

The Brain Drain

Myth and Reality – What It Is and What Should Be Done

Ross Finnie

**Research Fellow and
Adjunct Professor
School of Policy Studies
ref@qsilver.queensu.ca**

Abstract. *The brain drain debate has been marked by a considerable amount of confusion and frustration, largely because there has been relatively little hard data available, and that which exists has often been twisted into very different forms by those with competing policy agendas. The first goal of this paper is to pull together and summarize the available evidence regarding the size and nature of the outflows, thus establishing an empirical basis from which the issue can be addressed. The second goal is to address some of the major related policy issues. This begins with some general brain drain policy principles. The personal income tax cuts solution is then addressed with simulations of the effects on government revenues and the associated costs “per brain”, thus putting such discussions on a much firmer empirical footing. A number of alternative proposals are then suggested for various problem groups of brain drain workers.*

I. Introduction

The brain drain debate has been marked by a considerable amount of confusion and frustration. This is largely due to the fact that there has been relatively little hard data available, and that which exists has often been twisted into very different forms by those with competing policy agendas.¹ This has, in short, been an issue characterised by a good deal of heat and rather little light.

The first goal of this paper is to pull together and summarize the evidence available from the principal existing data sources regarding the size and nature of the outflows, thus dispelling some popular myths while establishing an empirical basis from which the issue can be more usefully addressed.

The second goal is to address some of the major related policy issues. This

begins by proposing three general principles for thinking about brain drain policy. First, since the evidence shows that the brain drain problem is mostly about a relatively small number of specific types of individuals leaving the country, including doctors and other health care workers, university professors, R&D and high tech professionals, high income earners in general, it is suggested that policy initiatives be targeted on those particular groups, thus minimizing the “spillover” effects of the actions taken.

The second brain drain policy principle stems from the observation that most of the particularly worrisome outflows also involve occupational and industrial sectors characterised by broad-based problems of a serious nature *apart* from any brain drain, thus suggesting that initiatives should begin by addressing those general problems on their own account — but with an understanding that any resulting sector-wide improvements should reduce the unwanted outflows as better and more interesting job opportunities emerge.

The third policy principle is to go beyond such general sectoral-wide measures to focus on the specific workers in question, especially the “best and brightest” amongst them whose losses are the most costly for the nation and who face the most attractive outside opportunities in some very competitive international labour markets. Initiatives could range from wage increases and improved work conditions in the sectors where governments have such direct leverage to specific tax changes that would make remaining in the country more financially worthwhile for certain types of brain drain workers.

With these general principles established, various more specific policy op-

tions are discussed. The first of these is the idea of cutting personal income taxes which has been mentioned so often. Simulations are performed to show the effects of a number of tax cut scenarios in terms of government revenue losses and the associated costs “per brain” of such an approach, thus putting such discussions on a much firmer empirical footing.

A number of alternative proposals are then suggested for the particular groups of brain drain workers identified above. Implementing such measures should help staunch the flows of these specific types and also illustrate the sorts of initiatives which could be applied to others. Taken together, they outline at least one component of what could comprise an efficient and effective strategy for dealing with the brain drain problem as it exists in Canada today that would, in particular, *not* change the basic nature of the country and would, instead, even strengthen it to the degree more structural problems were attended to in the most critical sectors.

This paper should, therefore, advance the brain drain debate by putting it on a useful empirical footing; by suggesting some general principles for effective and efficient policy undertakings; by placing the personal income tax cut suggestion in a better light and thus perhaps taking it off the list of oft-proffered policy choices; and by suggesting a range of specific measures for some of the most important brain drain groups. It will certainly not be the last word on the brain drain issue, but it should at least further our understanding of what the terms of the debate are and what might be done.

II. The Brain Drain: An Empirical Perspective²

II.1 Outflows to all Destinations

The analysis begins with a historical perspective of the total flows into and out

of Canada. The first graph, based on historical census data, shows that rates of permanent out-migration are currently near an all time low, and also that Canada has enjoyed a net inflow of permanent migrants for a very long time, this continuing into the present.

As for more recent trends, Statistics Canada has employed three different data sources to provide estimates of the size of the total outflows: personal income tax data, the Census Reverse Record Check, and the U.S. Current Population Survey (see Appendix A). Probably the most reliable of these are the tax data, derived from the records of those moving from Canada abroad using the address provided on individuals' tax files. These indicate that the number of tax filers leaving Canada to all destinations has increased steadily in recent years, from about 15,360 in 1991 to 28,870 in 1997, with an average of about 21,700 per year over this period (Graph 2). Estimates from the two other sources generate estimates of a similar magnitude.³

II.2 The Magnitude of the Flows to the United States

The same three data sources have also been used to estimate temporary and permanent migration to the U.S., and suggest that annual average emigration to that country in the 1990s was in the 22,000-35,000 range, thus representing about 0.1 percent of the Canadian population. (This estimate includes persons of all ages, including retired persons, children, and other non-working individuals, whereas the total outflows reported above were for tax filers/workers only.) Like the flows to all destinations seen above, these rates are low by historical standards.⁴

More specifically, the Reverse Record Check data provide an estimate of total

out-migration to the U.S. at the high end of this range. They suggest that 178,000 people left Canada to go to the U.S. between 1991 and 1996, and past experiences indicate that 126,000 of these would be expected to remain permanently in the United States and 52,000 to return to Canada (Graph 3).⁵ Emigration to the U.S. was, furthermore, 30 percent higher in this period than from 1986 to 1991 (as estimated from the previous RRCs), permanent migration increasing by 15 percent and temporary migration doubling. Alternatively, the tax filer data permit estimates of the upper and lower bounds of the number of Canadian tax filers who moved to the United States. These suggest that flows grew from the 8,000 to 12,000 range in 1991 to between 14,000 and 23,000 in 1997 (Graph 4). Adjusting for family members who accompany these tax filers render these figures more or less consistent with those from the Reverse Record Check data. Finally, the sample size upon which the CPS estimates are based are too small to provide very reliable estimates of the levels or trends in the flow of workers, but are generally in line with the other data.

There are a variety of reasons for this increased flow to the U.S. The first is the increasing integration of the two economies. Over the past decade Canada has become increasingly dependent on U.S. trade to the point where almost 90 percent of all exports are U.S. bound and almost 70 percent of all imports are from the U.S. An increase in the bilateral exchange of workers would be the natural consequence of this "integration factor", particularly in the area of services.

Second, and related, NAFTA has greatly reduced the administrative barriers to the bilateral exchange of skilled workers between Canada and the U.S. and has

surely lead to an increase in the level and duration of both temporary and permanent migration of skilled workers between the two countries. (See Appendix B for a discussion of the data based on temporary visas issued by the U.S. Immigration and Naturalization Service which, unfortunately, are judged to be too unreliable and ambiguous at this point to be of much use.)

