

Articles

Brain Drain and Brain Gain: The Migration of Knowledge Workers from and to Canada

Abstract

This paper examines available empirical evidence about the ‘brain drain’—the loss of knowledge workers from Canada to the United States, and about the ‘brain gain’—the gain of knowledge workers in Canada from the rest of the world. This evidence leads to the general conclusion that during the 1990s Canada suffered a net loss of skilled workers to the United States in several economically important occupations, although the numbers involved have remained small in an historical sense and small relative to the supply of workers in these occupations. Compared with the general population, however, emigrants are overrepresented among better-educated, higher-income earners and individuals of prime working age. Further, there was an upward trend during the 1990s in the number of people leaving Canada for the United States and other countries.

While losses of highly skilled workers to the United States accelerated during the 1990s, so too did the influx of highly skilled workers into Canada from the rest of the world. This is particularly true of high-technology industries where immigrant workers entering Canada outnumber the outflow to the United States by a wide margin. Indeed, immigrant high-technology workers represented an important part of employment expansion in these industries in the 1990s. Evidence also suggests that the labour market does not discern a quality difference between immigrant and native-born high-technology workers, as estimated life-time earnings of immigrant versus Canadian-born computer scientists are nearly identical.

Emigrants to the United States are more than twice as likely to hold a university degree than are immigrants to Canada. However, because of the overall greater number of immigrants, there are four times as many university graduates entering Canada from the rest of the world as there are university degree holders of all levels leaving Canada for the United States. The number of master’s and doctoral graduates alone entering Canada from the rest of the world is equal to the number of university graduates at all levels leaving Canada for the United States.

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1. BACKGROUND

The Canadian economy experienced a rapid increase in the demand for skill and knowledge in the 1990s (HRDC and OECD 1998). Virtually all job creation occurred in knowledge-based occupations—professional, managerial and technical. The employment rate among highly educated individuals (that is, the percentage employed) is much higher than among less educated people, and this gap is widening. Between 1989 and 1998, knowledge-based occupations gained 780,000 workers, while employment in most non-knowledge-based occupations declined (Graph 1). The employment rate of people with Grade 8 education or less fell from 60% in 1989 to less than 50% by 1998. On the other hand, the employment rate of people with a university education held steady at about 87%, even during the recession of the early 1990s (see Graph 2).

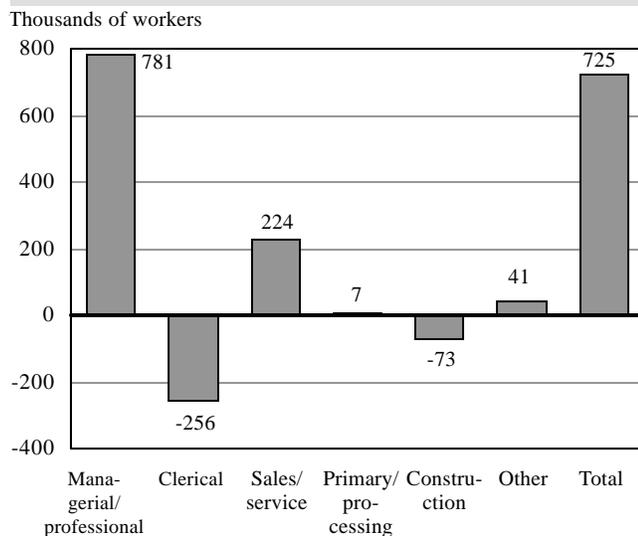
Partly in response to this increase in demand for higher levels of skill and education in the labour force, Canada has made huge additions to the stock of human capital. Both the incidence and average duration of initial education have increased to the point where Canada has

one of the most educated populations in the world (Graph 3). The students who flow out of the Canadian education systems and into the labour market are relatively highly qualified when compared with other countries' or with previous Canadian cohorts. Analysis performed by Human Resources Development Canada suggests that Canada does not suffer from any large-scale skill shortages at the aggregate level (Gingras and Roy 1998). However, this success comes at a cost—in 1995 Canada spent 7.0% of gross domestic product (GDP) on education, well above the mean of 5.6% for OECD countries.

Despite this positive picture at the aggregate level, it is clear that imbalances between the supply of and demand for skill exist in particular industries and occupations. For example, the Software Human Resources Council of Canada estimated a shortage of 20,000 computer programmers (Parsons 1996), paralleled by an estimate of 190,000 vacancies in the information technology sector in the United States (Miller 1997).

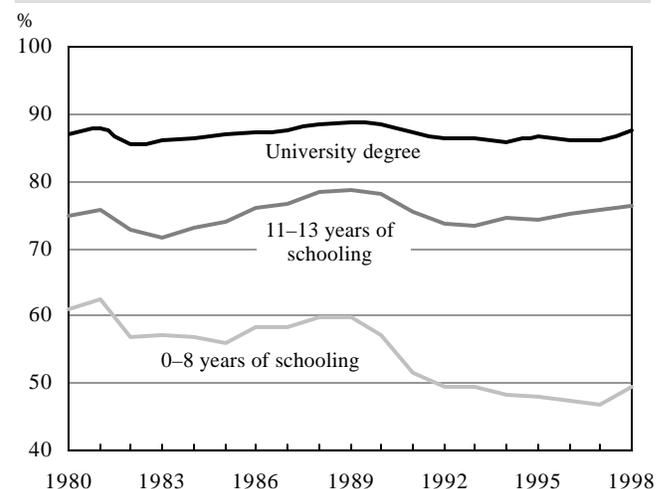
In this context we turn to the statistical evidence of the posited brain drain to the United States.

Graph 1
Change in full-time employment by occupation, 1989–1998



Source: Statistics Canada, Labour Force Survey.

Graph 2
Employment rate¹ by level of education, 25–44 age group



Notes:

See Table 1.

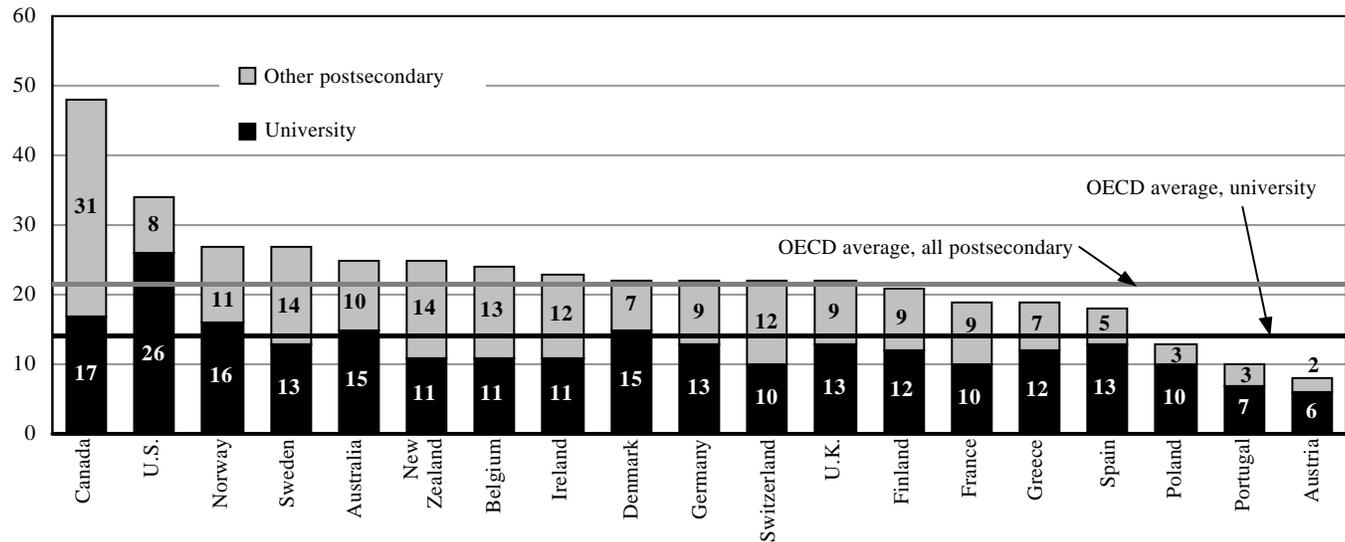
1. Percentage who are employed.

Source: Statistics Canada, Labour Force Survey.



Graph 3
Percentage of population aged 25–64 who completed university or other postsecondary education, OECD countries, 1996

% of adult population



Source: *Education at a Glance: OECD Indicators 1998*.

2 EMIGRATION FROM CANADA

2.1 Total emigration (permanent and temporary) to the United States

Traditionally, most people leaving Canada for the United States applied for permanent immigration. Temporary visas had limitations, such as restrictions on the number of renewals possible.

However, under the North American Free Trade Agreement (NAFTA), Canadian workers in qualifying professional occupations can readily gain entry into the United States, needing only to show proof of their qualifications and a job offer from an employer in the United States. Further, while the maximum validity for NAFTA visas is one year, there is no limit on the number of renewals. Hence, under NAFTA there may be more people remaining in the United States for an extended period of time without converting to permanent resident status. One might expect that a large increase in temporary migration (if it were a precursor to staying on in the United States) would eventually lead to a noticeable increase in permanent migration to the United States. The stability of the data on permanent emigration (1997 being the most recent year for which data are available) suggests we are not as yet witnessing such conversions on a large scale.

For these reasons, it is important to examine both permanent and temporary migration when estimating the magnitude and characteristics of outflow from Canada to the United States. The U.S. Immigration and Naturalization

Service (INS) provides reliable information on permanent migration from Canada to the United States. However, its data on temporary migration, while meeting the administrative purposes for which they were designed, do not provide a reliable count of people leaving Canada to live in the United States on a temporary basis. The limitations of these data are discussed in Section 2.1.3.

2.1.1 The magnitude of total emigration to the United States—consistent estimates from three data sources

Three sources of information exist on total migration from Canada to the United States (See Box on page 11). All of these sources have limitations. The estimates of both the U.S. Current Population Survey and the Reverse Record Check are subject to relatively high levels of sampling error. The tax data results are based on all filers, but without identification of the destination of movers, whether to the United States or elsewhere. However, it is possible to derive upper and lower bounds for tax filers who moved to the United States. The methodologies of these estimates are detailed in this section.

To reduce the sampling error of the CPS estimates, an estimate of the average number of Canadian-born people entering the United States per year during the 1990s has been constructed using CPS results from 1994 to 1999. According to the survey, in March 1994, 104,000 Canadian-born people had been living in the United States

Data Sources on Total Emigration

Current Population Survey (CPS): The CPS is a monthly survey of U.S. labour market conditions, carried out by the Bureau of the Census on behalf of the Bureau of Labour Statistics. Since 1994, a supplementary survey is conducted in March, profiling the characteristics of foreign-born people residing in the United States. This survey provides an estimate of the number of Canadian-born people who entered the United States during the 1990s and were still living there each year from 1994 to 1999. The CPS includes people whose usual place of residence for a period of six months or longer is the United States, and as such does not include people in the United States for shorter durations.

Reverse Record Check (RRC): The RRC is the means by which Statistics Canada estimates coverage in the Canadian Census of Population. The 1996 RRC included a sample of people residing in Canada at the time of the 1991 Census, as well as a sample of people entering Canada since the 1991 Census. Sampled individuals were contacted to establish where they had resided at the time of the 1996 Census. Those residing in Canada ought to have been included in the 1996 Census, hence among this group, those missed in the census provided an estimate of undercoverage in the census. A by-product of the RRC is an estimate of people who were living in Canada at the time of the 1991

Census or who entered Canada between 1991 and 1996, and who were residing in the United States at the time of the 1996 Census. The survey identifies (through a direct question) whether those who moved to the United States did so on a temporary or permanent basis.

Permanent movers are people who, at the time of the census, had left Canada with no intention of returning, as well as those who had resided outside Canada for at least two years but whose intentions about returning were unknown. Temporary movers are people who, at the time of the census, had resided outside Canada for at least six months with the intention of returning, or had resided outside Canada for no more than two years if their intentions were unknown.

Canadian Personal Taxation Data: All people receiving income from Canadian sources are required to file a Canadian tax return, including people leaving Canada during the tax year in question. For those moving from Canada, the date of departure but not the destination is captured on the tax form. For an income profile of movers in 1996 (the most recent year for which such data are available), we need to examine those who also filed tax returns in 1995 to capture a full year's income. About 96% of 1996 movers filed tax returns in 1995, hence this group is quite representative of 1996 movers.

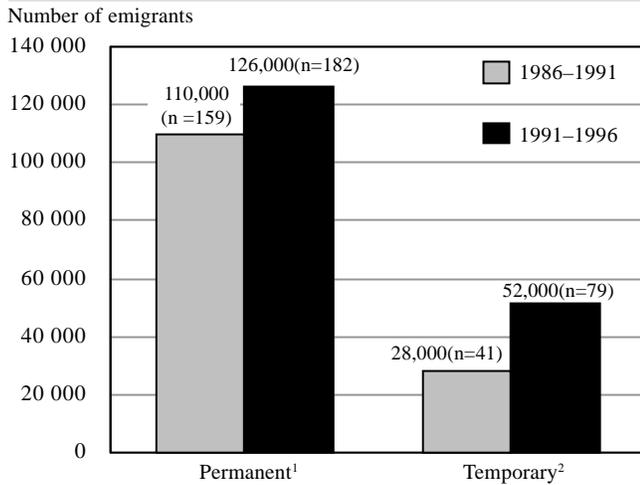
since January 1990. The implied annual outflow of people still residing in the United States over this period of four years and two months is 24,000. Similarly, the implied annual outflows of Canadian-born people still residing in the United States as derived from the 1995 to 1999 Current Population Surveys are 24,000, 17,000, 16,000, 18,000 and 20,000, respectively (see Table 2). Taking an average of the estimates from these annual surveys, the number of the Canadian-born who moved to the United States each year during the 1990s and who continue to reside in the United States is estimated at 20,000.

