	51.5	50.3	52.6
Special eligibility	1 200	1 700	1 400	1 300	1 600	1 700	1 730	1 100	890	2 850	1 600
Total programme	112 200	98 900	67 900	62 800	76 500	82 500	73 900	67 100	67 900	70 200	76 000

Note: Owing to rounding, the total may not be the exact sum of components.

1.From 1 July 1997 the Concessional Family category was replaced by the Skilled Australia-linked category and transferred from the Family to the Skill Stream. On 1 July 1999 it was renamed the Skilled Australian-sponsored category.

2. Includes Employer Nomination Scheme, labour agreements, and Regional Sponsored Migration Scheme.

3. Business Migration Programme changed to Business Skills during 1991-92.

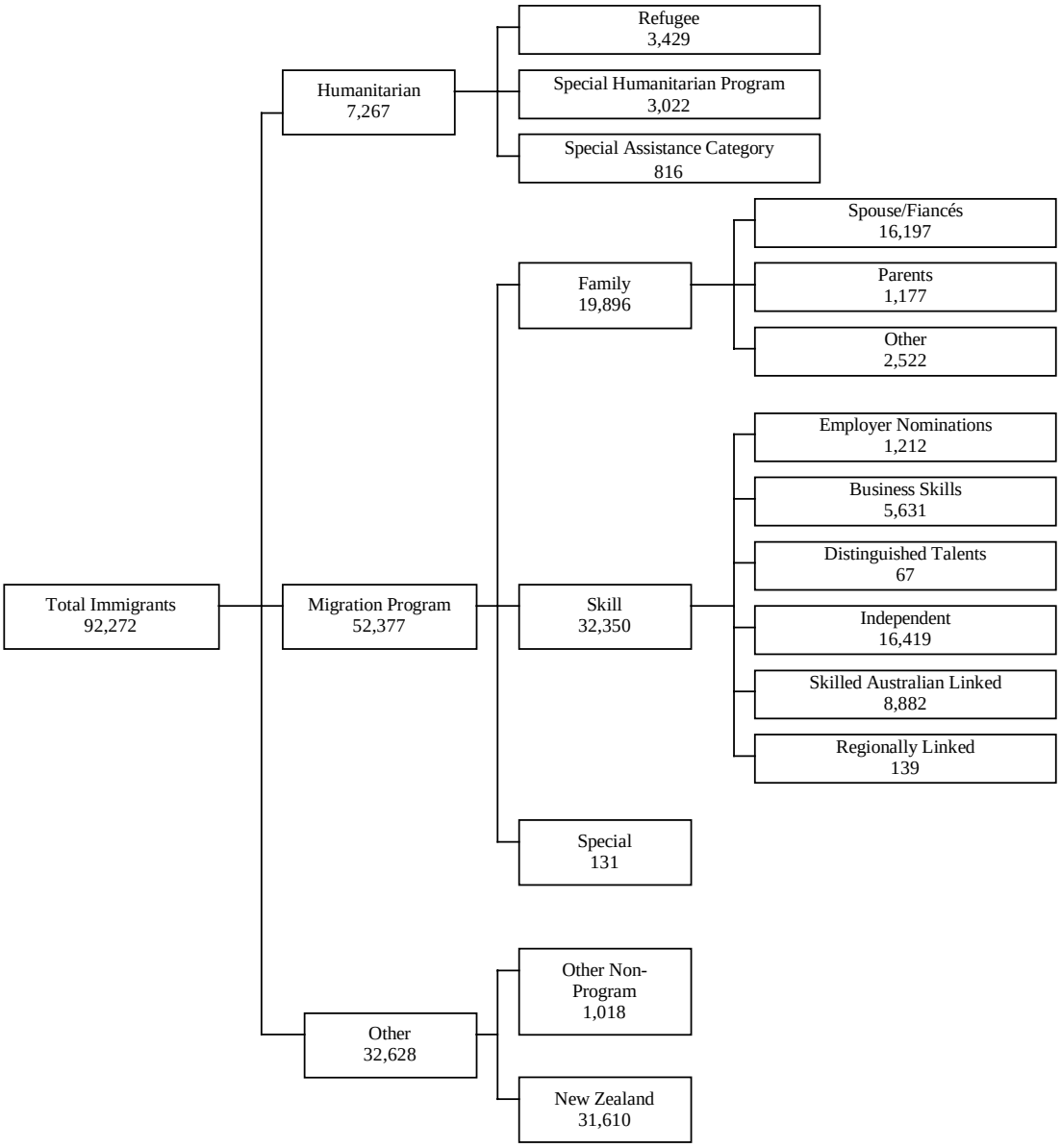
4. Named independent prior to 1 July 1999.

5. Legislation to implement a 4 000 contingency reserve in 2000-01 to aged parents was rejected in the Senate in October 2000.

6. A further 5 000 contingency reserve places still available in 2000-01 to migrants with skills in short supply.

Source: DIMA, *Population Flows: Immigration Aspects*, various issues.

Figure 3. Categories of immigration to Australia, 1999-2000



Source: Based on data in DIMA, 2000b.

The "Skill Stream" is aimed at attracting people with qualifications and relevant work experience who can help to address skill shortages in Australia and enhance the size, skill level and productivity of the Australian labour force. In 1999-2000, 35 330 people were granted skill visas, an increase of 330 (0.9%) on the 1998-99 level. Of total skill stream visas, 13.5% (4 780) were granted to onshore applicants. The United Kingdom accounted for 5 537 of all 1999-2000 skill stream visas granted. Other major source countries included South Africa (4 615), India (4 064), Indonesia (2 741) and the People's Republic of China (2 670).

A range of changes to the requirements for migration under the independent and skilled/Australian-linked (SAL) categories was introduced on 1 July 1999. The points test for these categories now places

greater emphasis on targeting migrants who have skills in shortage in the Australian labour market by awarding additional points to applicants whose occupation is on the Migration Occupations in Demand List (MODL). Further points are available to applicants with a job offer in one of these occupations. The new points test also takes account of other attributes, including Australian qualifications and work experience, fluency in a language other than English and spouse's skills.

A number of mechanisms within the skill stream aim to assist states and territories that wish to encourage more skilled migration to their regions.

- The state/territory nominated independent (STNI) scheme enables state and territory governments to sponsor independent category applicants, identified through skill matching, who are willing to settle in their state or territory. These nominations are based on an audit conducted by the state or territory government to establish which skills are in short supply and where they are needed.

- The skilled-regional sponsored category allows the sponsorship of applicants by relatives to join them in designated areas. Applicants must meet threshold English language, age and skill criteria. This category is not points-tested.

- The RSMS enables employers in regional Australia to nominate overseas personnel for permanent entry if the employer has been unable to recruit suitable skilled personnel on the local labour market. Applicants must meet English language, age and skill criteria.

- Regional established business in Australia (REBA) allows people who have successfully established a business venture in a designated area of Australia, and who are sponsored by the state/territory government, to apply for permanent residence.

- The Skill Matching Database, operated by the Commonwealth, identifies skilled applicants who meet threshold criteria for English language, age and skills and who are willing to settle in areas where their occupational skills are in demand. It is disseminated to state and territory governments and employers, to encourage skilled migration to their regions through the RSMS or the STNI. It also assists in the targeting of regional promotional campaigns.

There have been substantial fluctuations over time in the level of immigration into Australia (Figure 4). Currently, the level of settler intake is set each year by the federal government after consultations with major stakeholders such as unions, industry and state governments.

Recent studies (Murphy, 2001; Birrell, 2001) have documented four significant changes in immigration intake between 1995-96 and 2000-01:

- Total intake fell from 85 000 to 61 000.

- A marked switch towards the skill stream, which increased from 28 000 to 33 000, while the family intake fell from 39 000 to 23 000 and the humanitarian programme fell from 14 000 to 9 000.

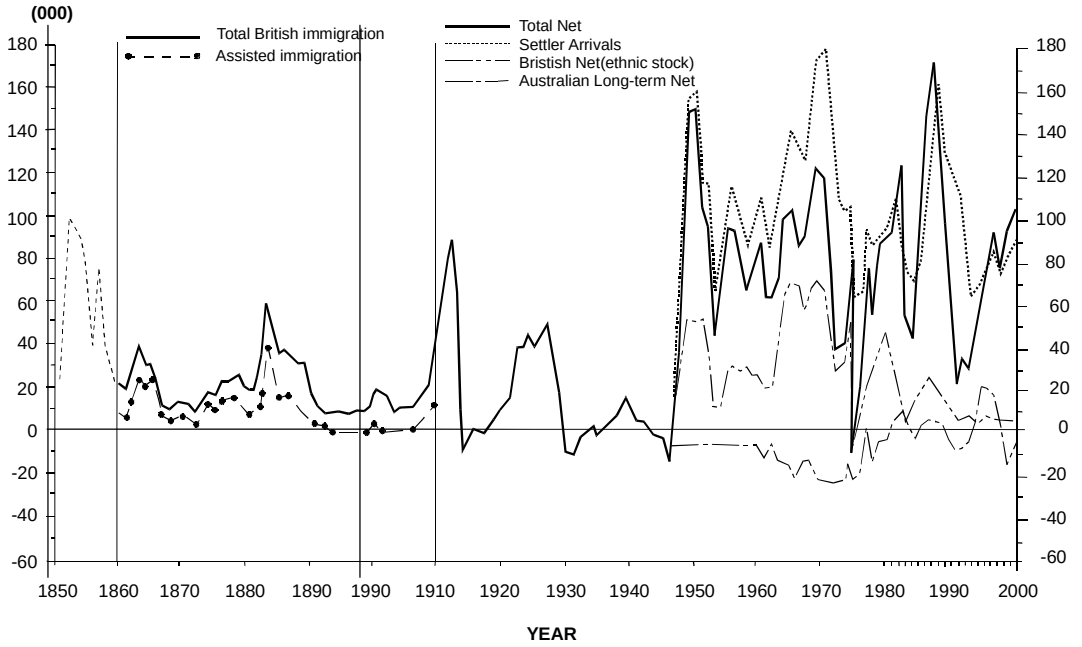
- Within the skill stream, the skill index rose from 66 to 70, while that for sponsored migrants rose from 64 to 66.

- The age structure of immigrants shifted towards the prime working ages. Those aged between 20 and 45 increased from 59% to 64%.

- Over this period there was a net gain of around 40 000 managers and administrators, 57 000 professionals and 21 tradespersons. The annual net gains of these groups show an increasing trend.

- Over 1997-98 and 1999-2000, managers and administrators had a net gain of 3.8% of the total employed stock and professionals had a met gain of 2%. The net gain of computing professionals was equivalent to 3.2% of the employed stock and that of accountants to 2%.

Figure 4. Annual migration, 1850-2000



Source: Price, 1979; Hugo, 1986; ABS Overseas Arrivals and Departures Bulletins; DIMA, 2000b.

The move towards a more skilled migrant intake is evident in census data relating to persons born overseas and resident in Australia for less than five years. Table 4 shows the educational level of recent migrants at the 1981, 1986 and 1996 censuses. There is a clear pattern of improvement in the educational profile. However, the increased shares are concentrated in the degree/diploma sectors, with an increase from 14.2% of recent migrant workers in 1981 to 36.5% in 1996. On the other hand, the proportion with certificates fell from 19.7% to 12.1% owing to the reduction of the significance of manufacturing in the economy over the last two decades. Because of shifting classification systems, it is less possible to show shifts in the occupational profile over the same period. Nevertheless, Table 5 shows the increasing representation of professionals among recent migrant workers.

An increasing proportion of Australia's skilled migrant workers obtains onshore approval, with persons entering Australia under another visa category and then applying to settle in the country. In recent times, this process has been made easier for some groups. For example, overseas students who graduate from Australian universities can readily gain entry; their qualifications do not have to be assessed. The assessment of qualifications of immigrants is an issue of concern. The degree to which qualifications must be assessed varies with the type of skill of the immigrant. In some areas (*e.g.* information technology) there is little professional regulation while in others (*e.g.* medical doctors) there is a high level of professional assessment and regulation.

Table 4. Overseas-born persons in workforce resident in Australia for less than five years, by educational category, 1981, 1986 and 1996
Percentages

Educational category	1981	1986	1996
Higher degree	2.3	2.5	5.8
Graduate diploma	0.7	0.6	1.3
Degree	6.7	8.1	18.9
Diploma	4.5	4.7	10.5
Trade certificate	10.1	8.7	9.4
Other certificate	9.6	10.4	2.7
No qualifications	66.1	65.0	51.4
Total	100.0	100.0	100.0

Source: Australian Bureau of Statistics, 1981, 1986 and 1996, One Percent Sample Tape of Population Census.