Third, the US economy experienced a period of strong economic expansion through the late 1990s which pushed unemployment rates in many occupations to historic lows and boosted earnings, especially for those at higher earnings levels, thus providing a strong “pull” factor for Canadians to move south, especially at the higher skill levels where the Canada-U.S. wage gap tends to be greatest.⁶

Finally, a variety of “push” factors have been also been operating, including substantial cut-backs in some of the key public sectors in this country, such as health and education, where the outflows turn out to have been particularly important. Neither have some of our private sector “knowledge industries” been characterised by the same dynamism as those south of the border, thus making outside opportunities more attractive.

Putting these U.S. numbers back into an international perspective, though, yields a bit of a surprise. Despite these “integration,” “pull,” and “push” factors, the Reverse Record Check data reveal that between the 1986-91 and 1991-96 periods, the share of all Canadian emigrants going to the United States remained approximately constant (Graph 5), at about half of all permanent emigrants and a third of all temporary emigrants (there was, on the other hand, a noticeable shift from Europe to Asia.) Moving to the U.S. does not, therefore, appear to have gained any

special attraction of late, and those flows seem to be part of a larger — indeed global-wide — trend. This finding is of some policy relevance, as it challenges the notion that Canada necessarily needs to become more like the U.S. to reduce the recently increased outflows.

II.3 The Characteristics of the Flows to the U.S.

The tax data indicate that the overwhelming majority of taxpayers leaving the country in 1996 for all countries, not just the U.S. (those data are not available), earned less than \$50,000 in the last full year prior to their departure (Figure 6). The country does, however, appear to be losing a significant fraction of its labour market elite, at least as judged by individuals’ incomes, with fully 0.89 percent of all tax payers earning \$150,000 or more in the last full tax year preceding their departure leaving the country, which contrasts with the .12 departure rate for all tax filers taken together (Figure 7). Emigration rates were also well above average for those earning \$75,000-\$99,999 and \$100,000-\$149,999, although it is important to note that these higher income categories amount to only a few thousand individuals (per year) in total. On the other hand, some of the lower income individuals who left might be recent graduates or others who are just getting started in their careers and whose losses are, therefore, perhaps also of special importance.

From an alternative perspective, estimates based on data provided by the U.S. Immigration and Naturalization Service and the 1996 Census indicate that Canada has definitely been suffering a net loss of workers in several key knowledge occupations (Graph 8). The numbers suggest, for example, that almost one percent of the country’s physicians left Canada for the

U.S. in 1996-97 alone. (This estimate casts some light on the income patterns just noted as well, since physicians are almost always high earners.) Natural scientists, nurses, engineers, post-secondary teachers (*i.e.*, professors), and managerial workers also left in large numbers.

Putting these data together with information available from Citizenship and Immigration Canada permits the calculation of net flows by occupation between the two countries. The most startling figures are the huge net losses for physicians and nurses, with departures outnumbering arrivals by ratios of 18.7 and 15.3 to one, respectively (Graph 9). Substantial net losses are also seen for the other high-emigration occupations noted above.⁷

The picture is much the same when viewed in terms of industrial sector, with the tax filer data showing that in 1996, ten industries accounted for over one-fifth of the close to 27,000 movers, including a cluster in the high technology area (Table 1). The balance of the other losses were spread quite uniformly over a large number of other industries.

Finally, U.S. CPS data have been used to examine the educational credentials of Canadian migrants, both temporary and permanent, to that country. They show that recent migrants to the United States have possessed very high levels of education relative to the average levels of both the Canadian-born population and recent immigrants to Canada. Among migrants to the U.S. aged 16 and over, for the period 1994-1999, for example, nearly half (49 percent) had a university degree. In comparison, data from the 1996 Census indicate that only 12 percent of the Canadian born population and 21 percent of recent immigrants to Canada had this level of qualification.⁸

It also appears that the country is shedding a significant fraction of its most highly educated recent graduates. Despite losing only 1.5 percent of all post-secondary graduates from the class of 1995, fully 12 percent of those at the doctoral graduates were living in the U.S. three years later, in 1998. Furthermore, the overwhelming majority stated that they had left for employment related reasons and a disproportionately high percentage of these (44 percent) ranked themselves in the top 10 percent of their graduating class. Migrants were also somewhat more likely to have received scholarships and other academic awards.⁹ On the other hand, these figures include foreign-born individuals who received their degrees in Canada and — again — do not take into account that some of these individuals will eventually return with useful work experience and important job skills.¹⁰

III. Brain Drain Policy

III.1 Some General Policy Principles

The evidence presented above shows that the brain drain is not particularly large in terms of the total numbers involved or the general “quality” of the majority of leavers, but that there are a number of important types of “knowledge workers” who are leaving in substantial numbers, whose departures represent the loss of substantial public investments in terms of those individuals’ education and job experience, and whose skills will be missed. These include health sector workers, especially physicians and nurses, university professors, cutting edge R&D and high-tech workers, and high income individuals in general.

One of the general principles of economic policy is that the specificity or breadth of the measures adopted should be commensurate with the problem faced so that it is addressed as efficiently as

possible with minimal collateral or spillover effects (as long as any countervailing “distortionary” effects are not large). Since the issue here is that certain relatively small, identifiable groups of individuals have been leaving the country, our inclination should be to direct initiatives at those particular individuals. *Policies to stem the brain drain should, therefore, be targeted on the particular groups of workers for whom outflows are a significant problem.*

At the same time, it seems that most of the particularly worrisome outflows involve individuals in occupational and industrial sectors characterised by broad-based problems of a serious nature *apart* from any brain drain. The brain drain is, from this perspective, the symptom of deeper problems which need to be addressed for their own sake, while any such general improvements should indeed attenuate the loss of skilled workers in these sectors as better job opportunities and work conditions emerge. *Policies should, therefore, begin by addressing the broad underlying problems which exist in the sectors of concern.*

Finally, within the problem sectors, other measures should focus on the particular workers in question (doctors, nurses, professors, R&D and high tech workers, etc.), especially the “best and the brightest” amongst them who not only represent the greatest losses to this country when they leave, but who also face the most attractive outside opportunities precisely because of their exceptional skills in the context of some very competitive international labour markets. *Initiatives should, then, include measures aimed at the specific workers in question, focussing on the most talented and internationally mobile amongst them.*

The rest of this section follows these general principles as it addresses various policy options for dealing with the brain drain problem. These are meant to offer concrete suggestions for some of the most important brain drain groups identified above and to illustrate the sorts of initiatives which could be employed elsewhere.

III.2 The General Income Tax Cut Suggestion: A Non-Starter **The Bluntness of the Tool and Its Associated Costs**

First, however, we deal with “the general income tax cut solution.” It is commonly suggested that an important means of reducing the brain drain would be to reduce personal income taxes — in a general way, but especially at higher income levels. The logic goes as follows: i) individuals are leaving to go to the U.S. at least partly to receive higher after-tax earnings; ii) while gross pre-tax salaries play an important role in this dynamic, Canada’s higher personal income tax rates leave individuals with less after-tax income for a given amount earned; iii) income taxes should, therefore, be cut to increase Canadians’ post-tax incomes and reduce the brain drain.