This estimate does not include non-Canadian-born people moving from Canada to the United States. Since the 1950s, the U.S. Immigration and Naturalization Service data on permanent migration from Canada as the country of last permanent residence have been consistently 40% higher than figures on migration of Canadian-born people. Hence, adjusting the CPS-based estimate of 20,000 Canadian-born upwards by 40% yields 28,000 as the estimate of the annual number of people (both Canadian and foreign-born) moving from Canada to the United States and continuing to reside in the United States during the 1990s.

The CPS data indicate a significant increase in the number of the Canadian-born who were living in the United States in 1998 and 1999 and who entered during the 1990s, but these estimates are based on very small samples and subject to a high degree of sampling error. However, the implied annual flow based on these two years of CPS data (see above) is virtually the same as that based on CPS data for the entire 1994 to 1999 period.

According to the Reverse Record Check, an estimated 178,000 people left Canada between 1991 and 1996 and were residing in the United States in 1996. Of these, 126,000 people expected to remain permanently in the United States, and an estimated 52,000 expected to return to Canada (see Graph 4). The implied annual average emigration of people continuing to reside in the United States from 1991 to 1996 may be estimated at around 35,000, of which 70% expected to be permanent. Emigration was 30% higher than in the period from 1986 to 1991 as estimated from the previous RRC. Between the periods, permanent migration increased by 15%, while temporary migration doubled.

Graph 4
Emigrants from Canada to the United States, 1986–1991 and 1991–1996



Notes:

n = sample size

1. Permanent emigrants are persons who, at the time of the census, had left Canada with no intention of returning, and those who had resided outside Canada for at least two years but whose intentions about returning were unknown.
2. Temporary emigrants are persons who, at the time of the census, had resided outside Canada for at least six months with the intention of returning, or had resided outside Canada for no more than two years if their intentions were unknown.

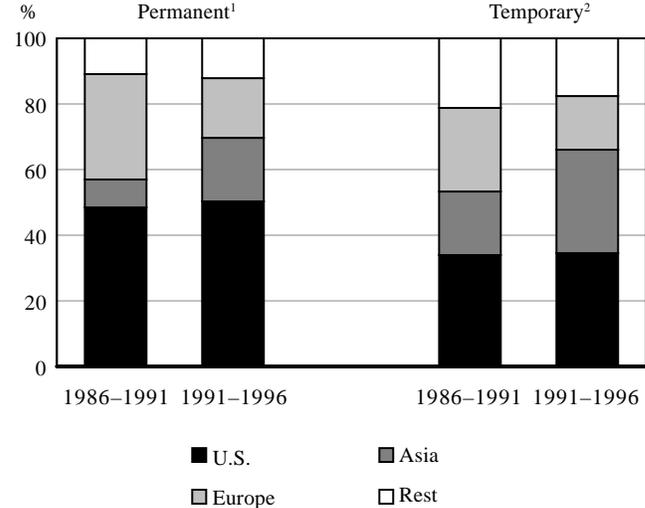
Source: Statistics Canada, Reverse Record Check Program, 1991 and 1996 Censuses.

The Reverse Record Check (RRC) reveals that between the two time periods, the share of emigrants to the United States remained constant, at half of all permanent emigrants and a third of all temporary emigrants. Over the same period, there was a noticeable shift from Europe to Asia in the destination of emigration. Among permanent emigrants, the Asian share increased from 9% to 19% while the European share dropped from 32% to 19% (see Graph 5). Among temporary emigrants, the Asian share increased from 20% to 31% and the European share dropped from 26% to 17%.

Canadian tax data provide estimates of the number of tax filers leaving Canada to all destinations during the 1990s. As these data are based on all tax filers and are therefore not subject to sampling errors, they provide a reliable trend over time in emigration of tax filers from Canada to all countries. It is worth noting, however, that tax filers need to identify themselves as movers, and there may be reasons (financial and otherwise) that could prompt filers not to make this declaration.

As shown in Graph 6, the data indicate that the number of tax filers who left Canada, whether permanently or temporarily, has increased steadily in recent years, from

Graph 5
Destinations of emigrants who left Canada, 1986–1991 and 1991–1996



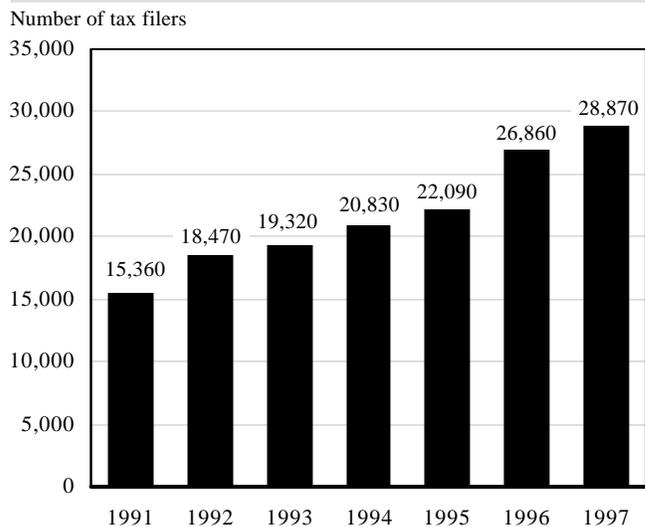
Notes:

See Table 3.

1. Permanent emigrants are persons who, at the time of the census, had left Canada with no intention of returning, and those who had resided outside Canada for at least two years but whose intentions about returning were unknown.
2. Temporary emigrants are persons who, at the time of the census, had resided outside Canada for at least six months with the intention of returning, or had resided outside Canada for no more than two years if their intentions were unknown.

Source: Statistics Canada, Reverse Record Check Program, 1991 and 1996 Censuses.

Graph 6
Tax filers who ceased to reside in Canada



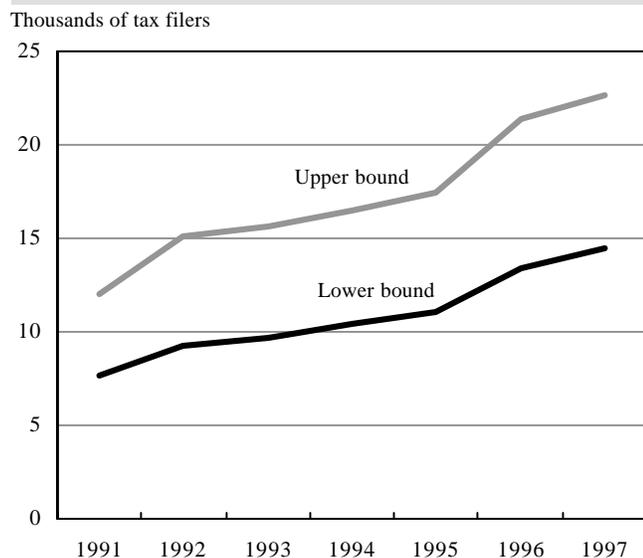
Note: Data based on Revenue Canada income tax files.

Source: Statistics Canada, Small Area and Administrative Data Division.

about 15,350 in 1991 to 28,900 in 1997, with an average of 21,700 per year. The only information available on the destinations of movers is the country from which the tax returns are filed, including a number filed from Canadian addresses. These filers may have used an accountant's or a relative's address in Canada to file their tax returns even though they are no longer residents of Canada, or they may have returned to Canada by the time of filing. Assuming that all tax filers who have filed from either a Canadian or U.S. address have moved to the United States yields an upper bound for tax filers who have moved to the United States. A lower bound on filers moving to the United States corresponds to half of tax filers leaving to all destinations; this is based on RRC estimates that between 1986 and 1996, half of all permanent migrants moved to the United States.

Graph 7 presents an estimate of the ranges of Canadian tax filers who may have moved to the United States between 1991 and 1997, under the above assumptions. The number of Canadian tax filers who moved to the United States can be estimated in the 8,000–12,000 range in 1991, increasing to the 14,000–23,000 range by 1997.

 **Graph 7**
Estimated number of tax filers who moved from Canada to the United States



Note: Data based on Revenue Canada income tax files.

Source: Statistics Canada, Small Area and Administrative Data Division.

From the averages of the lower and upper bounds between 1991 and 1997, the average emigration of tax filers from Canada to the United States may be estimated

to lie between 11,000 and 17,000. Since the tax filer data on movers show a one-to-one ratio between filers and dependents, the average annual emigration to the United States may be estimated to lie between 22,000 and 34,000 over this period.

In summary, estimates from all three data sources are consistent, placing annual average emigration to the United States in the 1990s in the 22,000 to 35,000 range. This is about 0.1% of the Canadian population—much smaller than what Canada has experienced historically. Nevertheless, tax filer data do suggest that there is an upward trend in total emigration (both permanent and temporary) from Canada in the 1990s.

2.1.2 Profile of emigrants (age, education, income and industries)

Age profile

Tax filer data based on the 1995 income and age profile of tax filers who left in 1996 show movers to be disproportionately in the 25 to 44 age group—at entry and mid-career levels—when compared with all Canadian tax filers. Close to 10,000 of those who left in 1996 were aged 25 to 34, while another 7,000 were aged 35 to 44; together they accounted for about two-thirds of those who left Canada, compared with only 44% of all tax filers. Some 4,000 people aged 45 to 54 left, representing the same share of movers (12%) as of all tax filers.

The Current Population Survey provides a similar age profile of Canadian-born people residing in the United States and entering during the 1990s, as shown in Table 2. As with tax data, overall CPS results portray emigrants to the United States as disproportionately in the 25 to 44 age group, which comprises about two-thirds of all emigrants to the United States.

Education profile

Current Population Survey results show recent migrants to the United States possessed very high levels of education—higher than those of both the Canadian-born population and recent Canadian immigrants. Among migrants to the United States aged 16 and over, for the period 1994 to 1999, nearly half (49%) had a university degree. From the 1996 Census, comparable figures were 12% for Canadian-born people and 21% among Canadian immigrants during the 1990s.

The high proportion of well-educated Canadians entering the United States in recent years may be partly the result of NAFTA provisions. NAFTA has made it much easier for university-educated Canadians (and college graduates in a few computer-related occupations) to live and work in the United States on NAFTA temporary visas,

while not making entry into the United States any easier for less educated Canadians.

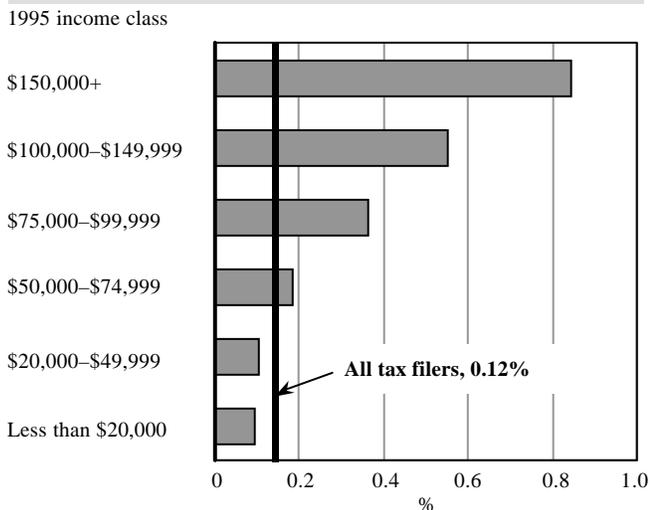
Income profile

Graph 8 gives the percentage of tax filers who left Canada in 1996 by 1995 income class. While movers represented only 0.1% of all tax filers, they were overrepresented among higher income earners. For example, tax filers who left Canada represented 0.9% of those reporting income of over \$150,000, and close to 0.6% of those with incomes between \$100,000 and \$149,999. Looking at this in

another way, movers were 7 times as likely as all tax filers to have incomes of over \$150,000 (4.0% of movers versus 0.6% of all tax filers). Similarly, movers were 5 times as likely to have incomes between \$100,000 and \$149,999 (4.0% of movers versus 0.9% of all filers).

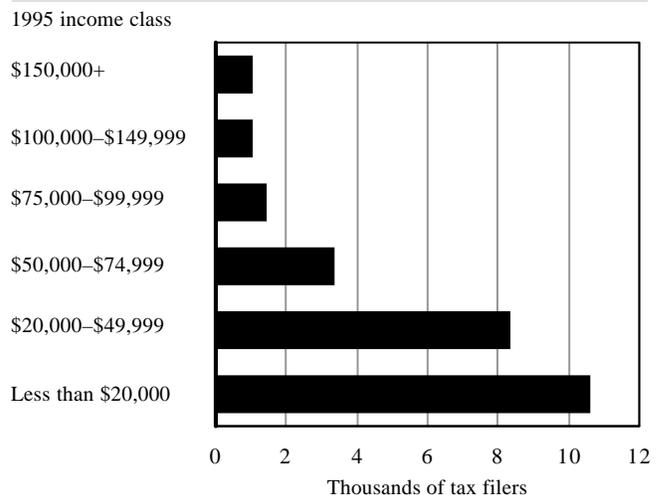
Graph 9 shows the number of tax filers who left Canada in 1996 by 1995 income class. Of the 25,700 who left, the majority, about 19,000, had incomes of less than \$50,000 in 1995, about 5,000 had incomes between \$50,000 and \$99,999, and a further 2,000 had incomes of \$100,000 or more.