Table 5. Overseas-born persons in workforce resident in Australia for less than five years, by occupation, 1986 and 1996
Percentages

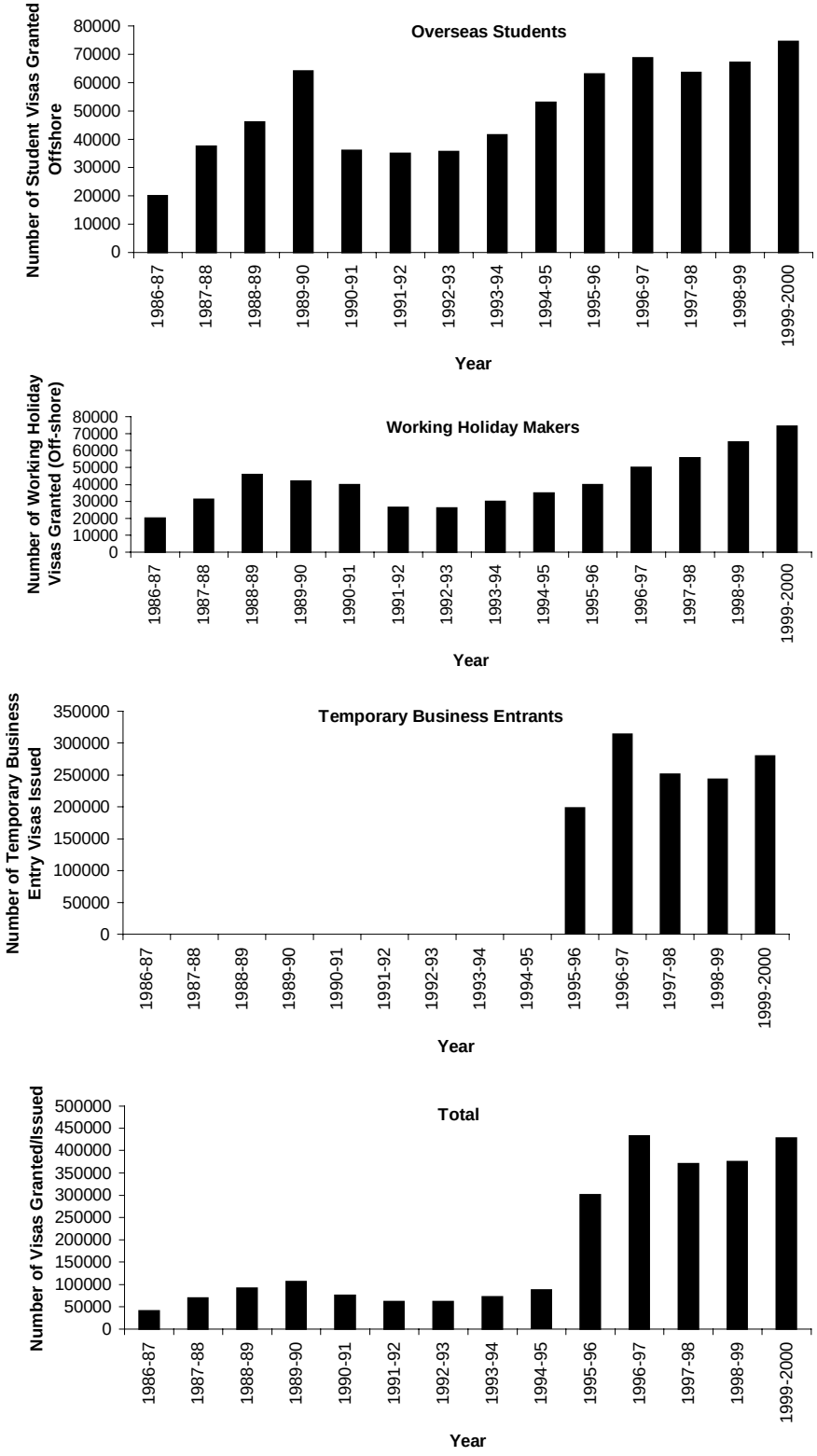
Occupational category	1986	1996
Managers, administrators	8.4	5.6
Professionals	14.5	22.7
Associate professionals	6.1	10.4
Trade and related workers	15.9	13.3
Advanced clerical and services		3.0
Intermediate clerical, sales	14.5	14.0
Elementary clerical and sales	13.3	7.6
Intermediate production and transport		10.4
Labourers and related workers	27.2	13.6
Total	100.0	100.0

Source: Australian Bureau of Statistics, 1986 and 1996, One Percent Sample Tape of Population Census.

Temporary worker migration

In post-war Australia there has been bipartisan agreement that permanent settlement of a significant number of overseas migrants is desirable. Accordingly, each post-war government has had an active immigration programme; the non-permanent labour migration encouraged by some other OECD countries during this period was strongly opposed. The permanent settlement paradigm clearly dominated Australian thinking and policy regarding international migration. There has, however, been a change (Hugo, 1999b). In response to important changes in the Australian economy, internationalisation of labour markets and globalisation forces more generally, there has been a major shift in policy which has allowed the entry of large numbers of people who have the right to work in Australia on a non-permanent basis. Figure 5 depicts recent trends in the major non-settlement categories under which people may enter Australia and be allowed to work. It is argued elsewhere that this represents a fundamental change in Australian immigration policy (Hugo, 1999b). Nevertheless, this type of visa entry has not been extended to unskilled and low-skilled areas; it has only been open to people with skills in demand and entrepreneurs.

Figure 5. Non-permanent migration to Australia of persons with the right to work by category, 1986-2000



Source: DIMA, *Population Flows: Immigration Aspects*, various issues.

A major watershed in Australian post-war immigration policy occurred in 1995 when the Labour government received a report headed by Mr. Neville Roach which recommended that the government:

> "fundamentally deregulate the rules governing temporary work visas for skilled business persons and specialist workers (mainly professional and managerial level workers, though trade level workers are eligible too)" (Birrell, 1998, p. 1).

As a result, in 1996, the new Coalition government put in effect most of the report's recommendations:

- Removal of previous restrictions governing the sponsoring of business people and specialists.
- Abolition of previous requirements that sponsors establish the lack of resident Australian workers available to do the work.
- Abolition of the requirement for some training benefit to Australian workers.
- Liberalisation of rules governing the sponsorship process.
- Establishment of a pre-sponsoring arrangement whereby employers can register as sponsors if they meet minimal requirements. They may then sponsor any number of the new "457" temporary entry category.
- A two-stage process was introduced for the entry of 457 workers: the sponsor nominates the position; if there is no objection from DIMA, the applicant can apply for a 457 visa.

The temporary business visa category was introduced in 1996 and, as DIMA (2000a, p. 48) points out:

> "The employer-sponsored temporary business visas allow employers to fill skill shortages from overseas and assess new ideas, skills and technology. The visa holders tend to be highly skilled and have relatively high income levels and [are] therefore able to contribute to economic growth through improved productivity and increased demand for goods and services. The entry of managers and skilled specialists under these categories can also enhance Australia's ability to compete in international markets."

In 1999-2000, a total of 35 006 temporary resident business visas were granted, an increase of 5.5% over 1998-99. The breakdown of occupations was as follows: professionals, 43%; associate professionals, 24%; managers/administrators, 24%; trades and related workers, 4%; other, 5%.

In fact, the top five occupations were: computing professionals (12.6%), self-employed (10.4%), general managers (8.3%), accountants (5.1%) and chefs (4.4%). The main countries of origin were: United Kingdom (23%), United States (10%), India (8%), South Africa (7%), Japan (6%), China (4%), Canada (3%), Ireland (3%), Indonesia (3%), France (2%).

There are three other categories of skilled temporary residents:

- Temporary resident medical practitioners are recruited to fill "area of need" positions, often for regional and remote areas. In 1999-2000, 2 515 visas were issued to 1 419 principal applicants and 1 096 dependants. The main origins are South Africa (19%), Indonesia (15%), United Kingdom (14%), China (8%), Singapore (6%), Hong Kong, China (3%), Chinese Taipei (3%), United States (3%), Malaysia (2%) and Germany (2%).
- Educational temporary resident visas were granted to 1 700 people to fill academic, teaching and research positions that cannot be filled from the Australian labour market.

- Independent executives come under a non-sponsored temporary visa that enables a person to enter Australia for the purpose of establishing or buying into a business and managing that business. In 1999-2000, 3 937 independent visas were granted. The main countries of origin were: South Africa (19%), Indonesia (15%), United Kingdom (14%), China (8%), Singapore (6%), Hong Kong, China (3%), Chinese Taipei (3%), United States (3%), Malaysia (3%) and Germany (3%).

Among the categories of temporary worker visas, one of the longest established has been that of students, especially from Asia. Students are allowed to work in Australia for up to 20 hours during term time and full-time during semester breaks. Over the 1987-99 period, the number of full-fee overseas students in Australia increased from 7 131 to 157 834 (DETYA, 2000).

There is undoubtedly a strong connection between student migration and eventual settlement of Asian origin groups in more developed countries like Australia. Students may overstay their education visas and gain a change of status to resident, or they may return to their home country on completion of their studies and subsequently immigrate officially to the country where they studied.

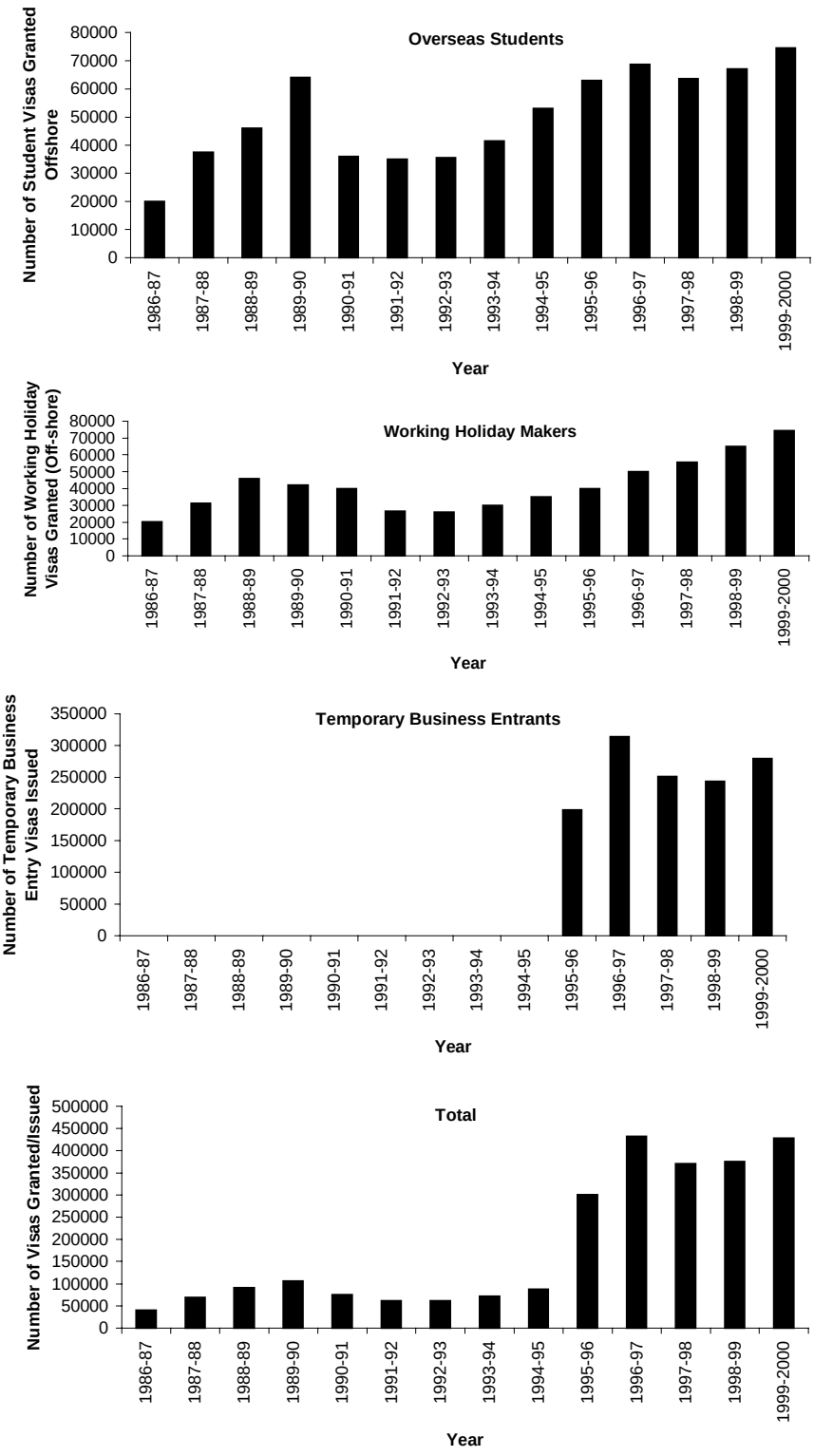
Figure 6 shows that there has also been a significant increase in working holiday maker (WHM) temporary migration in recent years. This has been comprehensively reviewed by the Australian Parliament Joint Study Committee on Migration (1997). WHMs are foreign nationals aged 18-30 from certain countries with which Australia has a reciprocal arrangement; they can work under certain conditions for up to 12 months. Their numbers have increased dramatically, more than doubling in the 1990s, and reached 74 454 in 1999-2000. Kinnaird (1999) reports that while the economic impact of this the migration is limited at national level it has significant impact in specific industries in specific areas. While Europeans dominate this category, there are significant numbers from Japan (8 510) and Korea (1 200).

Since 1995 there has been a new visa category of temporary business migrants. They are of five types:

- *Business visitors* who come for short periods and are in the short-term category.
- *Temporary business residents* who come for longer periods and are usually in the long-term category.
- *Independent executives* who enter Australia for the purpose of establishing, or buying into a business and managing that business.
- *Qualified general and specialist medical practitioners* where there is a demonstrated need for employing practitioners from overseas.
- *Educational*, for qualified people to join educational and research organisations to fill academic teaching and research positions that cannot be filled from the Australian labour market.

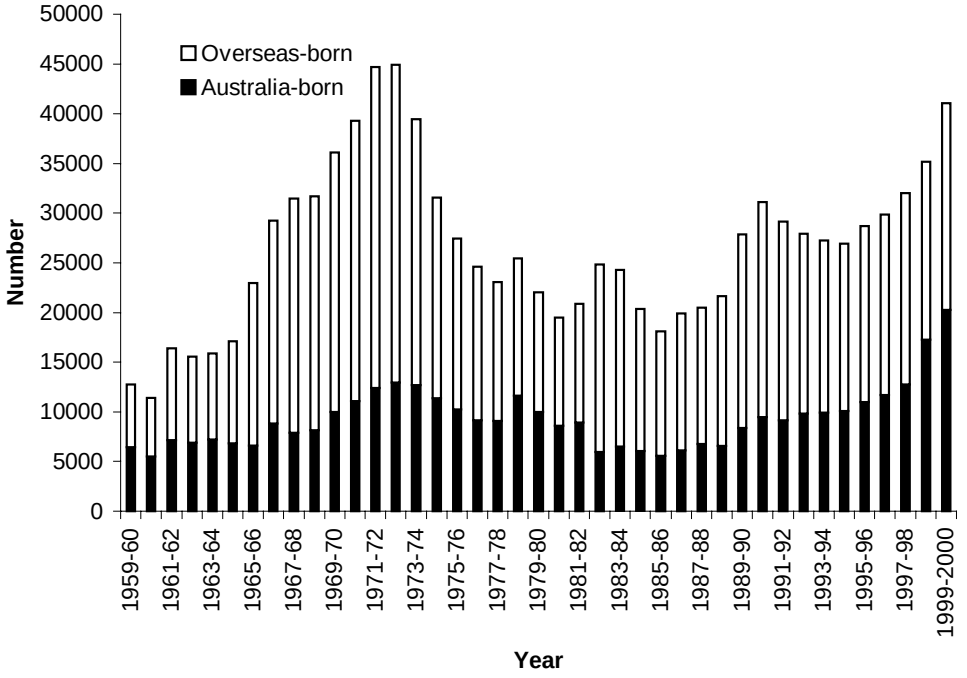
Figure 7 indicates there has been a fall in this category since a peak in 1996-97. In 1999-2000, a total of 236 085 business visitor visas were granted, 35 006 temporary business residence visas, 3 937 independent executive visas, 2 515 medical practitioner visas and 1 700 educational visas. Among the business visitors, North America accounts for almost one-quarter; the main Asian groups are from China (15%), Japan (7%) and India (5%).