And there is no doubt that lowering taxes would have some positive direct effect on the brain drain, diminishing the number of emigrants. Following from the preceding discussion, however, it is clear that reducing income taxes for all individuals, or even just those at the high end, to try to prevent a very small and very specific group of individuals from leaving the country would be a very blunt and costly policy instrument. The basic problem is that directing the cuts at all individuals, including the vast majority for whom emigrating is not even a remote

consideration, would engender important declines in government revenues and public spending.

It is, furthermore, not clear how much cutting taxes would actually reduce emigration. Individuals move for many reasons, including the higher gross salaries which typically drive the greatest part of the existing post-tax wage differentials, the availability of more challenging job opportunities, other work-related considerations, and a range of personal factors, and in the face of all these, tax cuts would likely have a relatively small overall effect.¹¹

The effects of the reductions in public spending necessitated by tax cut policy would, in addition, have an emigration-*increasing* influence due its effects on the quality of life available in this country which is a countervailing appeal for many who currently choose *not* to leave. These include not only the individual-level benefits upon which some analysts focus and make comparisons in terms of what might be available on a private basis in the US (health care, post-secondary education, *etc.*),¹² but also various public goods which *cannot* be purchased at the personal or even community level, such as the ability to walk the streets almost anywhere at any time, the advantages of better public health, the full “insurance” aspect of a more generous safety net, and other such benefits. Any significant cuts in social spending would also diminish the deep satisfaction which many Canadians feel by being part of a society where equality of opportunity, compassion for the disadvantaged, cultural identity, and other goals related to common purpose and social justice are given more central place. In short, if the country simply became more like the U.S. (due to the tax cuts), it would not be as attractive for

those who value this country precisely in the ways it differs from that country to remain here, and some of these individuals would surely leave as a result.

A final consideration of the tax-cut strategy is that Canada’s public social spending also has a productivity element. The nation’s public education and health systems, more generous welfare plans, and other tax-financed programmes have not only important social insurance and redistributive functions and, in some cases, notably health care, important efficiency properties in terms of delivering a given level of services to the general population, but also directly contribute to a more engaged and productive citizenry, as evidenced by our more favourable record regarding infant mortality, health, literacy, incarceration, and other favourable outcomes. Any such efficiency properties that were lost due to the adoption of a lower-tax/lower-benefits system should be taken into account when the productivity benefits associated with the hoped-for diminished brain drain stemming from a low-tax/low-benefits solution are considered.

The Numbers: Tax Cut Simulations

To place such income tax suggestions in a better light, simulations of adjustments to the Canadian income tax system along the lines of some of those which have been suggested have carried out. These are not meant to be exhaustive with respect to the type or magnitude of the tax change ideas that have been floated, but give a sense of what such initiatives might entail in terms of the number of individuals that would be affected and the effects on disposable incomes and total government revenues.

Five illustrative scenarios are considered: the first three are based on changing the

point at which the top federal tax rate in Canada cuts in to various higher levels, a common suggestion in the brain drain debate; the last two represent more wholesale shifts towards the American tax system. More specifically, we look at: i) moving the point at which the top Canadian rate of 29 percent cuts in to where the American rate jumps from 28 to 31 percent (*i.e.*, from CDN \$60,009 to CDN \$76,015), ii) moving the point at which the top Canadian rate begins to where the American rate increases from 31 to 36 percent (to \$170,305), iii) moving the point at which the top Canadian rate cuts in to the point where the top American rate of 39.6 percent begins (\$367,957), iv) replacing the three-tiered Canadian system of rates with the full six-tiered American system adjusting for the exchange rate, v) adopting the full federal U.S. system at the same dollar levels (*i.e.*, not adjusting for exchange rates).¹³

The results are shown in Table 2. The first scenario, representing a smallish increase in the income level at which Canada's top personal income tax rate cuts in, generates a relatively small loss of 697 million dollars in government tax revenues (federal and provincial combined), and also has little effect on individuals' incomes, increasing average disposable income a mere 651 dollars for those in the top income category (\$150,000 or more), and less for those below that — hardly the sorts of differences that would change many individuals' ideas about leaving the country.

Skipping scenario two and moving straight to the third, we observe a total loss in government revenues of a more substantial 2.2 billion dollars per year. Seen against total government spending, the amount is not particularly large, but also represents, for example, about half of what the provinces have just received

from the federal government in their hard-won health care accord. Disposable incomes are also up more, an average of \$4,060 for families with incomes of \$150,000 or over. Such differences could be important for those at that precise income point but would be obviously less significant for the higher income families in this open-ended income class. Perhaps more telling is that the changes in disposable income would average a much smaller \$543 for those with incomes from \$100,000 to \$150,000 and a marginal \$143 for those from \$75,000 to \$100,000 — rather negligible.

In the absence of much hard empirical evidence on the effects of changes in taxes or post-tax incomes on out-migration (see above), one may only speculate regarding the extent to which such changes would affect individuals' decisions to stay or leave, but it does seem hard to imagine their being a critical factor in many cases. Nevertheless, suppose we establish an upper bound by giving an extremely generous benefit of the doubt to the tax-cutting camp and assume that these relatively small tax system changes (scenario 3) would cause 5,000 individuals to stay in Canada. (Recall that there were only about this number of leavers with incomes over \$75,000 in total in 1996, the last year for which such calculations are available). The annual cost in terms of reduced government revenues would be \$437,000 per person, calculated quite simply as the associated reduction in government funds divided by the number of individuals hypothesized to stay in the country as a result. If we assume a smaller number of circumvented exits, the cost per person obviously rises: retaining 2,500 individuals would, for example, drive the cost to almost \$900,000 per person; halving that again — probably a more reasonable guess —

doubles the figure to 1.8 million dollars, all amounts in perpetuity. Other figures are offered just below.¹⁴

The bluntness of the general tax strategy is also seen in the number of people affected by the changes: a total of 1.4 million census families, or 9.8 percent of all those in the population, in the case of scenario 3, to stop, probably at very most, 5,000 individuals from leaving. That makes for 267 families, and of course a greater number of separate individuals, being affected for every person whose behaviour might, under a generous set of assumptions, be altered, and an even larger number as we relax our assumptions regarding the number of exits.

Turning to the first, and more radical, of the last two tax change scenarios, we see that adopting the entire U.S. tax system while adjusting the tax brackets by the exchange rate would make for rather massive changes in every respect: an 11 billion dollar decline in government revenues, substantial increases in individuals' disposable incomes, and the great majority of families in the population being affected. If we use Wagner's [2000] estimate that such a tax change would prevent the departure of about ten percent of the U.S.-bound emigrant population and assume it would have a similar effect on departures for other destinations, this would result in a cost of approximately 2.2 million dollars per non-drained brain — a costly proposition.¹⁵ But here it is even more preposterous to think of such changes as representing migration policy as such, since the effects on public spending would be far greater than anything to do with the brain drain *per se*. The final scenario, adopting the U.S. tax system without adjusting for the value of the dollar, again has smaller effects, but is not, in fact, so different from scenario

three, and need not be pursued any further for this reason.