Graph 8
Percentage of tax filers who ceased to reside in Canada in 1996



Notes:
See Table 4.
Data based on Revenue Canada income tax files.
Source: Statistics Canada, Small Area and Administrative Data Division.

Graph 9
Tax filers who ceased to reside in Canada in 1996



Notes:
See Table 4.
Data based on Revenue Canada income tax files.
Source: Statistics Canada, Small Area and Administrative Data Division.

Data Sources on Industrial Sectors of Movers

Data in this section are based on Revenue Canada T1 and T4 tax files and the Longitudinal Employment Analysis Program (LEAP) file, constructed by Business and Labour Market Analysis Division of Statistics Canada. The purpose of the LEAP file is to analyse the employment and income dynamics of employees in Canada, and the database includes a classification of employers by industry using the 1980 Standard Industrial Classification (SIC). The T1 file is built from individual tax returns to Revenue Canada, while the

T4 file is built from the T4 forms issued by employers concerning employees' income and deductions (CPP/QPP, EI, etc.). Linkage of these files has identified the SIC code of the employer of each individual. The SIC codes are associated with individuals' primary income in 1996. Two groups of tax filers were excluded in this linkage—individuals without any earned income and the self-employed who are not salaried employees.

Most of the analysis presented in this report examines brain drain and brain gain from the perspective of individuals. However, the issue can also be viewed from a business or industrial sector perspective. Such analysis is in its initial stages, using tax filer data (see Box on page 14). Industries (based on the 1980 Standard Industrial Classification codes) with the greatest number of movers in 1996 have been identified. Further analysis is planned to compare the industrial distribution of movers to that of all tax filers, in order to identify industries where movers are over-represented, and to examine trends over time.

The initial analysis (see Table 5) shows that, in 1996, 10 industries accounted for over one-fifth of the close to 27,000 movers. The industries with the most movers were Hospitals; University Education; and Elementary and Secondary Education. Also in the top 10 industries was a cluster of high-technology industries, including Architectural, Engineering and Other Scientific and Technical Services; Computer and Related Services; and Communication and Other Electronic Equipment. The other industries in the top 10 were Banks, Trust Companies and Credit Unions; Other Business Services; Federal Government Service; and Food Services.

In addition to the insights gained from an industrial perspective, this analysis also provides indirect information on the type of workers who are leaving. However the data need to be viewed cautiously. For example, not all movers employed by a university were necessarily full-time university professors; some may have been master's or doctoral students whose primary income was from teaching and/or research duties. Likewise, it would be wrong to assume all movers from high-technology industries are high-technology workers. Another limitation of the analyses undertaken thus far is the exclusion of the self-employed.

With these caveats in mind, this early work suggests that movers seem to be concentrated in knowledge-intensive industrial sectors. Most of the top 10 industries fall into high-knowledge industries as classified by Industry Canada (Lee and Has 1996).

2.1.3 U.S. Immigration and Naturalization Service data

In its annual Statistical Yearbook, the U.S. Immigration and Naturalization Service (INS) publishes numbers of both permanent and temporary visas issued to migrants to the United States, by country of origin. The INS data on permanent migration provide not only a reliable count of permanent migration from Canada to the United States, but also information on the occupation of the migrants. They are the principal data source used in the analysis of permanent migration in Section 2.2.2.

The INS data on temporary visas, while meeting the administrative purposes for which they were designed, do not provide a reliable statistical picture of the number of people leaving Canada for the United States per year. Moreover, for a number of reasons, the INS temporary data are of limited use, even as an indicator of trends in the temporary entry of Canadians to the United States. These limitations of the INS temporary data are discussed in this section. Appendix 2 provides INS temporary data to help in the discussion and illustration of these data limitations.

As opposed to a count of people, the INS temporary data are based on visas issued. General I-94 forms, used to capture all categories of temporary visas, are completed on initial entry to the United States and on renewal of visas that are done at border points. However, the data reported by INS make no distinction between initial entries and renewals.

To further illustrate this, consider the case of the NAFTA temporary worker visa, the so-called TN visa, which is valid for a maximum of 12 months. There are two ways TN visas can be renewed within this period—either by sending a renewal request to one of four INS service centres within the United States, or by exiting and re-entering the United States and getting a renewal at the border upon re-entry. The former method may take up to three months, while renewals can generally be done quickly at the border.

For renewals done at the central sites, no I-94 forms are generated and no counts are produced of the number of renewals. For renewals at the border, a new I-94 form is generated, hence these renewals are included in the count of temporary visas reported by the INS.

The INS data on temporary visas include visas issued in other circumstances. Individuals on temporary working visas are required to fill out a new I-94 form when they re-enter the United States after an absence of 30 consecutive days or longer. It is also becoming increasingly common for Canadians receiving income from U.S. sources to obtain a NAFTA visa. For example, a Canadian professor making three visits to the United States to give one-hour lectures for fees might generate three INS entries—but not a single stay of significant duration in the United States.

In summary, the INS figures on temporary workers, NAFTA or otherwise, do not represent the number of Canadian temporary workers going to the United States each year. These figures may include multiple entries made by the same individuals in a given year, as well as renewals made by the same individuals year after year. They also include an unknown number of single or multiple entries, involving very short stays.

Problems also arise in use of the INS temporary counts to illustrate trends over time in temporary migration to the United States. Increasingly, NAFTA visas are replacing the other categories of temporary visas. Given that NAFTA visas require renewal annually versus every three years for other visas, part of the overall increase in the number of temporary entries reflects more renewal activity in the larger NAFTA category.

Additionally, changes in U.S. immigration regulations regarding temporary workers from Canada to the United States may be resulting in increases in the total number of temporary visas that have nothing to do with the actual number of Canadians leaving to work in the United States. For example, in April 1997, the INS introduced stricter measures to crack down on visa overstaying. Changes in unpublished data provided to Statistics Canada by INS reveal a significant surge across all categories of temporary visas issued at that time, which subsided after a few months but was repeated around April the following year.

In summary, the INS data are not a reliable source of information on either the magnitude of temporary movements from Canada to the United States, or of their trend over time because of the many difficulties discussed above.

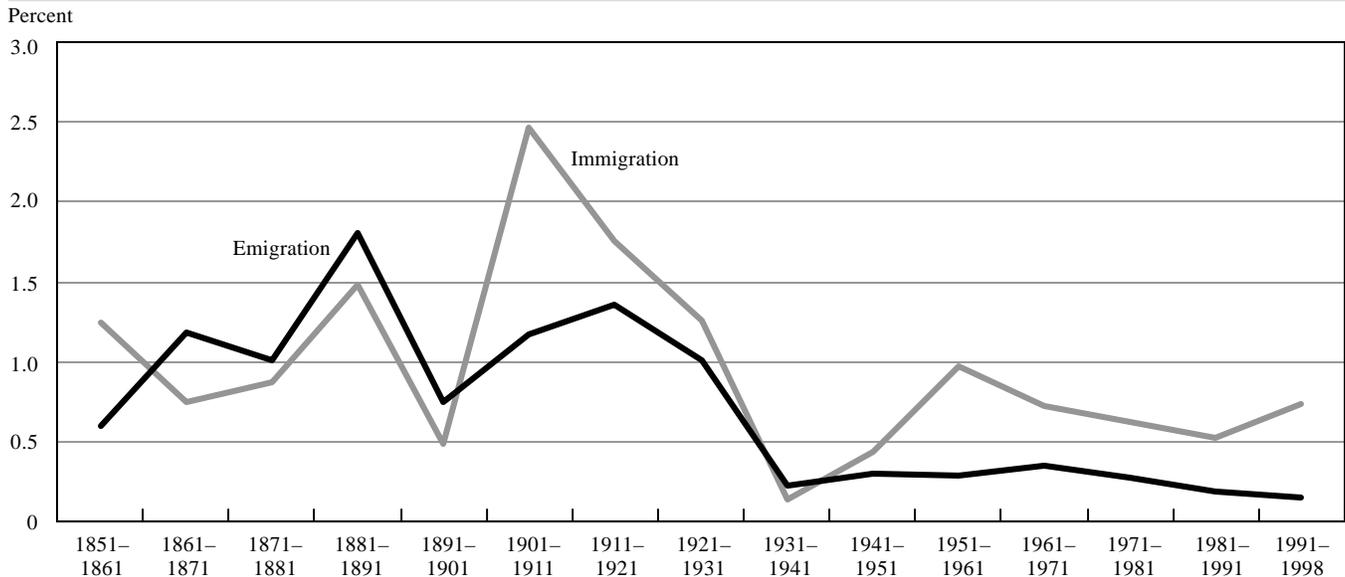
2.2 Permanent emigration

2.2.1 Magnitude of permanent emigration to all countries

Graph 10 clearly shows that as a share of the total Canadian population, permanent immigration (from all countries) and emigration (to all countries) have both decreased in recent years, compared with earlier in the 20th century. Permanent emigration per annum represented more than 1% of the Canadian population early in the century. By the 1930s it had dropped to about 0.35% of the population, holding steady at this percentage through the 1960s. By the 1990s permanent emigration had fallen to 0.15% of the population.

The only data available on total emigration (including both permanent and temporary) from Canada to all countries is that derived from the Reverse Record Check of the 1991 and 1996 Censuses. These data indicate that annual total emigration from Canada represented 0.22% of the population between 1986 and 1991, increasing to 0.27% between 1991 to 1996. Despite the small increase in the first half of the 1990s, emigration over this period was the lowest in Canadian history, and total emigration was a smaller percentage of the population than permanent emigration has been historically.

 **Graph 10**
Annualized permanent immigration to and emigration from Canada as a percentage of the population, 1851–1998



Note:

See Table 6.

Source: Statistics Canada, Demography Division.

2.2.2 Occupations of permanent emigrants to the United States

In this section we examine occupational data of permanent emigrants to the United States and immigrants from the United States. Earlier data may be found in Boothby (1993). It is worth noting that occupational data are not available for either temporary emigrants to the United States or emigrants to countries other than the United States.

Data Sources on Permanent Migration

The U.S. Immigration and Naturalization Service (INS) produces counts by occupation of permanent migrants whose last permanent residence was Canada. These data are produced annually for the United States fiscal year (October 1 to September 30), and are made available by the INS to Statistics Canada and to the public upon request.

Demography Division at Statistics Canada produces historical data on Canadian immigration and emigration.

The 1991 and 1996 Canadian Censuses are also used in this study. The censuses include variables on immigration status, year of immigration, educational attainment, occupation and income.

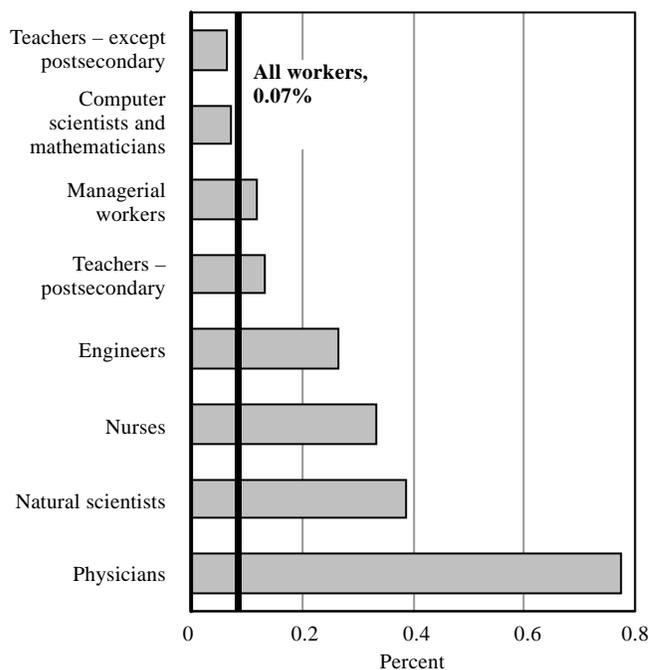
In 1996 and in 1997, total permanent emigration to the United States was equivalent to only 0.07% of the overall Canadian work force. Despite recent increases in knowledge-based occupations, permanent emigration remains small relative to the stock of workers in Canada. Physicians, nurses, engineers and scientists had the highest levels of emigration relative to the stock; however, these levels were less than 1% annually (Graph 11).

In the bilateral permanent migration of knowledge workers between Canada and the United States during the 1990s, Canada's largest losses were in the health professions, followed by engineering and managerial occupations (Graph 12). During the 1990s, there was a 19 to 1 ratio of physicians leaving versus entering Canada in the bilateral exchange with the United States, and similarly a 15 to 1 ratio of nurses, and 7 to 1 ratio of engineers and managerial workers.

Table 9 indicates an increasing trend in emigration in the 1990s among physicians and nurses. An average of about 150 physicians emigrated to the United States per year during the late 1980s, increasing to 450 per year in 1996 and 1997. Nurses leaving for the United States increased from 330 per year in the late 1980s, to about 750 in the early 1990s, and to 825 in 1996 and 1997. For



Graph 11
Annual emigration to the United States as a percentage of the Canadian work force in selected knowledge-based occupations, 1996–1997¹



Notes:

See Table 7.