Figure 6. Long-term migration to Australia by category, 1986-2000



Source: DIMA, *Population Flows: Immigration Aspects*, various issues.

Figure 7. Permanent departures of Australian-born and overseas-born persons from Australia, 1959-60 to 1999-2000



Source: DIMA, *Australian Immigration Consolidated Statistics* and *Immigration Update*, various issues.

Among the longer-term business residents, the United Kingdom provided almost one-quarter; the largest Asian groups are from Japan (6%), China (4%), India (8%) and Indonesia (3%). Table 6 gives the official estimates (DIMA, 2000a) of the stocks and flows of non-permanent entrants to Australia in 1999. At 30 June 2000, excluding New Zealand citizens, there were 513 900 persons in Australia on temporary visas. Of these, 181 900 had been in Australia for less than three months, 182 800 between three and twelve months and 149 200 for a longer period. The largest group came from the United Kingdom (76 100), followed by the United States (40 300), China (33 300), Japan (32 000) and Indonesia (31 300). At any one time, 2-3% of the Australian workforce is made up of people on temporary working visas.

Table 6. **Temporary entrants to Australia**

	Flow 1999-2000	Stock 30 June 2000
Visitors	3 057 147	184 270
Overseas students	74 428	121 140
Working holiday makers	74 454	45 264
Temporary business visitors	236 085	13 910
Temporary business residents	35 006	50 400
Bridging visa holders[1]	-	61 224
Social, cultural, international relations programme	37 880	24 590
Other	4 215	13 100
Total	3 519 215	513 898

1. Bridging visas provide lawful status to non-citizens who would otherwise be unlawful.
Source: DIMA, 2000a.

It is possible to examine the workforce characteristics of those with temporary visas who have the right to work in Australia. Table 7 presents information derived from passenger arrival and departure cards.

One difficulty with the information is the high proportion of "not stated" responses. A more comprehensive analysis would require examination of the visa application forms. Nevertheless, the occupational profiles presented in Table 7 seem indicative of actual patterns.

Table 7. Temporary entrants to Australia with the right to work by occupation, 1999-2000

Occupation	Working holiday makers		Temporary business entrants	
	Number	%	Number	%
Managers /admin	2 214	8.3	17 100	37.7
Professionals	7 652	28.8	16 270	35.8
Associate professionals	2 548	9.6	6 788	15.0
Tradespersons	3 024	11.4	1 020	2.2
Advanced clerical & service	1 214	4.6	458	1.0
Intermediate clerical & service	6 677	25.1	2 310	5.1
Intermediate product & transport	536	2.0	150	0.3
Elementary clerical, sales, service	2 106	7.9	1 038	2.3
Labourers	607	2.3	262	0.6
Total workforce	26 578	100.0	45 394	100.0
Not in workforce	15 182		18 326	
Not in employment	12 598		350	
Not stated	25 546		29 872	
Total	79 904		93 942	

Source: Unpublished data supplied by DIMA.

Among WHM, professionals and intermediate clerical and service workers appear to dominate. As would be expected, the profile of persons entering under the temporary business category is somewhat higher. Indeed, almost three-quarters of such entrants (73.5%) fall into the two highest status occupation categories of managers, administrators and professionals. This compares with 49.1% of permanent arrivals and 38.8% of the total Australian population. In sum, the impact of post-war immigration on the Australian workforce has been massive in both quantitative and qualitative terms. Over the post-war period, there have been large shifts in policy. Policy has shifted from an effort in the first 25 years to meet labour shortages to two decades of a focus on recruiting settlers with skills needed in the Australian labour market (in addition to family migration and humanitarian elements). Finally, in the 1990s, there has been a move towards a more flexible policy, designed to meet the needs of global labour markets and the internationalisation of economic activity, which incorporates both permanent and temporary immigration but increasingly focuses on specific skills.

Emigration

Australia tends to be categorised purely as an immigration country, but in fact, it also is a country of significant emigration. Table 8 shows that, in recent years, there have been substantial departures on a long-term or permanent basis. Former settlers have formed a major part of the outflow (see Figure 7). In 1999-2000, permanent and long-term departures (197 846) reached unprecedented levels, and the proportion of Australian-born among permanent departures reached its highest level ever (49.3%).

Table 8. Settlers and long-term migration, 1987-2000

	1987-88	1988-89	1989-90	1990-91	1991-92	1992-93	1993-94	1994-95	1995-96	1996-97	1997-98	1998-99	1999-2000
Permanent migration													
	143 480	145 316	121 227	121 688	107 391	76 330	69 768	87 428	99 139	85 752	77 327	84 143	92 272
Departures	20 470	21 647	27 857	31 130	29 122	27 905	27 280	26 948	28 670	29 857	31 985	35 181	41 078
Net	123 010	123 669	93 370	90 558	78 269	48 425	42 488	60 480	70 469	55 895	45 342	48 962	51 194
Long-term movement													
Arrivals	98 780	104 590	110 695	114 711	126 781	127 436	137 600	151 095	163 578	175 249	188 114	187 802	212 849
Departures	78 570	90 991	100 199	110 512	115 162	113 190	112 707	118 533	124 386	136 748	154 294	140 281	156 768
Net	20 210	13 599	10 496	4 199	11 619	14 246	24 893	32 562	39 192	38 501	33 820	47 521	56 081
Total permanent and long-term net gain	143 220	137 242	103 866	94 757	89 888	62 671	67 381	93 042	109 661	94 396	79 162	96 483	107275
% net migration from long-term movement	14.1	9.9	10.1	4.4	12.9	22.7	36.9	35.0	35.7	40.8	42.7	49.3	52.3

Source: DIMA, *Immigration Update*, various issues.

Table 9 provides occupational details on those leaving Australia permanently. It indicates that although Australia receives a net gain of all occupational categories, the occupational profile of emigrants is somewhat higher than that of permanent arrivals. The main difference is in the highest status manager/administrator category, which accounts for 18.2% of emigrants but only 12% of immigrants. Moreover, 61.7% of emigrants were employed before moving compared with 49.8% of settler arrivals.

Table 9. Percentage of arrivals and departures 1999-2000 by occupation

Occupations	Settler arrivals		Permanent departures		
	Number	%	Number	%	Difference
Managers & administrators	5 519	12.0	4 605	18.2	+914
Professionals	17 065	37.1	8 965	35.4	+8 100
Associate professionals	4 788	10.4	2 899	11.4	+1 889
Tradespersons	6 075	13.2	1 844	7.3	+4 231
Advanced clerical & service	1 395	3.0	990	3.9	+404
Intermediate clerical & service	5 487	11.9	3 483	13.7	+2 004
Intermediate production & transport	1 525	3.3	555	2.2	+970
Elementary clerical, sales, service	2 638	5.7	1 458	5.8	+1 180
Labourer & related workers	1 453	3.2	532	2.1	+921
Total workforce	45 945	100.0	25 351	100.0	
Total in employment		49.8		61.7	
Not in employment	4 134	4.5	569	1.4	+3 565
Not in labour force	41 228	44.7	15 079	36.7	+26 199
Not stated	965	1.0	79	0.2	+886
Total	92 272	100.0	41 078	100.0	+51 194

Source: DIMA, 2000b.

Settler loss has been an important feature of the post-war Australian migration scene, with around a fifth of all post-war settlers subsequently emigrating from Australia, most to their home country. Policy makers have been concerned about this loss (Hugo, 1994), which has a number of components: some migrants never intended to settle permanently in Australia, some who are influenced by family changes, others are unable to adjust to life in Australia, etc.

The pattern of settler loss varies among birthplace groups (*e.g.* it is high among New Zealanders but low among Vietnamese) but has tended to remain a relatively consistent feature of the post-war migration scene in Australia. The fluctuations in numbers are very much related to earlier levels of immigration. With an increase in the skill profile in immigration, an increase in settler loss can be expected, since skilled migrants are more likely to remigrate than family migrants.

Nevertheless, there has been a change, and a consistent increase, in the level of out-movement of Australian residents. This has begun to attract policy attention, since the departing residents tend to be younger and more educated than the population as a whole, and the issue of brain drain has arisen. There can be no doubt that the global migration system with respect to highly skilled labour has been transformed since the 1960s, when the first brain drain research was undertaken. Findlay (1990, p. 15) has summarised the situation as follows:

> "[P]rofessional transients are replacing settler migrants in the international migration systems of many countries. Where settler emigration is still permitted, it is skilled migrants who find it easiest and quickest to receive work and residence permits.... Most nations, however, do not continue to favour large scale settler

> migration and instead seek to meet specific skill shortages by permitting (if not promoting) transient skill movements. The transient skill flows already dominate the migration systems of some countries such as the United Kingdom.... They involve the international circulation of high level manpower between countries, with the migrants neither seeking nor being encouraged to remain in any particular place for a long time period. Foreign assignments are commonly for one to three years.... Given the circulatory nature of these high-level manpower movements, it has been suggested that these migration moves be seen as skill exchanges rather than brain drain."

Whereas in the 1960s the dominant form of professional international migration tended to involve permanent migration from less developed to more developed nations, the current situation tends to be characterised by a kind of "hypermobility" involving remigration and return (Richmond, 1991, p. 4). It is somewhat unrealistic to expect Australia not to be affected by this process and have its international migration of skilled groups dominated by traditional settler emigration movements. The great increase in highly mobile skilled labour has been encouraged by a number of developments over the last decade or so:

- The usurpation of many high-skill regional and national labour markets by labour markets that cross national boundaries.
- The internationalisation of capital.
- The exponential development of exchanges of all types owing to the development of communications.
- The reduction in the time and cost of travel.
- The expansion of multinational corporations.

In 1999-2000, 33.1% of all Australians leaving the country on a permanent or long-term basis (anticipated absence of over a year) went to the United Kingdom. The numbers have almost doubled over the last six years (Table 10). Women outnumber men, but out-movement of men has increased faster than that of women in recent years. The United States is the second most popular destination of Australian-born emigrants, with about a doubling in the numbers of young Australians going there (Table 11). However, women are less dominant than for migration to the United Kingdom.

Table 10. Permanent and long-term outmovement of Australian-born to the United Kingdom, 1994-2000

Year	Total	Sex ratio (men/100 women)	Percentage
1994-95	14 657	71.5	28.3
1995-96	15 873	70.2	29.2
1996-97	17 812	74.5	30.9
1997-98	21 209	80.1	33.7
1998-99	25 210	79.3	33.9
1999-2000	26 493	79.0	33.1

Source: DIMA Movements Data Base.

Table 11. Permanent and long-term outmovement of Australian-born to the United States, 1994-2000

Year	Total	Sex ratio (men/100 women)	Percentage
1994-95	6 495	96.3	12.5
1995-96	6 821	97.9	12.6
1996-97	7 526	105.9	13.1
1997-98	8 236	102.8	13.1
1998-99	10 164	101.7	13.7
1999-2000	11 472	96.6	14.3

Source: DIMA Movements Data Base.

It is important to examine the workforce characteristics of the Australian-born who move to other countries on a long-term or permanent basis. As Table 12 shows, the movement to the two main destination countries is dominated by the highly skilled. Almost 60% of workers going to the United Kingdom are in the manager, administrative, professional and associate professional categories, while 72.8% of these going to the United States are in those occupations. Only 37.7% of all employed persons in Australia are in these categories. Hence, it is very much a brain drain phenomenon. Moreover Table 13 shows that this selectivity characterises the flows to other destinations as well.

Table 12. Long-term and permanent departures of Australian-born to the United Kingdom and United States by occupation, 1994-2000

	United Kingdom		United States	
Occupation	No.	%	No.	%
Manager-administrator	9 782	10.2	4 914	15.8
Professionals	39 341	41.0	15 063	48.3
Associate professionals	8 238	8.6	2 709	8.7
Tradespersons	7 254	7.6	1 746	5.6
Clerks/sales/service/transport	29 415	30.7	6 348	20.3
Labourers	1 931	2.0	419	1.3
Total in workforce	95 961	(79.1)	31 199	(61.4)
Not in workforce	22 879	(18.9)	18 520	(36.4)
Not employed	716	(0.6)	316	(0.6)
Not stated	1 700	(1.4)	783	(1.6)
Total	121 256	(100.0)	50 818	(100.0)

Source: DIMA Movements Data Base.

The age of emigrants also needs to be considered. Table 14 shows the breakdown by age and sex of Australian-born persons leaving permanently or on a long-term basis for the United Kingdom and the United States. They are overwhelmingly young adults, but there are some significant differences. Two-thirds of the migrants to the United Kingdom are between 20 and 29. They are clearly part of the reciprocal movement of the WHM programme, *i.e.* they are young people on working holidays overseas who intend to return to Australia after a year or two. For the United States, instead, there is currently no such programme, so each person going there on a long-term basis needs to qualify to emigrate on the basis of work-related criteria. Those going to the United States are somewhat older; they are overwhelmingly already in the workforce, rather than recent graduates. Moreover, many young Australian families with dependant children are moving to the United States. The proportion of Australian-born under 10 years of age moving to the United States is twice that to the United

Kingdom. This is because young professionals, often with their families, dominate migration to the United States.