Tax Cuts: The Tail Wagging the Dog

General income tax cuts should, therefore, probably not play any sort of central role in the brain drain debate because the (net) effects on the number of person leaving would not likely be very great and effects on government revenues and public spending would be very large relative to the brain drain effects themselves. Meanwhile, other policy options are available. There may, therefore, or may not be good reasons to reduce personal income taxes, but that debate should be engaged on its own terms rather than dragged into the brain drain issue in the "tail-wagging-the dog" fashion it has been of late, as in references to "our brain draining levels of taxation". We now turn to consider other, more targeted strategies.

III.3 Public Sector-Type Workers Health Workers: Doctors, Nurses and Others

One particular group of concern is doctors, specialists in particular, (McKendry *et al* [1996]). As has been noted earlier, their outflows have been significant in terms of the numbers involved, and represent the loss of highly skilled individuals in whom the nation has generally invested a great deal, education through medical school being a very expensive proposition in terms of public funding. Furthermore, their talents are being especially missed at a time when the demand for doctors continues to rise while supply is still suffering from the medical school cut-backs implemented in the early 1990s, the increasing numbers of practitioners reaching retirement age, and other factors.

For these reasons, and following the general policy principles set out above, it

would appear that brain drain initiatives should include measures targeted on doctors (the first principle), and then begin with the consideration of initiatives related to the health sector, in which they are employed, as a whole (the second principle). This is an especially obvious strategy in a context where the large cuts in health spending instituted in the early- and mid-90s clearly contributed to the outflow of doctors from the country, these losses being related to the ensuing deterioration of working conditions and doctors' growing frustrations in their ability to exercise their talents in the manner for which they were trained due to the lack of operating room time, the dearth of state-of-the-art equipment, the loss of support staff, and other shortcomings in the system.¹⁶ A general, sustained reinvestment in the health system should, therefore, significantly stem those flows, and at the same time provide Canadians with important improvements in the health care they receive.

Furthermore — and fundamental to this level of our policy approach — Canadians do indeed seem to favour such re-investments on their own grounds, thus creating a “virtuous coincidence” in policy terms: better health care as its own worthwhile goal, but this also leading to an associated reduced brain drain which, in turn, would further augment the former.

If, however, such sectoral-wide initiatives did not reduce the outflows to the degree desired, the third (worker-specific) level of the policy strategy would suggest going beyond the health system in general to focus on physicians *per se*, with the goal being to make practising medicine in Canada more attractive in the context of a strong competing demand for physicians

in the U.S. and elsewhere. Raising fee schedules or otherwise improving their terms of employment or working conditions would be one obvious set of measures. Again keeping with the principles established above, though, such initiatives should be particularly focussed on the types of doctors who are the most likely to leave, whose losses would be felt the most, and for whom preventive measures would have the greatest effect in reducing those departures. Specialists would, for example, probably be favoured over family practitioners and lower skilled personnel in this respect.

A similar set of strategies could be applied to nurses, who have also been lost in significant numbers south of the border at significant cost to our health care system (policy principle number one). The sort of sectoral investments aimed at improving the health system in the whole (principle two) should again obtain positive results in terms of both delivering the improved health care that Canadians want as a goal in itself and reducing the number of nurses leaving the country as their working conditions improve. The impact of such general initiatives would be especially direct if they included re-creating the positions that were eliminated in the lean years, thus providing the job opportunities which were so scant for well nigh a decade, literally forcing nurses abroad.¹⁷ If necessary, other more worker-specific measures, such as salary increases and other improvements in working conditions and terms of employment, could also be initiated (policy principle number three), with particular emphasis, again, on those most in demand.

The same general approach could be used for other skilled health sector workers: the size and cost of their outflows might make them worth targeting (the

first policy principle); their outflows would decline in response to any general re-investments in the health system (the second principle); and further worker-specific measures might be appropriate if the sector-wide initiatives did not cut the flows sufficiently (the third principle).

With this set of policy suggestions set out, it should be noted that there have been some significant developments along these lines of late. In particular, health care funding appears to have turned the corner, having risen significantly in the past few years, and will benefit further from an injection of 21 billion dollars into the system over the next five years stemming from the federal-provincial agreement reached in the summer of 2000. One could argue where exactly this leaves the system after the previous half-decade or so of cuts and increasing demands on the system, but we should perhaps see some reduction in the outflows at least relative to their worst levels when more recent data become available. Nevertheless, more, and in some cases somewhat different initiatives along the lines sketched out above are probably needed to stem the drain more fully.

The University Sector

Another important case is the university sector, which appears to have been losing a significant number of professors, including some of its best, as well as a sizeable proportion of its recent Ph.D. graduates, to the U.S. To some degree this has always been the case and is to be expected since the U.S. has many of the world's best and richest universities and is thus able to make attractive offers to eminent or rising scholars in terms of salaries, teaching loads, and research opportunities. However, although the data are scant, there seems to be a general feeling that the situation has worsened in recent years

and that the departures are cutting a greater swath through Canadian institutions than in the past.

If this is the case, we should hardly be surprised. Government operating grants have declined and substantially increased tuition fees have not offset these cuts even as enrolments have risen, while research grants became scarcer through most of the 1990s, putting great pressures on the system.¹⁸ Universities have, in short, become less interesting and rewarding places to work, while U.S. demand has remained relatively strong or even risen, especially for those at the top of their fields. So, some have been departing for the U.S., and again these seem to have included a disproportionate number of our best.

With the university sector being vital to the formation of the nation's cadre of "knowledge workers" and playing a key role in its R&D performance, we begin with a recognition that university professors are probably a group upon which we should focus some of our brain drain attentions (the first policy principle), and that action should start with addressing the broader problems in the sector to the extent such initiatives are worthy on their own account apart from the brain drain problem itself (the second principle). And this could again easily enough begin with a reversal of the general funding restrictions seen over the last decade or more. This alone might deliver a good part of what might be hoped for in terms of reducing the unwanted outflows.

Additional worker-specific measures to further stem the outflows could, however, be targeted on professors *per se*, again focussing on the more active and talented ones, our "academic stars" (the third policy principle). These could come in the form

of boosting salaries and, probably at least as importantly, improving the research opportunities available, making it more rewarding to be a professor in a Canadian university, especially for those at the top echelons of their fields.

There have, in fact, been some significant developments along these lines over the last few years. Some institutions have, for example, diverted monies at the internal level to create special “retention” funds to provide salary premiums and research monies for those who face the greatest outside opportunities. More interesting is the recently instituted Canada Research Chairs programme, which will establish 2000 “U.S.-like” professorships over the next few years. There has also been a re-investment in the federal granting research agencies (SSHRC, NSERC, etc.), considerable sums have gone into the Canadian Fund for Innovation for research infrastructure, and a system of National Health Institutes for research in the health sector was introduced just this year.

