

The Role of Government in Post-Secondary Education in Ontario

Background Paper for the Panel on the Role of Government in Ontario

W. Craig Riddell
Department of Economics
University of British Columbia

August 2003
(revised October 2003)

An earlier version of this paper was discussed at a meeting of the Panel on the Role of Government in June 2003. I thank Michael Coelli for excellent research assistance, and Ron Daniels, Morley Gunderson, Bill Robson, Arthur Sweetman and Michael Trebilcock, for their comments and suggestions. I however am responsible for the contents of this report.

Table of Contents

1. Introduction	3
2. Background	4
3. Rationale for Government Involvement in Post-Secondary Education	7
<i>Private returns to education</i>	8
<i>Social returns to education</i>	9
<i>Innovation, knowledge creation and economic growth</i>	10
<i>Knowledge spillovers</i>	12
<i>Non-market effects of education</i>	14
<i>Intergenerational effects</i>	15
<i>Health and longevity</i>	17
<i>Criminal activity</i>	18
<i>Civic participation</i>	20
<i>Tax and transfer effects</i>	22
<i>Summary of evidence on social returns to education</i>	23
4. Inputs into Post-Secondary Education	26
<i>Expenditure per student</i>	27
<i>Expenditure relative to GDP</i>	29
<i>Expenditure relative to total public expenditure</i>	30
<i>Student/faculty ratios</i>	30
<i>Summary of evidence on inputs into post-secondary education</i>	31
5. Outcomes of Post-Secondary Education	32
<i>Educational attainment</i>	32
<i>Literacy skills of the adult population</i>	36
<i>Earnings and employment of post-secondary graduates</i>	42
<i>Summary of evidence on outcomes of post-secondary education</i>	48

Table of Contents (continued)

6. Lessons for Ontario's Policies and Institutional Arrangements	50
<i>Admissions policy and province-wide examinations in secondary school</i>	52
<i>Informative grade reporting in colleges and universities</i>	54
<i>Information on employment and earnings consequences of education</i>	56
<i>Encourage expansion of co-operative education programs</i>	58
<i>Financing post-secondary education and student access</i>	60
<i>Tuition fee policy</i>	64
<i>Income contingent student loans</i>	69
<i>Allocation of resources between colleges and universities</i>	75
References	78
Tables	87

1. Introduction

This study assesses the role of government in the provision and financing of post-secondary education in Ontario. Following the introduction, the report has five main sections. The next provides background on the current policy setting, specifically the increased importance of human capital formation in general and post-secondary education in particular. This is followed by a discussion of the rationales for government involvement in post-secondary education. The next two sections assess various features of post-secondary education in Ontario. Section four examines inputs into post-secondary education and section five describes some key outcomes of post-secondary education. To the extent possible, these sections compare Ontario with other jurisdictions in Canada and a selected number of industrialized countries. The last major section makes some proposals for changes to existing policies and institutional arrangements and assesses the advantages and disadvantages of these proposals.

The principal objective of the study is to provide a broad assessment of the role of government in post-secondary education in Ontario. If there was a substantial research literature in this area, this objective could be met by a "state of the art" review of this literature and its implications for government policies and institutional arrangements. Unfortunately, despite its evident importance, education is an under-researched subject in Canada. Research at the level of the province, where most policies relating to post-secondary education are established and implemented, is especially lacking. As a consequence, one objective of this study is to "paint a picture" of educational policy in Ontario and its consequences. Although this portrait is undoubtedly incomplete, it nonetheless attempts to provide a good deal of the information that is relevant to assessing the role of government in post-secondary education.

There is also a tradeoff between breadth and detail of coverage. Several of the issues examined in the paper -- such as tuition fee policy, access to post-secondary education, allocation of resources between colleges and universities, trends in the quality of post-secondary education in Ontario and competing jurisdictions -- could by themselves be the subject of separate studies. Given the purpose of the report, I have generally opted for breadth over depth.

2. Background

Education, training and skill formation have become prominent public policy issues in Canada and in many other countries. Several factors account for the increased attention being paid to the knowledge, skills and competencies of the population and workforce. Technological change -- especially advances in information and computer technologies -- and the globalization of production have resulted in growing demand for highly skilled workers and changes in the nature of skills needed in the workplace. These same forces may also have contributed to widening inequality between more- and less-skilled workers in employment, wages and other labour market outcomes. In addition, there is growing concern about future skills shortages, in part due to the fact that the leading cohorts of the well-educated "baby boom" generation are now approaching retirement age and are being replaced by the entry into the labour force of much smaller (though even better-educated) cohorts. Finally, within the economics profession there has been a resurgence of interest in the determinants of long-term growth in living standards, and "new growth theory" emphasizes the importance of human capital in the creation of new knowledge and in the growth of living standards over time.

These factors explain the increased emphasis on skills and knowledge in economic policy. However, as economic activity becomes more knowledge-based and less dependent on natural resources and physical capital, human capital is also increasingly being viewed as a central component of social policy. Many of our current social programs were shaped during the expansion of the welfare state that took place during the early post-war period. As substantial changes to the economic and social environment have occurred, a major reassessment of these programs has been underway. Governments have begun to move away from "passive" income maintenance programs toward "active" labour market and social policies that facilitate adjustment to change, assist the jobless to find work, and encourage labour force participation. Associated with this shift has been greater emphasis on individual responsibility and on providing those in need of assistance with the opportunity to improve their economic situation -- providing a "hand up" rather than a "handout". Investing in the human capital of those with limited marketable skills is a key component of such an approach. As stated by the former federal Finance Minister Paul Martin, "Providing security and opportunity for Canadians in the

future means investing in their skills, in their knowledge and capacity to learn....good skills are an essential part of the social safety net of the future."¹

The increased emphasis being placed on human capital as a component of social policy also reflects the view that education and training may ameliorate pressures for widening inequality in economic and social outcomes. According to this perspective, policies that promote additional investment in education should increase the supply of more skilled workers -- thus reducing upward pressure on their wages -- and reduce the supply of the less skilled -- thus reducing downward pressure on their earnings and employment opportunities. In periods in which the demand for more educated workers is growing rapidly, making higher education more accessible may prevent increases in income inequality that would otherwise occur.

Education is also often regarded as a mechanism for promoting equality of opportunity and social mobility. Productivity and economic growth are enhanced if the talents of the population are more fully utilized. The efficient allocation of talent requires that those with high ability should be able to pursue productive and rewarding careers whatever their family background. Thus promoting equality of opportunity should be a major objective of economic policy, especially in an environment in which success is increasingly dependent on human resources and knowledge. From the perspective of social policy, equality of opportunity may contribute to social cohesion and a belief in common interests among citizens.

The importance of this emergence of a common emphasis on human capital formation in both economic and social policy has been noted by several observers. For example, Courchene (2001, p. 285) states that we are presented "... with an historically unprecedented window of opportunity...[in which]... a societal commitment to a human capital future is emerging as the principal avenue by which to promote both economic competitiveness and social cohesion."

In this context, several general observations about investment in post-secondary education are worthwhile. First, one issue I do not attempt to address -- despite its importance -- is the question of "Where to invest?" in human capital formation. The

¹ Hon Paul Martin, "Presentation to the House of Commons Standing Committee on Finance, November 2, 1999. [Http://www.fin.gc.ca/update99/speeche.html](http://www.fin.gc.ca/update99/speeche.html).

production of skills, knowledge and competencies is a cumulative process and government intervention may be worthwhile at various points in the life cycle. Even if the social return to investments in post-secondary education is high, the payoff to government interventions at points such as early childhood or elementary and secondary schooling may be even higher.²

The "Where to invest?" question is made even more difficult to answer by the presence of intergenerational effects. Even if, for example, the return to investments in early childhood development is larger than that to post-secondary education, the most effective vehicle for bringing about improvements in early childhood development may be the family rather than programs financed or provided by governments. Increasing the extent of higher education among the current generation is one way to improve parenting skills and foster the development of the next generation.

A second general observation is that the "quality" of human capital may be as important as the quantity, even though the available data are generally much more informative about the quantity dimensions. Whether to invest in the "intensive margin" (quality) or the "extensive margin" (quantity) is an issue that pervades policy debate on post-secondary education.

A third observation is that the post-secondary education system is often characterized by excess demand for programs and the concomitant rationing and queues. This has especially been the case recently in Canada due to the rapid growth in demand for skilled workers, and the associated rapid growth in demand by young Canadians for post-secondary education. In this "market" grades play a major role -- indeed, grades are arguably the equivalent in educational markets of prices and wages in product and labour markets. This means that grades need to be highly informative if they are to appropriately guide decisions of students, faculty, educational administrators and employers. I argue later in the paper that grades are now less informative than they should be.

² Heckman (2000), for example, argues on the basis of the U.S. evidence that human capital investments early in the life cycle have the highest payoffs.

3. Rationales for Government Involvement in Post-Secondary Education

All Canadian jurisdictions are characterized by extensive government involvement in the provision and financing of post-secondary education. This involvement may be justified on efficiency or "prosperity" grounds -- that is, achievement of higher average living standards. The efficiency rationale is based on the presence of benefits from education that accrue to society as a whole in addition to the private benefits that accrue to those receiving the education. Government intervention is also often justified on equity grounds -- that is, promotion of equal opportunity, social mobility, and a more equal distribution of economic rewards. A key element of the equity argument is the observation that -- in the absence of interventions such as student loan programs -- individuals who might benefit from higher education but who do not have the financial resources to finance the investment are typically unable to use their potential human capital as collateral for a loan. In this respect there may be a case for governments to be involved in the financing of post-secondary education, especially for those from less advantaged backgrounds. Finally, education may also promote democratic values and citizenship.

Both the efficiency and equity rationales involve a potential "market failure." The first arises because of positive "external benefits" associated with education -- social benefits that exceed private benefits. The second arises because of a failure in credit markets that results in some individuals being unable to finance productive investments. This feature of credit markets makes investments in human capital fundamentally different from those in physical capital. Institutions such as limited liability, financial markets such as equity, bond, and venture capital markets, and financial institutions such as banks generally ensure that investments in physical capital with a high potential payoff (after adjusting for risk) can be financed. Similar institutional arrangements do not exist for financing human capital investments -- in part because of the abolition of slavery and other forms of indenture.³

In addition to human capital investments not being easily collateralized, the risks associated with these investments are inherently non-diversifiable. An individual

³ There are a few exceptions. For example, the Canadian Armed Forces' Regular Officer Training Program (ROTP) provides heavily subsidized university education in return for a commitment to serve in the Armed Forces for a minimum amount of time (currently 5 years) following graduation.

choosing to become, say, a pilot cannot diversify the risk associated with this occupation by selling claims on future income and purchasing claims on the future income streams of alternative occupations such as pharmacists, electricians and geologists. Inability to diversify risks is another way in which human capital investments differ from investments in physical capital.

The rationales for government intervention in the provision and/or financing of education have been described elsewhere (see, for example, Haveman and Wolfe, 1984; Poterba, 1995; Behrman and Stacey, 1997; Wolfe and Haveman, 2001; Laidler, 2002), so it is not necessary to provide a detailed discussion here. However, some discussion of these issues is included for several reasons. First, since the purpose of the paper is to assess the role of government in post-secondary education in Ontario, it is important to begin with a summary of the reasons why government intervention may bring about improvements in living standards, equal opportunity, income distribution, and democratic values. A clear statement of the reasons why government involvement may improve matters is often helpful in assessing the form that such involvement should take. Second, the efficiency and equity rationales for government intervention that are generally advanced are potentially empirically verifiable, and there have been recent advances in our knowledge about these issues. This evidence was not taken into account in earlier assessments of the case for government intervention.

This section of the paper thus provides a brief review of the current state of knowledge regarding the "social returns" to education -- ranging from impacts on crime, health, volunteer activity and democratic participation to social benefits associated with economic growth via the creation of new knowledge. Before examining the evidence on social returns, some brief comments on private returns to post-secondary education are warranted.

Private returns to education

As many studies have documented, education is one of the best predictors of success in the labour market. More educated workers earn higher wages, have greater earnings growth over their lifetimes, experience less unemployment and work longer. Recent evidence on the magnitudes of these private returns for Canada and Ontario is

reviewed later in the paper. There we conclude that the private financial returns to investments in higher education remain high despite the substantial increase in the supply of college and university graduates in recent decades and despite sharp increases in some of the costs of higher education (notably tuition fees). Real (i.e., after taking account of inflation) rates of return associated with higher lifetime earnings have been in the order of 7-10% in Canada in the past two decades.⁴ In addition to the effects on earnings over the life cycle, there are a number of benefits of education received by individuals or their families such as better health and enhanced education and health of children. Higher education can also be a source of personal development. For many individuals there is also substantial "consumption value" from education. Human beings are curious creatures and they enjoy learning new things. As a consequence of all these factors there are strong incentives for individuals and their families to invest in education.

Even if there were no "market failures" relating to human capital acquisition -- that is, no social returns in excess of private returns and no credit market failures prohibiting individuals from financing productive human capital investments -- there may nonetheless be a role for some government intervention. This is the case because the market for higher education suffers from pervasive problems of incomplete information - - a different type of market failure. Government intervention has the potential to improve the quantity and quality of information and thereby enable individuals to make more informed decisions. This issue is discussed in more detail later in the paper.

Social returns to education

Social returns to education refer to positive or negative outcomes that accrue to individuals other than the person or family making the decision about how much schooling to acquire. They are therefore benefits (potentially also costs) that are not taken into account by the decision-maker. If such "external benefits" are quantitatively important they could result in significant under-investment in education in the absence of government intervention. Many prominent social scientists, from Adam Smith to Milton Friedman to Kenneth Arrow, have suggested that education generates positive external benefits. A substantial amount of empirical evidence is now available on at least some of

⁴ These are before-tax rates of return. I discuss the impact of taxation below.

these outcomes. Several useful surveys of this literature have recently appeared, and I refer to these and some of the individual studies in this report. Most of the empirical evidence comes from the U.S. Much of the earlier literature focused on the correlation between educational attainment and various outcomes. Recent contributions have paid much more attention to distinguishing between correlations and causal impacts.

It is also important to note that the social returns to education are not necessarily as high as the private returns. To the extent that education plays a signaling or screening role in the labour market, social returns can be less than private returns (Spence, 1974). In the extreme case where schooling acts only as a signal and has no effect on individual productivity, the social returns to education are zero but private returns continue to be positive.

The content of education clearly matters. In totalitarian societies schooling is often used as a form of indoctrination. The discussion here presumes that the nature of education is similar to that in Canada and other Western democracies. As we will see, much of the empirical evidence relates to the United States.

I first discuss social benefits that take the form of market outcomes such as productivity, earnings and output of goods and services. This is followed by an examination of non-market outcomes such as health, civic participation and criminal activity.

Innovation, knowledge creation and economic growth

The factors that determine long term growth in living standards have received substantial attention in the past two decades. Much of this research has been dominated by "new growth theory" that emphasizes the contribution of knowledge creation and innovation in fostering advances in living standards over time.⁵ The influence of these new perspectives has been reinforced by empirical evidence that supports the view that education plays an important role in economic growth (see, for example, Barro, 2001).

The importance of economic growth (growth in average living standards) deserves emphasis. Even apparently small differences in growth rates will, if they persist

⁵ Previous theories of economic growth placed greater emphasis on "inputs" into production -- i.e. on the accumulation of physical and human capital.

over extended periods of time, make huge differences to the living standards of the average citizen. For this reason many economists have noted that understanding the determinants of long term growth is one of the most significant economic problems. As stated for example by Lipsey (1996, p. 4):

All the other concerns of economic policy -- full employment, efficiency in resource use, and income redistribution -- pale into significance when set against growth...All citizens, both rich and poor, are massively better off materially than were their ancestors of a hundred years ago who were in the same relative position in the income scale. That improvement has come to pass not because unemployment or economic efficiency or income distribution is massively different from what it was a century ago but because economic growth has increased the average national incomes of the industrialized countries about tenfold over the period.

A central tenet of the new growth theories is that knowledge creation and innovation respond to economic incentives, and can thus be influenced by public policy. The education and skill formation systems play an important role in fostering innovation and advancing knowledge. There are three main dimensions to this role. One is related to the research function of educational institutions, particularly universities. Such research can be an important source of new ideas and advances in knowledge. The other dimensions are related to the teaching function of universities and colleges. These educational institutions train many of the scientists and engineers who will make future discoveries. They also play a central role in the transfer of accumulated knowledge to new generations -- not just in science and engineering but also across a wide range of fields of study. The human capital of the workforce is thus regarded as a crucial factor facilitating the adoption of new and more productive technologies.

The transfer of knowledge function should be reflected in the private returns to education. Those receiving education will become more productive and thus more valuable to employers. The "return" to this investment takes the form of higher earnings than would have been possible without additional education.

In contrast, there will generally be social benefits associated with encouraging innovation and scientific advances that arise from the "public good" nature of knowledge. The potential market failure associated with the public good nature of knowledge is recognized by adoption of patent laws and other institutional arrangements to encourage

invention and innovation. In addition to these "dynamic externalities" that may contribute to greater growth in living standards over time, there may also be "knowledge spillovers" of a more static form if more educated individuals raise the productivity and earnings of those they work with or interact with in the community.