Table 13. Long-term and permanent departures of Australian-born to other areas by occupation, 1994-2000

Country	Total workers	Manager, administrative, professionals and para-professionals	
		No.	%
New Zealand	17 303	10 329	59.7
Germany	2 677	1 933	72.2
France	1 934	1 369	70.7
Other Europe	14 845	9 127	61.5
Singapore	7 876	6 566	83.4
Hong Kong, China	6 423	5 362	83.5
Malaysia	3 727	3 002	80.5
Japan	7 418	5 855	78.9
Other Asia	19 786	15 190	76.8
Other	35 491	24 720	69.8

Source: DIMA Movements Data Base.

Table 14. Permanent and long-term departures of Australian-born to the United Kingdom and the United States, age/sex structure

Age	United Kingdom				United States			
	M	F	Total		M	F	Total	
			No.	%			No.	%
0-9	4 252	4 238	8 490	7.0	3 531	3 559	7 090	14.0
10-19	2 453	4 064	6 517	5.4	2 098	2 434	4 532	8.9
20-29	31 998	46 178	78 176	64.5	7 669	8 701	16 370	32.2
30-39	9 685	9 703	19 388	16.0	7 129	6 428	13 557	26.7
40-49	2 649	2 702	5 351	4.4	3 233	2 825	6 058	11.9
50-59	1 035	1 283	2 318	1.9	1 327	1 109	2 436	4.8
60+	479	547	1 026	0.8	383	393	776	1.5
Total	52 551	68 715	121 266	100.0	25 370	25 449	50 819	100.0

Source: DIMA Movements Data Base.

Table 15 shows the age structure of the Australian-born moving on a permanent or long-term basis to the other major destinations. It shows that half or more are between 20 and 39 years old. There are some interesting variations. The smallest share in this age group go to New Zealand. This reflects the fact that 28.2% of the Australian-born moving to New Zealand are aged 0-9, as many of these children have parents born in New Zealand who return to their home country.

Table 15. Permanent and long-term departures of Australian-born to other areas by age structure

Destination	Percentage aged 20-29	Percentage aged 30-39
New Zealand	23.6	20.3
Germany	36.5	24.6
France	31.6	25.4
Other Europe	34.5	21.2
Singapore	20.1	27.5
Hong Kong, China	18.1	26.2
Malaysia	12.3	24.2
Japan	45.6	24.4
Other Asia	15.2	23.8
Other	25.4	21.9

Source: DIMA Movements Data Base.

The case of information technology workers

Like other nations, Australia is currently experiencing skill shortages in the information technology (IT) and telecommunications (T) industries. This is seen as a constraint to the growth of competitiveness of Australian industry and to the emerging information economy. Occupations involved in IT in Australia include: computing professionals, information technology managers, engineering technologists, technical sales representatives (information/communication), electrical engineering associate professionals, computing support technicians, electronic/office equipment tradespersons, communications tradespersons (NOIE, 1998, p. 3).

In 1998, total employment in these IT and T-related occupations was over 302 200, of whom 134 700 (45%) were computing professionals. Over the previous ten years, employment in these occupations grew by 46.4%. There are a number of indicators of a significant labour shortage in Australia's IT industry. In 1995, it was estimated that the number of computing professionals alone would increase from 79 400 in 1993-94 to 146 000 in 2004-05 (DETYA, 1995, p. 140). However, by 1998, there were already 134 700 (NOIE, 1998, p. 6). A study entitled *Future Demand for IT and T Skills in Australia* (AIIA, 1999) found that 360 000 were then primarily engaged in the IT and T industries and that the demand was likely to represent 29 700 in one year, 87 700 in three years and 169 000 in five years. This represents a growth in demand of around 9% a year; the current shortage of IT workers is generally considered to concern around 30 000 jobs.

Moreover, the demand for IT professionals is not being met by training within Australia. Birrell *et al*. (2000) have analysed the extent of IT training in Australian universities (Tables 16 and 17). They show a rapid increase in *both* commencements and completions in the IT area, but the figures do not come close to meeting the annual need of around 30 000 skilled people. Moreover, Birrell *et al*. argue that these figures are somewhat misleading in that a substantial share of the IT students in Australian universities are overseas students. In mid-1999 the government reversed its former policy that overseas students were required to leave the country on graduation for at least two years before applying for residence.

Table 16. Number of course completions[1] in IT[2] by local and full-fee paying overseas students, 1989-93 and 1993-98

	1989	1993	1998	Growth 1989-93	Share of growth (%)	Growth 1993-98	Share of growth (%)
Overseas	208	978	2 578	770	33.3	1 600	64.1
Local	2 588	4 110	5 007	1 522	66.4	897	35.9
Total	2 796	5 088	7 585	2 292	100.0	2 497	100.0

1. Includes undergraduate and postgraduate completions.
2. Includes students enrolled in courses reported by universities as field of study 0902 Computer science, information systems and field of study 040502 Business data processing.
Source: Birrell *et al*., 2000, p. 76.

Table 17. Commencements in IT in science, IT and business courses, 1990-99

								Growth 1990-99	
	1990	1994	1995	1996	1997	1998	1999	No.	%
Overseas	1 084	2 483	2 317	2 549	3 435	4 080	5 932	4 848	447.2
Local	9 060	8 696	9 502	10 643	11 039	11 274	13 531	4 471	49.3
Total	10 144	11 179	11 819	13 192	14 474	15 354	19 463	9 319	91.9

Source: Birrell *et al*., 2000, p. 77.

Indeed, after mid-1999, overseas students who pay full fees and graduate in IT and some other professional fields in demand in Australia have been encouraged to apply for permanent residence. Birrell *et al*. (2000, p. 81) report that in 1999-2000:

- There were 1 153 IT professionals who applied for settlement in Australia under the two points-assessed categories (independent and skilled Australian-linked categories).
- Of these, 708 received bonus points for having Australian qualifications: 188 from India, 92 from Hong Kong, China, 83 from Malaysia and most of the rest from East and Southeast Asian countries. Slightly less than half were recent graduates.

Hence only a small proportion of overseas IT students appear to take advantage of the new regulations. Birrell *et al*. also argue that the official IT enrolments (Tables 16 and 17) may exaggerate the degree of growth, since a rebadging of courses occurred in Australian universities in the 1990s. In summary, however, it is clear that the university system is not training sufficient graduates to meet the increasing demand for IT professionals.

Accordingly, considerable emphasis is being placed on international migration to meet the shortfall. In 1999-2000, 54.3% of the 92 272 settler arrivals in Australia were in the workforce prior to migration. The top three individual occupations were general managers (1 943 persons), computer professionals (1 778) and accountants (1 694). The computer professionals attracted to Australia as settlers almost all came under the two points-tested skill categories. The number of computing professionals coming to Australia under the temporary residence business visas in 1999-2000 was significantly greater than those coming permanently (4 411 persons). However, while 71.3% of all permanent and long-term temporary computer professionals arriving in Australia were in the long-term temporary category, this was the case for 43% of all IT and T people (DIMA, 2000a, p. 49).

On the basis of the available data, it is difficult to assess the patterns of migration of people with IT and T skills to and from Australia, since defining the category of workers is somewhat

problematical. The data used by NOIE (1998) to define IT and T occupations of persons leaving and arriving are different from those used by DIMA to define the sector. Accordingly, the data presented in Table 18 involve two definitions of IT and T workers. The NOIE definition is wider than that adopted in recent years by DIMA.

Table 18. Arrival and departure of permanent and long-term migrants with IT and T occupations, 1995-2000

Year	Arrivals		Departures		Net gain	
	Wider definition[1]	Narrow definition[2]	Wider definition	Narrow definition	Wider definition	Narrow definition
1995-96	5 946		3 318		2 628	
1996-97	6 062		3 912		2 150	
1997-98	6 189	4 708	4 477	3 743	1 712	965
1998-99		5 507		3 934		1 573
1999-2000		7 007		4 227		2 780

1. ASCO 1 definition includes data processing managers, electrical and electronics engineers, computing professionals, electronic engineering technicians, communications equipment trades, office equipment computer services and sales representatives.
2. ASCO 2 definition is more restrictive and includes information technology managers, computing professionals and computing supply technicians.
Source: DIMA unpublished data.

Nevertheless, some important trends can be discerned in the patterns of long-term and permanent movement of IT and T workers to and from Australia. First, there has been a substantial increase in the inflow of people with IT and T skills over the last five years. Second, the outflow has also been increasing; this reflects the high degree of turnover in the IT and T workforce internationally. Finally, there has been a substantial increase in net migration gain in recent years. Migration agents have actively recruited IT personnel for Australia from countries like India, and the results are evident in the increased inflow of IT professionals.

More insight can be gained from examining the involvement of IT professionals in different types of movement to and from Australia. Table 19 shows the breakdown of permanent and long-term movement in IT professions between 1997-98 and 1999-2000. With respect to permanent movement, Australia is experiencing a gain of IT professionals, despite significant permanent outmovement. Nevertheless, there has been a significant increase in net migration gain of IT professionals in the last year. While in 1997-98, all of the net gain in IT professionals was due to permanent arrivals, by 1999-2000 they accounted for only half. Hence, long-term movements of IT professionals have increased in significance in the last four years and have been an important factor in the growth of net gains of IT professionals from migration.

The changes in patterns of long-term migration of IT professionals shown in Table 19 are in line with an overall increase in non-permanent movement of migrant workers into Australia. However, in terms of the long-term migration of Australian residents and visitors, there is a net loss of Australian residents who are IT professionals through long-term movement. On the other hand, there is a significant return of Australian residents who are IT professionals, a sign that many Australians with IT skills who go overseas to work later return. It is apparent that the net gain of overseas visitors with IT skills who intend to stay in Australia for a year or more but eventually to leave has increased in recent years.

Table 19. Permanent and long-term arrivals and departures of IT personnel, 1997-98–1999-2000

	1997-98	1998-99	1999-2000	Percentage change	
				1997-98 to 1998-99	1998-99 to 1999-2000
Permanent arrivals	1 325	1 563	2 078	+18.0	+32.9
Permanent departures	593	765	700	+29.0	-8.5
Net permanent	732	798	1 378	+9.0	+72.7
L/T resident arrivals	1 823	1 361	1 896	-25.3	+39.3
L/T resident departures	2 277	2 372	2 302	+4.2	-3.0
Net L/T residents	-454	-1 011	-406	-122.7	+59.8
L/T visitor arrivals	3 148	2 583	3 033	-17.9	+17.4
L/T visitor departures	2 870	797	1 225	-72.2	+53.7
Net L/T visitors	278	1 783	1 808	+541.4	+1.4
Total arrivals	4 708	5 507	7 007	+17.0	+27.2
Total departures	3 743	3 934	4 227	+5.1	+7.4
Total net	556	1 573	2 780	+182.9	+76.7

Source: DIMA unpublished data.

Overall there has been an upswing in IT professionals moving to Australia on a long-term or permanent basis. There has also been significant outmovement involving both Australian residents and foreigners. It would seem, however, that the influx of IT professionals is still not sufficient to make up the shortfall between the demand and the output of training institutions. There is clearly a pressing need to increase the output of IT professionals from educational institutions.

Issues and policy questions regarding skilled migration

Immigration issues loom large in Australia, although the particular issues, and the debate they engender, vary from time to time. The level and nature of skilled migration to Australia is recognised as an important one in the Australian labour market and in national society and politics more generally. Some of the major issues relating to skilled migration that are of contemporary concern in Australia include:

- First, the balance between family and humanitarian elements of the nation's immigration programme and its skilled/economic aspect is a controversial issue. There has been a major shift in the last five years towards skilled migration. This is evident not only in terms of permanent migration but also in the explosion of temporary migration on the skilled migration side of the balance. Strong lobby groups support this change (*e.g.* governments, national and state, employers, etc.) but other groups believe there needs to be a shift back towards family and humanitarian migration (ethnic lobby groups, non-governmental organisations, etc.).

- Second, there is debate about to the extent to which the emphasis on skilled migration and the increase in the share of overseas-born migrants in the skilled labour force are being used to replace training the native workforce to adapt to the needs of the economy. This is a longstanding debate in Australia but has gathered importance in recent times. Birrell (2000), for example, has shown that in the rapidly expanding IT area, there has not been an adequate training response to the exponential increase in demand. The criticism is that Australia relies excessively on other countries for the workforce in strategic economic areas. Another

dimension relates to the failure to give native Australians an opportunity to participate in the new economy and their relegation to unemployment or a marginal position in the economy. Ideally, government policy should combine skilled migration with appropriate expansion of training activities.

- Third, the recognition of qualifications obtained in other countries is an important issue. Permanent migrants settling in Australia have long complained of not having their qualifications recognised by employers, professional associations or governments (*e.g.* Kunz, 1988). There have been efforts to improve the degree to which qualifications obtained overseas are regarded as equivalent to or better than those obtained in Australia (Iredale, 1997). There are considerable variations among particular skill areas in terms of requirements for formal recognition of qualifications. For example, the requirements for medical practitioners are extensive, while fewer demands are made of IT workers. However, it is important to point out that temporary migration involves no requirement for the recognition of qualifications but only nomination by a future employer.

- Fourth, some argue that foreign-born workers experience discrimination in the labour market. Although Australia and its states and territories have a strong battery of anti-discrimination legislation, such discrimination may still operate informally, so that it is not readily detectable and able to be addressed directly. As Australia has become more multicultural, discrimination appears to have declined.

- Fifth, there are concerns about temporary entry workers being tied to the employer sponsoring them. There is in fact some evidence that employers are turning away from the ENS and using the 457 temporary entry category to attract skilled workers – under the former, workers are not tied to employment with their sponsor; under the latter, they are. There is thus a danger that these workers may be exploited. There is no evidence of this in Australia, but there is in the United States (Martin and Lowell, 2000). There is also some concern that employers may prefer "tied workers" to native workers with the same skills.