Such strategies should not only keep a good number of top scholars at home, providing some badly needed keystones to the Canadian academic structure, but also make them more productive in their research endeavours. On the other hand, while focussing on research in this way might represent an efficient brain drain strategy, it also leaves much to be done in terms of a *general* re-investment in the post-secondary system which includes its teaching mission and the production of the nation’s pool of knowledge workers, an issue which is taken up further below.

Brain-Drain-as-Wake-up-Call for Further Change

In summary, the outflows of certain groups of valued, mobile public sector

workers such as those in the health care sector, university teachers, and other skilled personnel could be efficiently addressed with a combination of sector-wide and worker-specific measures which tended to the more fundamental underlying problems in the relevant sectors which warranted attention on their own and which provided additional individually-based incentives that made staying in Canada a more attractive proposition. And all without changing the basic nature of the country. Indeed, as opposed to a general tax cut strategy which would surely do that, the measures proposed here should *strengthen* the nation’s fabric to the degree they addressed the underlying causes of the brain drain problem rather than simply treating the symptoms.

Money should, however, probably not simply be poured *willy nilly* into the problem sectors or towards the specific workers in question. Instead, these are sectors which are generally protected from market competition and thus risk becoming inefficient in ways they should and need not, and the associated brain drain can, therefore, not only flag the insufficient financial support which has characterised these sectors over the last while as well as the need to meet especially hot labour market competition for certain particular groups of workers, but also point to where changes in the existing systems are needed. The brain drain could thus be a very positive force for change, perhaps of a relatively fundamental nature in at least some cases — a good signal of the need for “thinking outside the box”.

III.4 Private Sector Workers The R&D Sector

One of the most commonly cited examples of where the brain drain is a significant problem is the R&D sector, based on

the substantial numbers involved (as verified above in terms of the departing engineers and scientists and those in the relevant industrial sectors), and their importance to the nation's economic performance. The first of the policy principles set out above would, therefore, indicate their need to be targeted in terms of brain drain initiatives.

The second policy principle would then suggest identifying any general problems in the sector which should be addressed of their own accord. Doing this should lead to higher earnings and more interesting and challenging jobs, thereby reduce the brain drain, and in turn feed back into the sector's dynamism — once again the virtuous coincidence of policy outcomes noted above.

This is not the place to enter into any definitive analysis of the nation's R&D performance, but it would appear that there is indeed substantial room for Canada to become a more dynamically innovative country, and for public policy to play an important role in this.¹⁹ Action could begin by rejuvenating the government financed and operated National Research Council, which was emasculated in the early 1990s, as a larger and more dynamic pure and applied research organization, or perhaps developing a number of loosely-related NRCs focussed on different domains (health, electronics, *etc.*), to act as a keystone of the nation's R&D activities. Second, university-based research could be enhanced by directly providing the required funding for current projects and the required underlying infrastructure. Third, despite the fact that Canada already provides many generous tax incentives for private R&D activities, further measures could be considered, including various tax changes of the type recently suggested in the context of the

high tech sector, as discussed below.²⁰ Finally, the government could play a more active role could in encouraging, facilitating, and helping finance various types of R&D public-private-academic consortiums to co-ordinate and focus these activities.

Such initiatives, amongst others, should invigorate the nation's R&D sector and thereby reduce the related brain drain to more acceptable levels as a greater number of interesting and higher paying jobs became available. Nevertheless, our third, worker-specific policy principle would suggest considering other initiatives more narrowly focussed on making working in the R&D sector in this country more rewarding. Gross earnings are currently higher and taxes generally lower in the U.S. than Canada and these are a highly sought after and very mobile group of workers in a sector which is currently struggling to compete with its much more highly developed American counterpart, so it might make sense for governments to take actions to help narrow these gaps and thus keep more such workers at home, especially in the short run.

Such worker-specific policies represent a greater challenge for private sector workers than the public-type workers (doctors, professors, *etc.*) discussed above because the direct levers accruing to an employer, such as raising salaries or changing work conditions, are not available. One can, however, imagine governments identifying specific tax measures which would apply largely to R&D workers which would have much the same effect. Some examples relating to high tech workers are discussed in the next section, but similar measures could conceivably apply to R&D workers more generally.²¹

There have in fact been some important recent developments along these lines of

late. The federal government has made some substantial reinvestments in university-based research in the ways discussed earlier: the creation of the Canada Research Chairs, the restoration of the previous spending cuts to the research granting agencies, and investments in research infrastructure through the Canadian Foundation for Innovation. Secondly, and related, the critical area of health research has been given an important boost by, amongst other measures, the development of a series of National Health Institutes. Third, Industry Canada has developed a number of research consortiums of the general type suggested above and opened the door to others, these meant to gather together, co-ordinate, and focus various Canadian R&D interests and in some cases join them with international efforts in the same areas. Finally, the year 2000 budget and follow-up mini-budget have offered some important tax changes which should have their greatest effects on R&D activities in general and the high tech sector in particular (see below).

These developments are to be applauded, and what is primarily needed from this point is more — probably much more — of these types of initiatives (and more): more research institutes, greater support for university-based research, more incentives for private R&D activities, more consortiums, and so on. Other measures could also be suggested. This would result in a greater amount of high quality R&D taking place in this country, more good jobs for Canadians in the critical science and technology areas, and a reduced brain drain of these valued workers.

The High-Tech Sector

Turning to the high-tech sector specifically, its strong overlap with R&D activities

— many important R&D activities are high tech related and the high tech sector is largely driven by R&D of certain particular types — means that most of the above discussion again applies, and little more need be said here. One specific recent development which is worth mentioning in the context of the high tech sector, however, is the recent tax changes which have been made principally in its name. In particular, the taxation of stock options has been delayed until those shares are sold. In addition, the tax on capital gains has been effectively reduced through a substantial reduction in the inclusion rate (which is now lower than in the U.S.), “rollovers” of investments in certain types of companies now shield qualifying investments from taxation until they are taken out, and the general corporate income tax rate has been reduced from 28 to 21 percent.

While these represent general tax changes with very little that is specific to the high tech sector (or R&D) *per se*, their effects will likely be felt most in those areas, since they comprise the growth areas where more capital is needed, where profits are greatest, where stock options are a preferred means of compensation, and so on. The effect should, therefore, be to direct investment funds to these sectors and make working in Canada more attractive for this very important and mobile group of workers.

Other Private Sector Workers

The same approach of sector- and worker-specific initiatives could be used for other private sector workers who are concentrated in specific industries and occupations. While this leaves aside those who are not so congregated, the brain drain problem is typically defined in terms of such specific groups, especially the ones discussed here, so it would seem that

the problem could be largely dealt with in this way. Also, the changes in the tax treatment of investment incomes discussed above could make a significant difference for higher income individuals more generally, but in a much more efficient manner than the personal income tax initiatives which have been suggested.