The magnitudes of these "knowledge spillovers" -- both the dynamic and static types -- has been the subject of substantial recent research. Davies (2002) provides a careful review of this literature. He concludes that there is substantial evidence of dynamic externalities associated with education, although he cautions that there remains considerable uncertainty about their magnitudes. These dynamic externalities appear to operate primarily via technology adoption and innovation. His estimate of the magnitudes of these growth-enhancing social returns in excess of private returns is 1-2 percentage points. This estimate is consistent with the results of a number of studies of the relationship between education and growth. For example, the ambitious study of both static and dynamic impacts of education on economic growth by McMahon (1999) covering 78 countries over the 1965-1990 period obtains estimates of total returns to education for the U.S. of 14% of which private returns constitute 11-13%. Comparable estimates for the U.K. are total returns of 15% and private returns of 11-13%.

Another noteworthy finding in this literature is that post-secondary education is relatively more important for explaining growth in OECD countries, while primary and secondary schooling is more important in developing countries (Gemmell, 1995; Barro and Sala-i-Martin, 1995). This result is consistent with the view that tertiary education has a special role to play in preparing workers for technological adoption and innovation in the more advanced countries.

Knowledge spillovers

Static knowledge spillovers arise if more education raises not only the productivity of those receiving the education but also the productivity of those they work with and interact with. For example, in *The Economy of Cities*, Jane Jacobs (1969) argues that cities are an "engine of growth" because they facilitate the exchange of ideas, especially between entrepreneurs and managers. Such knowledge spillovers can take place through the exchange of ideas, imitation, and learning-by-doing. Evidence of the

role of knowledge spillovers in technological change has resulted in substantial attention being focused on the clustering of the agents of innovation -- firms, end users, universities and government research facilities (Bekar and Lipsey, 2002).

Rauch (1993) was the first study of human capital spillovers employing cross-sectional evidence on U.S. cities. He found evidence that higher average education levels in cities is correlated with both higher wages of workers (even after controlling for the individual's own education) and higher housing prices. Similarly, Glaeser, Scheinkman and Shleifer (1995) found that income per capita grew faster in U.S. cities with high initial human capital in the post-war period. In one of several studies of specific industries, Zucker, Darby and Brewer (1998) note an impact of the concentration of outstanding scientists in particular cities on the location decisions of new biotech firms. These studies provide some indirect evidence of human capital externalities. However, they are not conclusive because cities with higher average schooling levels could also have higher wages for a variety of reasons other than knowledge spillovers. In addition, the direction of causation could be the reverse -- higher incomes could lead to more schooling. Recent contributions have used "natural experiments" and other techniques to assess whether there is evidence of knowledge spillovers that is causal in nature.

Acemoglu and Angrist (2001) use variation in educational attainment associated with compulsory schooling laws and child labour laws in the U.S. to examine whether there is evidence of external returns to higher average schooling at the state level.⁶ They find small (about 1%) social returns in excess of private returns but these are imprecisely estimated and not significantly different from zero. Because compulsory schooling laws principally influence the amount of secondary schooling received, these results suggest that there are not significant knowledge spillovers associated with additional high school education. However, subsequent studies by Moretti (1998, 2002, 2003a) and Ciccone and Peri (2002) find stronger evidence of externalities associated with post-secondary education (graduates of four-year colleges in U.S.). These studies use a variety of data sources and focus on spillovers at the city level. Moretti (2003b) provides a useful survey of evidence on these city-level spillovers. Although this literature is still in its infancy,

⁶ Such laws result in variation in educational attainment (in this case, additional secondary schooling) that is independent of individuals' educational choices.

the most recent research indicates moderately large social returns due to knowledge spillovers from post-secondary (college in U.S. or university in Canada) education. For example, Ciccone and Peri (2002) estimate social returns of 2%-8% in excess of private returns. A cautious assessment of this recent literature would be that there are social returns of 1%-2% associated with static knowledge spillovers from post-secondary education in advanced economies. Together with the growth-enhancing dynamic effects, this evidence suggests that social benefits associated with technological adoption, innovation, and productivity enhancement from knowledge spillovers may yield social returns in the range of 2-4%.

Non-market effects of education

Berhman and Stacey (1997), McMahon (1997), Wolfe and Zuvekis (1997) and Wolfe and Haveman (2001) provide recent surveys of the literature that attempts to quantify the social and non-market effects of education. The non-market benefits of education considered are consequences other than those received in the form of higher wages or non-wage benefits from working. Some of these non-market effects -- such as improved own health or child development -- may be considered private in nature, or at least private to the family, and thus may be taken into account by individuals in choosing the amount of education to acquire. If so, they should not be treated as social benefits. Nonetheless, they are benefits that accrue to the individual or family, and thus should be added to the private benefits associated with higher lifetime earnings. I discuss the relevance of this point for policy with respect to education later in the paper. In addition, even effects such as improved health outcomes may be of some public value if they reduce reliance on publicly funded programs.

The empirical studies that these authors survey generally find considerable impacts of education on a wide variety of non-market and social benefits, even after controlling for such factors as income, age, race, etc. The research surveyed analyzed data from both developed and developing countries. Here is a list of the benefits (other than those discussed previously) that are considered:

- Effect of wife's schooling on husband's earnings.

- Effect of parents' education on child outcomes (intergenerational effects): education, cognitive ability, health, and fertility choices.
- Effect of education on own health and spouse's health.
- Effect of education on consumer choice efficiency, labour market search efficiency, adaptability to new jobs, marital choice, savings, and attainment of desired family size.
- Effect of education on charitable giving and volunteer activity.
- Effect of schooling on social cohesion: voting behaviour, reduced alienation and smaller social inequalities.
- Effect of education on reducing reliance on welfare and other social programs.
- Effect of schooling on reduced criminal activity.

Many of the studies surveyed also found relationships between the average education levels in the community and positive non-market benefits. For example, higher average education levels in the community (particularly young adults) lowered school dropout rates of children. Note, however, that not all of this research was able to control appropriately for unobserved factors that may impact both education and these non-market outcomes. Thus considerable care needs to be exercised in treating correlations between education and various outcomes as being causal in nature.

Brief summaries of the state of knowledge relating to these non-market social benefits of education are provided below. Special attention is devoted to recent research, which has generally devoted considerable attention to trying to estimate the causal impacts of education on various outcomes.

Intergenerational effects

Parents' education has strong effects on children, resulting in large intergenerational effects. As a consequence, the benefits of higher education accrue over extended periods. Two recent surveys by Greenwood (1997) and Maynard and McGrath (1997) summarize the literature on these effects. The research shows an impact of parental education on a number of child outcomes, including:

- Higher parental education is associated with lower fertility, via increased efficiency of contraception, as well as via raising the age of both marriage and first pregnancy. The resulting lower population growth is positive for economic growth in developing countries.
- The incidence of teenage childbearing is much higher for children of less educated parents. Teenage parents have elevated probabilities of dropping out of high school, demonstrated lower parenting skills, and experience higher rates of poverty. This has subsequent negative impacts on the children of teenage parents as outcomes for these children are generally worse than for other children.
- Child abuse and neglect are also associated with parental education levels.
- Higher parental education is associated with more substantial family investments in children, and these investments have an effect far greater than the societal educational investments made when the child enters school. Children of more educated parents generally perform better in school and in the labour market, and have better health. These impacts are significant even after controlling for parental income. The higher family investments typically take the form of parental time and expenditures on children.
- Children of less educated parents generally cost more to educate, needing special compensatory programs, as well as being more likely to require expensive programs like foster care and juvenile diversion.
- Higher parental education is associated with lower criminal propensities in children. It is also associated with lower probabilities of parental abuse and neglect, which also may reduce criminal behaviour and the need for the removal of children from the home.
- Higher parental education is associated with improved child health.

Although many of these consequences are internal to the family, and thus should be treated as private benefits, a number of these intergenerational effects of education also have benefits for society. These include: lower education costs, less use of foster care and juvenile diversion, lower crime, lower health costs, and lower dependence on welfare transfers.

Health and longevity

Grossman and Kaestner (1997) and Wolfe and Haveman (2001) survey a huge amount of empirical research on the causal effects of education on health. The overriding conclusion of these authors is that the empirical evidence supports the belief that education has a causal impact on health outcomes in the U.S., other developed countries, and in developing countries. Many studies are careful in uncovering causal impacts rather than simply correlations between education and health outcomes (which are known to be strong). In addition, as noted previously, there is also considerable evidence that child health is positively related to parents' education (Wolfe and Haveman, 2001).

There is less evidence on the actual pathways by which education impacts health. Education may impact how individuals assess information on how to improve health, and it may increase the efficiency by which individuals use that information in lifestyle choices. It may also impact the rate of time preference of individuals, with more educated individuals discounting the future less, and thus undertaking actions that improve health (e.g. smoking less). In a widely cited study, Kenkel (1991) found that education is not only associated with better health outcomes but also superior health behaviours such as reduced smoking, more exercise and lower incidence of heavy drinking. Interestingly, however, the influence of schooling does not mainly operate through its impact on health knowledge -- the estimated impact of additional education did not decline substantially when controls were included for health knowledge. This suggests that the effect of education on health occurs mainly through the utilization of health knowledge rather than the acquisition of such knowledge.⁷

Recent research by Lleras-Muney (2002) reinforces the conclusion that there is a strong causal effect of education on mortality in the U.S. She finds that an extra year of schooling results in a decline in mortality of at least 3.6% over a ten-year period, an impact that is larger than prior estimates of the effect of education on mortality. To deal with unobserved characteristics that impact both education and health she uses variation in educational attainment due to compulsory schooling laws as employed by Acemoglu

⁷ An important exception is the case of smoking, where Kenkel (1991) found evidence of an important interaction between health knowledge and education. Those with more schooling reduced their smoking more for a given increase in knowledge of the consequences of smoking. He also points out that prior to the

and Angrist (2001) and others. This methodology results in estimates that focus on the impact of additional high school on mortality, rather than on higher levels of post-secondary education.

Lleras-Muney and Lichtenberg (2002) examine one of the mechanisms by which education may impact health outcomes. They investigate whether education is correlated with adoption of newer prescription drugs. If more educated people are more likely to adopt newer drugs, due to more information or better ability to learn, and those newer drugs improve health, then this may be one mechanism by which education leads to better health. They find that education is correlated with the purchase of drugs that are more recently approved, after controlling for the medical condition, individual income and health insurance status. The impact of education is generally felt only for chronic conditions, where prescriptions are bought regularly for the same condition. This suggests that the more educated are better able to learn from experience.

Although better health is principally a private return, it may also be a social benefit if it means less reliance by people on publicly provided health care or welfare payments. In this respect, there is an important difference between morbidity and mortality. From the perspective of the public finances, reduced morbidity has a positive effect whereas increased longevity is more likely to negatively affect publicly funded programs such as pensions and medical care.

Criminal activity

Until recently the evidence from empirical studies of the impact of education on crime was mixed. For example, in their reviews of the literature Witte (1997) and McMahon (1999) concluded that the available evidence does not find that education impacts crime once other factors are controlled for.⁸ However, recent work by Grogger (1998), Lochner (1999) and Lochner and Moretti (2001) focuses specifically on the role of education and does find an impact of schooling on crime. Higher education levels may lower crime by raising wage rates, which increase the opportunity cost of crime.

report of the U.S. Surgeon General in the 1960s (which had a major impact on knowledge about the health consequences of smoking) higher education was not related to lower incidence of smoking.

⁸ There is however strong evidence of a link between time spent productively occupied -- either employed or in school -- and crime.

Education may also raise an individual's rate of time preference (the extent to which future consequences are discounted), thus increasing the cost of any future punishment as a result of crime. Lochner (1999) estimates the social value of high school graduation through reductions in crime, taking into account the costs of incarceration and costs to victims. The extra social benefits amount to almost 20% of the private returns to increases in high school completion. This may even be a conservative estimate as a number of crimes are not included in the analysis, nor are the potential benefits to citizens associated with feeling safe. In addition, some of the costs (such as criminal justice and law enforcement costs) are also not taken into account.

In subsequent research, Lochner and Moretti (2002) utilize a variety of data sets to examine whether increasing education levels cause reductions in crime among adult males in the U.S. They employ three sources of information: incarceration, arrests and self-reports of criminal activity. The authors find that higher education levels, particularly graduating from high school, consistently lower the probabilities of incarceration, of criminal arrests, and of self-reports of undertaking criminal activity. In U.S. Census data the probability of incarceration is negatively correlated with education levels, and is much higher for blacks than whites. This correlation may not be causal, however, if there are unobserved individual characteristics which both raise education and lower criminal activity. Following the methods used by Acemoglu and Angrist (2001) discussed previously, the authors employ compulsory school attendance laws as an independent source of variation in educational attainment. Their casual estimates of the impact of education on incarceration indicate that high school graduation lowers incarceration probabilities by 0.8 percentage points for white males and 3.4 percentage points for black males. Differences in educational attainment can explain as much as 23% of the black-white gap in male incarceration rates.

Data from the FBI's crime reports allows the impact of education on different types of crime to be estimated. Education was most effective in lowering violent crime rates like murder and assault, as well as motor vehicle theft. The third data set employed was a longitudinal survey that asked respondents about crimes they have committed. This source of information usefully supplements the data on arrests and incarceration

because it is possible that more educated people commit as much crime as less educated people, but are better at avoiding arrest or obtaining lighter sentences. The evidence, however, is that education has very similar impacts on self-reported criminal activity to that which it had on arrests and incarceration.

On the basis of this evidence, Lochner and Moretti (2002) calculate that raising the high school graduation rate by 1% will reduce the costs of crime by approximately \$1.4 billion dollars per year in the U.S.

Civic participation

The impact of education on civic participation has been analyzed by political scientists for a long time. The correlation between education and voting is strong. Higher education is also associated with greater charitable giving and more volunteerism. Helliwell and Putnam (1999) also find that education is correlated with typical measures of social capital: trust and social participation (club memberships, community work, hosting dinner parties). However, only recently have studies attempted to determine whether education exerts a causal influence on civic participation, or whether the correlation arises because both education and civic participation are jointly influenced by unobserved factors. Two recent papers that attempt to do so are Milligan, Moretti and Oreopoulos (2003) and Dee (2003).

Milligan, Moretti and Oreopoulos (2003) analyse the question of whether education improves citizenship. The authors focus on the U.S. and the U.K., but provide some results for Canada also. The main question is whether people who have more education are more likely to vote in elections. Analysis is also conducted on whether education raises the “quality” of people’s involvement in society. Here “quality” is measured by such things as whether people:

1. follow the news and political campaigns,
2. attend political meetings,
3. work on community issues,
4. try to persuade others to share their views,
5. discuss political matters with friends,
6. consider themselves politically active,

7. consider themselves close to a political party, and/or
8. trust the federal government.

As in previously discussed studies by Acemoglu and Angrist (2001) and Lochner and Moretti (2003), Milligan, Moretti and Oreopoulos (2003) use variation in educational attainment generated by compulsory school attendance laws and child labour laws. The estimates thus relate to the impact of additional secondary schooling on civic participation.

Generally the authors find that having a higher level of education does raise the probability of voting in the U.S., but not in the U.K. They suggest that this may be due to different voter registration methods in the two countries. In the U.S., registration is the responsibility of the individual, and thus many people are not registered. In the U.K., registration is undertaken by local authorities, and registration is required. Thus the vast majority of citizens are registered. If estimates of the impact of education on voting are made conditional on registration, the effect of education becomes much less in the U.S. There is little change in the U.K., as we would expect given the high level of registration. Canada has registration laws more closely resembling the U.K., and the impact of education on voting behaviour is much more muted than in the U.S. Having graduated high school raises the probability of voting by close to 30% in the U.S. (not conditional on registration), while the estimated impact is around 9% in Canada. The authors also find strong impacts of education on the measures of the “quality” of citizenship listed above.

Dee (2003) analyzes the impact of education on voting and civic behaviour in the U.S., using comparable methods to Milligan et. al. (2003) but with different data sources. He also finds a strong causal impact of education on voting behaviour, the probability of reading newspapers and support for free speech by various groups. Some of his results also provide evidence on the impact of post-secondary education on voting behaviour. For example, he finds that college entrance raises the probability of voter participation by approximately 20 to 30 percentage points. He also concludes that an additional year of high school increases the probability of voting in Presidential elections by around 7 percentage points. Education also increases certain measures of civic engagement and knowledge: the frequency of newspaper readership, and support for free speech by anti-

religionists, communists and homosexuals. He also finds that additional education does not increase support for free speech by militarists (someone who advocates outlawing elections and letting the military run the country) or racists.

In addition to these studies based on individual data, cross-country studies find that higher education has a positive effect on democratization and political stability. For example, McMahon (1999, 2001) finds significant effects of secondary schooling on measures of democratization, human rights, and political stability, after controlling for income per capita and military spending as a proportion of total public expenditure. McMahon also finds strong feedback effects on economic growth that operate through democratization and political stability.

Tax and transfer effects

Several studies discussed by Wolfe and Haveman (2001) find that those with more education are less likely to rely on public transfers, even when eligible for benefits. Indeed, evidence indicates that the mother's education even lowers take-up of welfare by eligible children. Although these consequences of education should not be ignored, the quantitatively most important effect is the impact of higher lifetime earnings on government tax receipts (Davies, 2002). For example, in Canada the modal marginal tax rate on university graduates -- taking into account sales, excise and income taxes -- is in excess of 50%. Thus each additional \$1,000 in labour market earnings generates an additional \$500 in tax revenue. Collins and Davies (2001) recently estimated the gap between before-tax and after-tax rates of return to a university bachelor's degree in Canada and the U.S. In Canada, for men and women together, the median reduction in the rate of return due to taxes was 1.9 percentage points. In the U.S. the corresponding reduction was 1.1 percentage points. On the basis of these calculations, Davies (2002) notes that the tax revenue associated with higher earnings adds approximately 2 percentage points to the social benefits of higher education.