- Sixth, there is some fear that education and training in certain areas in demand in the new economy (*e.g.* information technology) are too oriented towards overseas students and that sufficient places are not being provided for Australian students (*e.g.* Birrell, 2000). The recent changes that allow foreign students who graduate from Australian universities to remain and work in Australia are relevant in this context. Certainly, foreign students have concentrated in areas that feed into rapidly expanding parts of the labour market.

- Seventh, concerns are voiced about the role of recruitment agents in attracting foreign skilled workers. There is no doubt that there is increasing competition among destination countries for workers with skills which are particularly in demand. Recently, for example, there has been a scramble to attract Indian IT workers to a range of destinations. This has given an expanded role to intermediaries, migration lawyers, recruitment agents, etc., who have become an increasingly strong lobby for modifying immigration regulations and easing the entry of skilled immigrants into Australia.

- Eighth, an emerging area of debate relates to the emigration of skilled workers. A recently introduced innovation programme announced by the federal government had, as one of its objectives, to stem the flow of skilled young Australians overseas. However, it has been argued (Hugo *et al.*, 2001) that there is little value in governments attempting to stop recent graduates who seek to work overseas. Indeed, it is argued that this could be encouraged in order to allow young Australians to broaden and extend their expertise and experience and indeed expand and strengthen Australia's global linkages, especially in the economic sphere. On the other hand, there may be value in having policies which encourage skilled

Australians who are overseas to maintain strong links to Australia and which bring back skilled Australians later in their careers to contribute to the country's economic development.

- A final issue relates to the relation between temporary migration and permanent migration. Australia has had a policy shift towards non-permanent migration to attract skilled workers. To some extent, this reflects the fact that many skilled labour markets are international and temporary migration is in many ways better suited to competing globally for skilled workers than the longstanding settlement migration programme. Moreover, it is clear that some of the non-permanent entrants under the 457 temporary entry programme eventually decide to stay in Australia and apply for permanent entry. This is certainly the case in the United States where gaining temporary entry can be part of a deliberate strategy by migrants to settle permanently (Martin and Lowell, 2000).

There are definitely perceived advantages to temporary migrant workers, in that Australia does not have to pay for their training and those who are not needed at the end of their contract can be returned to their place of origin. However, the immigration programme may have goals other than to fill gaps in the labour market which temporary migration may not help to achieve. Are temporary skilled workers committed to national development, do they invest in housing and other elements of the social infrastructure, do they repatriate their earnings to their home country, etc.? These questions become particularly important when the goals of countries' migration programmes include "replacement migration" (United Nations, 2000). That is, in the face of declining and ageing populations in many OECD countries, they may be seeking to offset some of the detrimental effects of a declining workforce and of the ratio of the working age to the non-working, elderly population. Temporary skilled migrants are unlikely to have a major impact in this area, although they pay taxes while working in Australia and hence contribute towards the support of the older generation. Nevertheless, most will not bring families with them and will not contribute towards changing the balance in terms of the ageing of the population.

Conclusion

Australia has long been a country of immigration. However, immigration to Australia has dramatically changed in the last decade. In particular, it has become more oriented towards attracting skilled workers and it has increased substantially the proportion of workers who enter on a non-permanent visa. Unlike the other major changes that have occurred in Australia's post-war immigration, there has been little public discussion and scrutiny of these changes. Undoubtedly, the changes are an adaptation to an increasingly global economy and increased competition among countries for the limited international pool of highly skilled workers needed for the new economy. There has been a massive research effort to assess the economic impacts of permanent migration in Australia (see Wooden *et al.*, 1994, for a summary). However, there has been little effort to examine the impact of the new non-permanent worker migration. This research is urgently needed. In Australia, public debate on immigration relates almost entirely to permanent settlement; there is a need both to initiate and to inform discussion on the non-permanent migration of skilled workers.

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Chapter 18

THE CURRENT "GREEN CARD" INITIATIVE FOR FOREIGN IT SPECIALISTS IN GERMANY

by

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Introduction

More than 7 million foreigners reside in Germany (Table 1), and, like other European countries, Germany is reluctant to employ new immigrant workers. Recently, with an improving labour market situation and shortages of skilled labour occurring in certain sectors, a new immigration situation has arisen. Since August 2000, IT specialists from non-EU-countries may work in Germany for five years.

The regulation

Following complaints from firms that many IT jobs could not be filled and that the innovation, strength and competitiveness of German industry was being harmed, Chancellor Schröder announced in February 2000 a so-called "green card"[1] for foreign IT specialists, which allows them to work in Germany for a certain length of time. Since August 2001, a regulation is in force which makes it possible for specialists from non-EU countries to be employed in an IT activity for five years. Specialists in information and communication technology, such as specialists in software development, multimedia development and programming, the development of circuits and IT systems, and IT consulting, as well as systems specialists, Internet specialists and network specialists, are eligible. The "green card" regulation applies to foreigners from outside the EU and concerns:

- Persons with a degree from a university or polytechnic in the field of information and communication technology. It also applies to foreigners graduating from German universities and polytechnics (previously, they had to leave the country after graduating).
- Persons whose ability in the field is confirmed by an employer who agrees to pay an annual salary of at least DEM 100 000.

During the period of the green card, it is possible to change to another IT job in another firm. In this case, no effort is made to know whether a German or EU specialist would be available for the job and would therefore have priority. A self-employed activity is only possible under certain circumstances. The spouse may only take up employment after a waiting period of one year. At the start, a quota of 10 000 green cards was agreed. If there is further need, there are plans to increase the quota to 20 000. It is possible to apply for a first work permit until 31 July 2003.

Table 1. Non-nationals in Germany since 1960

Year	Foreign population[1] (thousands)	Non-national population as a percentage of total population	Foreign employees liable to social security contributions[2] (thousands)
1960	686.2	1.2	279.4
1968	1 924.2	3.2	1 014.8
1969	2 381.1	3.9	1 372.1
1970	2 976.5	4.9	1 838.9
1971	3 438.7	5.6	2 168.8
1972	3 526.6	5.7	2 317.0
1973	3 966.2	6.4	--
1974	4 127.4	6.7	2 150.6
1975	4 089.6	6.6	1 932.6
1976	3 948.3	6.4	1 873 8
1977	3 948.3	6.4	1 833.5
1978	3 981.1	6.5	1 862.2
1979	4 143.8	6.7	1 965.8
1980	4 453.3	7.2	1 925.6
1981	4 629.7	7.5	1 832.2
1982	4 666.9	7.6	1 709.5
1983	4 534.9	7.4	1 640.6
1984	4 363.6	7.1	1 552.6
1985	4 378.9	7.2	1 536.0
1986	4 512.7	7.4	1 544.7
1987	4 240.5	6.9	1 557.0
1988	4 489.1	7.3	1 607.1
1989	4 845.9	7.7	1 683.8
1990	5 342.5	8.4	1 793.4
1991	5 882.3[3]	7.3	1 908.7
1992	6 495.8	8.0	2 119.6
1993	6 878.1	8.5	2 150.1
1994	6 990.5	8.6	2 109.7
1995	7 173.9	8.8	2 094.0
1996	7 314.0	8.9	2 050.5[4]
1997	7 365.8	9.0	1 997.8
1998	7 319.6	8.9	2 023.8
1999	7 343.6	9.0[5]	2 015.1

1. 1960-84: 30.09; from 1985: 31 December of the year.
2. 1960-67: July; 1968-73: June; from 1974: December.
3. Since 1991, figures cover Germany as a whole.
4. Since 1996, figures cover Germany as a whole.
5. 30 September 1999.

Source: *Beauftragte der Bundesregierung für Ausländerfragen: Daten und Fakten zur Ausländersituation*, October 2000; Federal Statistical Office/Federal Employment Service.

The procedure

An IT firm applies to the employment office for a work permit. Within a week, the employment office verifies the following:

- The need for a skilled employee cannot be met by a domestic or an EU specialist.
- The applicant is qualified for the position. In order to assess this, it is necessary to have a certificate attesting to the fact that the applicant has obtained a university or polytechnic degree in information and communication technology. Alternatively, the firm may confirm an annual salary of at least DEM 100 000.
- The employer is not offering the foreign specialist less favourable conditions of work and pay than comparably qualified German specialists would receive. For this the employment office requires a description of the job to be filled.

On receiving a positive decision from the employment office, the employee can apply to the German embassy or consulate in his/her country of origin for a visa to enter the Federal Republic of Germany. After entering the country and registering at the residents' registration office and the aliens office, the foreign worker must apply for a residence permit from the aliens office within three months (= length of validity of the visa). This is granted if there are no reasons for refusal, such as criminal offences, etc.

Results to date

From the introduction of the green card initiative (1 August 2000) to the end of April 2001, almost 7 000 foreign IT specialists from outside the EU had taken up work (Tables 2 and 3). Half are concentrated in Munich, Frankfurt and Bonn-Cologne. Almost two-thirds are employed in firms with fewer than 100 employees, and most are men. Most of the IT specialists go to western Germany. One in eight received the work permit as a result of an agreement concerning an annual salary of at least DEM 100 000 (and did not necessarily study at a university or equivalent establishment). About one in seven had graduated from a German university or polytechnic. It is worth mentioning that the rejection rate is very low, well below 5%. Firms try to submit all the appropriate documents to obtain the desired work permits (green cards) as soon as possible.

If the rate at which green cards have so far been granted (600 to 800 a month) is maintained, the initial quota of 10 000 is likely to be exhausted in the autumn of 2001. Against the background of the needs announced by the IT industry – 75 000 IT job vacancies – this is not a high figure, given that, at present, only about 6 000 German IT students graduate each year from universities and polytechnics.

So far, the wave of immigration of IT specialists predicted by some politicians, who immediately called for a law to restrict immigration, has not occurred. The anticipated influx from India has stayed within limits, as the United States remains the preferred destination of Indian IT specialists. In the United States, English is spoken, there is an Indian community, the possibility of setting up one's own business is not ruled out and permanent settlement is possible.[2]

German firms are apparently satisfied with the procedures far.[3] There have been few complaints about too many rejections, bureaucracy or delays. Visas, work permits and residence permits have generally been granted quickly. The green card regulation stands out because it is clear and permits the control of inflows. These are important pre-requisites if the immigration policy is to be accepted by the population. The restriction of the stay to five years could dissuade many specialists from coming to Germany. In addition, the fact that it is difficult to become self-employed lowers the attraction.

Table 2. Green cards issued by country of origin, end of April 2001

Nationality	Total	Men
Bulgaria	228	184
Yugoslavia, Croatia, Bosnia-Herzegovina, Slovenia, Macedonia, Montenegro	446	377
Romania	631	548
Hungary	267	242
Czech Republic/Slovakia	463	440
Russian Federation, Belarus, Ukraine, Estonia, Latvia, Lithuania	1 004	898
India	1 403	1 291
Pakistan	118	117
North Africa (Algeria, Morocco, Tunisia)	242	224
South America	164	118
Others	2 022	1 708
Total	6 988	6 147

Source: See Table 1.

Table 3. Green cards issued by regional breakdown (*Länder*), end of April 2001

Regional State (Bundesland)	Total	Of which males
Schleswig-Holstein	64	56
Hamburg	244	219
Mecklenburg-Vorpommern	5	5
Niedersachsen	86	77
Bremen	10	8
Nordrhein-Westfalen	1 028	890
Hessen	1 518	1 347
Rheinland-Pfalz	148	126
Saarland	57	52
Baden-Württemberg	1 330	1 163
Bayern	2 030	1 800
Berlin	232	202
Brandenburg	29	26
Sachsen-Anhalt	5	5
Thüringen	28	24
Sachsen	174	147
Federal Republic of Germany	6 988	6 147
West	6 680	5 881
East	308	266

Source: See Table 1.

The green card initiative has triggered a new debate about German immigration policy. Whereas the public used to be generally reserved, the idea that targeted immigration is becoming sensible and necessary is gaining acceptance. This could cause problems for the green card initiative since it is an isolated, specific action. There are calls for extending the programme to other fields. If only certain sectors receive the work permit, other industries will demand the same right. Sooner or later, therefore, it will not be possible to avoid a coherent immigration law regulating who and how many may immigrate.[4]

ANNEX

PROVISIONAL APPRAISAL BASED ON A FIRST SURVEY AFTER SIX MONTHS OF THE GREEN CARD

An initial study was conducted among firms and holders of the green card.[5] It examines many aspects of the green card initiative. The survey team interviewed 700 employers who have taken on specialists with a green card and 500 green card employees. More than 70% of the firms and 35% of the green card employees took part in the survey.

The firms rapidly saw positive effects. Before the introduction of the green card, almost half of the firms interviewed had to turn down orders because of a serious lack of personnel. The search for suitable staff lasted on average more than 20 weeks, an unacceptable length of time for this rapidly growing and innovative industry. With the aid of the new work permits for foreign IT experts, it has been possible to fill job vacancies within six weeks. Of the firms interviewed, 82% said that this has clearly improved their competitiveness. As a result, one-third of the firms have invested in Germany and been able to expand. In numerous cases, plans to move business activities to another country have been withdrawn. Almost one-fifth of the firms interviewed gave such details. Without the opening up of the labour market, attractive jobs would have been lost or would not have been created. It is not necessary to explain in detail how negative the effect on Germany as an economic location would have been.

The employment of foreign specialists does not come at the expense of company-based additional training. This is only the case in 8% of the firms, and it is generally only temporary, until the order bottleneck has been reduced. Green cards and additional training are not incompatible, on the contrary. In many cases, the green card creates the conditions for investing once again in staff training. As far as the satisfaction of the employers and the green card employees is concerned, there is much positive feedback from both sides. Of the firms interviewed, 75% said that they were very pleased with the foreign experts' skills. Three-quarters of the firms and 82% of the green card employees would like to continue the employment beyond the period of five years.