III.5 Supply Side Policies

This paper has focussed on the brain *drain*, but a related issue is the *supply* of workers and the notion of filling labour shortages where the outflows have been problematic. The first point to make here, though, is that if the underlying problems are not dealt with in the problem sectors as discussed above, any enhanced supply will tend to be sucked out of the country for the same reasons as current workers.

That said, there are certain areas where the nation is likely to face labour shortages in the years to come regardless of what is happening in terms of the brain drain, since the new global economic order means that the same forces that are causing the strong demand for certain types of workers in other countries and enticing Canadians to leave are largely operating in a similar manner in Canada. In short, as the worrisome brain drain workers are the ones we most want to keep in the country, they also point to where we should be concerned regarding domestic supply in the years to come.

There are, first of all, a variety of issues pertaining to post-secondary education. In short, is Canada producing the quantity and quality of "knowledge" workers which will allow it to successfully compete at the international level in the 21st century? The general problems plaguing the post-secondary system and the quality of university (and college) education avail-

able in this country have been noted above and need not be addressed further here. These are, however, central issues which absolutely must be attended to.

A more specific question is whether we are producing the right *mix* of graduates. The shares of graduates of different disciplines seems, for example, to have been surprisingly stable and it is entirely possible that the system needs to be more responsive to market demands. There appears, for example, to have been effectively no increase in the number of science and technology graduates of late despite the importance of such individuals to the nation's economic performance.²² Neither does the country appear to be producing as many graduates at the Master's and Ph.D. levels as it should — again especially in the critical areas of science and technology.²³

As for immigrants, the existing evidence (Zhao *et al* [2000]) suggests that while Canada suffers a net loss to the U.S. for various critical classes of knowledge workers, the substantial inflows from other countries generally leave the country as a net gainer in terms of overall flows, even in such critical areas as computer programmers.

The questions that remain, however, include the following: What is the quality of these workers? Are their talents being fully utilised in this country? Could immigrant selection procedures, settlement policies, professional accreditation procedures, or other initiatives permit the country to take greater advantage of this source of high skilled labour? How many leave for the U.S. after only a short stay in Canada and could anything be done to keep them here?

Immigrants offer a rich source of high skilled labour for Canada related to the

unique sets of skills they possess stemming from their educational backgrounds and accumulated job experience, the different languages they speak, their understanding of other cultures, and other attributes which are particularly valuable attributes in the emerging global economy which should help Canada compete at the international level in the years to come. Addressing these issues could, therefore, pay large benefits to Canada in brain drain areas specifically, as well as more generally.

IV. Conclusion

The brain drain is a problem which needs to be addressed.

It is, however, of a very different nature than most might imagine. It is certainly not a question of great hordes of Canadians leaving *en masse*, as current outflows are quite small by historical standards. Focussing on the movements to the U.S. which dominate the debate, the number of departures does appear to have increased in the 1990s (as to other destinations), but is still estimated to amount to only between fifteen and twenty-five thousand workers per year — on the order of one-tenth of one percent of the working population and the U.S.

Neither are great swaths being cut through the ranks of our “best and brightest”, as the flows are simply not very large even at the high end as, for example, measured by individuals’ income levels. Several thousand “higher-income” (quite generously defined) departures per year (to all destinations) would simply not appear to be grounds for panic, especially when many of these individuals will come back at some point with new skills and valuable experience to lend to the country.

That said, the brain drain *is* a significant problem in the sense that certain specific

groups of skilled workers are leaving at disproportionately high rates and will be missed, including doctors, nurses, and other health care workers, university professors, engineers and scientists and others in R&D activities and the high tech in particular, and high income individuals in general.

With the empirical record thus established, various policy options have been considered, guided by three policy principles. First, initiatives should target the relatively few specific groups of workers which comprise the greatest part of the brain drain problem. Second, actions should begin by addressing the general problems which characterise the brain drain sectors which should be dealt with on their own account, with an understanding that such actions will also lead to a reduced brain drain as the sectors are strengthened and more interesting and better paying employment opportunities emerge. Third, to the degree such sectoral actions do not stem the outflows to the desired levels, other worker-specific measures could be adopted, with these focussed on the most talented individuals who face the best outside offers precisely because of their special skills in some very competitive labour markets. A range of specific proposals for the brain drain sectors identified in the data was then proposed.

The oft-proposed idea of general personal income tax cuts was also evaluated and judged to have a number of fundamental problems. Most importantly, general tax cuts would comprise an extremely blunt policy instrument, since they would apply to all individuals, most of whom are not at the slightest risk of leaving the country, and would thus be very costly in terms of revenue losses and the required reductions in public spending. Even under the most optimistic assumptions, the cost per brain would be

high, on the order of half a million dollars, and might well be several times this amount, all on a perpetual basis. In short, there may or may not be good reasons to cut personal income taxes, but that issue should be debated on its own terms, rather than dragged into the brain drain debate precisely because the brain drain effects would be small relative to the more general consequences of any such initiative and other more efficient and effective policies are available.

The paper then concluded with a brief consideration of supply side measures relating to post-secondary graduates and immigrants, where it was suggested that certain related initiatives could comprise part of a general solution regarding the general shortage of workers in the problem brain drain sectors.

In conclusion, then, the brain drain is principally a problem of relatively small numbers of specific types of high skilled workers leaving the country, *pushed* by various underlying problems in the sectors in question, *pulled* by strong labour market demand at the international level, and *accommodated* by the increased integration of the Canadian and

U.S. economies and a general increase in labour mobility at the international level. The most effective and efficient general strategy for dealing with the problem would, therefore, be to address the deeper sectoral issues at their fundamental level, thus dealing with the push factors, make working in Canada a more attractive proposition in terms of remuneration and working conditions for the relevant groups of workers, thus substantially neutralising the pull side of the dynamic, while understanding that such labour flows will increase in all directions due to the integration or “globalisation” factor.

Such directed and focussed strategies would thus address the brain drain problem as it actually exists, and would, unlike the general tax cut approach, do so without changing the basic nature of the country — indeed, strengthening it to the extent it led to intelligent policy initiatives which shored up some key sectors in our economy while indeed keeping some of our key knowledge workers at home. All this would thus comprise a “Canadian way” of meeting the brain drain challenge, rather than simply following the American lead in a race to the bottom in terms of taxes and, of necessity, public spending.

Appendix A: Data Sources on Emigration

Reverse Record Check (RRC): The RRC is the means by which Statistics Canada estimates coverage in the Canadian Census of Population. A by-product of the RRC is an estimate, for the five year inter-censal period, of the number of people who were living in Canada at the time of the 1991 Census or who entered Canada between 1991 and 1996 who were then residing in the United States at the time of the 1996 Census. Permanent movers in the RRC data are defined as people who, at the time of the RRC, 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 RRC, had resided outside of Canada for at least six months but who expressed their intention of returning, or who had resided outside Canada for no more than two years if their intentions were unknown.