1. 1996 to 1997 annual average for emigration; 1996 data for work force by occupation.

Sources: U.S. Immigration and Naturalization Service; and Statistics Canada, 1996 Census.

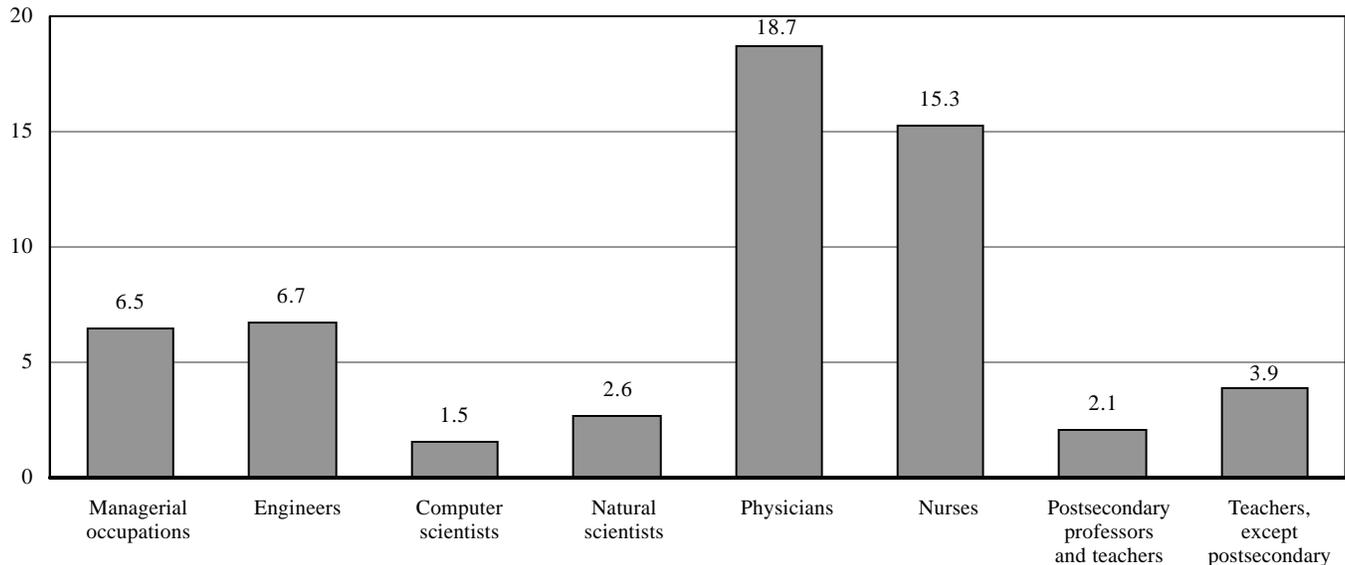
remaining knowledge occupations, the general pattern was for permanent emigration to increase from the late 1980s to the early 1990s, before decreasing somewhat in 1996 and 1997.

Relative to the supply of new graduates, the annual loss of physicians and nurses in recent years has been relatively large. Among physicians, the annual outflow was equivalent in magnitude to about one-quarter of the supply of new graduates, with about 450 leaving (1996–1997 average), compared with a 1995 graduating class of just over 1,700. Among nurses, the outflow was also equivalent to about a quarter of the new graduates, with losses of 800 compared with 3,000 graduates. The annual loss of engineers, computer scientists and natural scientists has been smaller relative to the new supply of university graduates in these fields. The annual average loss of engineers in 1996 and 1997 was equivalent to 4% of 1995 university graduates in engineering (12,300). The annual average loss of natural scientists in 1996 and 1997 was equivalent to 1% of 1995 university graduates in these disciplines (18,900).



Graph 12
Ratio of outflow to inflow from permanent migration between Canada and the United States, managerial and selected professional occupations, 1990–1997

Ratio of outflow to inflow (inflow = 1)



Note:

See Table 8.

Sources: U.S. Immigration and Naturalization Service; and Citizenship and Immigration Canada, Landed Immigrant Data System.

The bilateral exchange of postsecondary faculty between Canada and the United States has been more balanced, although during the 1990s faculty emigrating to the United States outnumbered those moving to Canada by a 2 to 1 ratio. Additionally, data of the Association of Universities and Colleges of Canada (AUCC) indicate that among faculty who left their positions (other than for retirement) in 1996 and 1997, senior professors were more likely to leave Canada than to move within Canada (AUCC 1997). Among faculty leaving their position, 58% of senior professors left Canada, compared with 40% of mid-career and 47% of entry-level faculty.

2.3 Recent graduates who moved to the United States

Statistics Canada, in collaboration with Human Resources Development Canada, recently carried out a survey of 1995 graduates who moved to the United States. The findings of that survey can be found in *South of the Border: Graduates from the Class of '95 Who Moved to the United States* (Frank and Bélair 1999). The survey found that the overall percentage of 1995 postsecondary graduates living in the United States in 1997 remained small (1.5%). Graduates with more advanced degrees, however, were more likely to leave, with 12% of PhD graduates living in the United States in 1997. A dispro-

portionately high percentage (44%) of movers ranked themselves in the top 10% of their graduating class. Movers were also somewhat more likely than non-movers to have received scholarships or other academic awards. The survey also found that movers to the United States had significantly higher salaries than did non-movers. A possible contributing factor might be the high proportion of the movers who rated themselves near the top of their classes.

The survey found that 18% of movers to the United States had moved back to Canada by 1999. The salaries of those back in Canada at the time of the survey in 1999 were similar to those remaining in the United States, evidence that those returning may be bringing valuable work experience from the United States back to Canada.

Among those who moved to the United States for work-related reasons, the most common reasons cited included greater availability of jobs and higher pay. A very small percentage of graduates explicitly mentioned lower taxes as one of the reasons for their move.

2.4 Emigration to the United States—A summary

Overall, emigration to the United States remains small by historical standards and small relative to the stock of workers in the Canadian labour force. However, emigrants are overrepresented among the prime working

age groups, the well educated, and high-income earners. In the public sector, emigrant outflows are the greatest among people employed by hospitals, universities and other educational institutions and government. In the private sector, emigrant outflows are the greatest in high technology, finance and business services. When placed in the context of the bilateral exchange with the United States, Canada clearly suffers a net loss of highly educated workers.

3. CANADIAN IMMIGRATION

While the above analysis shows that Canada suffers from a brain drain to the United States, the following analysis presents data from a variety of sources to explore the extent to which this 'drain' is offset by a concomitant 'gain' of skilled workers from the rest of the world. We profile the age, education and occupation of recent immigrants and examine their contribution to the employment expansion of the high-technology sector.

3.1. Intended occupations of recent immigrants

LIDS data on the intended occupation of immigrants (see Box below) show that knowledge-based occupations in high demand experienced large increases in permanent immigration from the mid-1980s until 1997, the most recent year for which data are available. Over this period, permanent immigration increased fifteen-fold among computer scientists, ten-fold among engineers, eight-fold among natural scientists, and four-fold among managerial workers (see Graph 13). In 1997, the combined immigration of computer scientists, engineers and natural scientists surpassed 20,000.

Data Sources on Canadian Immigrants

The Landed Immigrant Data System (LIDS) developed by Citizenship and Immigration Canada is a principal source of data on immigration to Canada. The LIDS files have been used as a source of information on the intended occupation of immigrants at the time of becoming landed immigrants based on their education and work experience.

The census is another important source of data on immigrants. The 1996 Census has been used to profile the educational level of immigrants and to examine the occupations of people immigrating between 1990 and 1994. The 1996 Census has also been the source of data used in estimating the lifetime annual earnings of immigrant and Canadian-born computer scientists.

On the other hand, permanent immigration has decreased in knowledge-based occupations for which the labour market demand was not as strong during the 1990s, namely physicians, nurses and teachers. Between 1990 and 1997, annual immigration fell 30% among post-secondary teachers, 50% among elementary and secondary teachers, 40% among physicians and 70% among nurses.

The 'points system' used in the selection of independent immigrants has been contributing to the recent increase in Canada's gain of individuals in high-demand occupations. The high points awarded to individuals in these occupations help them reach the necessary points to immigrate to Canada. Points are also awarded for factors such as level of education and abilities in an official language.

The Canadian Occupational Projections System (Roth 1998) forecasts that demand for high-technology workers will remain high, above the level of current domestic supply. It is worth noting in this context that Canada produces proportionately fewer graduates in the fields of mathematics, sciences and engineering than other G-7 countries, with the exception of Italy. In 1995, Canada produced 741 university graduates in science-related fields per 100,000 people aged 25 to 34 in the labour market, compared with 938 in the United States, and an average of 831 across OECD countries (OECD 1997).

3.2 Aggregate fit between intended and actual occupations of immigrants

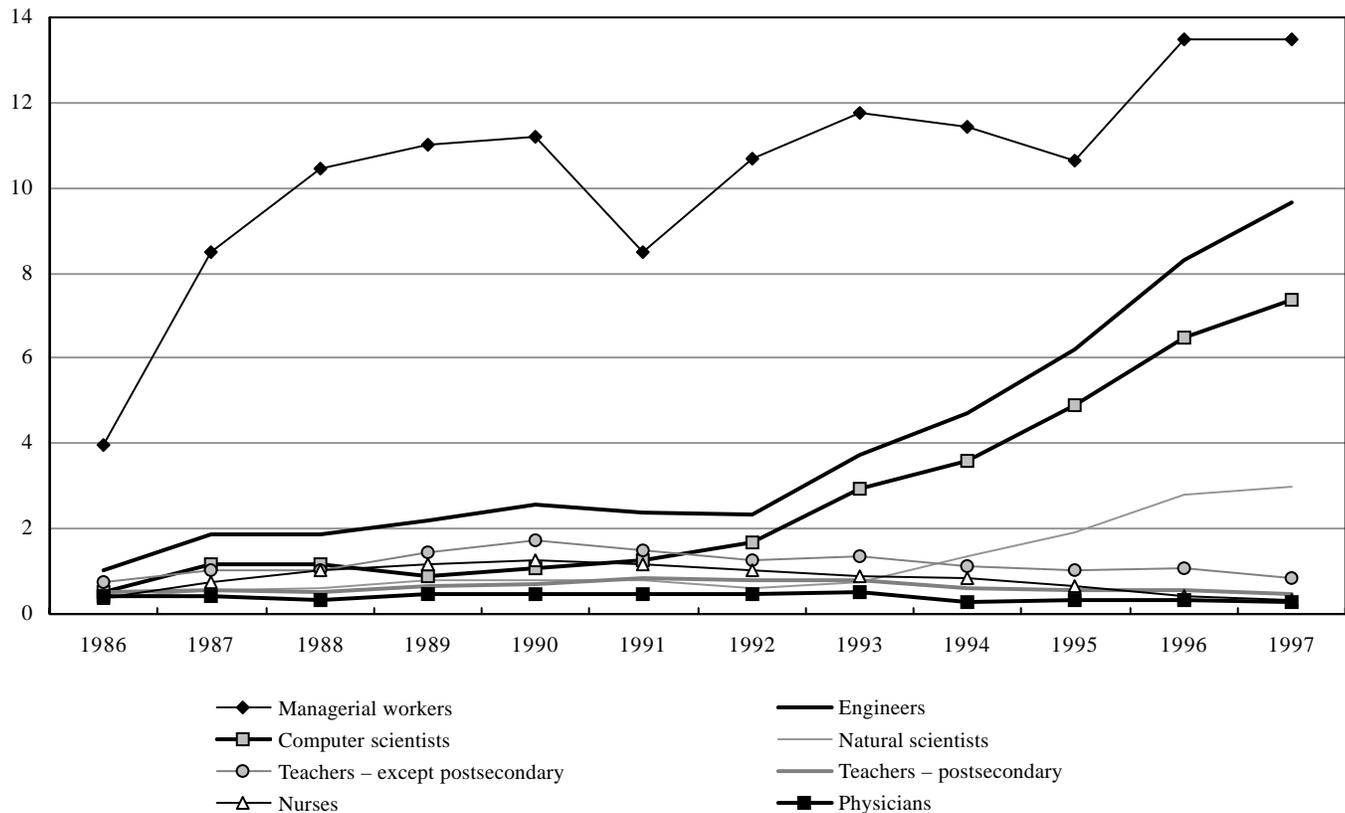
In this section we examine the aggregate fit between the intended occupation of immigrants when they became landed immigrants in Canada and their realized occupations. This aggregate fit helps shed light at an aggregate level on the adjustment and integration of immigrants into the Canadian labour market. Current data sources do not permit examination of the labour market adjustment at an individual level; however, new initiatives will permit such analysis (see Box on page 27).

The LIDS database of Citizenship and Immigration Canada (see Box on left) shows that between 1990 and 1994, 1.17 million people became landed immigrants in Canada. The 1996 Census found 0.98 million people who reported immigrating to Canada over the same period—83% of the Citizenship and Immigration Canada figure. There are several reasons for this difference, including deaths, return of immigrants to their country of origin, or emigration to another country. Additional reasons include undercounting of immigrants in the census, and possible reporting errors by immigrant respondents—for example, in reporting the year of landing in Canada.



Graph 13
Canadian immigration¹ by selected occupation, 1986–1997

Thousands of immigrants



Notes:

See Table 10.

1. Refers to permanent migration into Canada from all countries.

Source: Citizenship and Immigration Canada, Landed Immigrant Data System.