The green card has already led to considerable employment effects in the run-up phase. Within only six months, some 17 500 jobs were created, 5 000 for green card employees and 12 500 for "local" workers. Demand is estimated to be considerably higher for 2001. Firms are expected to require 42 000 green card experts, who will bring about the creation of a further 76 000 jobs in Germany. The study also reveals one serious weakness, however: unlike other countries, Germany is still far from having professional recruitment strategies for specialists from all over the world. According to the study, this is also the decisive reason why the demand for staff cannot be met as quickly as necessary.

NOTES

1. The name was borrowed from the American green card. In the American context, a green card gives an immigrant the right to live and work in the United States permanently. After five years, the immigrant can apply for American citizenship. This differs from the German "green card", which is instead a temporary work permit.

2. Since the beginning of the 1990s, the United States has had a special immigration programme for foreign IT specialists (H-1B visa), 40% of whom are from India. The annual quota has been increased to around 200 000.

3. See the *Süddeutsche Zeitung* of 21 March 2001, "Aus der Green Card wurde eine Goldcard" ("The green card became a gold card").

4. An "immigration commission" has also already been established and is drawing up proposals for an immigration policy to be completed by mid-2001.

5. WIMMEX AG (2001), "6 Monate Greencard in Deutschland – Eine Zwischenbilanz", Munich, www.wimmex.com/.

Chapter 19

INTERNATIONAL MOBILITY OF HIGHLY SKILLED WORKERS: THE UK PERSPECTIVE

by

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Introduction

Economic migration to the United Kingdom has for the most part remained unchanged since the Immigration Act 1971 came into force in 1973. The immigration rules and the work permit scheme which has been in operation since 1 January 1980 have operated principally along the same lines since then. Any changes that have occurred have been uncontroversial, mainly because the principal beneficiaries of these changes have been from white developed countries. The lack of a policy of managed economic migration and the reluctance of successive governments to impose quotas have meant that the traditional debate on economic migration numbers, so prevalent in many EU countries, has remained off the political agenda.

Since 1997, however, the public debate on immigration has moved forward significantly. The debate has, surprisingly, been driven by the government itself as part of its review of the United Kingdom's competitive future. The conclusion that knowledge plays a central role in economic growth and that skills are key requirements for economic success is unsurprising. What has been surprising is the way in which the government has driven the re-evaluation of skills needs within the UK labour force in light of these developments. Nowhere has the disparity between the supply of and demand for these skills been so acutely highlighted as in the information technology, communications and electronics (ITCE) sector, which has experienced substantial growth in the last ten years.

Previously, arguments about benefits of economic migration and maximising its economic benefits had fallen on deaf years. In the past four years, the debate has moved on considerably. This may have also been due to the debate surrounding the large increase in asylum seekers arriving in the United Kingdom since 1998. Much has been said about the skills of many asylum seekers and refugees and the need to integrate these into the labour market, particularly in areas such as health.

The current UK government clearly believes that migrants can bring benefits to the economy, especially at a time of chronic labour shortage in respect of certain key skills. It has therefore moved to identify these shortages and formulate a strategy both for long-term answers, in the form of better training and education, and shorter-term answers, in the form of the use of overseas nationals who bring the skills and knowledge required to drive activity and growth.

This chapter examines the particular issues surrounding skill shortages in the ITCE sector in the United Kingdom and government initiatives to seek to attract the best possible skills to the United Kingdom. It looks at the shortcomings of previous work permit and immigration rules and at the changes made to respond to a changing economic climate.

Economic migration to the United Kingdom: a brief history

It should be stated at the outset that the United Kingdom has traditionally been a country of emigration and not immigration. Many British subjects born in Britain have historically sought employment and other opportunities abroad, principally in the Commonwealth, or served the Empire in its former colonies. Migratory movements to the United Kingdom before World War II were effectively driven by political or religious persecution and only involved small numbers. However, it should also be noted that the history of immigration law in the United Kingdom has often mirrored these migratory movements. The 1905 Aliens Act was the first attempt to control immigration, following the anti-Jewish campaigns in reaction to Jewish immigration from Eastern Europe between 1880 and 1905. Aliens were for the first time classed as desirable or undesirable based on whether or not they were in a position to obtain means of adequately supporting themselves and their dependants.

The end of World War II gave a significant impetus to migration to the United Kingdom, principally from the New Commonwealth countries.[1] For the first time, a British government actively recruited workers from its colonies to deal with the wartime labour shortage. These economic migrants found employment extremely easily and were well received into British society as partners in the struggle to win the war. The ready acceptance of "colonial" migrants went some way towards attracting further migration throughout the 1950s, mainly into low- or semi-skilled work in the transport and health sectors. This type of migration was facilitated by British immigration and nationality laws.[2] Such post-war migration has traditionally been described as occurring in "waves", first from the Caribbean, then from India, Pakistan and Bangladesh. The standard theory has been that perceived racial tensions flowing from immigration led to restriction of the rights of Commonwealth citizens to come to the United Kingdom free of immigration control.[3] With the passing of the 1971 Immigration Act, immigration for economic purposes from the New Commonwealth largely came to an end.

In the meantime, aliens not from the Commonwealth were regulated by the Aliens Order 1953. Those wishing to work in the United Kingdom required the issuance of a work permit by the then Department of Employment and Productivity, which took into account the local labour situation. Such work permit holders were admitted for an initial period of 12 months and extended year on year until the completion of four years when restrictions on the time allowed to remain in the United Kingdom were usually removed.

With the 1971 Immigration Act, the situation of aliens and citizens of former Commonwealth countries effectively converged. All non-British nationals without the "right of abode" required work permits or permission to work or engage in business in a number of categories. Certain specific immigration categories were reserved for Commonwealth citizens.[4]

Since that time, it has traditionally been accepted that immigration policy had become settled as follows: first, that there was to be no more primary non-white immigration but some family reunion; second, that there was no major public policy discussion of the immigration system; and third, that there was no repatriation of immigrants or their descendants. This was underpinned by race relations and equal opportunities legislation which sought to integrate migrants into an increasingly diverse and multicultural society.

The idea that migration to the United Kingdom tailed off in the 1970s does not bear up to scrutiny. Migration flows into the United Kingdom did not drop substantially after 1971, and, in addition to the largely uncontroversial and predominantly white labour-related migration, there was substantial return migration throughout the period. Additional migration from (and to) Ireland has also taken place, as well as migration from EU member states. On the whole, the period from the 1950s to the 1970s was marked by net emigration, while in the 1990s net migration to the United Kingdom increased significantly.

Finally, it should be noted that post-war economic migration to the United Kingdom was marked by the lack of clear policy. Apart from a number of bilateral agreements for bulk recruitment of low-skilled labourers (for example from Italy), economic migration was neither formally organised nor subject to quotas. At the same time, the more permanent nature of economic migration to the United Kingdom, where permanent residence could be obtained after four years, was in marked contrast to other European countries (where temporary migration schemes predominated).

The regime for economic migration

The old work permit rules

The work permit system has been in operation since the 1950s. It was formalised in the work permit scheme in 1980, which set down clear criteria for the issue of work permits. Since then, it has effectively always taken into consideration local labour market conditions and been market driven. The system has not been characterised by quotas for maximum numbers of foreign nationals to be admitted to the United Kingdom for the purpose of employment. Migration for this purpose has effectively been controlled by an adjustment of the skills levels required to meet the criteria of the work permit scheme and by the definition of which posts are deemed to be "in short supply".

The number of work permits issued has fluctuated in accordance with UK economic conditions based on employer demand. The scheme has been characterised by the balancing of employers' need to recruit or transfer skilled workers from non-EEA (European Economic Area) states and protecting job opportunities for resident workers (including workers within the EEA).

The UK employer applies for a work permit for a specific employee and a specific post. Applications are assessed using the following criteria: first, whether there is a genuine vacancy for an employee; second, what skills, qualifications and experience are needed to do the job; third, whether the person is suitably qualified and experienced; and fourth whether there are suitably qualified and experienced "resident workers" available. Before October 2000, permits were only issued for workers with a degree or equivalent professional qualification; senior executive or administrative skills; highly qualified technicians with specialised or rare skills and key workers.[5]

Persons for whom a work permit was sought were expected to have substantial relevant experience, normally two years at the level of the post on offer. Postgraduate studies could count towards this experience. Where the person did not hold a degree, an alternative of five years senior (usually board) level experience was accepted. Permits were not issued for jobs at manual, craft or clerical-secretarial levels. Permits under the postgraduate Training and Work Experience Scheme (TWES) were also issued on the understanding that the trainees would leave the United Kingdom at the end of the period of training.

The employer had to satisfy the Overseas Labour Service (OLS) (as it then was) that the post in question could not be filled by a resident or an EEA worker. The post generally needed to be

advertised in a national newspaper and reasons for choosing the overseas national over and above any resident or EEA respondents had to be given. Work permits were issued for a period of up to four years. The work permit employee could then apply for permanent residence if still required for the employment at the end of the four years.

On 1 October 1991, a two-tier system was introduced, making it easier for employers to obtain work permits to recruit employees for high-level positions:

- Senior level intra-company transfers when the employee has worked for a wholly owned subsidiary or within a group of companies for at least six months.
- Posts at board level or equivalent for which there is no other suitable candidate.
- New posts central to investment projects bringing jobs and capital to the United Kingdom.
- Occupations which require high-level skills, qualifications and experience and which are acknowledged by the industry or profession as being in acute short supply (as designated by the OLS).

With regard to the acute short supply categories, these have historically been concentrated in the health sector (NHS). For example, on 4 April 1998, the list included intensive care, paediatric, neo-natal theatre and mental health nurses together with psychologists, occupational health therapists, veterinary surgeons, pharmacists and actuaries. Most of these posts have remained on the shortage supply list for a considerable time. However, the list did not contain any ITCE occupations.

Outside the acute shortage supply list, the practice has generally been that UK employers must demonstrate to the OLS that the particular skills required for the post on offer cannot readily be found in the United Kingdom and that advertising would be pointless. Generally, the OLS has dealt with these requests on a case-by-case basis and has, where necessary, consulted professional and sectoral bodies for confirmation of the lack of skills in the UK market.

In the case of the ITCE sector, the OLS deferred to the knowledge of outside professional bodies[6] when these bodies have confirmed that the skills required for the post were not available in the United Kingdom or EEA. This piecemeal consultation driven by individual applications made by employers has informed the OLS as to the categories to be listed in the shortage supply occupation. However, despite significant calls for placing many ITCE posts on the shortage occupation list since 1998 (principally due to the need to implement all Y2K solutions and growth in the sector), the OLS did not include any IT posts within the list until March 2000 (see below).

Sole representatives of overseas companies

The immigration rules have for a considerable time made provision for representatives of overseas companies to come to the United Kingdom to establish a branch or subsidiary. The current rules require the representative to be a senior employee with full authority to take operational decisions on behalf of the overseas firm. He or she must not hold a majority share in the overseas company. Applications by those with 30% or more of the shares in the overseas company have historically attracted close scrutiny, on the basis that the representative might be a significant owner of the business and would therefore be treated under the business rules. In fact, the rules on share ownership have been the greatest disincentive for overseas entrepreneurs with a significant shareholding in the overseas company who do not wish to invest their own money in the UK subsidiary (as required under the business rules, see below). In addition, the rules require the business

to remain centred abroad. This has caused difficulties when the UK subsidiary has been successful and the management of the company has moved to the United Kingdom. Again, these rules have dissuaded companies from investing in the United Kingdom.

The business rules

It should be pointed out that the UK immigration rules make provision for the entry and residence of businesspersons wishing to invest their own money (currently a minimum of GBP 200 000) in a new business in the United Kingdom which they effectively control and manage on a self-employed basis. These provisions[7] have changed little since the early 1970s except for increases in the minimum investment figure. This category has been dogged by lengthy delays in processing the applications in the United Kingdom and the failure of the Home Office (which administers this category) to recognise changes in the way entrepreneurs wish to conduct their businesses and their reluctance to commit their own funds to a new venture. The rules have effectively failed to take account of the increasing blurring of boundaries between employment and self-employment.

The investor rules

Finally, the 1994 immigration rules introduced rules for foreign nationals with GBP 1 million at their disposal wishing to invest GBP 750 000 in the United Kingdom by purchasing shares in British companies or UK government bonds. The category has excluded the investor from taking employment in the United Kingdom during his/her residence in the United Kingdom and has effectively been used by the extremely wealthy for the purposes of obtaining permanent residence and British citizenship in the long term. The rules have not sought to attract investment to any particular sector in the UK economy.

Criticisms of the immigration rules and the work permit scheme

As can be seen, the work permit scheme has not traditionally been geared to identifying skills shortages in the labour market and to adapting to a rapidly changing business environment. The rather *ad hoc* approach, while ensuring flexibility, did not provide employers seeking to recruit in areas with skills shortages with the certainty they required when seeking to employ highly skilled foreign nationals. Further, persons who had completed their vocational or professional training in the United Kingdom could not be retained under the TWES rules. In addition, the immigration rules' strict adherence to labels of "employed" and "self employed" failed to take into account changes in the way entrepreneurs might wish to structure their business and seek to attract investment to the United Kingdom.

Skills shortages in ITCE: climbing up the agenda

Overview: the ITCE sector to 1999

With regard to the ITCE sector as a whole, turnover in 1996 was GBP 92.4 billion with an added value of GBP 42.7 billion. This equated to 6.5% of UK GDP. In March 1998, around 872 000 people were employed in ITCE occupations,[8] with growth in employment in the sector well in excess of 10% a year between 1996 and 1998. Demand for Y2K solutions and possible entry into the European Monetary Union (EMU) drove employment growth and demand for ITCE skills up to 1999-2000.

Nevertheless, some research has indicated that the IT service industry alone would need to recruit over 340 000 people between 1997 and 2006.[9]

The UK approach has been to define skills shortages as occurring where there is a "genuine shortage in the accessible labour market of the type of skill being sought and which leads to a difficulty in recruitment". In addition, "skills gaps" have been defined as a deficiency in the skills of an existing employee or new recruit that results in the reduction of business performance.