Canadian Personal Taxation Data: All residents receiving income from Canadian sources are required to file a Canadian tax return, including people leaving Canada during a given tax year. Upper and lower bounds of out-migration to the United States can be derived by geo-coding the address provided by such tax filers. The reason that these data can only be used to calculate upper and lower bounds on the outflow of workers to the U.S. is that roughly 1/3 of these filers file from a Canadian address; the bounds result from making limiting assumptions about the destination of such filers. The taxation data provide no information on the permanency of these moves.

The Current Population Survey (CPS): The CPS is a monthly survey of U.S. labour market conditions. Since 1994, a supplementary survey has been conducted in March to profile the characteristics of foreign born people residing in the United States. The survey thus provides an estimate of the number of Canadian-born individuals 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 U.S. for shorter durations. Nor do the CPS data pick up individuals who were born elsewhere who came to Canada and subsequently left the country to live in this U.S.

Appendix B: Temporary Visas

Visa data on “temporary” workers, including those entering under special arrangements stemming from NAFTA available from the U.S. Immigration and Naturalization Service have been used to analyse the level and trend of temporary migrants to the U.S. (e.g., Conference Board of Canada [2000], Devoretz [1999], Devoretz and Laryea [1998], Iqbal [2000], Globerman [1999]). These studies seem to indicate that a significant number of workers have been leaving Canada to work in the U.S. on a “temporary” but perhaps prolonged basis, with a certain number of these individuals assumed to be converting to permanent residency in time. The data also seem to show a sharp increase in the late 1990s. Not surprisingly, these findings have been the cause for a good deal of concern regarding recent levels and trends in emigration and the ability of the more conventional data sources to capture such recent developments.

However, the very fact that these empirical patterns cannot be confirmed by other data and some important identifiable problems with their construction leaves their significance very much open to question. In some cases, for example, these temporary visa figures include very short-term stays, as little as a few weeks, which could in no real sense be considered as any sort of real “emigration” *per se*. Furthermore, the lengths of stay which are observed in the data are often overstated because many Canadians (in particular) do not turn in their visas at time of departure.

As for the number of visas, individuals who leave the U.S. for any period of time to go to any country except Canada or Mexico are issued new visas upon their re-entry, as are those who go to one of those two countries for more than thirty days, resulting in multiple issues and an inflated number of entrants.

Similarly, for some types of visas, renewals are uniformly treated as new issues and are therefore separately included in the numbers, biasing them further upwards. Furthermore, apparently most of those for whom simple extensions are available choose instead to obtain new visas, and are thus counted again, because the procedures are easier. With most visas good for one year, a new entry will, therefore, be registered on an annual basis for each individual. Furthermore, a six-month category — thus potentially resulting in two registered entries per year corresponding to the standard renewal procedures — has been increasingly used of late, especially for nurses, who comprise a substantial share of these entrants.

In short, the significance of these temporary visa data in terms of representing the true number of Canadians are very difficult to interpret. As for the trends over time, the number of temporary visa issues also appears to have been affected by changes in administrative policy, with the post-1997 increases upon which many analysts have concentrated, in particular, appearing to stem from efforts by U.S. officials to reduce the number of workers in the U.S. without valid documentation.

It is, in addition, not possible to convert the most common type of temporary visa ("TN" for Trade-NAFTA) to a permanent residency, thus casting doubt on any assumptions about the longer-term nature of these movements.

Finally, to the degree these temporary movements are indeed just that, they would capture the useful accumulation of work experience and the acquisition of various job skills that will increase their productivity when they return to Canada — thus representing a sort of investment in Canadian workers, rather than their loss, in any long run sense.

The best estimates are that temporary visas were being issued to several thousand Canadians per year through the late 1990s. But while it will be important to watch these data to better ascertain how many individuals are actually involved, to better calculate the duration of the absences, to learn more about the kind of movements they actually represent, and to assess the degree to which they matriculate into permanent displacements, they do not at this time appear to comprise a very reliable indicator of the true extent or nature of this type of emigration and any interpretation of these flows should be made with a great of caution.²⁴

Notes

- 1 See Emery [1999], Simpson [2000], and Wagner [2000] regarding the politicisation of the brain drain debate. Emery, in particular, predicts the issue will not go away because various other causes will continually be linked to it for reasons of political expedience.
- 2 This section borrows very heavily from Zhao *et al* [2000]. A great debt is owed to one of the co-authors of that piece, Scott Murray of Statistics Canada, for his participation in the writing of this section.
- 3 Zhao *et al* [2000].
- 4 See Zhao *et al* [2000] and Helliwell [1999] for a historical perspective of the Canada-U.S. flows. Helliwell argues that the long-term downward trend has been principally due to a narrowing of the income gap between the two countries as well as expanded opportunities for post-secondary education in Canada, offset by improvements in the employment opportunities in certain sectors in the U.S. and improvements in transportation and communication which have lowered the personal costs of leaving.
- 5 It is an open question as to whether this historical relationship between permanent and temporary emigrants has shifted in recent years.
- 6 See Simpson [2000] and Helliwell [1999, 2000], amongst others, regarding the Canada-U.S. wage gap.
- 7 Occupational characteristics are currently available only for permanent migrants to the U.S.
- 8 Zhao *et al* [2000].
- 9 Frank and Belair [1999, 2000].
- 10 See Helliwell [1999, 2000] for an analysis of graduates from the University of British Columbia and a discussion of those data in the context of the more general NGS-based results.
- 11 See Conference Board [1999] and Simpson [2000], amongst others, for comparisons of pre- and post-tax earnings differences in Canada and the U.S. In a recent unpublished paper, Wagner [2000] estimates that moving to the full U.S. tax system would reduce out-migration by something around 10 percent. Surveys which ask individuals the specific reasons they emigrated also suggest that tax rates have by no means been a dominant factor. See McKendry *et al* [1996] regarding doctors, Frank and Belair [2000] for the case of recent post-secondary graduates, Conference Board [1999] for references to other specific studies, Simpson for a sample of “Star Spangled Canadians” covered in his interviews, and Helliwell [2000] for a summary of the existing evidence.
- 12 That is, Canadians pay for their health system, post-secondary education system, and other benefits and services through their tax dollars, while these have to be purchased in private markets in the U.S. (in particular), and the benefits of those socially provided items have to be taken into account when evaluating the effects of taxes on well-being and comparing post-tax incomes in the two countries.
- 13 These simulations were carried out using the Statistics Canada SPSPD/M database and model, a micro-level system designed to estimate the effects of changes in the tax system or other policy parameters on a variety of outcomes, such as those studied here. The figures presented here are based on the 2000 tax year. The SPSPD/M is a “static” set-up in that any potential behav-

ournal responses, such as individuals' work patterns, are not taken into account, but suits our purpose of giving a rough idea of how government revenues and individuals' incomes might shift with the tax changes being considered. The authors are grateful to Brian Murphy of Statistics Canada for carrying out these simulations.