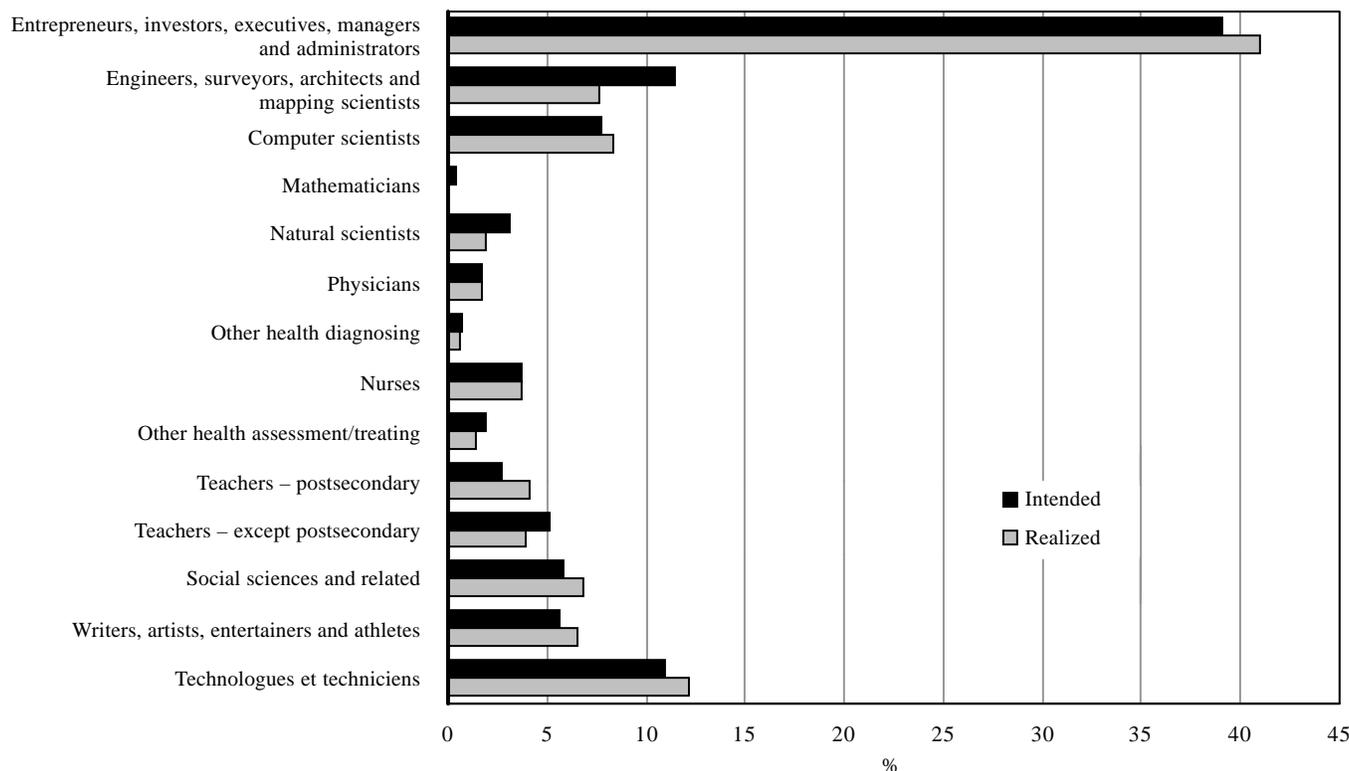
The aggregate fit has been examined by comparing the occupational distributions of the LIDS and census data sets (see Graph 14). The aggregate fit in knowledge-based occupations was very close, with the intended and actual percentage of recent immigrants (i.e., between 1990 and 1994) working in these occupations being equal, at 11.6%. Among recent immigrants intending to work in non-knowledge occupations, the aggregate match between intended and realized occupations was not as close. On becoming landed immigrants, 42% of recent immigrants planned to work in non-knowledge occupations, but in 1996 only 36% were working in these occupations. The closer aggregate fit in knowledge-based occupations is not surprising, given the differential demand in the Canadian labour market. Between 1990 and 1998, full-time employment of professional and managerial workers grew by 780,000, compared with growth of merely 55,000 for all other workers.

The fit between intended and realized occupations varied for individual knowledge-based occupations (see Graph 14). A higher percentage of recent immigrants reported working as computer scientists in 1996 (8.3% of those in knowledge-based occupations) than the intended percentage at the time of landing (7.7% of those intending to work in knowledge-based occupations). On the other hand, lower percentages of recent immigrants reported occupations in engineering and natural sciences in 1996 than the intended percentages at the time of landing. Between the 1991 and 1996 censuses, employment of computer scientists grew by 30%, while employment of engineers and natural scientists grew more slowly, by 5% and 11%. The high demand for computer scientists may have drawn some of the immigrants with training in engineering, mathematics and natural sciences into computer sciences.



Graph 14

Percentage of immigrant knowledge workers who arrived in Canada between 1990 and 1994, by intended occupation at entry and realized occupation in 1996

**Note:**

See Table 11.

Sources: Citizenship and Immigration Canada, Landed Immigrant Data System; and Statistics Canada, 1996 Census.

The actual percentage of recent immigrants working in natural and applied science occupations combined (including computer sciences) was lower (18.1% of those in knowledge-based occupations) than the intended percentage at the time of landing (22.7% of those intending to work in knowledge-based occupations). One possible factor may be ‘flow-through’ immigration in these high-demand occupations; that is, a portion of the new immigrants may have emigrated to other countries, particularly the United States. Additionally, among the great number of immigrants Canada admitted each year in the 1990s in these high-technology fields, a portion may not have successfully integrated into the Canadian labour market and found employment in their field of training.

The intended and actual percentages of immigrants working as physicians and nurses matched quite closely. It seems, therefore, that despite licensing requirements for health professionals, immigrant health professionals had successfully integrated and were practising in their field of training in Canada. The health sector may have been better able to absorb immigrant physicians and nurses,

perhaps because of the relatively small number admitted each year.

The situation for educators at postsecondary levels was different from that of educators at the elementary and secondary levels. The actual percentage of immigrants working as postsecondary teachers (4.1%) exceeded the intended percentage (2.7%). It may be that some of the recent immigrants were graduate students at the time of landing but by 1996 were teaching at universities or colleges. The actual percentage of immigrants working as elementary and secondary teachers (3.9%) was below the intended percentage (5.1%). This may reflect more limited opportunities for new hiring of teachers because of factors such as declining school-age populations in some jurisdictions and reductions in public spending on education as part of the effort by governments to reduce or eliminate deficits.

The realized percentages in managerial, administrative and technical occupations were all close to or slightly higher than the intended percentages in these occupations.

3.3 Occupational distribution of recent immigrants compared with the native-born and immigrants of previous years

Another way to examine the impact of recent immigrants on the Canadian labour market is to compare their occupational distribution with those of the Canadian-born population and previous cohorts of immigrants. The objective is to learn whether recent immigrants tend to be over-represented in occupations where shortages have existed in recent years, such as high-technology occupations. Likewise, it will also identify occupations in which immigrants tend to be underrepresented. Comparing the occupational distributions of recent immigrants and earlier cohorts of immigrants will shed light on adjustment issues—in particular, whether the length of stay has a positive impact on occupational profiles.

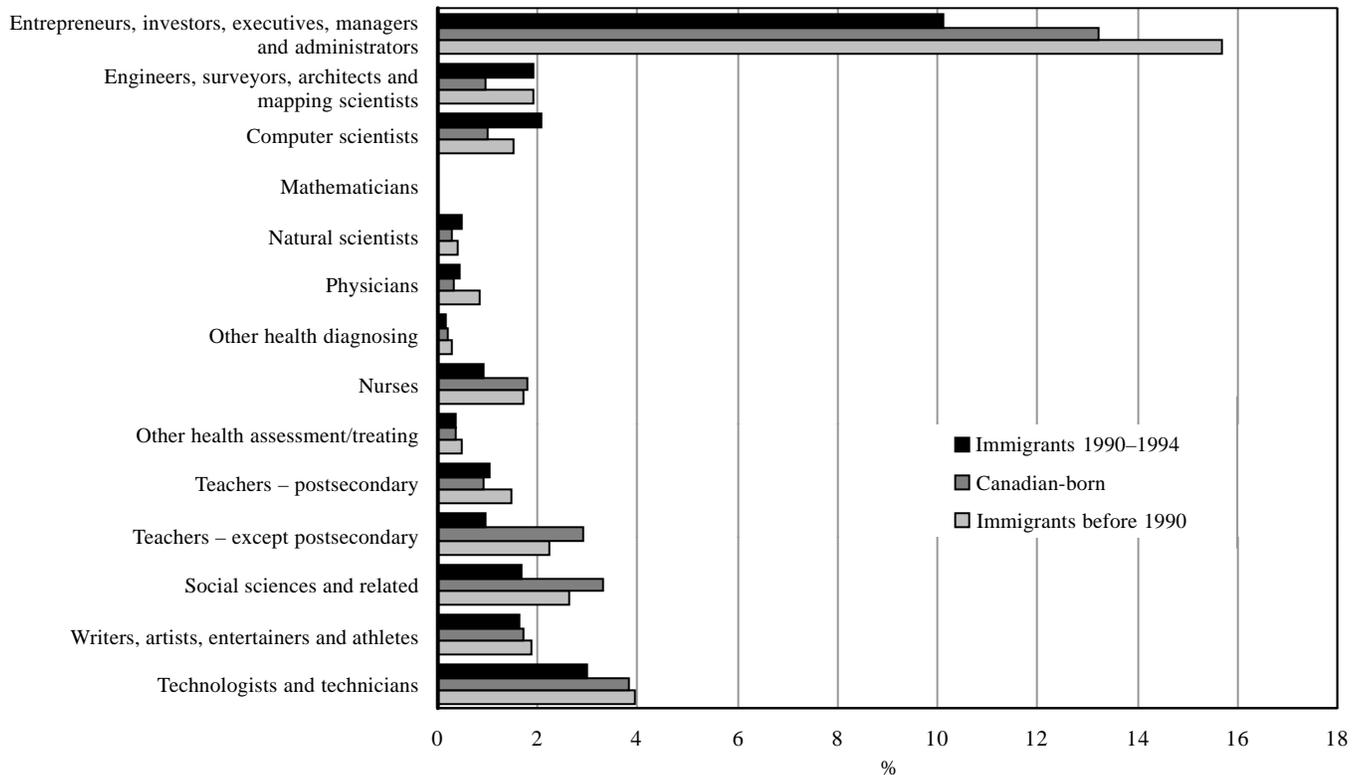
In the 1996 Census, among people aged 15 and over, 57% of recent immigrants (those who immigrated into Canada between 1990 and 1994) were in the labour force, compared with 65% of the Canadian-born and 59% of immigrants who came to Canada before 1990. The lower rate of labour force participation among recent immigrants

may reflect initial difficulties faced by newcomers in adapting to the Canadian labour market. On the other hand, the lower rate of labour force participation among immigrants who came to Canada before 1990 compared with the Canadian-born population can be mainly attributed to their older age. When viewed by age group, labour force participation rates of pre-1990 immigrants were comparable to or higher than rates of the Canadian-born population. Rates were identical for people aged 25 to 54; however, at ages 55 to 64, pre-1990 immigrants had a higher labour force participation rate than the Canadian-born.

If the experience of immigrants of previous cohorts is any indication, we can expect the labour force participation of recent immigrants to converge towards that of the Canadian-born.

Recent immigrants were twice as likely as the Canadian-born population to be working as computer scientists and engineers (2% versus 1%, respectively) and in natural sciences (2.5% versus 1.3%, respectively) (see Graph 15). These are precisely the occupations where employment has been expanding and where a shortage of workers has been reported.

Graph 15
Distribution of workers in individual knowledge-based occupations as a percentage of the work force in 1996, by immigration status



Note:

See Table 12.

Source: Statistics Canada, 1996 Census.

On the other hand, recent immigrants were underrepresented in managerial occupations, nursing, teaching at below-postsecondary levels, and social sciences and related occupations, compared with the Canadian-born. However, immigrants who came to Canada prior to 1990 were equally represented or overrepresented in the same occupations, with the exception of elementary and secondary teachers. The underrepresentation of recent immigrants may be a reflection of adjustment issues and/or lower labour market demand in these occupations.

3.4 Age and education profiles of recent immigrants

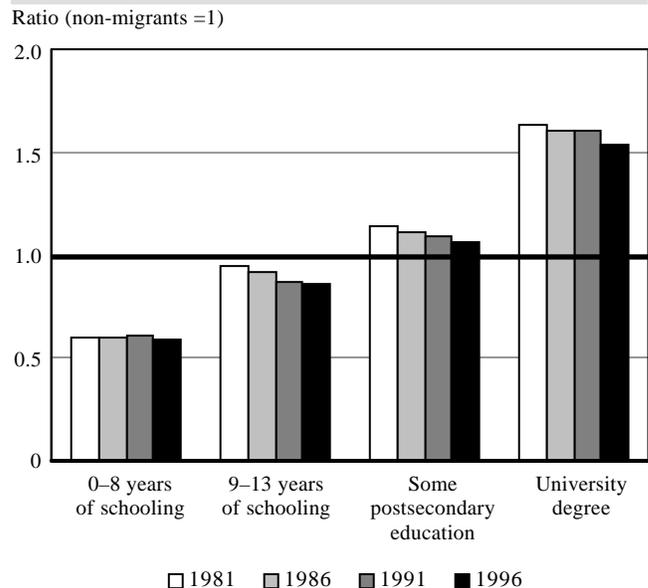
In general, international migrants tend to be younger and more highly educated than non-migrant populations. Why? Because immigration laws tend to favour migrants who are highly educated—this is true of immigration laws in both Canada and the United States. At the same time, the accompanying knowledge and skill levels of highly educated people are also likely to be in demand, not only in their native countries but also abroad, reducing a major element of uncertainty surrounding a life-altering decision. More highly educated people are also more likely to have the contacts and information needed to move to another country. Age is a factor inasmuch as younger people may, on balance, be less likely to be tied down by personal and financial commitments.