With regard to skills generally, 68% of employers in 1998 believed that the skills required of their employees were increasing; 15% stated that there was a gap between the skills of current employees and those required to meet future business objectives.[10]

In April 1999, 19% of engineering firms expected a shortage of labour that would limit output (compared to 15% in manufacturing). Skills shortages were reported in the recruitment of skilled individuals for professional and technician posts, precisely those required for the electronics sector to move its manufacturing base into higher value added knowledge-based areas.[11] The supply of higher-level skills in the sector has shrunk in recent years despite the general expansion of higher education. While overall numbers entering higher education have increased substantially over the period 1990-97, the expansion of those entering engineering and technology courses has been minimal (and in the case of maths and physics, decreasing). This has been accompanied by a drop of 44% in the level of those pursuing vocational electronics HNC/HND (higher national certificate/higher national diploma) courses in the period 1995-98. Perceptions about pay levels in the sector, coupled with the requirement for qualification in maths (and in some cases, physics) were seen as dissuading new entrants.

Several surveys carried out in 1998 suggested that recruitment and retention problems in the ITCE sector had become much more acute in the period 1996-98,[12] while the National Expenditure Survey 1998 suggested that pay for computer analysts and programmers increased by 25% more than the national average in the period. While, as stated above, demand was driven largely by short-term problems (Y2K, EMU) it was particularly acute for systems development staff, fourth-generation language programmers and networking specialists, all posts oriented towards longer-term business needs. The IT industry also indicated that there were significant problems with attracting new entrants to what were perceived to be technology-dominated jobs.[13] Indeed, IT posts were regarded as less attractive than posts for funeral directors.[14] A clear problem for employers has been the lack of qualifications in the workforce. The 1996 Skills Audit found that the United Kingdom lagged behind competitors (United States, France, Germany) in the qualifications of its workforce (particularly in higher education and vocational training). For those higher-education graduates in computer-related courses, a considerable number chose not to work directly in the sector.

Assessing skills shortages

In order to address the issue of skills across the labour market, the National Skills Task Force was created in 1998. It expressed concerns about the availability of ITCE skills.[15] Next, the ITCE Skills Strategy Group was appointed by the Department for Education and Employment (DfEE) and the Department of Trade and Industry (DTI) in January 1999 to advise on national strategy to meet the skills need of the ITCE sector. While its conclusions as to the extent of the shortages were less clear, it acknowledged a long-term problem with the supply of skilled labour in the sector if growth was to take place as predicted. Importantly, it recommended that specific ITCE occupations should be designated as skills shortage areas for the purposes of the administration of the work permit scheme and that such shortage occupations should be agreed between the DfEE and sector organisations as matter of urgency.[16]

Motivation for change: the new economic drivers

Competitiveness White Paper

In 1998, the DTI published its Competitiveness White Paper (*Our Competitive Future: Building the Knowledge Economy*). The White Paper reiterated the importance of the emergence of knowledge-based economies and the central role of knowledge as a determinant of economic growth. The report stated that "investment in the generation of knowledge, the education and training of the workforce and exploitation of new ideas are now seen as a keen requirements for success". While recognising the strengths of the United Kingdom in a number of sectors, the report also recognised longstanding shortcomings in terms of productivity, innovation, investment and skills levels. Further, a slow uptake of digital technologies in the United Kingdom was attributed to insufficient skills, with the United Kingdom having the weakest IT skills in its workforce and academic shortages in the IT professions. One of the conclusions of the report was to examine "whether there is scope to lower barriers to immigration that prevent entrepreneurs and skilled professionals from coming [to] or remaining in the United Kingdom".

Budget 1999-2000

The pre-budget review in November 1999 marked the announcement of the government's thinking on immigration and skills shortages as well as innovation and investment. Under the title "Meeting the Productivity Challenge", the government recognised that United Kingdom needed:

> "to attract the most skilled and most enterprising people from abroad to add to the skills pool of resident workers. This will increase the quality of the United Kingdom's human capital and will allow greater economic activity and more employment opportunities for all in the longer term. Skilled foreign workers will help the United Kingdom address skill gaps, both where there are transient shortages in particular areas, for example among IT workers, or where skills shortages persist. The Government is therefore making it easier for skilled foreign workers in key areas to come and work in the United Kingdom, where they have the skills and attitudes to help generate an enterprise economy."

The following initiatives were announced:

- To add relevant categories of IT workers to the list of work permit shortage occupations as recommended by the IT, Communications and Electronics Skills Strategy Group report.
- To undertake a fundamental policy review of work permit arrangements, with a view to simplifying the process for employers and providing criteria which better reflect the global labour market.
- Following the DTI's Competitiveness White Paper, to consider recommendations to make the processes in the Immigration and Nationality Directorate more business friendly.
- To investigate ways to make it easier for foreign entrepreneurs and small investors to come and start businesses in the United Kingdom.

The results of consultations were announced in the 2000 Budget (21 March 2000). The Budget recognised skills shortages as an obstacle to productivity, growth and employment opportunities. While the shortages could be addressed partially through education and training, "access to skilled

people from overseas is also part of the answer. Equally important is to enhance the United Kingdom's image as an attractive location for talented overseas students and entrepreneurs". The Budget also set out the Government's thinking on the work permit system: "The United Kingdom has always benefited from a market-driven work permits system, so that employers can recruit skilled people from abroad without any artificial limits or quotas on the number of work permits that can be issued. This rationale will remain the same."

The Government therefore announced that it wished:

- To ensure that the work permit and immigration arrangements help attract overseas students to the United Kingdom and enable employers to recruit talented foreign graduates by: providing a more transparent path for those students whose skills are needed to switch to work permits without leaving the country; reviewing the TWES; and exploring other ways of making it easier for students with valuable skills to get permission to work.

- To make the shortage category list, which allows for streamlined applications, more responsive to emerging skills shortages by: implementing today new shortage categories for IT workers; and, for the future, by improving sectoral labour market analysis by the OLS to more rapidly identify skills shortages.

- To reduce the burdens on business by: eliminating the labour market test for extensions and changes of employment for work permit holders; eliminating the need for permits for supplementary work; increasing the maximum period for a work permit to five years; and introducing season tickets for workers who enter for short periods on a regular basis and explore the scope for more permit-free categories.

- To ensure that the system reflects current UK and global labour markets by: revising the skills criteria for business and commercial work permits; reviewing the current key worker category for less skilled workers; and redesigning the arrangements for entertainers.

- To maximise the benefit to the UK economy of a flexible and modernised UK work permit system by: marketing it more effectively at home and abroad; introducing electronic filing of applications; and improving the interface between the OLS and the Home Office, including providing a one-stop shop for applications and extensions from people already in the United Kingdom.

A number of pilot projects were also proposed:

- To allow multinational companies to self-certify entry clearance for intra-company transfers.

- To enable people of outstanding ability to gain entry clearance to seek work in the United Kingdom.

- To introduce a new category of "innovators", relaxing the capital requirements for entrepreneurs offering exceptional economic benefit, to come to the United Kingdom to set up high-tech businesses.

The realisation of these changes is discussed below.

The new work permit scheme

General changes

In March 2000, the DfEE announced the results of its review of the work permit arrangements.[17] This confirmed that work permit arrangements would continue to be driven by the labour market. A specific commitment was given to identify shortages in ITCE, with skills shortages being established more quickly and effectively through a rolling programme of sector analysis and consultation.

A new pilot scheme was launched to enable multinational corporations to self-certify work permits for their intra-company transferees. Work permit applications can now be made electronically. The OLS made substantial commitments to reduce processing times for applications.

Changes to the skills criteria

As from 1 October 2000, the skills criteria of the scheme were changed so that the prospective employee would only need to meet the following criteria: a UK equivalent degree-level qualification; or an HND level qualification which is relevant to the post on offer; or a HND-level qualification which is not relevant to the post on offer; plus one year's relevant work experience. Alternatively, the prospective employee would have three years' experience using specialist skills acquired by doing the type of job for which the permit is sought for least three years. This type of job should be at National Vocational Qualification (NVQ) level 3 or above and would include head or second chefs, specialist chefs with skills in preparing ethnic cuisine and those with occupational skills and language or cultural skills not readily available in the EEA.

The change in criteria marks a significant departure from the previous regime of degree plus two years work experience (or five years senior-level experience without a degree). It now means that overseas graduates can apply for a work permit on graduation (subject to the usual resident labour testing through advertising). This is partly driven by a wish to attract the best students to the United Kingdom, who might then wish to remain for work on graduation. In addition, the key worker category (and the three-year limit on key worker permits) was effectively removed.

As a result of this change, the training aspect of the TWES was incorporated into the main part of the scheme. This has therefore removed the requirement that those pursuing postgraduate vocational training leave the United Kingdom at the end of their period of training for two years before applying to return as work permit holders. The work experience aspect of the scheme has been retained, prohibiting those who have completed their work experience (typically 12-24 months) from remaining in the United Kingdom as work permit holders until they have been abroad for 12 or 24 months (depending on the length of their work experience).

Labour market testing through advertising is now no longer needed if the employer applies for an extension of an overseas national's approved employment when the job remains the same. Similarly, no advertising is needed when an individual changes employment within the existing employer's organisation, provided the job requires similar skills and experience. Supplementary employment with another employer in the United Kingdom is also allowed without the need for a work permit, provided the work is in the same field as the work permit employment.

Work permits can now be issued for five years (increased from four years). Additional changes also include the possibility of submitting applications for work permits electronically and new

procedures to speed up the endorsements of passports when permits are issued to those already in the United Kingdom.

Acute shortage skills

In March 2000, following the recommendation of the ITCE Skills Strategy Group, the shortage occupation list was altered to reflect ITCE skills shortages. For the first time, specified ITCE occupations, agreed between the DfEE and sector organisations, were set out in the list. These were:

- *IT manager*: normally a person with a senior role, typically with at least seven years' experience in an organisation in the field and with specific responsibility for planning, organising, co-ordinating and controlling IT projects and for the development, operation and support of IT applications systems and networks.
- *Analyst programmer*: normally a person with experience of both technical analysis and programming functions, playing a role in the technical aspects of delivering complete systems and with skills in one or more current technologies.
- *Business analyst*: normally a person combining both technical and commercial knowledge to define the commercial requirements and objectives for a significant part of a business system or application. Typically, the person should have at least five years postgraduate experience or three years if he/she holds a degree in systems analysis.
- *Database specialist*: normally a person responsible for the design, support and maintenance of corporate databases and usually with knowledge and experience of the utilisation of database software within various hardware configurations.
- *Network specialist*: normally a person involved in high-level design and installation of communication networks, including the provision of hardware and software and the provision of advice on overall security of corporate networks and associated operating and recovery procedures.
- *Software engineer*: normally a person with in-depth knowledge of operating systems, application software and software development tools and with responsibility for design and development of systems, including communications systems and networks.

Skills in the following technologies were stated as being in particularly short supply in these occupations: Active Server Pages/Active X, All Customer Relationship Management (CRM) and Computer Telephony Integration (CTI) packages (especially Siebel, Clarify, and Oracle CRM), C and C++ programming languages, Java/Java Script, Oracle, Peoplesoft, Perl/Perl Script, SQLServer, Visual Basic/Visual C++, XML/DHTML.

This list has been amended[18] to remove references to previous experience (for IT managers and business analysts) and to include Broadvision e-commerce tools as a listed shortage technology.

Employers wishing to employ persons in these categories must demonstrate that the post on offer meets the description set out above and that the employee meets the scheme's basic skills criteria. The post does not need to be advertised.

Shortages continue to be assessed on an ongoing basis. This is done on both a case-by-case basis (when an employer asserts that there is a shortage of certain ITCE skills) and through consultation with sector representatives.

Finally, it should be noted that visa procedures for those nationals requiring visas who have been issued work permits are also being reviewed. This is because visa-issuing posts in some countries, particularly the Indian sub-continent, require all visa applicants to be interviewed, often with lengthy waits. The procedures are being reviewed under the Foreign and Commonwealth's Business Express Programme.

New opportunities for entrepreneurs and the highly talented

The innovator category

On 25 July 2000, the UK Government announced a pilot scheme aimed at attracting entrepreneurs with new and creative ideas wishing to set up a business in the United Kingdom. The pilot scheme runs for two years, from 4 September 2000 to 4 September 2002. This new category was designed to attract entrepreneurs whose business proposals would lead to "exceptional economic benefit" to the United Kingdom, particularly in the areas of science and technology, including e-commerce. This new "innovator" category allows these entrepreneurs to come to the United Kingdom to set up a business without a minimum investment and without committing their own money to the business.

Applicants are required to show entrepreneurial ability, technical skills and a good business plan that can develop e-commerce or other new technologies in the United Kingdom. The application must meet four minimum requirements.

- The proposed business must create two full-time jobs for people who are settled in the United Kingdom. (These can be made up from a number of part-time jobs.)
- The entrepreneur must hold at least 5% of the shares in the company, which must be registered in the United Kingdom.
- The entrepreneur must be able to support and accommodate him/herself and any dependants without having to do other work or get help from public funds until the business provides an income.
- The entrepreneur must have enough money available (or agreed in principle) to finance the business for the first six months after arrival in the United Kingdom.

Applications are assessed using a points system. To qualify, the individual must have a minimum number of points in three different areas and achieve an overall score. The areas are:

- *Personal characteristics*, including work and business experience, proven entrepreneurial ability, educational qualifications (mainly in technology, science and business) and personal references.
- *Business plan*, including evidence that the business plan is realistic (technical, commercial and financial planning) and plans for creating a management team.
- *Economic benefit*, including the type and number of skilled jobs to be created, new and creative aspects of the proposals (for example, will it introduce a new technology, process or

product to the United Kingdom or to the business area?) and the amount to be spent on research and development.

Applications are made from abroad and are given priority, in contrast to "normal" business applications. Applications are ruled on by the Home Office and now take two weeks to process. An initial assessment showed that there had been a reasonable take-up, principally by US nationals with US venture capital funding.