- 14 These calculations do not take into account the offsetting savings in government revenues which would result from these individuals staying in the country.
- 15 Suppose we take emigration to the U.S. to be approximately 25,000 per year (greater than the upper bound given in Graph 3). With Graph 5 telling us that U.S. emigration amounts to about half of all outflows, Wagner's 10 percent yields a total effect of a reduction of 5,000 emigrants per year. Dividing the 11 billion revenue loss by this number gives the 2.2 million dollar cost per brain.
- 16 See Helliwell [1999] and Simpson [2000], amongst others, for similar views regarding the importance of such "push" factors in the health sector, as well as other public sectors (*e.g.*, education). Canadian Medical Association [1999] offers one perspective of the decline in spending on health care and its effects, while McKendry *et al* [1996] report that working conditions were a significant factor for many doctors who left the country and for those thinking about leaving — even though many of them considered Canada to have a generally better health system than the U.S.
- 17 In his analysis of University of British Columbia graduates, Helliwell [1999] finds no such exodus of nurses in the 1990s and blames the departures found in more general data sources on the health sector cutbacks which reduced the job opportunities in other provinces.
- 18 See AUCC [1999] for documentation and discussion of these developments.
- 19 See Schwanen [2000] for an excellent discussion of the nation's R&D performance as it relates to the brain drain *per se* which is very much in the spirit of the analysis offered here. Other writers who focus on the science and technology sectors include Devoretz [1999] and Devoretz and Larya [1998]. See also Lavoie and Finnie [1999] for related discussions in the context of the career opportunities available for recent science and technology graduates.
- 20 See Mintz [2000] for a good discussion of some of the most important tax issues of the day, especially as they relate to economic efficiency.
- 21 This would in some sense amount to doing in a much more selective way what many low tax advocates suggest doing at a very general level, and would thus be much more efficient in terms of delivering a given amount of reduced brain drain per foregone tax dollar spent. Furthermore, such tax policies are eminently defensible on their own merits, regardless of their brain drain effects — the criterion that was established above for any general personal income tax changes.
- 22 Finnie [forthcoming], for example, shows that the shares of Bachelor's level graduates across different discipline categories was effectively unchanged from the early-80s to 1990, while Lavoie and Finnie [1999] and Finnie and Lavoie [2000] find similar results through 1995 in their focus on science and technology graduates.
- 23 See the above Finnie-Lavoie references and Schwanen [2000].
- 24 See Hoefler *et al* [2000] for an excellent discussion of these points, Helliwell [1999]

for a general concurrence with the assessment adopted here, and Globerman [2000] and Simpson [2000] for alternative descriptions of the different kinds of temporary visas and types of workers covered by them.

References

AUCC [1999], *Trends: The Canadian University in Profile*, Association of Universities and Colleges of Canada, 96 pp.

CMA [1999], *Investing in Health Futures: No Time Like the Present*, Canadian Medical Association, report prepared for the 132nd Annual Meeting, 39 pp.

Conference Board of Canada [1999], "Are We Losing Our Minds? Trends, Determinants and the Role of Taxation in Brain Drain to the United States", 35 pp.

Devoretz, Don [1999], "The Brain Drain is Real and it Costs Us", *Policy Options*, V. 20, No .7, pp. 18-24.

Devoretz, Don and Samuel A. Laryea [1998], "Canadian Human Capital Transfers: The United States and Beyond", C.D. Howe Institute Commentary No. 115, 40 pp.

Emery, Herb [1999], "The Evidence Vs. the Tax-Cutters", *Policy Options*, V. 20, No .7, pp. 25-29.

Finnie, Ross [forthcoming], "Fields of Plenty, Fields of Lean: the Early Labour Market Outcomes of Canadian University Graduates by Discipline", *Canadian Journal of Higher Education*.

Finnie, Ross and Marie Lavoie [2000], "Careers in Science and Technology in Canada: Evidence on Recent Graduates", forthcoming Human Resources Development Canada (Applied Research Branch) Research Paper.

Frank, Jeffrey and Eric Belair [2000]. "Pathways

to the United States: Graduates from the Class of '95", *Education Quarterly Review* (Statistics Canada Cat. No. 81-003-XIE), Vol. 6, No. 3, pp. 36-44.

____ [1999], "South of the Border: Graduates from the Class of '95 Who Moved to the United States", Statistics Canada.

Globe and Mail [2000], "Planet America: Science" — The Eureka Formula", pp. A12-13.

Globerman, Steven [1999], "Perspectives on North American Free Trade", Industry Canada Research Publications Program, Paper No. 3 (April), 35 pp.

Helliwell, John [1999], "Checking the Brain Drain: Evidence and Implications", *Policy Options*, V. 20, No .7, pp. 6-17.

____ [2000], "Globalization: Myths, Facts and Consequences", C.D. Howe Benefactors' Lecture, 55 pp.

Hoefer, Mike, Doug Norris and Elizabeth Ruddick, "Canadians Authorized to Work in the United States Under NAFTA Provisions", paper presented at the November Metropolis Conference in Vancouver.

IRPP [1998], "A Tax Cutting Strategy for Canada", *Policy Options symposium*, V. 19, No. 10 (December), 48 pp.

____ [1999], "The Brain Drain", *Policy Options symposium*, V. 20, No. 7 (September), pp. 3-43

Iqbal, Mahmood [1999], "Are We Losing Our Minds?", *Policy Options*, V. 20, No .7, pp. 34-38.

Lavoie, Marie, and Ross Finnie [1999], "Is it Worth Doing a Science or Technology Degree in Canada? Empirical Evidence and Policy Implications" (with Marie Lavoie), *Canadian Public Policy*, Vol. XXV, No. 1, pp. 101-21.

McKendry, Robert J. R., George A. Wells, Paula Dale, Owen Adams, Lynde Buske, Jill Strachan, and Lourdes Flor [1996], "Factors Influencing the Emigration of Physicians from Canada to the United States", *Canadian Medical Association Journal*, V. 4, N. 2 (Jan.), pp. 171-81.

Mintz, Jack [forthcoming], *Creating the Canadian Advantage: A Framework for Economic Policies*, C.D. Howe Institute, forthcoming.

Schwanen, Daniel [2000], "Putting the Brain Drain in Context", C.D. Howe Institute Commentary No. 140, April,

Wagner [2000], "Do Tax Differences Contribute Toward the Brain Drain from Canada to the U.S.?", paper presented at the Canadian Economics Association meetings, May, 2000, Vancouver.

Zhao, John, Doug Drew, and T. Scott Murray [2000], Brain Drain and Brain Gain: The Migration of Knowledge Workers from and to Canada: *Education Quarterly Review* (Statistics Canada Cat. No. 81-003-XIE), Vol. 6, No. 3, pp. 8-44.