The propensity to be younger and better educated is also evident among interprovincial migrants, suggesting that a common economic incentive may be operating in both international and interprovincial migration.

Data from the last four Canadian censuses show interprovincial migrants to be about 1.5 times as likely to be 44 years of age or less, and about 1.5 times as likely as the non-migrant population to have a university education (see Graph 16). In comparison, recent immigrants were about 1.25 times as likely as the Canadian-born population to be 25 to 44 years of age. Adjusting for age, recent immigrants were close to 2 times as likely as native-born Canadians to have a university education. Recent immigrants were even more likely to hold advanced university degrees, between 2 and 3 times as likely to have a master's degree, and about 4 times as likely as the Canadian-born to have a doctorate (see Graph 17).

As we saw in section 2, migrants to the United States are even more highly educated than recent Canadian immigrants. However, because of the much larger number

Graph 16
Ratio of distribution of interprovincial migrants to non-migrants,^{1,2} by highest level of educational attainment



Notes:

See Table 13.

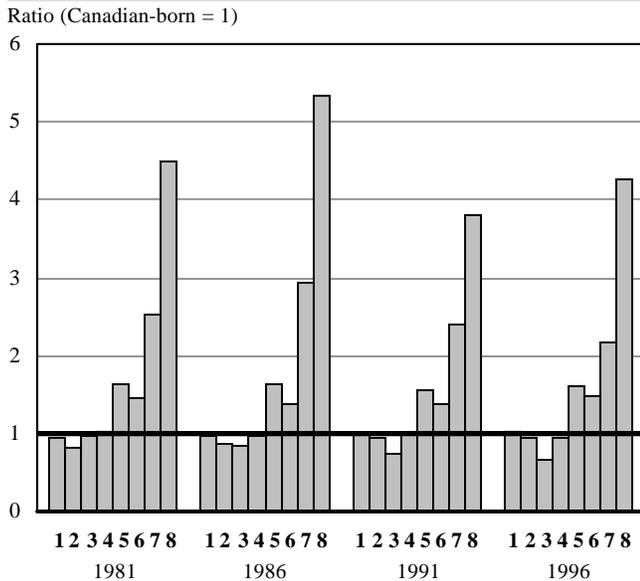
1. The above comparison is age-adjusted, using the entire 15+ Canadian population as the standard population.
2. To illustrate the interpretation of the ratio, the ratio of 1.5 for the category of 'university degree' means that interprovincial migrants were 1.5 times as likely as non-migrants to be university degree holders, adjusting for age differences in the two populations.

Sources: Statistics Canada, 1981, 1986, 1991 and 1996 Censuses.

of Canadian immigrants, university graduates migrating to Canada from all countries in the world outnumber graduates leaving for the United States (permanent and temporary) by a ratio of approximately 4 to 1. There are as many immigrants entering Canada with a master's or doctorate as the number of university graduates at all levels leaving for the United States.

Based on the 1996 Census, about 39,000 degree holders entered Canada per year (both permanently and temporarily) from 1990 to 1996, including 11,000 master's and PhD degree holders. This compares with an estimated 10,000 university graduates at all levels combined leaving Canada for the United States per year in the 1990s, based on the 1994 to 1999 U.S. Current Population Surveys. The latter estimate includes both permanent and temporary

Graph 17
Ratio of distribution of recent immigrants¹ to the Canadian-born, by highest level of educational attainment^{2, 3}



- 1 Less than high school
- 2 Secondary school graduate
- 3 Completed non-university
- 4 Some postsecondary
- 5 Bachelor's degree or higher
- 6 Bachelor's degree
- 7 Master's degree
- 8 Doctorate

Notes:

See Table 14.

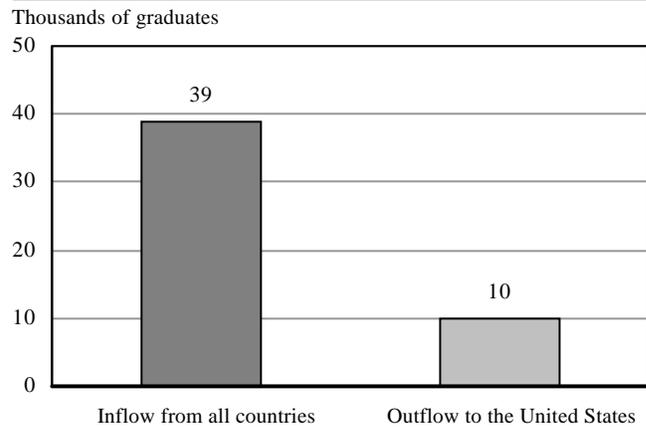
1. Recent immigrants are defined as those who arrived in Canada in the five-year period prior to each census.
2. The above comparison is age-adjusted, using the Canadian-born as the standard population.
3. To illustrate the interpretation of the ratio, the 1996 ratio of 4 for the category of 'doctorate' means that recent immigrants were four times as likely as the Canadian-born to hold a doctorate degree, after adjusting for age differences in the two populations.

Sources: Statistics Canada, 1981, 1986, 1991 and 1996 censuses.

migrants, and both the Canadian and foreign-born. It is important to point out that university graduates emigrating to countries other than the United States are not included because of lack of data.

Undoubtedly, a factor influencing the high educational qualifications of recent immigrants is the 'points system,' which, as previously mentioned, aims at selecting independent immigrants on the basis of their education, labour market experience and language abilities. Canada's immigration laws, however, are multifaceted. The goal is not only to promote Canada's economic interest (as

Graph 18
Annual average number of university graduates migrating to Canada from all countries (1990–1996)¹ and emigrating from Canada to the United States (1990–1999)¹



Note:

1. Includes both temporary and permanent migration.

Sources: U.S. Current Population Surveys, 1994–1999; and Statistics Canada, 1996 Census.

manifested by the 'points system' in selecting independent applicants), but also to reunite families and to assist refugees on humanitarian grounds. The two latter objectives are reflected in the other two main classes of immigrants—family class and refugees. Immigrants who are admitted in these two classes are not subject to the same screening as independent immigrants. However, when immigrants of all classes are grouped together, they still have significantly higher educational qualifications than the Canadian-born population, especially at the master's and PhD levels.

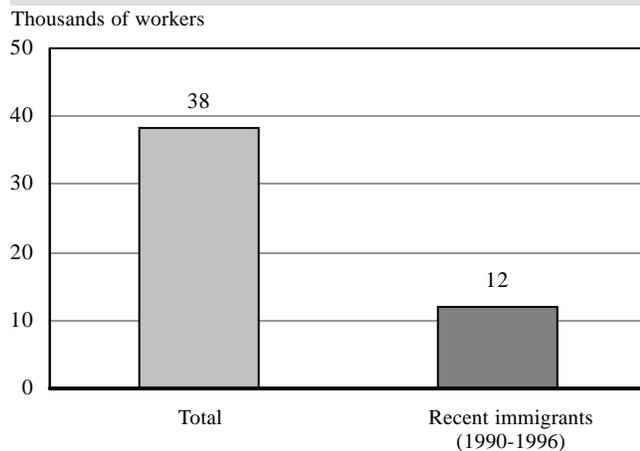
3.5 Expected lifetime earnings of immigrant computer scientists

Much of the debate on brain drain and brain gain has focussed on the shortage of skilled workers in the information technology sector. Because of the high demand for these workers, this sector is keenly aware of losses from migration to the United States. It is equally important, however, to consider the contribution of recent immigrants in this sector.

As shown in the previous section, recent immigrants are twice as likely as the Canadian-born population to be in high-technology occupations. In recent years, with the expansion of the high-technology sector, employment of high-technology professionals has grown rapidly, not only among immigrants, but also among the native-born. Between 1991 and 1996, employment of computer engineers, systems

analysts and computer programmers grew by 39,000, from 124,000 to 163,000. As shown in Graph 19, recent immigrants (since 1990) accounted for almost a third of this increase. It is clear that recent immigrants have become an important component of high-technology employment expansion and that they are contributing to meeting the high demand for workers in this sector.

Graph 19
Increase in employment among computer engineers, systems analysts and computer programmers between 1991 and 1996 for total population and recent immigrants

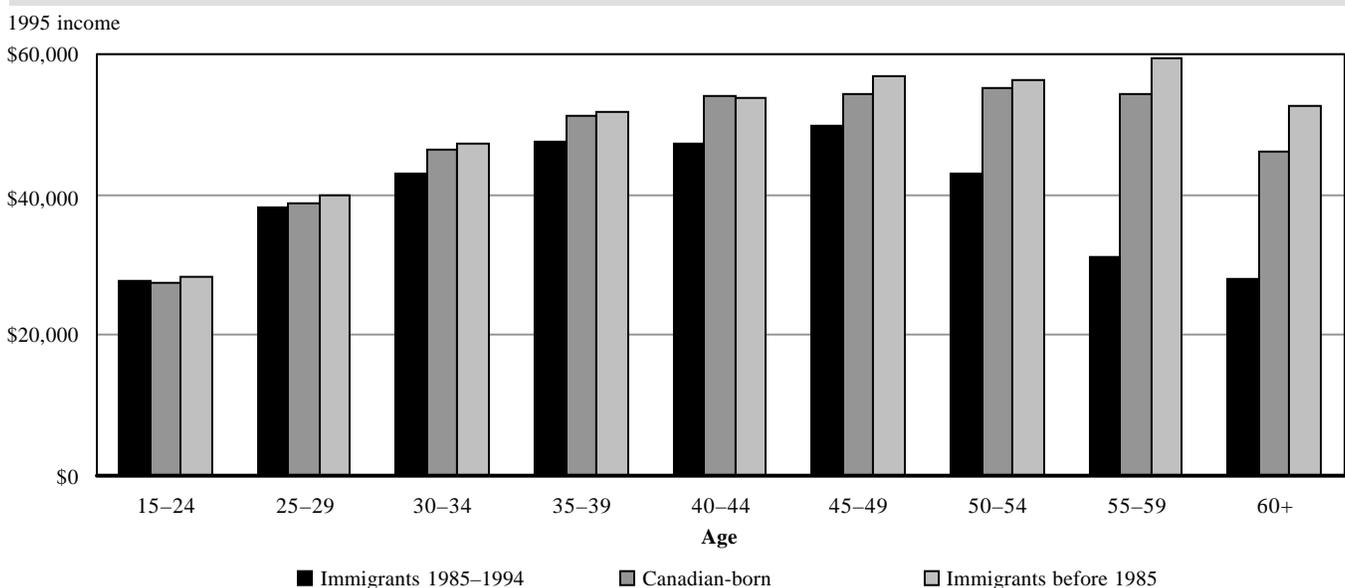


Source: Statistics Canada, 1996 Census.

We examine the issue of the quality of recent immigrant computer scientists by comparing their expected lifetime earnings with those of Canadian-born computer scientists. Earnings, inasmuch as they represent the value placed on a human resource by the marketplace, are an indicator of quality.

Results of the 1996 Census show that, among those aged 15 to 49, the annual income of immigrant computer scientists who had been in Canada for less than 10 years was slightly lower than their Canadian-born counterparts. Among those aged 50 and over, immigrants in Canada for less than 10 years earned significantly less than the Canadian-born. Compared to the Canadian-born, immigrants in Canada for more than 10 years had similar incomes up to the age of 44, and had higher incomes after age 45. Hence, it appears that those immigrating at relatively younger ages integrate well—and actually earn more—than the Canadian-born computer scientists after the age of 45. On the other hand, those immigrating at older ages appear to experience more difficulties. For the most part, immigrant computer scientists tend to be quite young (average age in the early 30s) when they immigrate into Canada. An analysis of expected lifetime earnings (see Box on page 26) showed that the projected lifetime earnings of young immigrant computer scientists were comparable with—only 1% below—those of their Canadian-born counterparts.

Graph 20
Income of computer scientists employed full time and year-round, by age and immigration status, 1995



Note:

See Appendix 1.

Source: Statistics Canada, 1996 Census.

Hence, in high demand occupations, there is no evidence that the labour market discerns qualitative differences between immigrant and Canadian-born workers. In the absence of qualitative differences, given the sheer numbers involved, it is clear that immigrant computer scientists are making a significant contribution to Canada's high-technology industries.

Lifetime Earnings of Computer Scientists

Appendix 1 provides detailed calculation of projected lifetime income of immigrant computer scientists and their Canadian-born counterparts. The first part of the table provides age-specific income of computer scientists in three categories—immigrants in Canada for less than 10 years, the Canadian-born population, and immigrants in Canada for 10 years or more. This part of the table also provides the standard population of computer scientists in Canada.