Highly talented persons

Currently under discussion is a new category for "highly talented persons" to come and work in the United Kingdom. This is principally aimed at attracting knowledge, particularly R&D, to the United Kingdom. Although the criteria remain under discussion and no formal commitment has been made, this would allow individuals with a PhD, at least five years senior-level work experience and a record of significant achievement in their field to come to the United Kingdom to engage in work which requires or exploits their skills. They would also have to demonstrate a minimum earning figure of GBP 40 000 in the 12 months preceding the application (or that they were in the top 5% earnings bracket in their country). It is anticipated that the Home Office will take responsibility for this category.

Conclusion

On 11 September 2000, the Immigration Minister Barbara Roche MP set out the Government's position on future economic migration and formally launched the debate on economic migration. This debate had been ongoing in the United Kingdom for a considerable time, focusing both on legal and illegal migration, refugees and the ways of tackling skills shortages both at the top and bottom ends of the labour market. Her speech recognised the success achieved by migrants and the substantial economic benefit that they have brought to the United Kingdom. Reiterating the Government's position on the importance of skills in the knowledge-driven economy, the Minister remarked that:

> "as with other aspects of globalisation there are potentially huge economic benefits for Britain if it is able to adapt to the new environment. We are in competition for the brightest and best talents-the entrepreneurs, the scientists, the high technology specialists who make the whole economy tick. In order to seize the opportunities of the knowledge economy and to play a constructive part in shaping these huge changes, we need to explore carefully their implications for immigration policy."

The changes that have taken place to date mark a clear break with the past. Managing migration to the United Kingdom's benefit is now the driving force. The official debate has started and is ongoing.

NOTES

1. British colonies which achieved formal independence in 1950s and 1960s and subsequently joined the ranks of the Commonwealth (including India, Pakistan, West Indies, East Africa, South East Asia). It should be distinguished from the old Commonwealth (including Australia, New Zealand, Canada and South Africa).

2. The 1948 British Nationality Act provided the right to citizens of United Kingdom and colonies to enter, work and settle in Britain.

3. Commonwealth Immigrants Act 1962 and 1968.

4. UK ancestry provisions and allowing two-year working holidays.

5. These are defined as those with technical or specialised skills and experience essential to the operation of the employer's business. They need not hold high academic or professional qualifications but must possess specialised skills, knowledge or experience not readily available in the EEA. The jobs of others should depend on them. This category has been used for specific posts in hotel and catering and posts involving use of language skills. Work permits could not be renewed beyond three years.

6. In the case of IT, mainly to the Computing Services & Software Association (CSSA).

7. Paragraph 200, Statement of Changes in Immigration Rules HC 395, 23 May 1994.

8. "Skills for the Information Age", Final Report of the ITCE Skills Strategy Group (but see the Labour Force Survey 1998 figure of 750 000, which excludes some categories of IT workers).

9. Institute of Employment Research, University of Warwick.

10. Skills Needs in Britain Survey 1998.

11. EMTA, Labour Market Survey of the Engineering Industry 1998.

12. IT Skills Survey, Microsoft January 1998; Survey of Fringe Benefits, Additional Payments and Contract Staff 1999, Computer Economic Limited.

13. "Towards a National Agenda", First Report of the National Skills Taskforce, DfEE, 1999.

14. Mail of Sunday Survey, February 1999.

15. "Towards a National Agenda", op. cit.

16. Final Report of the ITCE Skills Strategy Group, DfEE 1999.

17. Outcomes of the Review of Work Permit Arrangements, DfEE March 2000.

18. April 2001.

ANNEXES

ANNEX 1

CURRENT REGULATIONS IN OECD COUNTRIES REGARDING POSSIBILITIES FOR STUDENT VISA HOLDERS TO CHANGE RESIDENCE STATUS, 2001

Country	Possibility of changing residence status
Australia	Students who have gained Australian qualifications are exempt from the skilled work experience requirement if they apply for a skilled visa within six months of completing their diploma. If eligible, they can apply for most permanent visas, *e.g.* spouse visas and skill under points-tested skilled entry.
Austria	No in general, but students graduating in IT can change their status and access the labour market. Free labour market access for students during their stay on the basis of an inter-university student exchange programme or EU educational programme. Seasonal work permits in tourism or in agriculture possible for all foreigners including foreign students and graduates.
Canada	Students can work (with employment authorisation) for one year after completion of post-graduate degree (no validation required).
Finland	Stay of foreign students is seen as temporary but students can apply for a permit on new grounds through a Finnish representation abroad. Students do not need a work permit for part-time work (max. 20h/week) during the academic year of his/her institution or during its holiday seasons.
France	Yes in general but students graduating in IT in France (engineers) can change status on simple request.
Germany	Yes after they have successfully passed their examination (new legislation).
Ireland	Employers may seek to have work permits issued in respect of students for jobs in their field of study and students in certain skills areas may apply for a work authorisation/working visa when they have an offer of employment.
Japan	Yes. Students may apply for residence.
Korea	Students who have gained a master's degree or higher in the field of IT can apply for a work permit. Those with a work permit can change their visa status from student to employment for a maximum of three years.
Mexico	Yes but no special procedure.
New Zealand	Yes, students may apply for residence. The General Skills Category (GSC) awards additional points for qualifications gained in New Zealand. In addition, students with a New Zealand qualification are not required to have any work experience to qualify under the GSC. Students may also apply to remain in New Zealand as temporary visitors or under work permit policy.
Norway	Yes, for students who have not received financial benefits from Norwegian authorities. No, for students who have received such benefits.
Czech Republic	Yes but no special procedure.
Switzerland	Yes but no special procedure (new legislation).
United Kingdom	In-country changes to work permit status for students completing degrees in the United Kingdom are allowed in certain circumstances. In general, in-country changes to work permit status are not allowed, except for trainees who can apply for a Training and Work Experience Scheme visa. Settling procedures are more flexible for Commonwealth, EEA and EU residents.
United States	Yes but no special procedure.

Source: OECD (NEIM), on the basis of information provided by SOPEMI correspondents.

ANNEX 2

CRITERIA FOR RECRUITMENT AND RESIDENCE OF SKILLED FOREIGN WORKERS IN SOME OECD COUNTRIES

Main categories of workers by country	General admission conditions and specific admissions	Availability of domestic workers as grounds for refusal	Quotas	Authorised length of stay and possibility of renewal	Possibility of family reunification
		Australia			
1. Permanent immigration programme					
1.1. Skilled-independent 1.2. Skilled-Australian sponsored	• Generally post secondary but in a small number of cases substantial work experience may be acceptable. • Minimum requirements on skill, age and English language ability. • Points test. Applicants are awarded points according to age, skill, English language ability and experience. Additional points awarded for applicants whose skills are in short supply in Australia, *e.g.* information technology, accountancy and nursing for spouse skills and where applicable for family links and language skills other than English. • Sponsorship (only for the category "skilled Australian sponsored") by a relative who is an Australian citizen or permanent resident.[1]	Sponsoring employers must demonstrate that job vacancies cannot be filled from the local labour market.	No. Planning levels adjusted subject to demand and economic and labour market needs.	Permanent.	Spouses, *de facto* partners and dependent children receive a visa at the same time as the skilled applicant as part of the family unit. Parents of the skilled applicant may be separately sponsored for permanent entry within capped numbers.
2. Temporary immigration programmes (Economic Stream)[2]					
Business entry visas and other temporary visas for skilled workers	Nominated by the employer.	Yes for non-key activities (except for skills that are in shortage). This is not required for key activities.	No.	Business entry visa: up to 4 years. Other temporary visas for skilled workers: up to 2 years. No restrictions on renewal.	Members of the family unit may be granted visas to join temporary residence visa holders in Australia. The application can be separate or combined with the main applicant.

Main categories of workers by country	General admission conditions and specific admissions	Availability of domestic workers as grounds for refusal	Quotas	Authorised length of stay and possibility for renewal	Possibility for family reunification
		Canada			
1. Permanent immigration programme					
1.1. Skilled workers	• Objective of post-secondary educational level as minimum. • Selection test that awards points on the basis of criteria such as level of education, linguistic knowledge, skills and experience. Family members of a person who has already settled in Canada receive supplementary points.	No.	No but planning ranges are given annually for each immigration category.	Permanent.	Immediate family members may accompany the principal applicant or may be sponsored at a later date.
1.2. Business immigrants (investors, entrepreneurs, self-employed)	Investors must make a minimum investment in a Canadian business, entrepreneurs and self-employed must be able to create jobs in Canada.	No.		Permanent.	Immediate family members can accompany the principal applicant or may be sponsored at later date.
2. Temporary immigration programmes					
2.1. Highly skilled temporary workers	Established by employer to Canadian standards.	Yes, even if there are many exceptions.	No.	3 years maximum (renewable).	Yes. Applications may be made for employment authorisation (no validation required).
2.2. Special pilot project for professionals in the field of software development	Post-secondary educational level.	No.	No.	3 years maximum (renewable).	Yes but not the right to work.
2.3. Temporary workers under NAFTA or the Canada-Chile Free Trade Agreement	Post-secondary educational level (list of occupations).	No.	No.	One year (renewable).	Yes but not the right to work.
		France			
General requirement	• The firm must exist for more than 3 years and have more than FRF 3 million of capital • An monthly wage equal or above FRF 25 000.	No.	No.	• For long-term contract, one year (renewable). • For short-term contract, 9 mos. (renewable). Total of 5 years.	Yes, application may be made for a one-year visa and a further application for family reunification.
Simplified procedure for IT Specialists	A degree in IT or equivalent professional experience and an annual salary above FRF 180 000.	No.	No.		

Main categories of workers by country	General admission conditions and specific admissions	Availability of domestic workers as grounds for refusal	Quotas	Authorised length of stay and possibility for renewal	Possibility for family reunification
		Germany			
Special programme for IT workers ("Green card" programme)	University or polytechnic level of education or an annual salary higher than DEM 100 000.	Yes.	20 000 (evaluation of the programme after 10 000).	5 years maximum.	Yes.
		Ireland			
Fast-track scheme for workers with special skills (IT specialists, Nurses, construction professionals, etc.)		No.	No.	2 years (renewable).	Yes after working in Ireland for only 3 months. Family members can then work if they apply for a work permit.
		Japan			
Engineers and specialists	College degree or at least 10 years work experience (3 years in some specific cases). Salary must be equivalent to that of a Japanese national worker in the same conditions.	No.	No.	1 year or 3 years (renewable).	Yes but family members are not allowed to work without authorisation.
		Korea			
Professionals and technicians[3]	At least 5 years work experience in IT or master's degree level with at least 2 years work experience in the relevant field.	No	No	Duration of stay is now permanent.	Yes.
		Netherlands			
Fast-track application process for IT specialists and nurses		There is a national labour market test but they are exempt from a regional labour market test.	No.	3 years (renewable).	Yes but family members cannot work without a work permit.

Main categories of workers by country	General admission conditions and specific admissions	Availability of domestic workers as grounds for refusal	Quotas	Authorised length of stay and possibility for renewal	Possibility for family reunification
		Norway			
Work permit delivered to workers with special skills	Usually at least 2 years of tertiary education. Special skills obtained through work practice may be considered. Applicants must hold a job offer by the employer or a standardised contract of service.[4]	Yes, the skill must be absolutely necessary to the activity.	No.	1 year (renewable). After 3 years, a permanent permit may be issued.	Yes.
		Switzerland			
Skilled workers (outside EEE[5])	Skills do not refer to a minimum educational level but to skills that are needed and evaluated locally.	Yes.	Yes, locally.	Depends on the sector of activity.	No.
		United Kingdom			
Simplified procedure for some highly skilled workers (Shortage occupation list), including some IT or communication specialists. Pilot project allowing people of outstanding ability to apply for entry and then seek employment	UK degree level qualification or higher national diploma plus one year of experience or at least 3 years of work experience in the field for which the permit is delivered.	Yes, not applicable in case of renewal.[6]	No.	The maximum period has been extended to 5 years. After 4 years, the worker has the right to settle (indefinite leave to remain) if they are still in employment.	Yes.

Main categories of workers by country	General admission conditions and specific admissions	Availability of domestic workers as grounds for refusal	Quotas	Authorised length of stay and possibility for renewal	Possibility for family reunification
		United States			
1. Permanent immigration					
Employment-based immigration (Green Card system for professionals with advanced degrees in sciences art or business, priority workers and other skilled workers)	N/A.	Yes.	Generally limited to 140 000 annual entries (including family members).	Permanent.	Yes.
2. Temporary immigration					
H-1B programme	Bachelor degree or 4 years of study at college level. 3 years of relevant experience can count as 1 year of college. Having an employment offer at the same conditions as nationals.	No.	Yes, 195 000 for the next 3 years. Jobs in non-profit-making organisations and universities are not included in this quota.	6 years. Residence allowed while immigrant application is being considered.	Yes but family members are not allowed to work without authorisation.
Temporary skilled immigrants accepted under NAFTA	Bachelor degree or 4 years of study at college level. 3 years of relevant experience can count as 1 year of college.	No.	No, except a quota for Mexican professionals (5 500) until 1 January 2004.	1 year renewable indefinitely.	Yes.

1. Applicants who meet the minimum skill, age and English language requirements, but who may not meet the points test can be eligible in the skilled-regional sponsored category if they are sponsored by relatives living in a designated area (Sydney, Newcastle, Wollongong, Perth, Brisbane, the Sunshine Coast and the Gold Coast are not designated areas).
2. Other more limited programmes (labour agreements, regional headquarters agreements) allow employers to negotiate with the Government the temporary entry (generally for 3 years) of skilled workers.
3. Immigration and emigration laws have recently been revised to facilitate the entry of personnel from these categories. More deregulation should promote the entry of IT specialists.
4. The application for a work permit must be lodged from the home country. The Public Employment Service provides assistance to employers who want to recruit staff members from European countries (excluding Nordic countries), especially for doctors, dentists, nurses and engineers. Nordic nationals do not need a permit to work in Norway. Other EU nationals only need an EU residence permit that may be issued while being in Norway.
5. No minimum skill level is imposed for EEA workers. The free movement of persons between Switzerland and the European Union should enter into force in 2001.
6. Fast track procedure (50% of applications are clear within a week and 90% in 4 weeks).

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