Because of the progressive nature of income tax, the reductions in the rate of return due to taxation are larger at higher income levels. For example, Collins and Davies (2001) estimate reductions of 2.8 percentage points for Canadian men at the 90th percentile of the earnings distribution and 1.9 percentage points for corresponding U.S.

men. This calculation highlights an important point made by Allen (1998). The combination of higher earnings associated with additional education and a progressive income tax system implies that we have in place a "contingent loan" system for financing higher education, albeit in a limited form. In short, those who earn more as a consequence of additional education also pay more over their lifetimes in tax revenue. I return to this point later in the paper.

Summary of evidence on social returns to education

A central, if not the primary, reason for public funding -- and in many cases also provision -- of education has been the belief that there are major social benefits from additional schooling, in addition to the private benefits. Evidence on the magnitudes of these external benefits has, however, been lacking until recently. Beginning in the 1960s and 1970s, with the availability of large micro data files on individuals, social scientists have confirmed that educational attainment is correlated with numerous individual and social outcomes such as lifetime earnings, health and civic participation. However, it remained unclear to what extent the positive correlation between schooling and outcomes such as earnings and health reflected a causal impact of education or was due to both schooling and individual outcomes being related to some unobserved factor. Resolution of this issue is crucial as the economic efficiency case for public subsidization rests on education causing social benefits to occur. Recent research using natural experiments and related statistical methods has strengthened the case for believing that the social benefits of education are substantial.⁹

Summarizing the evidence surveyed in this section yields the following approximate estimates of the social returns to schooling:

1. Dynamic externalities associated with economic growth	1-2 percentage points
2. Static knowledge spillovers	1-2 percentage points
3. Non-market external benefits	3-4 percentage points
4. Social benefits associated with taxation	2 percentage points
Total	7-10 percentage points

⁹ As discussed later in the paper, these methods have also provided important new evidence on the causal impact of education on private benefits, particularly earnings.

The quantitative estimate for non-market benefits is based on calculations by Wolfe and Haveman (2001) after removing benefits associated with intergenerational effects and health, both of which are arguably principally private to the individual or family. The other estimates were discussed previously.

These estimates suggest that the social benefits of education may be similar in magnitude to the private benefits associated with higher lifetime earnings, which are also in the range of 7-10 percent. If so, the social returns to education are substantial and justify significant public subsidization of this activity.

The estimated (real) social return of 7-10 percent is arguably a conservative estimate. After a detailed survey of the available evidence, Wolfe and Haveman (2001) conclude that the social return from non-market effects of schooling are of the same order of magnitude as the private returns to education from higher earnings. They do not, however, include the social benefits from higher tax revenue or the growth-enhancing effects of knowledge creation and innovation. On the other hand, they do include in their calculations the intergenerational effects and the impacts of education on health, both of which are excluded from the above estimates on the basis that they are principally private in nature. Similarly, Davies (2002) also concludes that the social returns are similar in size to the private returns. His estimates are similar to those above except that he estimates a value of zero for static knowledge spillovers. The main reason for this different conclusion is that Davies (2002) did not have access to the very recent research by Moretti (2002, 2003a) and Ciccone and Peri (2002) that finds evidence of knowledge spillovers associated with post-secondary education in U.S. cities. Davies' conclusion was principally based on earlier research by Acemoglu and Angrist (2001), who concluded that additional secondary schooling did not have positive external effects on the earnings of other workers in the same state.

Several additional observations are warranted. First, there remains considerable uncertainty about the magnitudes of the social benefits of schooling. In contrast to the substantial amount of research that has been carried out on the relationship between schooling and earnings, much less is known about the causal impact of education on other outcomes. This is particularly the case with respect to Canadian evidence. As

indicated in the previous survey of research, most of the evidence on causal impacts comes from U.S. studies. Some of the impacts of schooling may be universal in nature, but others are likely to depend on the social and institutional setting. This situation was evident in the case of civic participation, where education appears to have a much larger effect on voting behaviour in the U.S. than it does in Canada and the U.K., for reasons that seem to be related to systems of voter registration in the respective countries. It is quite possible that the magnitudes of the impacts of education on Canadian criminal activity and health outcomes are different from those in the U.S., even if the direction of the influence is the same in the two countries.

Second, there is substantial uncertainty about the size of the social benefits associated with post-secondary education. Much of the U.S. evidence on causal impacts of schooling uses as a source of independent variation in educational attainment the changes in compulsory school attendance laws and child labour laws. As discussed, these studies provide evidence on the causal impact of additional schooling at the secondary level. The clearest evidence of positive social benefits from post-secondary education is that associated with growth-enhancing effects from technological change and innovation and knowledge spillovers from more educated workers. There is also some evidence that post-secondary education enhances civic participation. Many of the studies of intergenerational effects also report evidence of significant impacts associated with post-secondary education.

A third observation is that I have not included in the above calculation of social benefits the evidence of intergenerational effects such as those on child development, health and education associated with the educational attainment of the parents. Nor have the effects on the individual's health behaviours and health outcomes (as well as those on the spouse) been included. Whether these are appropriately viewed as private or social benefits depends to an important extent on whether individuals take these consequences into account at the time they choose how much education to acquire. The case for regarding these consequences of additional schooling as private benefits is based on the argument that a rational individual should take these effects into account in making their educational choices (even if they do not yet have a spouse or children). Although many individuals appear to be motivated in part by career prospects in making their educational

decisions, it is less clear that they take into account these other benefits. If they generally do not do so, there is a case for including these consequences as social benefits, as scholars such as Wolfe and Haveman (2001) do. In these circumstances, the above estimates understate the social benefits from education. On the other hand, if we treat the intergenerational effects and health and longevity consequences as being strictly private benefits, then the total private benefits are much larger than is commonly believed. This conclusion would enhance the case for government involvement in the financing of post-secondary education, in order to help ensure that individuals from disadvantaged backgrounds can take advantage of investments with potentially high returns. In addition, there may also be a case for governments providing more information than is currently available on the non-market consequences of additional schooling, rather than focusing principally on the consequences for future employment and earnings.

In summary, although more research on these issues is needed (especially more Canadian research), the value of the social benefits of education appears to be similar in size to the private market returns to education from higher lifetime earnings. Thus the benefits of education are considerable, and any decisions regarding public support for education should take these social and non-market benefits into account.

4. Inputs into Post-Secondary Education

The resources devoted to post-secondary education depend on government policies and on the decisions made by students, their families, and educational institutions. This section compares the resources that Ontario devotes to post-secondary education to other Canadian jurisdictions. Whenever possible, the allocation of resources between key components such as universities and colleges is also examined. Comparisons to other countries are also included when data permit and when meaningful comparisons can be made.

Education systems vary substantially from country to country. For example, there are important differences across countries in the provision of publicly-funded early childhood and pre-elementary schooling, in the extent to which students are streamed into “academic” and “vocational” programs, in the ways in which school and work experience can be combined, and in the extent to which the system provides a “second chance” for

those who drop out at some stage. There are also major differences across countries in post-secondary educational institutions. These differences make international comparisons of educational inputs and outcomes difficult. Although considerable progress has been made in improving the comparability of educational data across OECD countries, these institutional differences among education systems should be kept in mind when interpreting comparative statistics.¹⁰

Tables 1 to 3 report expenditures on post-secondary education relative to various benchmarks: per student, as a proportion of GDP, and as a proportion of total public expenditure. Each table compares Canadian expenditure to the G-7 countries, Australia and the OECD average.¹¹ In addition, each table reports expenditure for Ontario, other Canadian provinces, and the Canadian average. Breakdowns of expenditure into university and non-university post-secondary are provided when the data are available.

Expenditure per student

Relative to other countries, Canada invests a substantial amount in post-secondary education. Table 1 reports expenditure (from public and private sources) per full-time equivalent student, an input-based measure of the quality of education. As this table illustrates, Canadian expenditure per student is second highest (after the U.S.) among the G-7 countries and substantially above other G-7 countries, Australia and the OECD average.¹² At the same time, there is a large gap in expenditure per student between Canada and the U.S. Canadian post-secondary education expenditure per student is 70-80 percent of that in the U.S.¹³ This gap is entirely due to much higher U.S. expenditure per student at the university level, where Canadian expenditure is only about 60% of the

¹⁰ The series of OECD publications *Education at a Glance: OECD Indicators* make a valuable contribution to international comparisons of educational expenditures and outcomes in OECD countries.

¹¹ Because the actual exchange rate may understate or overstate differences in purchasing power across countries, expenditures are reported in US dollars using purchasing power parity (PPP) exchange rates. PPP exchange rates are based on the cost of a fixed basket of goods and services in different countries, and equalize the purchasing power of different currencies.

¹² Canadian expenditure per student is also second highest (after the U.S.) at the elementary and secondary level (OECD, 2002). However, the gaps between the U.S. and Canada and other OECD countries are larger at the post-secondary level than at the elementary and secondary levels.

¹³ In 1995 Canadian expenditure was 70% of the U.S. level, while in 1999-2000 it was 80% of the U.S. level (see Table 1).

U.S. level. Indeed, at the non-university post-secondary level Canada's expenditure per student exceeds that of the U.S. and all other G-7 countries.

At the university level, expenditure per student ranges from about \$17,700 in New Brunswick to over \$29,000 in B.C. However, B.C. is an outlier in this respect -- in most jurisdictions expenditure per student falls in a fairly narrow range of approximately \$18,000 to \$23,000. Ontario's expenditure per student is about \$ 1,000 below the national average, and falls below that of Quebec and all provinces to the west of Ontario, but above the Atlantic provinces. There is much greater variation across provinces in expenditure per student at the non-university post-secondary level, perhaps reflecting not only differences in quality but also variations in the composition of this diverse category across jurisdictions.¹⁴ According to the most recent data, Ontario spends a bit more per student than the national average at the community college level, about the same as Nova Scotia but less than most of the western provinces.

The comparison to the U.S. is important because Ontario educational institutions compete with their American counterparts for students and faculty. This competition is most evident at the university level, and it is at this level that the expenditure gap is largest. Combining the above facts that Canadian expenditure per student is about 60% of that in the U.S. at the university level and that Ontario's expenditure is below the Canadian average implies that Ontario expenditure per student is about 55% -- just over one-half as large -- of that in the U.S.¹⁵

For post-secondary education as a whole, Ontario's expenditure per student fell below the national average by about \$1,000 in the mid-1990s, and was approximately \$300 below the Canadian average at the end of the decade. This situation is in sharp contrast to that of elementary and secondary education, where Ontario ranks first among Canadian provinces in expenditure per student and substantially above (approximately 15%) the national average (Council of Ministers of Education, Canada and Statistics Canada, 2000).

¹⁴ The non-university post-secondary category includes trade/vocational education and community college programs. Note that the 1999-2000 data refer to community colleges only.

¹⁵ This large gap is also noted in the November 2002 report of the Task Force on Competitiveness, Productivity and Economic Progress (2002).

Expenditure relative to GDP

Table 2 reports expenditure from public and private sources on post-secondary education as a percentage of national income (GDP). This measure reflects expenditure per student and the number of students. It indicates the fraction of total output devoted to the consumption of and investment in education.¹⁶

Even among the G-7 countries and Australia, large differences are evident in the relative share of national income devoted to higher education. Canada's expenditure (from public and private sources) on post-secondary education was equal to 2.5% of GDP in 1995 and 2.3% in 1999-2000 -- a level that is highest in the G-7, similar to that of the U.S., and (although not shown) among the highest in the OECD.¹⁷ In Canada and the U.S., the share of GDP devoted to formal post-secondary education is more than double that of other G-7 countries, and substantially above the OECD average.

Although Canada and the U.S. devote similar resources to post-secondary education, the composition of expenditure differs markedly between the two countries, with Canada spending a much lower fraction of GDP on university education and a much larger proportion on non-university post-secondary education. Indeed, the fraction of Canadian GDP spent on non-university post-secondary far exceeds that of any other G-7 country and is more than four times the OECD average.

Canada's relatively high percentage of GDP spent on higher education reflects both the substantial per-student expenditures illustrated in Table 1 and comparatively high participation rates in post-secondary education. Cross-country differences in educational attainment are described below.

The fraction of provincial GDP devoted to higher education in Ontario is lower than all other Canadian provinces (although similar to that of Alberta), and substantially below the national average (about 83% of the Canadian average). This gap exists in both university and non-university post-secondary education. In Ontario, as was the case in

¹⁶ Some care needs to be exercised in interpreting this measure in the Canadian setting. Because of equalization payments, poorer provinces can spend more than their GDP would indicate on post-secondary education, while the opposite is true for richer provinces. In addition, there is no reason to expect that expenditure on post-secondary education will change proportionally with GDP, so richer regions and countries may spend a smaller fraction of their national income on this activity.

¹⁷ The Scandinavian countries also typically rank at the top of the OECD in terms of the percentage of GDP devoted to higher education.

Canada as a whole, the fraction of GDP devoted to higher education declined during the latter half of the 1990s.

Expenditure relative to total public expenditure

Table 3 reports public expenditure on post-secondary education as a proportion of total public expenditure. Canada ranks at the top of the G-7 countries on this dimension, reflecting both Canada's relatively high resource effort devoted to post-secondary education and the fact that much Canadian expenditure is publicly financed. The U.S. and Australia are the countries closest to Canada on this dimension. The fraction of total public expenditure devoted to post-secondary education did, however, decline in Canada during the latter half of the 1990s. In contrast, this proportion increased or remained the same in other G-7 countries and on average across the OECD.

Across provinces, in 1995 Ontario placed in the bottom group in terms of the proportion of public expenditure devoted to higher education, along with Nova Scotia, New Brunswick and Manitoba. By the end of the decade, Ontario was the lowest ranked province on this dimension. Newfoundland, Quebec, Saskatchewan and Alberta allocate the largest shares of their public expenditure to higher education, while a middle group consisting of P.E.I. and B.C. (together with New Brunswick in 1999-2000) devote a larger share of their public budgets to higher education than do the bottom group. Although as a group Canadian governments spent less of their total budgets on post-secondary education at the end of the decade than in 1995, some provinces such as New Brunswick, Nova Scotia, Manitoba, Saskatchewan and Alberta shifted in the direction of increased expenditure.

Student/faculty ratios

Expenditure per student is one measure of the quality of education. Another -- reported in Table 4 -- is the student/faculty ratio. Although the number of faculty only represents one input into educational production, it is a key input. Furthermore, this measure has the advantage of being based only on quantities, and thus not affected by differences in the prices of educational inputs across countries or regions. Unfortunately the most recent international (OECD) data are not very informative as Canadian data

were provided only for non-university post-secondary education. Earlier international data for 1996 indicated that Canadian student/faculty ratios at the university level are similar to those in the OECD overall, but higher than most G-7 countries. At the non-university post-secondary level, both the 1996 and 1999 data indicate that Canadian student/faculty ratios are below the OECD average. Across provinces, Ontario and Alberta have the lowest quality of university education (highest student/faculty ratios) according to this measure. Indeed, in both 1993/94 and 1997/98 all other eight provinces have student/faculty ratios that are substantially below those in Ontario and Alberta and generally less than the national average. Furthermore, the differences across provinces widened during this period, as Alberta and Ontario experienced the largest increases in student/faculty ratios. As a consequence, Ontario's student/faculty ratio at the university level increased from approximately 6-7% above the Canadian average in 1993/4 to 11% above in 1997/98.

The increase in Ontario universities' student/faculty ratio that took place between 1993/94 and 1997/98 is part of a longer-term trend. As documented in Council of Ontario Universities (2000) and Davenport (2002), the ratio of full-time students to full-time faculty increased steadily from under 17 in 1988 to about 22 in 2000 -- a rise of approximately 25 percent.

Summary of evidence on inputs into post-secondary education

In summary, Canada invests heavily in educating its population. However, despite being one of Canada's wealthiest provinces, Ontario devotes fewer resources to higher education than most other Canadian jurisdictions. Ontario's relatively low level of expenditure per student on post-secondary education (especially at the university level) contrasts with the situation of elementary and secondary schooling, where Ontario spends more per student than any other province. The low allocation of resources, relative to other Canadian jurisdictions, is most evident in the proportion of provincial GDP devoted to higher education and in the proportion of public expenditure spent on higher education. According to the most recent data, Ontario ranks at the bottom of all provinces on both these measures. This situation is also evident in Ontario's relatively high student/faculty ratio in university education, a characteristic it shares with Alberta. There is also some

evidence that Canada overall, and Ontario in particular, are falling behind other jurisdictions in terms of resources devoted to post-secondary education. For example, the proportion of GDP spent on higher education declined in Ontario and most Canadian provinces in the 1990s. The student/faculty ratio also increased sharply in Ontario (and Alberta) relative to other provinces during the 1990s.

Canada and the U.S. spend similar amounts relative to their national income on higher education, and much more than other advanced countries. However, there is a dramatic difference between Canada and the U.S. (and, indeed, other OECD countries) in the composition of that expenditure. Canada spends much less on the university sector and much more on non-university post-secondary education. Relative to GDP, Canadian expenditure on non-university post-secondary education substantially exceeds any other G-7 country and is far above the OECD average. Ontario is similar to other Canadian provinces in this respect.