With this standard population, it is possible to calculate the age-adjusted income for the three groups of interest. In other words, we were able to obtain the average income of computer scientists in these three groups if they all had the same age profile as the entire computer scientist population.

As immigrant computer scientists to Canada, just like emigrant computer scientists to the United States, tend to be young (early 30s), it is reasonable to project their duration of employment to be 35 years—also the number of years customarily needed for full pension. Step 5 in the table calculates the cumulative difference in the income of immigrant computer scientists in their first 10 years of employment in Canada, compared to the Canadian-born. Step 6 calculates the cumulative difference in the income of immigrant computer scientists in the next 25 years of employment in Canada, compared with the Canadian-born. Step 7 calculates the annualized difference in the income of immigrant computer scientists in their entire 35 years of employment, compared with the Canadian-born. This analysis showed expected lifetime earnings of young immigrant computer scientists were comparable with—only 1% below—their Canadian-born counterparts.

4. CONCLUSIONS AND FURTHER INITIATIVES

Is there a 'brain drain' to the United States? Yes—Canada suffers a net loss of workers in a variety of key knowledge-based occupations. The magnitude of these losses is relatively small—about 0.1% of all tax filers, and

less than 1% of the stock of workers in any specific knowledge occupation. The composition of emigrants, however, is weighted towards the better-educated, high-income earners and people of prime working age. Further, they are drawn from sectors that are thought to be important to Canada's economy and society. The recent survey of the 1995 graduates who moved to the United States indicated a disproportionately higher percentage (12%) of PhD graduates having moved there. Likewise, 0.9% of tax filers with annual incomes of \$150,000 or higher left Canada in 1996, a migration rate nine times as high as that of all tax filers. Tax filer data also indicate an upward trend in the number of people leaving Canada in the 1990s.

On the other hand, Canada receives more university graduates than it loses to the United States. For every university degree holder migrating from Canada to the United States, whether on a temporary or permanent basis, there are four university degree holders (including one master's or PhD) migrating from the rest of the world to Canada. Compared with the Canadian-born population, after adjusting for age differences, recent immigrants are overrepresented among university degree holders, especially advanced degree holders such as master's and PhD.

Recent immigrant high-technology workers are making an important contribution in helping to meet the high demand in the high-technology sector. Immigrants in the 1990s account for about a third of the increase in employment among computer engineers, systems analysts and computer programmers.

Clearly, the data suggest that the issue of the 'brain drain' is far more complex than first appears. Questions remain about the size of the flow of emigrants and the permanency of their moves, and the degree to which the best and the brightest may be overrepresented. Questions also remain about the extent to which Canadian immigrants—the so-called 'brain gain'—compensate for the 'drain.' This paper has presented data from a variety of sources germane to these questions in the hope that improved data can render the public debate more productive. Given that the most recent data to examine the issue are in many cases two or more years old, questions remain about how the situation may have evolved in more recent years and may still be evolving. Statistics Canada will continue to monitor and update existing sources of data, and will work with Human Resources and Development Canada, Industry Canada, and Citizenship and Immigration Canada to extend and improve what is known about the nature, extent and economic impact of the brain drain to the United States and the brain gain from the rest of the world.

Further Initiatives

Further Analysis of Tax Filer Data

As indicated in the paper, industrial sector analysis of movers using tax filer data is in its initial stages. Together with Industry Canada, Statistics Canada will be examining the number and income profiles of movers by industrial sector, in comparison with all tax filers as well as trends over time.

National Graduates Surveys (NGS)

The National Graduates Survey (NGS), developed by Human Resources Development Canada and Statistics Canada, is being enhanced to provide estimates of the number of graduates of postsecondary institutions leaving Canada for the United States, by level and field of study, both two and five years after graduation. Previously it included only graduates remaining in Canada. The next survey will be conducted in 2000, a five-year follow-up of the graduating class of 1995. A survey of the class of 1999 is planned for the year 2001.

Survey of Air and Land Travelers to Canada

The feasibility of conducting surveys on air and land travelers to profile Canadians returning from the United States to Canada and U.S. citizens coming to Canada is currently being explored. Such surveys have potential to generate information on the intent, experience, and duration of Canadians working

in the United States and the bilateral exchange of high-skilled workers between Canada and the United States.

U.S. 2000 Census

The 2000 Census of the United States will provide in-depth information on the magnitude as well as the characteristics of Canadians who are living in the United States.

Longitudinal Survey of Immigrants

The Longitudinal Survey of Immigrants is a new survey being developed by Statistics Canada in collaboration with Citizenship and Immigration Canada to provide information on the early experiences of recent immigrants to Canada. Immigrants will be interviewed six months, two years and four years after arriving in Canada.

Longitudinal Immigrants Database (IMDB)

The IMDB is a longitudinal file linking immigration and taxation administrative records into a comprehensive database to allow analysis of the economic performance of the immigrant population in Canada. The data are updated annually and are currently available for the period of 1980 to 1995. Citizenship and Immigration Canada has performed preliminary analyses, and Statistics Canada has been involved in the development of the database.

ACKNOWLEDGEMENTS

We thank many people who have been involved in this examination, including Herb O'Heron of the Association of Universities and Colleges of Canada and the following from Statistics Canada: Jane Badets, Brigitte Bouchard, George Butlin, Ivan Fellegi, Pat Grainger, Karen Hall, Chris Jackson, Bob McCrea, Margaret Michalowski, Doug Norris, Ginette Preseault and Linda Standish. We are also grateful to the many reviewers, including Ivan Fellegi, John Jackson and Mike Sheridan of Statistics Canada; Lori Whewell and Shane Williamson of Industry Canada; Elizabeth Ruddick of Citizenship and Immigration Canada; and Dan Boothby, Phillippe Massé, Richard Roy and J.P. Voyer of Human Resources Development Canada. We also thank the referees for helpful suggestions.

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Table 1
Employment rate by level of education, 25–44 age group, 1980–1998

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989
0–8 years of schooling	61.1	62.4	56.8	57.1	56.8	56.0	58.4	58.3	59.7	59.8
11–13 years of schooling	74.8	75.9	72.8	71.7	73.1	73.9	75.9	76.6	78.4	78.8
University degree	87.0	87.9	85.6	86.2	86.5	87.1	87.3	87.7	88.5	88.8
	1990	1991	1992	1993	1994	1995	1996	1997	1998	
0–8 years of schooling	57.0	51.6	49.5	49.5	48.4	48.1	47.3	46.9	49.6	
11–13 years of schooling	78.0	75.4	73.6	73.4	74.6	74.4	75.1	75.8	76.4	
University degree	88.4	87.3	86.3	86.4	85.8	86.6	86.0	86.0	87.5	

Notes:

See Graph 2.

Employment rate is defined as the percentage of persons employed.

Source: Statistics Canada, Labour Force Survey.



Table 2
Canadian-born population living since January 1990 in the United States, 1994–1999

	1994		1995		1996		1997		1998		1999		Average
	Estimates	Sample size (n)	Estimates										
number													
Age group													
All ages	104,000	(62)	126,000	(74)	105,000	(63)	116,000	(59)	152,000	(73)	185,000	(87)	131,000
25–44	53,000	(32)	46,000	(27)	54,000	(29)	68,000	(33)	101,000	(48)	101,000	(49)	71,000
16+	72,000	(44)	84,000	(47)	81,000	(50)	91,000	(49)	129,000	(63)	169,000	(77)	104,000
percent													
25–44 as percentage of population 16+	73.6		54.8		66.7		74.7		78.3		59.8		68.3
number													
Gender													
Male	45,000	(27)	66,000	(41)	51,000	(29)	68,000	(30)	83,000	(37)	101,000	(47)	69,000
Female	59,000	(35)	60,000	(33)	54,000	(34)	48,000	(29)	69,000	(36)	83,000	(40)	62,000
Education													
University	31,000	(22)	34,000	(24)	38,000	(22)	42,000	(28)	80,000	(37)	83,000	(36)	51,000
percent													
University as percentage of population 16+	43.1		40.5		46.9		46.2		62.0		49.1		49.0

Notes: 1994–1996 data were published by the U.S. Bureau of the Census; 1997 data are special tabulations by the U.S. Bureau of the Census for Statistics Canada; 1998 and 1999 data were retrieved by Statistics Canada using U.S. Federal Electronic Research and Review Extraction Tool (FERRET), <http://ferret.bls.census.gov>, with technical assistance from the U.S. Bureau of the Census.

Source: U.S. Bureau of the Census, Current Population Survey, March Supplement, 1994–1999.



Table 3
Destinations of emigrants who left Canada, 1986–1991 and 1991–1996

	Permanent ¹				Temporary ²			
	1986–1991		1991–1996		1986–1991		1991–1996	
	Distribution	Sample size	Distribution	Sample size	Distribution	Sample size	Distribution	Sample size
	%	number	%	number	%	number	%	number
U.S.	48	159	50	182	34	41	35	79
Asia	9	29	19	67	20	22	31	65
Europe	32	92	19	62	25	32	17	32
Rest	11	36	12	40	21	24	18	38

Notes:

See Graph 5.

1. Permanent emigrants are persons who, at the time of the census, had left Canada with no intention of returning, and those who had resided outside Canada for at least two years but whose intentions about returning were unknown.
2. Temporary emigrants are persons who, at the time of the census, had resided outside Canada for at least six months with the intention of returning, or had resided outside Canada for no more than two years if their intentions were unknown.

Source: Statistics Canada, Reverse Record Check Program, 1991 and 1996 Censuses.



Table 4
Tax filers who ceased to reside in Canada in 1996 as a percentage of all tax filers in 1995, by 1995 income class

1995 income class	Movers in 1996	All tax filers in 1995	Movers as percentage of all tax filers
	number		%
Less than \$20,000	10,570	10,752,300	0.10
\$20,000–\$49,999	8,340	7,546,750	0.11
\$50,000–\$74,999	3,330	1,713,300	0.19
\$75,000–\$99,999	1,420	373,000	0.38
\$100,000–\$149,999	1,020	176,700	0.58
\$150,000+	1,020	115,000	0.89
Total	25,700	20,677,050	0.12

Notes: Data based on Revenue Canada income tax files.

See Graphs 8 and 9.

Number of movers in 1996 in this table is slightly smaller than that shown in Graph 6. The reason is that only movers who also filed a tax return in 1995 are shown here in order to capture 1995 full year income.

Source: Statistics Canada, Small Area and Administrative Data Division.



Table 5
Tax filers leaving¹ Canada for all destinations, by industry of employer, for 10 industries with largest loss of employees, 1996

Industry (1980 SIC code)	Number of movers in 1996
Hospitals	1,060
University Education	910
Elementary and Secondary Education	690
Architectural, Engineering and Other Scientific and Technical Services	660
Computer and Related Services	580
Banks, Trust Companies and Credit Unions	520
Food Services	440
Federal Government Service ²	420
Communication and Other Electronic Equipment	360
Other Business Services	290
All remaining industries	10,640

Notes: Data based on Revenue Canada income tax files.

1. These data exclude movers without earned income and self-employed who were not salaried employees. The industry is that of movers' principal employer (in terms of 1996 earnings).
2. Except Defence Services.

Source: Statistics Canada, Small Area and Administrative Data Division.



Table 6
Canadian immigration and emigration,
annual averages by decade as a
percentage of the population,
1851–1861 to 1991–1998

	Immigration as a percentage of population	Emigration as a percentage of population
1851–1861	1.24	0.60
1861–1871	0.75	1.19
1871–1881	0.87	1.01
1881–1891	1.48	1.80
1891–1901	0.49	0.74
1901–1911	2.46	1.18
1911–1921	1.75	1.36
1921–1931	1.25	1.01
1931–1941	0.14	0.22
1941–1951	0.44	0.30
1951–1961	0.97	0.29
1961–1971	0.72	0.35
1971–1981	0.62	0.27
1981–1991	0.52	0.19
1991–1998	0.73	0.15

Notes:

See Graph 10.

Source: Statistics Canada, Demography Division.



Table 8
Ratio of outflow to inflow from
permanent migration between Canada
and the United States, managerial
and selected professional occupations,
1990–1997

Occupation	Annual average outflow ¹	Annual average inflow ²	Ratio of outflow to inflow
Managerial occupations	2,470	381	6.5
Engineers	521	77	6.7
Computer scientists	135	88	1.5
Natural scientists	144	55	2.6
Physicians	320	17	18.7
Nurses	773	51	15.3
Teachers – postsecondary	231	112	2.1
Teachers – except postsecondary	296	76	3.9

Notes:

See Graph 12.

1. Outflow refers to permanent emigration from Canada to the United States.

2. Inflow refers to permanent migration from the United States to Canada.

Sources: U.S. Immigration and Naturalization Service; and Citizenship and Immigration Canada, Landed Immigrant Data System.



Table 7
Annual emigration to the United States
as a percentage of the Canadian work
force in selected knowledge-based
occupations, 1996–1997¹

Knowledge-based occupations	Emigrants	Employed work force	Emigrants as a percentage of the work force
Teachers – except postsecondary	267	416,970	0.06
Computer scientists and mathematician	124	168,385	0.07
Managerial workers	2,263	1,927,760	0.12
Teachers – postsecondary	192	146,235	0.13
Engineers	458	172,415	0.27
Nurses	825	246,800	0.33
Natural scientists	174	44,630	0.39
Physicians	460	59,340	0.78

Notes:

See Graph 11.

1. 1996 – 1997 annual average for emigration; 1996 data for work force by occupation.