We now turn to an examination of the consequences of these differences in investment in higher education across countries and provinces.

5. Outcomes of Post-Secondary Education

This section examines outcomes associated with post-secondary education, and compares consequences in Ontario to those observed in other jurisdictions. Outcomes such as educational attainment and individual skills depend not only on government policies but also on the decisions of students, their families, and educational institutions. Other outcomes such as employment and earnings of post-secondary graduates depend on an even larger set of factors.

Educational attainment

Measures of educational attainment in Canada, other countries, Ontario, and other Canadian provinces are reported in Table 5. The data show the highest level of educational attainment for the working age population, those 25–64 years of age. Note that this table provides information on the education levels of the "stock" of individuals at a point in time. It thus reflects decisions about investments in education made at various points in time, some recently and some many years ago.

By these measures, Canadian educational attainment is high by international standards, reflecting the substantial expenditure on formal education. In 2001, eighty-two percent of Canada's adult population had completed high school (referred to as “upper secondary” in the OECD data) or post-secondary education, much higher than the OECD average of 66%. Canada's proportion is similar to that of Germany, Japan, and the U.K., but substantially below the U.S. where 88% of the adult population have at least a high school diploma.¹⁸ Although not shown, average completed years of schooling in Canada are also among the highest in the OECD, albeit below the U.S. and some European countries such as Germany.¹⁹

Canada stands out in terms of the fraction of the adult population with completed post-secondary education. Canada's proportion (54%) is not only more than double the OECD average of 26%, but is also the highest in the OECD countries and substantially higher than the U.S., the country ranked second (where 37% have completed post-secondary education). Canada's extremely high ranking on this dimension arises principally because of the very substantial fraction of the population with non-university post-secondary education—at 34%, triple the OECD average and more than double any other G-7 country. At the university level, Canada is above the OECD average (20% versus the OECD average of 15%) and similar to Japan and the U.K., but substantially below the U.S. where 28% have graduated from university.

Canada's ranking at the top of the OECD, in terms of the fraction of the population with completed post-secondary education, has led some analysts to comment that Canada's population is among the most highly educated in the world—even surpassing the U.S., the country traditionally regarded as having the most highly educated population. However, it is important to keep in mind that Canadian educational attainment ranks below the U.S. in two key dimensions: the fraction of the population with completed secondary education (Canada has many more high school dropouts) and

¹⁸ The comparison of Canada and the U.S. with several European countries is quite sensitive to the definition of ‘upper secondary education’. For example, France and the U.K. have both short duration and long duration upper secondary schooling, whereas these are rare in North America. If the short upper secondary programs are excluded, the U.K.'s proportion with upper secondary or higher drops from 83 to 62 percent and the French figure falls from 64 to 34 percent. See OECD (2001).

¹⁹ See OECD (1998) for international data on years of completed schooling. The measurement of years of schooling is problematic in countries like Germany where there are extensive apprenticeship programs that combine work and school.

the proportion with a university degree. Thus at the two extremes of the educational attainment distribution—in Canada, roughly the bottom 20 percent and top 20 percent—Canada ranks significantly below the U.S. It is in the middle of the distribution where Canadian educational attainment dominates according to the OECD measures. In both countries, approximately 60 percent of the adult population have completed high school or a non-university post-secondary program. However, the composition of this middle group differs substantially between the two countries: in Canada more than half (34 percent out of 62 percent) have completed non-university post-secondary education, whereas less than one-sixth (9 percent out of 59 percent) of Americans are in this category.

However, the OECD data probably overstate the educational attainment of Canadians. To examine this issue in detail is clearly beyond the scope of this study. However, a brief comparison to the U.S. is informative and highly relevant to this analysis.

The OECD data are obtained from the statistical agencies in each country. One major difference between Canada and the U.S. is that the American data do not classify those with a trade certificate as "post-secondary" whereas Canadian data does. According to the 1996 Canadian Census, those with a trade certificate represent about 40% of the non-university post-secondary category.²⁰ Furthermore, about one-half of this group did not complete high school, so would appear in the U.S. data as high school dropouts. The other half would be classified in the U.S. data as high school graduates. Adjusting the Canadian data in Table 5 for these differences would result in the "non-university post-secondary" category falling from 34% to 21% of the working age population. The proportion of high school dropouts would rise from 18% to 24% and that of high school graduates would increase from 28% to 35%. Clearly this single adjustment has a major impact on the measured educational attainment of Canadians -- although even at 21% rather than 34% Canada still stands out in terms of the proportion of the population in the non-university post-secondary category. Additional adjustments might be needed for making appropriate comparisons between Canada and the U.S., as well as between

²⁰ Statistics Canada, PUMF on Individuals, User Documentation.

Canada and other countries.²¹

In summary, according to commonly used measures, Canadian educational attainment is very high by international standards, a finding that is consistent with the country's substantial investment in education. The distribution of the educational attainment of Canadians also has some unique features. At the bottom and top of the educational attainment distribution—specifically, those with less than completed high school and those with a university degree—Canadian educational attainment is similar to that of several other OECD countries but significantly lower than that of the U.S. However, in the middle of the distribution—those who have completed secondary school but not university—the proportion of Canadians with a community college diploma or trade school certificate is unusually high and the proportion of high school graduates relatively low. However, this “non-university post-secondary” group is heterogeneous. Canada's provincial education systems have “forgiving” features and provide various routes to a community college diploma or trade school certificate. Approximately 40 percent of the “non-university post-secondary” group consists of those with a trade certificate, and about one-half of these individuals did not complete secondary school.

²¹ For example, relative to other countries, the extent of Canadian non-university post-secondary education may be somewhat overstated because of the Quebec CEGEP system. These institutions provide both “general” and “professional” programs. The former constitute a stage between high school and university, providing the equivalent of the final year of high school and the first year of university in most other Canadian provinces. The professional programs provide the equivalent of the final year of secondary school and a two-year community college program in English Canada.

Graduates of the professional CEGEP programs are similar to graduates of professional/vocational community college programs in English Canada, and are appropriately classified as “non-university post-secondary”. Students who pursue the CEGEP general stream and who obtain a university degree will also be appropriately classified in the data as university graduates. However, those who pursue the general stream but who subsequently do not enter or complete university will be measured as “non-university post-secondary graduates” in Quebec but would appear as high school graduates (albeit with some, but incomplete post-secondary education) in English Canada. Some adjustment to the Canadian data to account for this difference may be appropriate.

Furthermore, there is a long tradition among U.S. labour economists of treating as a separate educational category those who attended but did not graduate from a four year college -- a group referred to as "Some post-secondary". The reason for doing so is that in the U.S. these individuals tend to have more years of completed schooling and higher earnings than high school graduates who did not attend college. In the OECD data these individuals are classified as high school graduates in both countries. However, comparison of U.S. data in Jaeger and Page (1996) and Canadian data in Ferrer and Riddell (2002) indicates that this "Some post-secondary" group is a much larger fraction of the population in the U.S. than in Canada. Thus if "Some post-secondary" is treated as a separate category of educational attainment the recorded proportion of Americans with post-secondary education would increase further relative to that of Canadians.

This raises some questions about whether these individuals should be placed in a higher educational attainment category than secondary school graduates, and how similar individuals are classified in other countries. In the case of the U.S. those with a trade certificate would be classified in one of the high school categories. Thus the extent of post-secondary education among Canadians may be overstated by measures provided by Statistics Canada and the OECD. However, even after making adjustments for the differences in the way the "trade certificate" group is classified in Canada versus the U.S. (and possibly other countries), it nonetheless remains the case that Canada has an unusually high proportion of its workforce with a non-university post-secondary diploma.

The top panel in Table 5 shows educational attainment of the working age population in Ontario relative to other provinces and the Canadian average, using data from the 2002 Labour Force Survey. These data provide information on the education of individuals residing in the province; such individuals were not necessarily educated in the province. All Canadian provinces exhibit the very substantial fraction of the population with a non-university post-secondary education that was evident in the cross-country data. Ontario's proportion (32%) is slightly below the national average (34%). Ontario has the highest proportion of its population with a university degree -- 24% versus the national average of 21 percent. Ontario also has an above average proportion with a high school diploma and below average fraction of high school dropouts. By these measures, Ontario's working age population is one of the most highly educated in Canada, although the fraction of the population with a university degree still falls below that in the U.S.

Measures of educational attainment such as years of completed schooling and highest degree or diploma received are frequently used to compare the amount of human capital of the population or workforce over time and across regions and countries. Nonetheless, these are indirect measures of human capital, reflecting principally the inputs of time and other resources into the production of skills, knowledge, and competencies. We now turn to measures of the outcomes of human capital formation.

Literacy skills of the adult population

Data on student achievement, which have become increasingly available in Canada, provide some information on the skills of those who will be entering the labour

force in the future -- that is, the flow of new entrants. Until recently, however, no nationally representative measures of the skills and knowledge of the existing stock—the adult population—were available. The International Adult Literacy Survey (IALS), which was carried out in over 20 countries during the 1994–98 period, represents a breakthrough in international data collection, providing for the first time measures of the literacy skills of the adult population that are comparable across countries, provinces and language groups.²²

The survey provided three measures of literacy: prose, document, and quantitative literacy. Details of the tests used to measure these skills are given in Organization for Economic Cooperation and Development and Statistics Canada (1995); the main point is that these measures correspond to information-processing skills needed to perform everyday tasks at home, at work, and in the community. For each respondent, the survey measures prose, document, and quantitative literacy on a scale from 0 to 500. These numerical literacy scores are also grouped into five main levels of competency, with level 1 being the lowest and level 5 being the highest. According to Statistics Canada, individuals with only level 1 or level 2 literacy skills have marginal or quite limited capabilities (Crompton 1996).

Table 6 summarizes some of the key findings from the IALS. In order to maintain comparability with previous sections of this paper, results are reported for Canada and other participating G-7 countries (Germany, U.K., and U.S.).²³ Within Canada, results are reported for Ontario, Quebec, Atlantic provinces and Western provinces. The latter two groups are used because the sample size does not permit meaningful estimates at the provincial level in smaller provinces.

The top panel shows the mean score on each of the three literacy scales and the score at the 25th and 75th percentiles of the literacy distribution. The average scores rank Germany at the top (with the exception of the prose scale, on which Canada ranks first and Germany second), followed by Canada, the U.S., and the U.K. at the bottom. Although the differences in mean scores among these four countries may not appear large, they are non-trivial. For example, on the document scale, the mean score in

²² See Organization for Economic Cooperation and Development and Statistics Canada (1995, 2000) for further details on this survey.

²³ France also participated in IALS, but the French results have not been publicly released.

Germany, the top-ranked country, is 285, while that in the U.K., the bottom-ranked country, is 268. An individual with a score of 268 is in the middle of the distribution in the U.K. but would be at approximately the 33rd percentile of the distribution in Germany—that is, about two-thirds of Germany's adult population would have superior document literacy skills.

Compared with many countries participating in the IALS survey, especially continental European countries, Canada, the U.K., and the U.S. display substantial variation in the literacy skills of the adult population (Organization for Economic Cooperation and Development and Statistics Canada 1995, 2000). This phenomenon is evident in Table 6(a) from a comparison of the lower and upper tails of the literacy distributions for Canada and Germany. At the 25th percentile, the German score exceeds that of Canada on all three literacy scales, with the differential being especially large for document and quantitative literacy. However, at the 75th percentile the Canadian score exceeds that of Germany in both prose and document literacy and is approximately equal to that of Germany in quantitative literacy. In general, individuals in the top 25 percent of the Canadian literacy distribution have higher literacy skills than their German counterparts, while individuals in the bottom one-quarter of the Canadian literacy distribution have lower skills than their German counterparts.

Table 6(b) shows the percent of adults with low literacy skills (level 1 or level 2) by broad age groups.²⁴ For the adult population as a whole, the ranking is the same as before: Germany has the lowest percent of adults with low literacy (the exception being the prose scale, on which Canada ranks at the top), followed by Canada, the U.S., and the U.K. However, important differences in the country rankings are evident among age groups. Among young adults (16-25 years of age), Canadians rank at the top, followed closely by Germans. In the U.K., and especially in the U.S., the incidence of low literacy skills among young adults is much higher. In contrast, Canada has the highest incidence of low literacy skills among those 46-55 years of age, exceeding even the U.K. on this

²⁴ On a scale of 0 to 500, literacy level 1 corresponds to a score from 0 to 225 and level 2 corresponds to a score from 226 to 275.

dimension and substantially above Germany.²⁵

The bottom panel, 6(c), provides some insight into the relationship between education and literacy in these countries. Among those with less than a completed secondary school education, literacy skills of Canadians are very poor, substantially below the U.K. and Germany but above the U.S. However, average literacy scores improve substantially with educational attainment, and this gradient appears to be steepest in Canada. Canadian high school graduates rank second (after Germany) among this group of countries, and post-secondary graduates rank at the top, despite the very large fraction of the Canadian population with post-secondary education (the post-secondary category combines university and non-university post-secondary).

These results suggest that Canadian literacy skills are reasonably good by international standards, especially among younger cohorts and post-secondary graduates.²⁶ However, the literacy skills of older Canadians and those with less than a high school education are relatively poor. The fact that, on average, young Canadians display high levels of literacy compared to their counterparts in Germany, the U.S., and the U.K. may be due in part to the increased quantity of education received by recent cohorts compared to earlier generations. This possibility is reinforced by the result that Canadian post-secondary graduates achieve literacy scores that are relatively high compared to their counterparts in other countries that participated in the IALS survey.

In all of these countries, a disturbingly large fraction of the population has low levels of prose, document, and quantitative literacy. Nonetheless, to the extent that these information-processing skills used in daily activities are an outcome of the education system, this simple examination of the IALS data suggests that Canada's education system may be doing a reasonably good job of enhancing literacy skills.

Within Canada, the most striking feature of the data in Table 6 is the "east-west gradient" in skills. In general, literacy skills of the working age population are lowest in the Atlantic provinces and Quebec, higher in Ontario, and highest in western Canada.²⁷

²⁵ The literacy assessments are carried out in English or French (respondent's choice). One factor contributing to the high incidence of low literacy skills is the relatively large fraction of the Canadian population that consists of immigrants for whom English or French is not their native language.

²⁶ This conclusion continues to hold if a wider group of countries, including Australia and Sweden, is examined (Riddell and Sweetman 2000).

²⁷ Note, however, that literacy scores in Quebec are generally below those in the Atlantic provinces.

This pattern is evident in the mean scores on all three literacy measures. However, the gap between Ontario and the western provinces is generally smaller than the gaps between Ontario and provinces to the east of Ontario. Ontario's working age population also has skills slightly above the national average according to each of these literacy measures.

Looking at the tails of the literacy distribution, the east-west gradient also holds for the 25th percentile. On all three literacy measures, Ontario falls short of Western provinces but the person at the 25th percentile in Ontario's literacy distribution has a higher score than her counterpart in Quebec and the Atlantic provinces. Ontario also places at or somewhat above the national average. However, at the top of the distribution Ontario performs much better. For both prose and quantitative literacy, Ontario's population has the highest score at the 75th percentile, while for document literacy Ontario places just below the Western provinces. On each of the literacy measures Ontario ranks well above the national average at the 75th percentile. These data suggest that the literacy skills of Ontario's working age population are about average (or slightly above average) compared to Canada as a whole, but that those who place in the top 25 percent of the literacy distribution in Ontario are among the best in Canada.

Turning to panel (b), a similar east-west gradient is evident in the fraction of the population with low literacy skills. Again, Ontario tends to place closer to the Western provinces than to Quebec and the Atlantic provinces. However, a very different picture arises when the literacy skills of younger and older groups are examined. As was the case for Canada as a whole, the incidence of poor literacy skills is much higher among those aged 46-55 than among those aged 16-25. This is especially the case in Quebec and the Atlantic provinces. The performance of young Ontarians is however a concern. In Ontario, the incidence of low literacy among those aged 16-25 is 35%, above the national average and higher than Quebec and much higher than in western Canada.

The bottom panel shows the relationship between broad educational levels and literacy skills. As noted above, Canada's education-literacy gradient is relatively steep compared to other countries. Substantial regional variation in the slope of this gradient is also evident. The slope is steepest in Quebec, where those with less than high school education have the lowest literacy skills and post-secondary graduates have the highest

skills. In Ontario the gradient is a bit steeper than the national average, while the Atlantic and Western provinces have gradients that are flatter than the Canadian average.

Analysis of the IALS data indicate that education is an important input into the production of literacy skills (Green and Riddell, 2003). Because other factors (such as parents' education) also influence the production of literacy skills, it is desirable to go beyond simple tabulations and include a multivariate analysis of the contribution of post-secondary education to the production of literacy skills. Results of this analysis are reported in Table 7. In order to focus on the production of literacy skills in Canada, immigrants are omitted from the sample. The dependent variable is the individual literacy score (an average of the scores on prose, document and quantitative literacy), and the estimated equations include controls for gender, educational attainment, potential experience,²⁸ and parents' education. For education the omitted (or reference) category is individuals whose highest level of education is a high school diploma, so the coefficient estimates indicate the difference in literacy associated with lower or higher levels of education. For Canada as a whole, individuals who did not complete high school have literacy scores 41 points lower than high school graduates, after controlling for other influences. The literacy gains associated with non-university post-secondary and university are 20 points and 39 points respectively. In general, those with higher education perform much better on these tests of literacy skills than do their less-educated counterparts.²⁹

Across regions, Ontario has the largest estimated gap in literacy between high school dropouts and graduates -- a difference of 51 points. The increases associated with post-secondary education relative to high school completion are 15 points for non-university and 35 points for university graduates. Thus the gains in literacy associated with post-secondary education in Ontario are a bit lower than the Canadian average. As suggested by the simple tabulations in Table 6, Quebec displays the steepest gradient, i.e. the largest literacy gains associated with post-secondary education.

²⁸ Potential experience is defined as Age - Years of completed schooling - 6. This is the amount of experience an individual would have if they entered the labour market after completing school and worked continuously until the date of the survey.

²⁹ Although these results control for parent's education, it is possible that some of the positive relationship between literacy and education is due to unobserved factors such as "ability" that are correlated with both educational attainment and literacy.

Earnings and employment of post-secondary graduates

As many studies have documented, schooling is one of the best predictors of “who gets ahead”. Better-educated workers earn higher wages, have greater earnings growth over their lifetimes, experience less unemployment, and work longer. Many studies have analysed the relationship between education and labour market outcomes such as employment and earnings.³⁰ However, most research on the economic return to education uses data at the national level. This research is briefly reviewed here, and its implications discussed. In addition, new evidence on the relationship between education and earnings for the province of Ontario is presented.

The economic return to education depends not only on the effectiveness of education in enhancing skills and knowledge that have value in the workplace, but also on the state of the provincial economy and labour market. Thus this analysis is in part directed at assessing the effectiveness of Ontario's economy and labour market in providing positive employment and earnings outcomes to well-educated individuals. The labour market premium on education also influences the likelihood that well-educated workers will immigrate to Ontario and emigrate from Ontario.

The strong positive relationship between education and earnings is one of the most well established relationships in social science. Many social scientists have, however, been reluctant to interpret this correlation as evidence that education exerts a causal effect on earnings. According to human capital theory, schooling raises earnings because it enhances workers' skills, thus making employees more productive and more valuable to employers. However, the positive relationship between earnings and schooling may arise because both education and earnings are correlated with unobserved factors such as ability, perseverance, and ambition (hereafter simply referred to as “ability”). If there are systematic differences between the less- and well-educated that affect both schooling decisions and labour market success, then the correlation between education and earnings may reflect these other factors as well. According to signaling/screening theory, such differences could arise if employers use education as a signal of unobserved productivity-related factors such as ability or perseverance (Spence,

³⁰ Earnings is the most commonly used measure of labour market success because it captures both the wage rate or “price” of labour services and employability (hours, weeks and years of work).

1974). In these circumstances, standard estimates of the return to schooling are likely to be biased upwards because they do not take into account unobserved “ability”.

This “omitted ability bias” issue is of fundamental importance not only for the question of how we should interpret the positive relationship between earnings and schooling, but also for the emphasis that should be placed on education in economic and social policy. To the extent that estimates of the return to schooling are biased upwards because of unobserved factors, estimated average rates of return to education may substantially over-predict the economic benefits that a less-educated person would receive if he/she acquired additional schooling. The estimated average rates of return in the population reflect both the causal effect of schooling on productivity and earnings and the average return to the unobserved ability of the well-educated. However, if those with low levels of education are also, on average, those with low ability or ambition, they can only expect to receive from any additional schooling the return associated with the causal effect of schooling on earnings. That is, average rates of return in the population reflect the causal effect of schooling on earnings and the return to unobserved factors. The marginal return—the impact of additional schooling for someone with low levels of education—may be substantially below the average return. In these circumstances, education may not be very effective in improving the employment or earnings prospects of relatively disadvantaged groups. Similarly, investing in additional education may not be an effective way of offsetting pressures for widening income inequality.

Unbiased estimates of the causal effect of education on earnings are thus important for current debates about economic and social policy. In the absence of experimental evidence, economists have examined quasi-experiments or “natural experiments” that isolate the influence of education from the possible effects of unobserved ability. A large number of such studies have now been carried out, using data on identical twins or on sources of variation in education such as those implied by compulsory schooling laws or proximity to a college or university. As a result, considerable progress has recently been made in assessing the magnitudes of these potential biases and estimating the causal effect of education on earnings.³¹ A consistent

³¹ See Card (1999, 2000) for surveys of this progress and of the international evidence and Riddell (2002) for a discussion in the Canadian context.

finding of this large body of research is that conventional estimates of the return to schooling tend, if anything, to *under-estimate* rather than over-estimate the causal impact of education on earnings.³² As a consequence, we can examine conventional estimates of the rate of return to education and we can be reasonably confident that these are not substantial over-estimates of the true return to education.

A number of studies of the relationship between education and earnings in Canada have recently been carried out.³³ These investigations yield estimates of the “return to education” that are similar to those obtained in many studies carried out in other developed countries: approximately 8-10 percent (real) rate of return when the analysis is based on annual earnings and 6-9 percent when the analysis is based on weekly earnings.³⁴ Such estimates compare favourably with rates of return on physical capital investments.

Table 8 summarizes the results of a recent study of the education-earnings relationship carried out by Ferrer and Riddell (2002). This study used Canadian census data that provide not only a large representative sample but also information on both years of completed schooling and all degrees, diplomas and certificates received. This rich information on educational attainment allows one to analyze the influence on earnings of both years of schooling and “sheepskin effects”—increases in earnings associated with the receipt of a diploma, certificate, or degree. As indicated in the first row of the table, when “years of schooling” alone is used to control for the influence of education, each additional year of schooling is estimated to be associated with an increase in female earnings of approximately 9%, and of male earnings of approximately 6%, after controlling for other influences. Females benefit more from higher education than do males, a reflection of the general finding that the gap between male and female earnings is largest at low levels of education and least at high levels of schooling.

Ferrer and Riddell (2002) find that a more general specification in which both years of schooling and receipt of credentials (i.e. variables that indicate receipt of diplomas, certificates, and degrees) provides a better fit to the data. In this more general

³² This occurs because omitted ability bias appears to be relatively small and there are additional sources of bias that operate in the opposite direction.

³³ See Ferrer and Riddell (2002), Rathje and Emery (2002) and Vaillancourt and Bourdeau-Primeau (2002).

specification, the estimated coefficients on the “years of schooling” variable decline but are nonetheless still substantial (3.3% for males and 5.5% for females). The total return to any specific level of education consists of the “years of schooling” effect and the cumulative impact of the estimated “sheepskin effects”.

The findings in Table 8 have several implications that are worth noting. First, as in other recent studies, estimated rates of return to schooling are substantial. Second, there is a significant earnings premium associated with completing an educational program relative to dropping out. Particularly large “sheepskin effects” are associated with the completion of a university bachelor's degree and with degrees in medicine, dentistry, optometry, and veterinary medicine. Third, community college and trade school programs appear to do a good job of enhancing the earnings of those who do not complete high school. These individuals do substantially better in the labour market than high school dropouts without a trade certificate or college diploma, and even experience higher earnings than those whose highest educational attainment is a high school diploma. Fourth, relative to high school graduates, university programs enhance earnings more than do college and trade school programs. For men, the cumulative earnings gain associated with completion of a college diploma or trade certificate is 12.5% or approximately 7 percent per year of additional schooling, whereas the cumulative earnings gain associated with a university bachelor's degree is 37% or approximately 9 percent per year of additional schooling.³⁵ For women the equivalent cumulative gains are 15.8% or approximately 9 percent per year of additional schooling for college programs and 49% or approximately 11 percent per year of education for university bachelor's degree programs.

Table 9 reports empirical estimates of the return to education for Ontario and Canada as a whole using data from the 2002 Labour Force Survey. These results are based on estimation of an earnings function in which the dependent variable -- the logarithm of hourly earnings -- is regressed on educational attainment, age, province of

³⁴ Estimates of the impact of schooling on annual earnings exceed those of the impact on weekly or hourly earnings because those with more education also work more weeks per year.

³⁵ These cumulative effects are calculated by combining the return to each year of education and the estimated sheepskin effect associated with degree completion. On average, high school graduates who completed a college or trade school program had 1.8 additional years of schooling and university bachelor's degree graduates reported 4.4 years of additional education.

residence, and additional variables that control for other influences on earnings.³⁶ This earnings function approach is widely used in empirical studies of the rate of return to education. It also yields insights into the relative magnitudes of other influences on earnings.

Six categories of educational attainment are available in the Labour Force Survey: less than high school, high school graduate, some post-secondary, post-secondary certificate or diploma, university bachelor's degree, and university postgraduate degree.³⁷ In the regression analysis, the omitted category is high school graduate, so coefficient estimates indicate the earnings difference associated with less or additional education compared to the reference category, after controlling for other influences on earnings. Because the dependent variable is measured in logarithms, the estimated coefficients show the percentage increase in wages associated with each level of education. Thus, for example, for Canada as a whole male high school dropouts earn approximately 14 % less than high school graduates while the equivalent earnings gap for female high school dropouts is approximately 21 %. Similarly, those who attended but did not complete a post-secondary educational program earn 4 % (males) and 6 % (females) more than secondary school graduates. As was the case for the Table 8 results based on 1996 Census data, there are large earnings gains associated with post-secondary education. Earnings increases of 13 % for men and 15 % for women are experienced by those who completed community college or trade school programs, while earnings gains of 34 % for men and 39 % for women are associated with university bachelor's degrees. Further sizeable gains are associated with completion of a postgraduate degree. As indicated in Table 9, males with a postgraduate degree earn 42% more than high school graduates do, and 8% more than those with only a university bachelor's degree. The comparable gains for females are greater: women with a postgraduate degree experience earnings 53% higher than high school graduates, and 13% more than women with only a university bachelor's degree.³⁸

³⁶ Province of residence variables are included to control for differences in average wages across regions due to factors such as differences in the cost of living.

³⁷ Estimates of the additional returns to a postgraduate degree compared to a bachelor's degree are sensitive to whether or not the postgraduate category includes professional programs such as law, dentistry and medicine.

³⁸ The postgraduate category includes professional programs such as medicine and dentistry.

The top five rows in Table 9 show the comparable returns to education in Ontario.³⁹ For ease of interpretation these are reported as deviations from the estimated coefficients for Canada as a whole. Thus high school non-completion is associated with a smaller earnings loss in Ontario than in Canada -- approximately 2 percentage points less for men (i.e. 12 % rather than 14 %) and 3 percentage points less for women (i.e. 18 % rather than 21 %). Similarly, there is a somewhat larger earnings gain associated with "some post-secondary" for men and women (about 3 percentage points higher).

The returns to non-university post-secondary education in Ontario are also modestly larger than for Canada as a whole -- about 2 percentage points higher for men and women. However, the reverse is true at the university level, where estimated returns are 2 % and 3 % lower for university bachelor's degrees for males and females respectively and 1 % and 4 % lower for postgraduate degrees.

In summary, returns to education in Ontario are similar to elsewhere in Canada. Relative to high school graduates, dropouts suffer a smaller earnings loss in Ontario and individuals with a college diploma or trades certificate experience a somewhat larger earnings gain. The estimated returns for university bachelor's degrees and postgraduate degrees are slightly lower in Ontario. However, none of the differences between Ontario and other provinces are substantial.

Unlike the Census, the Labour Force Survey data do not provide information on years of education. Thus it is not possible to calculate the rate of return to educational investments on a "per year of additional schooling" basis. Nonetheless, the estimates reported in Table 9 do appear to support the finding from Census data that rates of return from investments in college and trade school programs are somewhat lower than from university programs. For example, in the estimates reported above the earnings gain from university bachelor's degree programs is more than double that of college/trade school programs, while the years of additional schooling beyond high school is approximately twice as large. However, the gap between the rate of return to college and that to

³⁹ In interpreting these results, it is important to keep in mind that we are not comparing differences across provinces in average wages. Rather, we are examining how the earnings-education "gradient" -- the slope of the relationship between earnings and education -- varies across jurisdictions. Wage levels are higher in Ontario than most other provinces, the exceptions being B.C. for both genders and Alberta for males.

university is somewhat smaller in Ontario than in Canada as a whole.⁴⁰

The empirical results in Table 8 based on 1996 Census data and in Table 9 based on 2002 Labour Force Survey data indicate that the private rate of return to investments in non-university post-secondary education are positive and reasonably large, but below those associated with university education. This comparison takes into account differences in the length of time required to complete these programs. Unfortunately there is not much other evidence on this subject -- one that is clearly important given the substantial amount of resources devoted to the non-university post-secondary sector in Canada.⁴¹ However, this conclusion was also reached in an earlier study by Vaillancourt (1995) based on 1986 Census data. In a detailed analysis that took into account both the direct (books, tuition, etc.) and indirect (opportunity costs of not working) costs of post-secondary education, Vaillancourt (1995) concluded that private rates of return for Canadian men were 6.6% for college program and 8.3% for university bachelor's degree programs. The equivalent results for women were 17.3% for college programs and 18.8% for university BA programs.

Summary of evidence on outcomes of post-secondary education

This section has provided a detailed examination of the outcomes associated with post-secondary education in Canada and Ontario, focusing on educational attainment, the literacy skills of the adult population, and the employment and earnings of workers with different levels of education. The main findings have been summarized at each stage, so a detailed summary is not needed. Rather, some of the most salient conclusions are noted.

Measured educational attainment in Canada is high by international standards, reflecting the substantial expenditure made on elementary, secondary and post-secondary education. Nonetheless, the educational attainment of Canadians still ranks below the U.S. at the university level. Where Canada stands out is in terms of the fraction of the population with a non-university post-secondary diploma or certificate. Some of the very

⁴⁰ One possible explanation for this difference is that there are more 3 year undergraduate bachelor's degree holders in Ontario than in other provinces.

⁴¹ There have been numerous studies of the rate of return to university education, including recent studies by Rathje and Emery (2002) and Vaillancourt and Bourdeau-Primeau (2002). However, the majority of these studies compare lifetime earnings of high school graduates and university graduates, leaving out the non-university post-secondary sector.

substantial differences between Canada and other OECD countries in this respect may reflect differences in measurement. However, even after measurement differences are taken into account Canada appears to be unique among advanced countries in this respect.

Despite the fact that its expenditure on post-secondary education is only average or somewhat below average, Ontario possesses a population that is among the most highly educated in Canada. Ontario is below the Canadian average in terms of the fraction of the population who are high school dropouts, and above average in terms of the proportions with a high school diploma and a university degree. Nonetheless, Ontario still ranks below the U.S. in terms of the proportion of university graduates. Like the rest of Canada, Ontario has a very large fraction of the population with non-university post-secondary education.

Although Ontario's population is among the most highly educated in Canada, the literacy skills of the adult population are about average by Canadian standards. Provinces to the east of Ontario tend to have populations with poorer literacy and those to the west have higher measured literacy skills. In all provinces, those with more education have better literacy skills on average. The average increment in literacy associated with post-secondary education, or "gradient", is substantial, albeit somewhat lower in Ontario than in Canada as a whole.

Recent data indicate that there continue to be substantial private rates of return to investments in post-secondary education, despite the very rapid growth in the supply of more highly educated workers in the 1980s and 1990s. Most estimates place average real rates of return to post-secondary education at 6-9% for men and 8-10% for women, although there are substantial differences across fields of study. Such rates of return compare very favourably with potential investments in physical capital. A significant amount of recent empirical research indicates that these impacts of education on earnings are "causal" in nature -- that is, a consequence of education making workers more productive to employers rather than higher education reflecting signaling or screening in the labour market.

In Ontario, private returns to investments in higher education are similar to those prevailing in the rest of Canada. Non-university post-secondary education raises earnings

in Ontario somewhat more than elsewhere in Canada, and raises earnings of university graduates somewhat less. Nonetheless, the differences across provinces are not substantial, as one would expect in a national labour market with a high degree of regional mobility.

Evidence from both 1986 and 1996 Census data and 2002 Labour Force Survey data suggests that the private rate of return to non-university post-secondary education is lower than that associated with university programs (although still substantial). Given the substantial fraction of Canadian national income spent on the non-university post-secondary sector, there is a need to understand better the private and social returns to this type of education and how these returns compare to those associated with university education. The limited available evidence suggests that a shift in resources within the post-secondary education "envelope" away from non-university and toward university may be warranted.

6. Lessons for Ontario's Policies and Institutional Arrangements

This section outlines several proposals that have the potential of leading to improvements in post-secondary education in Ontario. The first two proposals are directed toward improving the information content of grading standards and providing improved incentives for student learning. Subsequent proposals relate to improved information on the employment and earnings consequences of different educational programs, and expansion of co-op programs. The major challenges relating to post-secondary education in Ontario relate to funding of universities and colleges, promoting excellence in teaching and research, and student access and affordability. The rest of the section discusses these issues. The balance of resource allocation between universities and colleges is also discussed.

Before examining specific proposals, several general points that emerged from the previous analysis are worth highlighting. First, investments in higher education have a high payoff for individuals and their families, at least on average. Thus there are powerful incentives to undertake these investments. However, there is also considerable uncertainty about the consequences of attending college or university. Some individuals may be uncertain about what course of study to pursue or whether they will succeed in

completing the program. Even those who are confident that they will complete their chosen program of study will typically be uncertain about the career opportunities they will face after graduation. Access to good information about the consequences of pursuing various forms of higher education could help reduce these uncertainties. In addition, programs intended to help students finance higher education need to be designed in a manner that recognizes the risks associated with human capital investments.