Sources: U.S. Immigration and Naturalization Service; and Statistics Canada, 1996 Census.



Table 9
Annual average permanent emigration
from Canada to the United States,
by occupation, 1986–1989, 1990–1995,
and 1996–1997

Occupation	1986–1989	1990–1995	1996–1997
Physicians	149	267	460
Nurses	331	756	825
Teachers – postsecondary	194	244	192
Teachers – except postsecondary	238	306	267
Computer scientists	99	139	124
Engineers	468	542	458
Natural Scientists	97	134	174
Managerial workers	1,653	2,539	2,263
All other occupations	6,637	6,048	3,850
All occupations	9,397	10,973	8,610

Source: U.S. Immigration and Naturalization Service.



Table 10
Canadian immigration¹ by selected occupation, 1986–1997

	1986	1987	1988	1989	1990	1991
Managerial workers	3,984	8,514	10,453	11,027	11,193	8,494
Engineers	1,005	1,881	1,881	2,207	2,544	2,357
Computer scientists	493	1,184	1,151	895	1,094	1,272
Natural scientists	364	549	598	773	784	779
Teachers – except postsecondary	727	1,026	1,040	1,459	1,736	1,491
Teachers – postsecondary	503	576	502	667	719	829
Nurses	393	739	1,049	1,188	1,270	1,163
Physicians	419	427	339	460	450	489
	1992	1993	1994	1995	1996	1997
Managerial workers	10,710	11,740	11,452	10,630	13,467	13,500
Engineers	2,318	3,736	4,719	6,195	8,285	9,673
Computer scientists	1,698	2,921	3,610	4,887	6,480	7,355
Natural scientists	623	770	1,335	1,934	2,797	2,997
Teachers – except postsecondary	1,237	1,375	1,129	1,042	1,085	855
Teachers – postsecondary	771	799	586	553	540	488
Nurses	1,012	872	827	634	421	350
Physicians	464	529	258	305	341	270

Notes:

See Graph 13.

1. Refers to permanent migration into Canada from all countries.

Source: Citizenship and Immigration Canada, Landed Immigrant Data System.



Table 11
Percentage of immigrant knowledge workers who arrived in Canada between 1990 and 1994, by intended occupation at entry and realized occupation in 1996

	Intended	Realized
	%	
Entrepreneurs, investors, executives, managers and administrators	39.1	41.0
Engineers, surveyors, architects and mapping scientists	11.4	7.7
Computer scientists	7.7	8.3
Mathematicians	0.4	0.1
Natural scientists	3.1	1.9
Physicians	1.7	1.7
Other health diagnosing	0.7	0.6
Nurses	3.8	3.7
Other health assessment/treating	1.9	1.4
Teachers – postsecondary	2.7	4.1
Teachers – except postsecondary	5.1	3.9
Social sciences and related	5.8	6.8
Writers, artists, entertainers and athletes	5.6	6.6
Technologists and technicians	11.0	12.1
Total knowledge workers	100.0	100.0

Note:

See Graph 14.

Sources: Citizenship and Immigration Canada, Landed Immigrant Data System; and Statistics Canada, 1996 Census.



Table 12
Distribution of workers in individual knowledge-based occupations as a percentage of the work force in 1996, by immigration status

	Immigrants 1990–1994	Canadian-born	Immigrants before 1990
Entrepreneurs, investors, executives, managers and administrators	10.13	13.21	15.69
Engineers, surveyors, architects and mapping scientists	1.89	0.96	1.93
Computer scientists	2.06	1.01	1.53
Mathematicians	0.04	0.04	0.05
Natural scientists	0.48	0.28	0.40
Physicians	0.42	0.33	0.82
Other health diagnosing	0.15	0.20	0.26
Nurses	0.92	1.78	1.70
Other health assessment/treating	0.35	0.37	0.48
Teachers – postsecondary	1.02	0.92	1.48
Teachers – except postsecondary	0.96	2.89	2.23
Social sciences and related	1.69	3.32	2.63
Writers, artists, entertainers and athletes	1.62	1.71	1.88
Technologists and technicians	3.00	3.80	3.93

Note:

See Graph 15.

Source: Statistics Canada, 1996 Census.



Table 13
Ratio of distribution of interprovincial migrants to non-migrants,^{1,2} by highest level of educational attainment

	Distribution of migrants by education	Distribution of non-migrants by education	Ratio of distribution of migrants to non-migrants
	%	%	
1981			
0–8 years of schooling	12.0	20.1	0.6
9–13 years of schooling	36.2	38.2	0.9
Some postsecondary education	38.0	33.2	1.1
University degree	13.8	8.5	1.6
1986			
0–8 years of schooling	10.2	17.1	0.6
9–13 years of schooling	34.2	37.4	0.9
Some postsecondary education	39.4	35.4	1.1
University degree	16.2	10.1	1.6
1991			
0–8 years of schooling	8.4	13.9	0.6
9–13 years of schooling	32.8	37.5	0.9
Some postsecondary education	40.5	37.2	1.1
University degree	18.3	11.4	1.6
1996			
0–8 years of schooling	7.3	12.2	0.6
9–13 years of schooling	30.2	35.2	0.9
Some postsecondary education	40.5	38.2	1.1
University degree	22.1	14.4	1.5

Notes:

See Graph 16.

1. The above comparison is age-adjusted, using the entire 15+ Canadian population as the standard population.
2. To illustrate the interpretation of the ratio, the ratio of 1.5 for the category of 'university degree' means that interprovincial migrants were 1.5 times as likely as non-migrants to be university degree holders, adjusting for age differences in the two populations.

Sources: Statistics Canada, 1981, 1986, 1991 and 1996 Censuses.



Table 14
Ratio of distribution of recent immigrants to the Canadian-born,¹ by highest level of educational attainment^{2,3}

	Distribution of recent immigrants by education	Distribution of the Canadian-born by education	Ratio of distribution of recent immigrants to the Canadian-born
	%	%	
1981			
Less than high school	45.3	48.0	0.9
Secondary school graduate	11.3	13.9	0.8
Completed non-university	18.5	19.1	1.0
Some postsecondary	10.0	9.9	1.0
Bachelor's degree or higher	14.9	9.1	1.6
Bachelor's degree	11.6	7.9	1.5
Master's degree	2.5	1.0	2.5
Doctorate	0.8	0.2	4.5
1986			
Less than high school	42.7	44.4	1.0
Secondary school graduate	11.8	13.4	0.9
Completed non-university	17.0	20.2	0.8
Some postsecondary	10.7	11.1	1.0
Bachelor's degree or higher	17.7	10.8	1.6
Bachelor's degree	12.9	9.4	1.4
Master's degree	3.7	1.3	2.9
Doctorate	1.1	0.2	5.3
1991			
Less than high school	38.1	38.4	1.0
Secondary school graduate	14.4	15.3	0.9
Completed non-university	17.1	22.8	0.7
Some postsecondary	11.1	11.0	1.0
Bachelor's degree or higher	19.5	12.5	1.6
Bachelor's degree	14.8	10.7	1.4
Master's degree	3.7	1.5	2.4
Doctorate	0.9	0.2	3.8
1996			
Less than high school	35.8	35.0	1.0
Secondary school graduate	14.2	14.9	1.0
Completed non-university	16.6	24.8	0.7
Some postsecondary	10.4	11.0	0.9
Bachelor's degree or higher	23.2	14.3	1.6
Bachelor's degree	18.0	12.2	1.5
Master's degree	4.0	1.9	2.2
Doctorate	1.2	0.3	4.3

Notes:

See Graph 17.

1. Recent immigrants are defined as those who arrived in Canada in the five-year period prior to each census.
2. The above comparison is age-adjusted, using the Canadian-born as the standard population.
3. To illustrate the interpretation of the ratio, the 1996 ratio of 4 for the category of 'doctorate' means that recent immigrants were four times as likely as the Canadian-born to hold a doctorate degree, after adjusting for age differences in the two populations.

Sources: Statistics Canada, 1981, 1986, 1991 and 1996 Censuses.



Appendix 1 Calculation of age-standardized employment income for computer scientists¹ employed full time, year-round, by age and immigration status, 1995

Age group	(Pi)	Age-specific employment income (Ei)			
		Standard population (All computer scientists employed full time, year- round in 1995 ²)	Immigrants who entered Canada between 1985 and 1994	Immigrants who entered Canada before 1985	Canadian-born
15-24	3,490		\$27,675	\$28,281	\$27,488
25-29	21,225		\$38,209	\$39,908	\$38,805
30-34	32,890		\$43,024	\$47,149	\$46,406
35-39	28,755		\$47,415	\$51,696	\$51,298
40-44	20,990		\$47,254	\$53,909	\$53,958
45-49	12,815		\$49,932	\$56,831	\$54,479
50-54	6,135		\$42,942	\$56,251	\$55,152
55-59	2,065		\$31,251	\$59,433	\$54,323
60+	760		\$28,025	\$52,565	\$46,239
(1) Total standard population	129,125		(X)	(X)	(X)
(2) Total employment income = $\Sigma(P_i * E_i)$	(X)	\$5,667,070,985	\$6,350,614,662	\$6,237,339,844	
(3) Age-adjusted employment income = (2)/(1)	(X)	\$43,888	\$49,182	\$48,305	
(4) Income difference from the Canadian-born	(X)	(\$4,416)	\$877	(X)	
(5) Cumulative difference in income of immigrants in their first 10 years of employment in Canada from the Canadian-born	(X)	(\$44,164)	(X)	(X)	
(6) Cumulative difference in income of immigrants in the next 25 years of employment in Canada from the Canadian-born ³	(X)	(X)	\$21,931	(X)	
(7) Annual average difference in income of Immigrants in 35 years of employment in Canada from the Canadian-born	(X)	-\$635	(X)		
(8) As percentage of age-adjusted average employment income of the Canadian-born	(X)	-1%	(X)		

Notes:

See Graph 20.

(X) Not applicable.

¹ Includes approximately 3% mathematicians, statisticians and actuaries in order to be comparable to the category of emigrants to the United States, set by U.S. Immigration and Naturalization Service.

² Excludes immigrants landed in Canada in 1995 and 1996 as they have, by and large, not worked year-round in Canada in 1995. Also excludes temporary residents.

³ 35 years are chosen as it is the usual number of years required for full pension. Further, the average age of both immigrant computer scientists to Canada and emigrant Canadian computer scientists to the United States is the early 30s; therefore, 35 years of employment is a reasonable estimate for them as well.

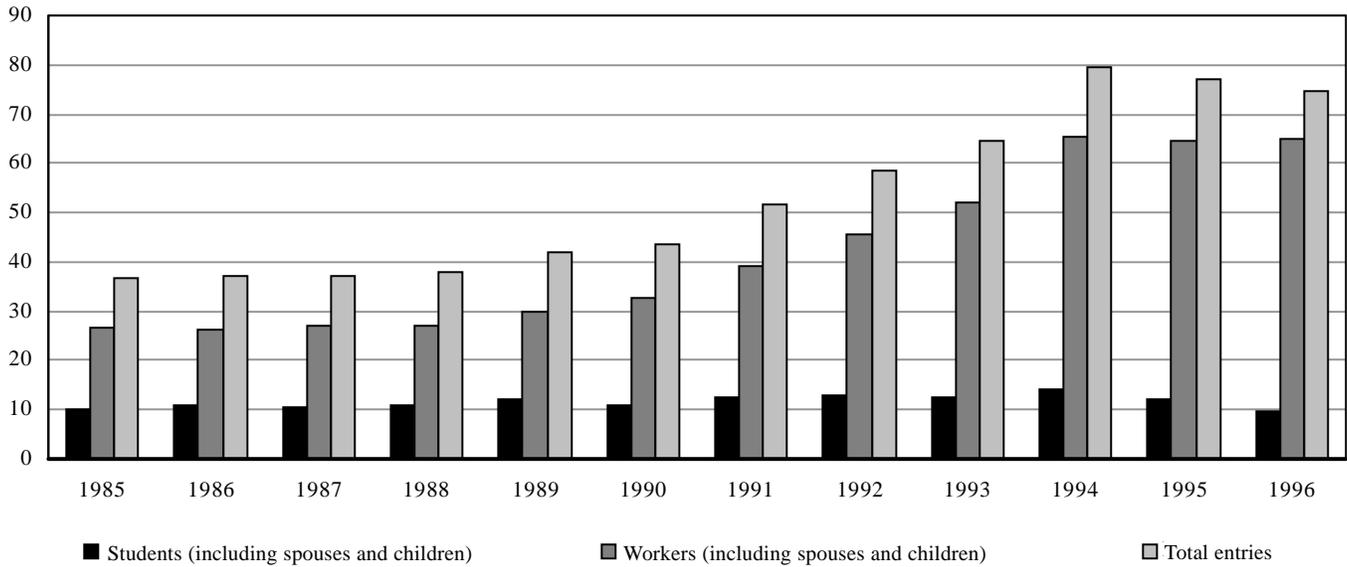
Source: Statistics Canada, 1996 Census.



Appendix 2

Temporary entries by Canadian citizens to the United States to study or work¹

Thousands of entries

**Note:**

1. Data based on new I-94 forms filled out by Canadian citizens when crossing the border to the U.S. to work or study. These data include initial entries, renewal of visas at border-crossings and multiple entries by same individuals in a given year. As such, they do not provide a reliable measure of the number of individuals going to the U.S. to work or study each year.

Source: U.S. Immigration and Naturalization Service.