One potentially important role for government is that of ensuring that timely and useful information is available to students and their families to help them make good educational decisions. Some of the proposals outlined in this section are intended to increase the amount and quality of such information.

Grading systems are also an important source of information in the education system. They act as a signal that influences student choices and the allocation of resources within educational institutions. I argue below that there is considerable evidence that grading systems have become less informative than they used to be, and less informative than they could be at present. Improving grading systems is another area where government could play a useful role.

Improved information about opportunities and consequences of post-secondary education and more informative grading systems are both important. However, the critical challenges facing post-secondary education in Ontario relate to the adequacy of funding on the one hand and access and affordability on the other. Another general point that emerged from the previous analysis is that the social returns to education are substantial. There is much more uncertainty about the magnitudes of the social benefits of education than is the case for the private benefits. Nonetheless, on the basis of currently available evidence a reasonable estimate is that the social benefits may be similar in size to the private benefits. This suggests that there is a rationale for substantial government subsidization of higher education. Indeed, on economic efficiency grounds this evidence suggests that a rough rule of thumb to guide public policy may be that about one-half of the cost of higher education should be subsidized by governments. The extent of subsidy could be even greater if one also puts some weight on equity or equal opportunity considerations relating to access to higher education.

Issues relating to the adequacy of funding of post-secondary education and access and affordability are both critically important and complex. Several of the proposals discussed below address these issues in a limited fashion. However, a detailed examination of these questions would require a separate study.

Admissions policy and province-wide examinations in secondary school

The post-secondary education system is characterized by extensive rationing, especially in the universities. The number of students admitted into each institution is substantially less than the number of applicants.⁴² Even among those admitted there is extensive rationing in specific programs of study. Admission decisions are principally based on the student's high school grades. In several provinces there is evidence that competition for university admission has intensified in recent years, with the strong growth in demand for highly skilled workers.⁴³

A desirable characteristic of the admissions process is to make as few mistakes as possible. Like "Type 1" and "Type 2" errors in statistics, admission errors take two main forms: admitting students who should not have been admitted and not admitting students who should have been admitted. Each type of error is costly, both to the individuals involved and to the higher education system and the taxpayers that subsidize it.

High school grades are used not only for admission but also for decisions relating to scholarships and student financial assistance. Again there is potential for both "Type 1" and "Type 2" errors. Both are costly and unfair.

In order to minimize admission and student funding errors, high school grades need to be informative about student aptitude and good predictors of their suitability for further study. If the same student would receive a substantially different grade at one school than at another school, admission and student financial assistance decisions are likely to contain many mistakes. A potentially potent way of reducing the variability in

⁴² Because most students apply to more than one institution, the extent of excess demand (gap between number of applicants and number of admissions) for the system as a whole is difficult to measure with publicly available data.

⁴³ The evidence needs to be examined with some care because there has also been significant grade inflation at the secondary school level. For example, the proportion of students designated as "Ontario scholars" (based on an average grade of 80% or higher) has increased dramatically over the past four decades.

grading standards across schools is to introduce (actually re-introduce) province-wide examinations in the final year or years of secondary school.⁴⁴

Secondary school grading systems are also important for the incentives they provide to student learning. In Canada, the provinces that stand out as having the best performance in student achievement in secondary school are Quebec, Alberta and British Columbia (see Riddell, 2003, and Sweetman, 2003, and the references cited there). A key ingredient of their success appears to be the use of province-wide curriculum-based examinations in secondary school.

Empirical evidence suggests that curriculum-based province-wide examinations in high school have beneficial effects not only on student learning, but also on school administrator behaviour, teacher behaviour and home behaviour and attitudes (see, for example, Bishop, 1995, 1997, 2002). In his background paper for the Panel on the Role of Government, Sweetman (2003) reviews this evidence. As he notes, curriculum-based exit examinations usually exist as part of a package of educational policies, such as a more rigorous curriculum and more highly trained teachers.⁴⁵ Province-wide examinations in secondary school are an important part of this package, and appear to result in improved performance on student achievement tests, often several years prior to the examinations themselves. Importantly for the present discussion, such examinations also result in lower variability in student outcomes.

From the perspective of post-secondary education, province-wide examinations are also likely to result in improvements. First, students are likely to be better prepared for college or university. Both the average quality of students should be higher and, perhaps even more important, the variability in student knowledge and ability should be lower. A related, and key, reason for recommending this change is that it should improve the incentives for student learning in high school. At the present time there exist large differences in average grades across high schools in the province. Only a few programs adjust for these differences when making admission decisions. At a time when competition for post-secondary admission is intense, such differences in grading

⁴⁴ Ontario had province-wide curriculum-based examinations in Grade 13 until the 1960s.

⁴⁵ As noted by Sweetman (2003) it is important to distinguish between the types of curriculum-based examinations discussed here and minimum competency tests. Whether the latter have beneficial effects is less clear.

standards can lead to choices by students that are not conducive to learning. For example, students may attend (or switch to) an "easy grading" school or program of study when in fact a more challenging school or more enriched program would be more beneficial in terms of the skills and competencies acquired. A third reason for recommending this change is that province-wide examinations -- and the concomitant improvement in information about student achievement -- should result in fewer errors in admission and student financing decisions.

Informative grade reporting in colleges and universities

Grading standards in colleges and universities act like the "price system" in product and goods markets -- they guide decision-making by students about courses and programs as well as the effort devoted to study. By influencing student choices they also affect the allocation of resources within educational institutions to departments and faculties.

Grading standards have changed dramatically in recent years. Sabot and Wakeman-Linn (1991) examine grades in a number of disciplines in 8 U.S. colleges and universities for the academic years 1962-63 and 1985-86. At the beginning of their sample period there was remarkable similarity in average grades and the distributions of grades across different disciplines. In the following 23 years, in most subjects there was substantial grade inflation, and the degree of inflation was far from constant across disciplines. As a consequence, by the end of the period one can readily identify "high grading" and "low grading" disciplines.

Anglin and Meng (2000) analyse the experience of Ontario universities and report similar results. They examine grades in introductory courses in 12 disciplines in seven universities for the academic years 1973-74 and 1993-94. Over this 20-year period there was significant grade inflation in many disciplines and the degree of grade inflation varied substantially across subjects. In 1993-94, in the three easiest grading departments (English, French and Music) more than 60% of all students received an A or a B, and less than 13% received a D or an F. In contrast, in the three hardest grading disciplines (Chemistry, Mathematics and Economics) less than 45% of all students received an A or a B, and more than 30% received a D or an F.

Because of these differential rates of grade inflation across departments and academic disciplines there are now large differences in average grades across courses of study. These differences may have significant implications for students' educational choices and for the allocation of resources within educational institutions. For example, a desirable feature of an education system would be that students choose the courses and fields of study that are most appropriate given their interests and aptitudes. The grades that are received in various courses, especially in the early years at a college or university, provide students valuable feedback on their abilities and aptitudes. If some disciplines consistently award higher grades than others, students will receive incorrect signals. They will be less able to judge where their comparative advantage lies, and thus less able to assess their relative suitability for different fields of study.

Even if students can "see through" the veil of differential grading standards, there are powerful incentives to pursue further study in disciplines that award high grades. Evidence indicates that students respond to these incentives. For example, Sabot and Wakeman-Linn (1991) developed a panel data set that tracked a representative sample of students at Williams College through their undergraduate studies. After controlling for other influences, they found that subsequent enrollment in low-grading departments is affected by the absolute grade that the student received in their introductory courses.

The growth of graduate and professional programs, especially those that draw students from a range of disciplinary backgrounds, has increased the problems associated with highly variable grading standards across disciplines. Grades play a key role in determining who is admitted to graduate and professional programs beyond the bachelor's level, as well as which applicants receive scholarships and fellowships for advanced study. Knowing this to be the case, students considering advanced study have a strong incentive to pursue undergraduate studies in "soft grading" subject areas.

Grades also affect the allocation of resources within educational institutions. In many colleges and universities, resources flow to the areas with the most students. Departments and faculties with declining enrollments face the prospect of reduced budgets. As a consequence, there may be an incentive for some disciplines to award higher grades in order to attract students.

Potential employers of post-secondary graduates also take grades into account. In technical and professional fields, in particular, employers use grades as an indicator of which students are well trained. In many areas, grades are one of the measures used to rank the most promising candidates. Grade inflation and highly variable grading standards across disciplines -- especially the latter -- are likely to result in less-informed decisions by potential employers. Employers selecting among graduates from different institutions -- even among students from the same school who have followed different courses of study -- have very little objective basis for judging the achievement levels of students.

The current situation is not unlike that of a consumer buying a car and being told the price but not whether the currency in which the price is quoted is Canadian dollars, Euros, U.S. dollars, or pesos. The present lack of information content in grades is probably distorting decisions throughout the post-secondary education system -- including student decisions about courses or programs to pursue, admission decisions for many graduate programs, granting agency decisions about scholarships and fellowships, and employer decisions about who to interview for a job opening and who to hire.

The problems associated with differential grading standards could be dealt with by the colleges and universities themselves. However, governments could also play a useful role. Governments could encourage colleges and universities to report grades in a comparable and informative manner. For example, reporting the class median grade plus the grade at the 25th and 75th percentile is a straightforward yet very informative addition to simply reporting the student's grade. Even better would be to report the grade at each quintile of the class grade distribution.⁴⁶ Not only would this modest change in procedures result in grades that are substantially more informative, this proposal could also help offset pressures for grade inflation.

Information on employment and earnings consequences of education

Post-secondary education is a major investment decision. The significance of this decision has been growing as more of the cost of providing higher education has been shifted from governments to students and their families. Yet in many cases choices such

⁴⁶ I am told that Queen's University does this.

as which institution to attend and what course of study to pursue are made with relatively little information about the long-term consequences. Except for some professional programs, few departments, faculties, schools or institutions provide information on the subsequent success of their graduates.⁴⁷ As stated by Romer (2000, p. 26), "The market for education suffers from pervasive problems of incomplete information."

The desire for information upon which to base choices is illustrated by the success of *MacLean's* magazine's annual ranking of Canadian universities, and similar rankings in the U.S. Although these publications provide some information that may be useful for assessing the quality of the university experience, they do not provide critical information on the subsequent employment and earnings of graduates of various institutions and programs. High school students can obtain useful information about the consequences of pursuing higher education from publications such as Human Resources Development Canada's *Job Futures*.⁴⁸ But this information is quite aggregate in nature, so does not help students choose specific educational institutions or programs. In addition, it is not clear that guidance counsellors make good use of this information.⁴⁹ For questions such as whether to study physiotherapy or biology or which college or university to attend, many students principally rely on information from family and friends, information that may be anecdotal in nature. This could help to explain why individuals from lower socio-economic backgrounds tend to over-estimate the costs of post-secondary education and understate the benefits more than their counterparts from higher socio-economic backgrounds.⁵⁰

⁴⁷ Romer (2000) reports the results of an experiment in which he initiated the application process for the top 10 graduate programs in the U.S. in mathematics, physics, chemistry, biology, computer science and electrical engineering as well as the top 10 business and law schools. Among the 60 requests from science and engineering programs, none provided information about the salaries of graduates, either in the initial information packet or in response to a follow-up request for such information. Seven of the business schools and four of the law schools gave salary information in the information packet and one business school and three law schools provided such information in response to a further request.

⁴⁸ This publication provides information on current earnings and unemployment rates by occupation and field of study. The information by field of study is broken down by trade/vocational, community college/CEGEP, and university, but is national in nature (Canada-wide averages).

⁴⁹ The Report of the Expert Panel on Skills (Advisory Council on Science and Technology, 2000) noted that there is no formal training program for career counsellors in Canada. It recommended that federal and provincial governments should consider developing standards for career counsellors so that they understand how labour markets function and are better able to advise students.

⁵⁰ Tomkowicz, Shipley and Ouelette (2003) find that all Canadians over-estimate the costs of pursuing post-secondary education, but those from lower socio-economic backgrounds do so in the extreme. At the

However, information on the employment and earnings of post-secondary graduates is potentially available. One source is Statistics Canada's regular Surveys of Graduates that follow graduates 2-years and 5-years after completing their studies. These data are used as input into *Job Futures* but the information is not provided in a way that allows students to assess the probable consequences of choosing a particular educational program. In this respect, a source of information with considerable potential is the administrative data on post-secondary students that are collected in several provinces as well as by Statistics Canada. The study of co-operative education programs discussed in the next section is an example of useful information based on administrative data sources (in this case, the University Student Information System).

This is another area where governments could play a useful role. Because individual students and their families have strong incentives to make good educational choices, it is not necessary for governments to be extensively involved in regulating the post-secondary education system. Rather they should focus on ensuring students and their families have access to high quality information to guide their schooling decisions. This may involve better training for career counsellors and provision of more detailed information on employment and earnings outcomes, including outcomes associated with specific programs of study. In addition, as discussed elsewhere in this section, governments should focus on ensuring that funding and other arrangements provide appropriate incentives for educational institutions to offer high quality programs.

Encourage expansion of co-operative education programs

Co-operative education programs combine education and work terms, providing students with the opportunity to apply their skills and knowledge as part of the educational process. These programs also have the benefit of providing feedback from employers to educational institutions, thus potentially making the educational process more relevant to the workplace. In Canada, the use of co-op programs has been growing. Some colleges and universities have specialized in offering such programs, and many post-secondary education institutions now offer at least some co-op programs.

same time, all Canadians understate the benefits, but those from lower socioeconomic backgrounds do so to a much greater extent.

An additional advantage of co-op programs in the current environment is that they enable students to increase their earnings while attending university or college. Co-op programs may thus enhance access to higher education, especially among those who have limited access to funds from other sources. The work terms are also likely to provide employment that is more relevant to the course of study than the part-time employment that many college and university students rely on to help finance their studies.

Relatively little is known about whether the impact of co-op programs on the employment and earnings of graduates differs from the impact of regular (i.e. non-co-op) programs in the same field or discipline. A study by Darch (1995) used Statistics Canada's Survey of 1990 Graduates to compare labour market outcomes of co-op graduates to those of other graduates. That study found that co-op graduates in mathematics and the physical sciences were more likely to be working full-time than their non-co-op counterparts, and that co-op graduates in these fields as well as business and economics experienced higher wages. In engineering, where co-operative education is most common, no differences were found between co-op and non-co-op graduates. However, an important limitation of this study is that it only observed graduates at a single point in time (two years following graduation). It is quite possible that co-op programs provide a temporary advantage by enabling graduates to obtain employment more quickly following graduation, but that over time graduates of other programs catch up. In addition, because co-op programs take longer to complete, for evaluating the impact of co-operative education it is more appropriate to compare co-op and non-co-op students who begin their studies at the same time. A limitation of the Survey of Graduates is that it only allows comparisons among those who complete their studies at the same time.

A recent study by Heisz and Sweetman (2003) uses administrative data from Statistics Canada's University Student Information System (USIS) to track the employment and earnings of graduates of co-op and other programs over their subsequent careers. These data provide much larger sample sizes than the Surveys of Graduates, and also allow comparing graduates who began their studies at the same time. They also have the major advantage of providing information on the employment and earnings patterns of graduates over their subsequent careers rather than just at a point in time. Heisz and

Sweetman find that graduates of university co-op programs not only earn more than do other university graduates immediately after completing their studies but in many fields also earn significantly more over their lifetimes. This study provides striking evidence that supports the case for expanding co-operative education programs.⁵¹

In summary, there appears to be a good case for expanding the availability of co-operative education programs. *On a priori* grounds these have some important benefits. They improve access to post-secondary education and they enhance the linkages between colleges and universities and the employers of their graduates.⁵² There is also substantial student interest in this approach -- there is excess demand for most co-op programs. Furthermore, recent evidence on the lifetime employment and earnings of co-op and non-co-op graduates suggests that co-operative education programs may enhance the productivity and earnings of students more than regular programs.

Financing post-secondary education and student access

The problems and associated challenges facing post-secondary education in Ontario have been noted elsewhere in this study. On a per-student basis, funding from government has declined substantially over the past two decades. This is especially the case for operating funding. Increased revenue from higher tuition fees has offset the declining government contribution to some extent. However, this offset has only been partial, in part because of government-imposed limits on tuition fee increases. The main consequence of declining revenue per student has been a decline in the quality of higher education in Ontario, and in many other provinces. This decline in the quality of education is perhaps most evident in the steady increase in class size in Ontario universities, as documented by the Council of Ontario Universities (2000) and Davenport (2002). As noted in section 4, student/faculty ratios in Ontario universities are also

⁵¹ It remains unclear, however, to what extent the evidently superior labour market outcomes of co-op graduates reflect a causal impact of the program (i.e. that co-operative education programs have more "value added") or reflect the fact that co-op programs select the best students. Heisz and Sweetman (2003) address this "selection bias" issue in various ways, and conclude that most of the higher earnings of co-op graduates appears to reflect the "value-added" of these programs. Nonetheless, the authors also point out that further research on this issue is needed,

⁵² The latter may be a mixed blessing, and is clearly more beneficial in some disciplines than others. On balance, however, I believe that the net benefits are positive. In areas outside of those in which co-op programs have traditionally been used the benefits may be substantial.

significantly higher than in other Canadian provinces (except Alberta, which is similar to Ontario in this respect).

Less evident to those outside the universities themselves has been the loss of many of Canada's leading scholars, mainly to the United States, but also to the United Kingdom and continental Europe. Especially in disciplines for which there is an international market for top scholars, Ontario universities have been unable to compete with better-funded institutions in other countries, and the quality of the faculty has declined.⁵³ Problems of retention and recruitment of faculty appear to have been most pronounced in business (especially finance and accounting) and economics, electrical engineering and computer science, and parts of medical science. However, they may intensify and become more widespread with the impending retirement of many current faculty members.

These problems with inadequate funding of post-secondary education largely reflect the response of provincial governments to two pressures. The principal source is the demand for funding for health care. To many citizens the problems with the quality of publicly funded health care are more immediate. Provincial governments of all political persuasions have been unable or unwilling to curtail the public's demand for increased health care funding, and other government priorities have suffered. This situation is illustrated succinctly by the title of a recent column by Jeffrey Simpson: "Sickness today is robbing hope tomorrow."⁵⁴ The second political pressure is that associated with tuition fee increases. Tuition fee increases have sparked substantial public debate and protest and most provincial governments have responded by imposing limits on tuition fee increases. Although the response of provincial governments to these two forces is arguably short-sighted -- and may well be recognized as being myopic by those making the decision -- the nature of electoral politics often results in government decisions that pay insufficient attention to longer-term considerations.

⁵³ Economics is a good example because it is the case I am most familiar with and because there is an international market for top scholars. During the 1970s and 1980s two Ontario economics departments -- those at Queen's University and the University of Western Ontario -- ranked among the top 40 economics departments in the world, had outstanding faculty, and produced many graduates who have gone on to successful careers in government, academia and the private sector. Both departments have subsequently lost many of their leading scholars and have declined substantially in international rankings.

⁵⁴ Globe and Mail, August 8, 2003.

In addition to the problems associated with inadequate funding, Ontario's university system has also, in my opinion, been based on a funding mechanism with basic flaws. Since its introduction in the 1960s, funding has been based on a weighted average of the number of students in various programs, where the weights reflect the presumed relative cost of educating students in various programs.⁵⁵ One problem with this BIU system is that it does not adequately distinguish between the teaching and research functions of universities. There is some recognition of these two functions because the BIU weight on students in more research intensive graduate programs is higher than that on students in less research intensive programs. However, within a given type of program there is no recognition of differences in the quantity or quality of research carried out, and thus no allowance for the costs associated with a greater volume of research or higher quality research.

This problem with the funding formula may be adequately dealt with by other programs, both federal and provincial, that directly fund research. In recent years, a number of important initiatives at both the federal and provincial level have enhanced research-based funding for Ontario universities.⁵⁶ These initiatives, together with the Canada Research Chairs program, help universities attract and retain leading scholars.

The second major problem with the funding formula is that it makes no distinction between high quality and low quality educational programs. As a consequence, the Ontario universities are relatively homogeneous. Clearly some institutions and programs are more prestigious than others, but the quality differences across institutions and programs are smaller than, for example, one observes in many U.S. states or in the U.K. There also appears to be less specialization by institutions in specific areas of strength or expertise. Despite Ontario's status as Canada's largest and wealthiest province, there are no research-intensive universities with the stature of the top state-funded universities in the U.S. such as the University of California, Berkeley or the University of Michigan. Furthermore, to my knowledge there are no Ontario institutions

⁵⁵ This "Basic Income Unit" system was introduced in 1967-68. A major modification in 1987-88 severed the direct link between funding and student enrollment by introducing a "corridor" within which changes in student numbers do not result in changes in funding.

⁵⁶ At the federal level these include the Canada Foundation for Innovation and indirect funding for research. At the provincial level these include the Ontario Research and Development Challenge Fund, the Ontario Investment Trust, and the Premier's Research Excellence Awards.

that specialize in providing excellent undergraduate education, as is the case at a number of American liberal arts colleges like Dartmouth College. I expect that this lack of differentiation in educational programs is in part a consequence of the funding mechanism -- a formula that provides the same amount of money for a student in a low quality program as in a high quality program. It probably also reflects the inability of institutions to charge tuition fees (except recently in the case of professional programs) that reflect program quality and the associated costs.

An additional challenge is that of maintaining affordability and access to higher education in an environment where tuition fees have been rising and demand for post-secondary education remains strong. Most increases in college and university tuition have been met with protests and considerable public debate.

The policy changes outlined below constitute a package of reforms intended to address these challenges. The set of policies I recommend includes deregulation of tuition fees in universities and colleges and introduction of an income-contingent student loan program. Although these proposals are discussed individually they should be viewed as components of an interdependent package.

Important tradeoffs need to be made in any such set of policy proposals. I believe that this particular package makes choices that deal well with these tradeoffs. However, the post-secondary education system is complex, the challenges facing the system are large, and the available research does not always enable us to confidently predict the consequences of major policy changes. Furthermore, implementation often matters -- "the devil is in the details." Attention to these details is needed in introducing these or an alternative set of reforms.

Tuition fee policy

After declining in real terms for many years, tuition fees in Canadian universities bottomed out in the 1980s and increased substantially in the 1990s.⁵⁷ Towards the end of the 1990s tuition increases in undergraduate arts and science slowed as several provinces imposed limits on fee increases. However, fees for graduate and professional programs

⁵⁷ For details on the evolution of tuition fees see Council of Ministers of Education, Canada and Statistics Canada (2000) and Junor and Usher (2002).

continued to rise. University tuition fees in Ontario have followed a similar path to those for Canada as a whole. For example, undergraduate arts tuition increased from approximately \$1,800 (in 2000 dollars) in 1980-81 to approximately \$4,000 in 2000-01. The equivalent changes in Canada as a whole were from approximately \$1,500 in 1980-81 to \$3,500 in 2000-01. In both Ontario and Canada most of the increases took place in the 1990s. College fees have also increased substantially -- in Ontario from approximately \$1,000 (in 2000 dollars) in 1990-91 to \$1,800 in 2001-02.

The paths of undergraduate fees and fees for graduate and professional programs have diverged since the late 1990s. This pattern reflects the steady deregulation of tuition fees for professional and graduate programs across the country. Most provinces have maintained some controls on undergraduate fees, although the limits on the rate of increase vary across provinces and some jurisdictions such as British Columbia have fully deregulated fees. I believe that Ontario should also adopt this approach.

Deregulating tuition fees would have several benefits. Perhaps most important, this change would encourage universities to expand enrollment at a time when there appears to be substantial excess demand for university programs. This change would also ameliorate the funding difficulties that colleges and universities currently face. As a consequence, the slide in the quality of higher education in Ontario could be reversed. If combined with additional financial support to students, this initiative would continue the general shift toward reduced government financing of educational institutions and increased financing directly to students or their families. This shift -- evident in both Canada and the U.S. -- has important consequences. Colleges and universities become more dependent on revenue directly from students, and thus are likely to become more responsive to student preferences. Competition intensifies in an important dimension -- that of offering educational programs that will attract students. There may also be some advantage in students being aware of the resource cost of providing higher education, a cost that is less apparent when university or college attendance is heavily subsidized.

Subsidized tuition for post-secondary education has frequently been criticized as a regressive or inequitable policy because children from more advantaged backgrounds are more likely to attend college or university. This inequality in participation may arise because more educated parents instill in their children a greater desire for higher

education. It may also reflect the greater ability of wealthy parents to invest in the early education outcomes of their children, thus ensuring that their secondary school achievement is high enough for acceptance at university. Even if subsidized tuition does result in some individuals from less advantaged backgrounds attending university or college when they would not otherwise do so, the policy is poorly targeted because of the large proportion of "windfall beneficiaries" among high income families. Combining higher tuition fees with increased financial support for youths from lower income families is thus a more equitable way to promote equality of opportunity.

Another major benefit of abandoning fee regulation is that institutions will be more able to specialize in providing high quality educational programs. Those that choose to do so will be able to charge fees that reflect the higher costs of these programs. For example, many believe that it would be desirable to have undergraduate courses staffed by leading scholars and first-rate teachers, in which students have ample opportunity to interact with faculty, and in which students are assigned written work and make oral presentations. What most undergraduates get are large classes, many taught by graduate students or sessional lecturers, and in which there is no opportunity for class discussion. Tests and examinations are often multiple choice and there is little or no written work. Although this "anonymity model" of undergraduate education may appeal to some students, many would prefer -- and would be willing to pay the higher costs associated with -- the higher cost model that is much more demanding of faculty time. Deregulating tuition fees would allow these alternatives to be made available to students and their families.

The principal objection made to tuition fee deregulation is that higher fees may discourage some students from pursuing post-secondary education. A particular concern is that this effect may be more pronounced among those from more disadvantaged backgrounds. More than any other consideration, the fear that higher tuition fees may reduce equality of access to education dominates debate on tuition fee policy. Although it is certainly possible that deregulating tuition fees will have adverse consequences, there are a number of reasons why access to higher education may not be adversely affected. Indeed, higher fees may improve access.

One reason why tuition fees may have only a modest impact on participation in post-secondary education is that these fees constitute only a relatively small part of the total costs of attending university or college. The most important costs are the opportunity costs of not working.⁵⁸ Even after the substantial fee increases that took place in Canada during the 1990s, tuition fees constitute only about 30% of the cost of attending university.⁵⁹ The fraction of total costs associated with tuition fees would be even lower if it is more costly to live in the town or city in which the student is attending college or university than the location where he or she would otherwise work.⁶⁰

Another important consideration is that tuition fees affect both the demand for and supply of higher education. University spaces are limited in number and are rationed primarily on the basis of high school grades. As a consequence it is not surprising that achievement in high school has a large impact on university attendance (see Butlin, 1999, and Raymond and Rivard, 2003, for Canadian evidence). Higher fee revenue can allow educational institutions to increase the number of students admitted. Furthermore, this increase in supply may improve the equality of access to higher education because high school achievement is positively correlated with family background. The higher grades received by students from wealthier families may reflect receipt of more support while attending school and prior to attending school, as well as attending better schools. Because of the positive relationship between high school grades and family background, relaxing restrictions on university entrance tends to improve equality of access because students from less advantaged backgrounds are over-represented among the marginal admissions.

For these reasons the relationship between tuition fee policy and equality of access to post-secondary education is an empirical question. Evidence on this issue is available from a number of sources. The most pertinent evidence comes from the Canadian experience during the 1990s when tuition fees rose dramatically. I also briefly review the Australian and U.S. evidence.

⁵⁸ These are usually estimated as two-thirds of the average annual earnings of high school graduates of the same age, reflecting the fact that college and university students attend school for approximately 8 months per year.

⁵⁹ See Rathje and Emery (2002) who use tuition fee and other data for 1998.

⁶⁰ Estimates of the cost of attending university or college typically do not include accommodation and other living costs because the individual would need to incur these costs even if not attending school.

Early Canadian studies (for example, Mehmet, 1978; Meng and Sentance, 1982) concluded that in Canada, as in many other countries, children from high income families are much more likely to obtain a post-secondary education. However, as documented by Christofides, Cirello and Hoy (2001), differentials in post-secondary attendance by family income have narrowed. Between 1975 and 1993, a period during which participation in post-secondary education increased substantially, the increase in participation among children from low income families was much greater than that among high income families. Nonetheless, a substantial level of inequality remained at the end of their sample period. Christofides, Cirello and Hoy (2001) also find that tuition fees had negligible impacts on attendance at a university or college.

These findings suggest that the long-term trend in Canada has been toward increased participation in post-secondary education among children of lower income families. However, an important question is whether this favourable development may have been reversed in the 1990s when tuition fees increased substantially. Recent studies by Corak, Lipps and Zhao (2003) and Raymond and Rivard (2003) provide the first evidence on this issue.

Corak, Lipps and Zhao (2003) note the flattening trend in educational attainment in Canada in the 1990s, at the university level in particular, but also emphasize that recent tuition increases have not resulted in a reduction in aggregate attainment levels from the peaks of the early 1990s. A particularly important finding is that equality of attendance did not deteriorate to any extent during the late 1990s when tuition fee increases at the college and university levels were largest. Indeed, there was some improvement in participation among children from low income families relative to those from middle and upper income families. Using a different data source, Raymond and Rivard (2003) study the transition of recent high school graduates to post-secondary education. They conclude that tuition increases have not impacted overall post-secondary education attendance, even if one looks only at children from low income families. While additional research is needed, the evidence to date indicates that the steep tuition fee increases during the 1990s did not reduce overall participation in higher education, nor did these increases reverse the long-term trend toward greater equality in participation in post-secondary education by family income.

There is a vast U.S. literature on equality of college (university) attendance, particularly with regards to visible minorities. The overriding conclusion is that parental income and education influence the educational attainment of youth, and that once family background is controlled for visible minorities are no less likely to attend college than are other youths. In a recent update of earlier surveys of U.S. studies of the impact of tuition and financial aid on the demand for higher education, Heller (1997) concludes that tuition increases and financial aid decreases lead to declines in enrollment. In addition, he concludes that youth from low income backgrounds are more sensitive to tuition and financial aid changes than those from middle or higher income backgrounds. Surveyed studies also find that students in community colleges (two-year colleges) are more sensitive to tuition and financial aid changes than are those at four-year colleges and universities.

This interpretation of the evidence has been challenged by a number of authors. The important influence of parental income on the educational attainment of youth is often viewed as arising from the borrowing constraints that youth face when making investments in higher education. In these circumstances, one would expect participation in post-secondary education to be quite sensitive to tuition fees and other costs of attending college or university. However, Cameron and Heckman (2001), among others, challenge this interpretation. They develop and estimate a sequential model of educational attainment and find that once one controls for tests taken earlier in high school parental income no longer exerts a significant influence on post-secondary attendance. The influence of parental income arises from investments in learning earlier in the life cycle (early childhood, elementary and early secondary school). According to their evidence, tuition subsidies have little or no impact on the equality of college attendance. Rather, they argue that policies aimed at earlier learning outcomes will have much larger effects on the quality of educational attainment.⁶¹

The Australian experience is discussed in more detail in the next section. Australia moved from a regime with zero tuition to one with substantially higher tuition fees combined with an income contingent student loan program for assistance with tuition fees. At the time that these changes were made considerable concern was expressed that

⁶¹ See also Heckman (2000) for a discussion of this point.

equality of access to higher education would suffer. Indeed, most of the research on the impacts of the Australian innovations has focused on this question. The available evidence suggests that these changes did not result in any significant deterioration in equality of access to university. The introduction of the income contingent loan program coincided with a significant expansion of the university sector (funded from higher tuition revenue) with attendance rates rising for youth from most family backgrounds.

In summary, the case for reducing (preferably eliminating) regulation of tuition fees is strong. Allowing educational institutions to determine their fee structure will promote competition in post-secondary education, ameliorate the budgetary problems facing universities and colleges, and facilitate expansion of enrollment in periods of growing demand for higher education. The worry that higher fees will result in reduced participation in post-secondary education by youths from disadvantaged backgrounds appears to be over-emphasized. Both Australia and Canada have recently experienced substantial increases in tuition fees for higher education, albeit combined with very different approaches to improved student financial assistance. In both cases these sharp increases do not appear to have resulted in greater inequality of access among youth from different family backgrounds. Furthermore, subsidized tuition is a very blunt -- as well as regressive -- instrument for promoting equality of opportunity in higher education. A more equitable way to achieve this objective is to combine tuition fee deregulation with increased financial support for students from lower income families.

Income contingent student loans

In the absence of fee regulation, what form of student support would ensure reasonable access to post-secondary education? One option would be to maintain the status quo, supplemented by an enhanced student loan program and agreements with educational institutions to set aside some of the increased revenue from higher tuition for student financial support. Although this approach has some advantages -- including the fact that we have considerable experience with these programs -- it also has potential drawbacks. High student debt loads may become even more of a concern than is the case at present. Perhaps more important, individuals from low income families may become less likely to pursue higher education because of fear of accumulating high debts. This is

a legitimate concern because of the risk associated with human capital investments. As discussed previously, individuals can do little to diversify these risks. Under conventional student loan programs, it is inevitable that some individuals will leave college or university with a substantial debt and limited income-earning opportunities. In addition, encouraging educational institutions to provide financial support to students from low-income families involves means-testing of family income. As is the case in any program that is means-tested, there will be some adverse consequences due to effects on the incentives to earn or accurately report income.

Both conventional and income contingent student loan programs directly address the credit market failure that otherwise makes it difficult for individuals to borrow to finance human capital investments. Income contingent loan programs have the additional -- and major -- benefit of reducing the risk associated with investing in post-secondary education. Those graduates with above-average earnings pay back a higher amount, and those with below-average earnings repay a lesser amount. An additional advantage of income contingent loan programs is that repayment is scheduled in a manner that reflects the evolution of the individual's ability to pay. An income contingent loan (ICL) program may also result in fewer defaults and lower administrative costs than conventional student loan programs. This benefit is most likely to be realized if the ICL program is integrated with the income tax system.

Several factors need to be considered in designing an income contingent loan program.⁶² One important challenge is that of limiting the amount of adverse selection. The typical ICL program requires borrowers to pay a proportion of their income to repay their loan. This creates an incentive for those who anticipate high post-graduation incomes to not participate in the program. Their costs of repayment may be lower under a conventional loan program. Their incentive not to participate in the ICL program is stronger if conventional loan programs remain available, or are available in other jurisdictions. Similarly, those who anticipate low incomes are more likely to participate in an ICL program than a conventional loan program. Calculations by Krueger and Bowen (1993) based on U.S. data indicate that the required ICL repayment rates can

⁶² For useful discussions of design issues see Kesselman (1993), Krueger and Bowen (1993) and Finnie and Schwartz (1996).

become quite large if there is a moderate degree of adverse selection.⁶³ One way of dealing with this potential problem is to establish minimum and maximum payments for participants.

By raising marginal tax rates on income, an ICL program may also exacerbate the "brain drain" problem. This concern could also be addressed to some extent by setting a maximum payment for participants. However, there are clearly tradeoffs that need to be made in establishing minimum and maximum payment levels. Higher minimum payments and lower maximum payments reduce the risk-pooling benefits of ICL programs, which is one of their principal advantages over conventional student loan programs.

The Australian experience is worth examining in some detail, both because it has operated an ICL program since the late 1980s and because the Canadian and Australian economies and societies share many common features. Australia instituted its Higher Education Contribution Scheme (HECS) in 1989.⁶⁴ Under this system, university students are assessed tuition fees for each year of study, and can choose to repay these fees via the taxation system, as essentially a tax surcharge, once their income exceeds certain threshold levels. If students choose to pay these fees up front, they receive a 25% discount. The discount was increased in 1993 from the 15% rate in effect when HECS was first implemented. Each student's HECS debt is not assessed any real interest rate. It only increases with the nation-wide Consumer Price Index inflation rate.

HECS was introduced from the starting point of free university tuition, a policy implemented in 1974. At that time youth from severely disadvantaged backgrounds could also receive non-repayable grants from the government to cover living and other education expenses. There was no government-sponsored student loan scheme in effect.

When the HECS system was first implemented, each student was assessed the same tuition fee for a full year of study (pro-rated for part-time study). The charge represented approximately 20% of the average cost of providing a university undergraduate education. In 2003 Canadian dollars, this flat fee was approximately

⁶³ The required repayment rates also depend on other factors, such as the extent to which the program is self-financing or subsidized by taxpayers.

\$2450. This annual charge also increased with an index of higher education operating grants until 1997, when wholesale changes to the HECS were implemented.

The income threshold where repayment of HECS debts began was set approximately equal to average weekly earnings in 1989. Required rates of repayment have steadily been increased since HECS was first implemented in 1989. At that time, repayment began at 1% of income above the threshold level but below a second threshold, 2% of income above this second threshold but below a third threshold, then 3% on income above the third threshold level. These rates increased to 2%, 3% and 4% respectively in 1990/91, increased again to 3%, 4% and 5% in 1993/94, and then rates of 3.5%, 4.5%, 5.5% and 6% were added in 1996/97.

The 1997 changes to the HECS system were far-reaching, with the benefits to students falling considerably. The fees charged to students increased significantly (65% on average), with three different rates (bands) charged depending on the university program. The placement of programs into different bands did not purely reflect cost considerations. It also reflected future earnings potentials for graduates. In 2003 Canadian dollars, the three fee bands are approximately \$3400, \$4900 and \$5700 respectively. A second major change to HECS made in 1997 was the repayment schedule. The threshold income level where repayments started was lowered considerably, to around 65% of average weekly earnings, or from approximately \$29,000 to \$21,000 in 2003 Canadian dollars. Other changes included allowing a certain number of university places to be made available to students paying full fees, for students whose high school achievement was not high enough to allow entry into the program of their choice under the government-subsidized HECS scheme.

A major concern of introducing (or raising) university tuition fees, even if students do not have to pay the fees up-front, is that it may preclude students from less-advantaged backgrounds from attending university. Under the previous zero-fee system, evidence suggests that family background was still a very important determinant of the probability of attending university in Australia. This is consistent with evidence from

⁶⁴ For more details of the HECS system, see *The National Report on Higher Education In Australia 2001* (Department of Education, Science and Training, 2003). The appendix in the Aungles et al (2002) study provides a very detailed history of HECS over the 1989 to 2002 period.

other countries on the intergenerational link in education attainment, whatever the nature of the education funding system.

The available evidence suggests that the introduction of HECS did not lead to any significant deterioration in equality of access to university. The introduction of HECS coincided with a significant expansion in the university sector in Australia (funded by HECS), with attendance probabilities rising for youth from most family background groups. Chapman (1997) found no evidence that the introduction of HECS diminished access to university in aggregate or for the disadvantaged. Probably the best evidence comes from the study by Chapman and Ryan (2003) who conclude that neither the introduction of HECS in 1989, nor the changes implemented in 1997, discouraged university attendance in general, or among youth from the lowest wealth groups. The wealth distribution of attendance at university became more equal over the period, mostly via increased attendance in the middle of the distribution. There was also no evidence of a reduction in attendance by marginal decision-makers in response to the introduction of HECS.

Other studies report similar results. Aungles et al (2002) updated previous government research by Andrews (1997, 1999). They found that the introduction of HECS in 1989 had no negative effect on applications for university in aggregate among school leavers, with the overall expansion in available places swamping any negative demand effect. The significant changes to HECS in 1997 did lead to lower aggregate applications among school leavers, however, and also lower demand from mature age students, especially those studying part-time or externally. The reductions in income thresholds where repayments began would immediately and directly impact those earning full-time wages. The authors found that there was no adverse effect of the introduction of HECS, or the 1997 changes, on the overall share of students from low socioeconomic status (SES) backgrounds attending university. There was, however, some evidence that the introduction of differential fees by course did impact the share of students from low SES backgrounds from enrolling in the highest fee band courses (law, medicine, dentistry and veterinary science).

When HECS was first introduced, the government of the day highlighted six disadvantaged equity groups that were under-represented in higher education in

Australia. A particular goal was improving access to higher education for these disadvantaged groups. The six groups were:

1. people of Aboriginal and Torres Strait Islander descent;
2. people from socioeconomic disadvantaged backgrounds;
3. women (especially in non-traditional areas);
4. people from a non-English speaking background who had arrived in Australia within the previous ten years;
5. people with disabilities; and
6. people from rural and isolated areas.

The National Report on Higher Education in Australia (2001) notes that although the representation of these six groups have not deteriorated since 1989, it has only improved for the third and fourth groups on this list.

Andrews (1999) also examined attitudinal surveys measuring individual responses to the HECS scheme. These surveys suggested that the introduction of HECS was not a major factor in the decisions of individuals on whether or not to attend university.

Chapman (1997) provides some evidence on repayments and administrative costs. He suggests that the administrative costs involved in implementing the scheme and collecting repayments are very small. Australian Taxation Office costs for collection and administration were only around \$5 to \$6 million per year, or 1% of current revenue (which is rising quickly as the system has been in effect longer). University administration costs were also small (around \$12 million per year). Such university costs are already born by Canadian universities in their tuition collection. Chapman (1997) also discusses simulations that suggest that up to 96% of male and 77% of female HECS debts will eventually be repaid. The lower repayment rate of female debt reflects the lower employment levels of females over their life cycle. Repayment is faster for workers that do better in the job market, which means the government subsidy to those workers (via zero real interest rates on the debt) is lower. Chapman also suggests that the implicit government subsidy given to students via charging a zero real interest rate on the debt can be as much as 35% of the value of the debt.

The amount of revenue being raised by the HECS system continues to grow as more repayments are made via the tax system. All HECS revenue is remitted to

universities as part of the government grants to those institutions. This revenue exceeded \$800 million annually in 1999/00, and represented 31% of university operating grants. Most students choose to pay for their university education by deferring fees and repaying via the tax system. However, over \$200 million annually is paid up-front by students (around 20% of students who could pay via HECS) choosing to take advantage of the significant (25%) discount afforded to students paying up-front.

In summary, deregulating tuition fees will result in a need for increases in the supply of funds available to students to finance investments in higher education. This increase could be brought about by supplementing existing student loan programs and arranging for additional student financing to be made available by colleges and universities. However, an important drawback associated with this approach is that it does not deal with the risky nature of investments in post-secondary education. An income contingent loan program does address this problem because those whose post-graduation earnings are below average are not faced with high debt loads as would be the case under a conventional student loan program. Offsetting this smaller repayment by those whose earnings are below average are higher repayments from those who achieve above-average earnings. This "risk pooling" is the principal advantage of an ICL program relative to a conventional student loan program. Other advantages include scheduling of payments that is more closely aligned with the evolution of the individual's ability to pay, and perhaps reduced administrative costs and lower default rates. The Australian experience with an income contingent loan scheme appears to be positive. For these reasons, I believe that an ICL scheme is preferable on *a priori* grounds to a conventional student loan program. However, ICL programs have some disadvantages, of which adverse selection and higher marginal tax rates on earned income may be the most significant. Careful attention to these consequences will be necessary in designing an ICL program.

Allocation of resources between colleges and universities

As discussed in section 4, a salient feature of post-secondary education in Canada is the very large proportion of resources devoted to the non-university sector. Relative to other countries, Canada devotes much more of its national income to non-university post-

secondary education, and much less to the university component. Ontario is similar to Canada as a whole in this respect. Some of the differences between Canada and other G-7 or OECD countries are the result of differences in measurement. However, even after adjustments are made for measurement differences, Canada appears to be unique among advanced countries in terms of the resources devoted to non-university post-secondary education.

The reasons for the massive public expenditure on community college and trade school programs do not appear to be well understood. Whatever the contributing factors may have been in the past, an important issue for the future is to establish the appropriate balance of resources between the university and non-university sectors. The empirical evidence examined in section 5 suggested that the current balance may not be optimal. In particular, in Ontario -- as in Canada as a whole -- the private return to non-university post-secondary education is generally lower than that to university programs. In addition, the social benefits associated with university education -- in particular those related to the creation of new knowledge -- *may* be larger than those associated with college and trade school programs.⁶⁵ The limited available evidence suggests that a shift in resources within the post-secondary "envelope" away from community colleges and trade schools and toward universities may be warranted.

One approach to achieving the appropriate balance would be to entrust the resource allocation decision to a government agency. However, a more decentralized approach is probably preferable. The recommendations made previously in this section would result in a more decentralized post-secondary education system in which revenues of universities and colleges would become more dependent on student demand. Under such a regime, situations like the present in which there appears to be substantial unsatisfied demand for university programs would be periods in which both university enrollment and the proportion of post-secondary resources devoted to universities would rise. In other periods -- such as the 1970s when the returns to university education fell substantially -- the reverse would occur. As long as students have good information on the private benefits associated with college and university programs, such a decentralized

⁶⁵ I emphasize the word "may" here because the empirical evidence on social returns to education does not generally allow one to compare social returns of different types of post-secondary education.

system should be a reasonably satisfactory mechanism for regulating the share of resources devoted to the university and non-university sectors.

A final question is the extent to which the university and community college systems should be integrated. Some provinces such as Quebec, Alberta and British Columbia have adopted policies to promote integration of colleges and universities. Traditionally there has been limited cooperation and collaboration between colleges and universities in Ontario. However, recent initiatives (such as the creation of the College-University Consortium Council in 1996 and the negotiation of the "Port Hope Accord") have resulted in some movement in this direction. There appear to be potential benefits of encouraging greater integration, although it is difficult to determine whether these benefits are likely to be worth the additional costs. A key advantage of university transfer programs is improved access, especially for students who are uncertain about their ability to successfully complete a university program and for those who live near a college but not near a university.⁶⁶

Despite the importance of community colleges and trade schools in Canada's post-secondary education system, little is known about the consequences of this massive public investment. As discussed previously, most of the studies of the impact of post-secondary education on employment and earnings have focused on university programs. Our knowledge about the relative returns to university and non-university programs is based on a relatively small number of studies. Even less is known about the costs and benefits of promoting the integration of colleges and universities. These are clearly important areas for future research.

⁶⁶ Distance to a college or university is an important determinant of participation in post-secondary education in both Canada (Frenette, 2002) and the U.S. (Card, 1995).

References

- Acemoglu, Daron and Joshua Angrist. "How Large are Human Capital Externalities? Evidence from Compulsory Schooling Laws" *NBER Macroeconomics Annual 2000*, 2001, 9-59.
- Advisory Council on Science and Technology. *Stepping Up: Skills and Opportunity in the Knowledge Economy*. Report of the Expert Panel on Skills. Ottawa: Industry Canada, 2000.
- Allen, Robert C. "Paying for University Education in B.C." Department of Economics Discussion Paper No. 98-07, University of British Columbia, 1998.
- Andrews, Les. "The Effect of HECS on Interest in Undertaking Higher Education", Higher Education Division, Department of Employment, Education, Training and Youth Affairs, Commonwealth of Australia, Canberra, May 1997.
- Andrews, Les. "Does HECS Deter? Factors Affecting University Participation of Low SES Groups", Occasional Paper Series No. 99F, Higher Education Division, Department of Employment, Education, Training and Youth Affairs, Commonwealth of Australia, Canberra, August 1999.
- Anglin, Paul M. and Ronald Meng. "Evidence on Grades and Grade Inflation in Ontario's Universities" *Canadian Public Policy* 26 (September 2000) 361-368.
- Aungles, Phil, Ian Buchanan, Tom Karmel and Maureen MacLachlan. "HECS and Opportunities in Higher Education: a Paper Investigating the Impact of the Higher Education Contributions Scheme (HECS) on the Higher Education System", Research, Analysis and Evaluation Group, Department of Education, Science and Training, Commonwealth of Australia, 2002.
- Barro, Robert J. "Human Capital and Growth" *American Economic Review* 91(2) (May, 2001) 12-17.
- Barro, Robert J. and Xavier Sala-i-Martin. *Economic Growth*. New York: McGraw-Hill, 1995.
- Behrman, Jere R. and Nevzer Stacey. *The Social Benefits of Education*. Ann Arbor: The University of Michigan Press, 1997.
- Bekar, Clifford and Richard G. Lipsey. "Clusters and Economic Policy" *ISUMA: Canadian Journal of Policy Research* 3(1) (Spring, 2002) 62-70.
- Bishop, John H. "The impact of curriculum-based external examinations on school priorities and student learning" *International Journal of Educational Research* 23 (No. 8, 1995) 653-752.

Bishop, John H. "The effect of national standards and curriculum-based external exams on student achievement" *American Economic Review* 87 (May, 1997) 260-4.

Bishop, John H. "School choice, exams and achievement" In *Towards evidence-based policy for Canadian education*, ed. P. de Broucker and A. Sweetman. Kingston: John Deutsch Institute for the Study of Economic Policy and Statistics Canada, 2002, pp. 385-417.

Bouchard, Brigitte and John Zhao. "University Education: Recent Trends in Participation, Accessibility and Returns" *Education Quarterly Review* 6 (No. 4, 2000) 24-32.

Butlin, George. "Determinants of Post-Secondary Participation" *Education Quarterly Review* 5 (March 1999) 9-35.

Cameron, Steven V. and James J. Heckman. "The dynamics of educational attainment for black, hispanic and white males" *Journal of Political Economy* 109 (June 2001) 455-99.

Card, David. "Using Geographic Variation in College Proximity to Estimate the Return to Schooling" in *Aspects of Labour Market Behaviour: Essays in Honour of John Vanderkamp*. Toronto: University of Toronto Press, 1995, pp. 201-222.

Card, David. "The Causal Effect of Education on Earnings" in *Handbook of Labor Economics* volume 3A, edited by Orley Ashenfelter and David Card. Amsterdam: North Holland, 1999, pp. 1801-1863.

Card, David. "Estimating the Return to Schooling: Progress on Some Persistent Econometric Problems" National Bureau of Economic Research Working Paper # 7769, June 2000.

Card, David. "Canadian Emigration" mimeo, University of California, Berkeley. 2003.

Card, David and Thomas Lemieux. "Can Falling Supply Explain the Rising Return to College for Younger Men? A Cohort-Based Analysis" *Quarterly Journal of Economics* 116(2) (May 2001) 705-46.

Chapman, Bruce. "Conceptual Issues and the Australian Experience With Income Contingent Charges for Higher Education", *The Economic Journal* 107 (May 1997) 738-751.

Chapman, Bruce and Chris Ryan. "The Access Implications of Income Contingent Charges for Higher Education: Lessons From Australia", Centre for Economic Policy Research Discussion Paper No. 463, Australian National University, Canberra, April 2003.

Christophides, Louis N., Jim Cirello and Michael Hoy. "Family Income and Post-secondary Education in Canada" *Canadian Journal of Higher Education* 31 (No. 1, 2001) 177-208.

Ciccone, Antonio and Giovanni Peri. "Identifying Human Capital Externalities: Theory with an Application to U.S. Cities" IZA Working Paper # 488, April 2002.

Collins, Kirk and James B. Davies. "Tax Treatment of Human Capital in Canada and the United States: An Overview and an Examination of the Case of University Graduates" mimeo, Department of Economics, University of Western Ontario, 2001.

Corak, Miles, Garth Lipps and John Zhao. "Family Income and Participation in Post-Secondary Education" Statistics Canada, Family and Labour Studies Division, 2003.

Council of Ministers of Education, Canada and Statistics Canada. *Education Indicators in Canada: Report of the Pan-Canadian Education Indicators Program 1999*. Toronto and Ottawa: Council of Ministers of Education, Canada and Statistics Canada, 2000.

Council of Ontario Universities. *Access to Excellence*. Toronto: Council of Ontario Universities, 2000.

Courchene, Thomas J. *A State of Minds: Toward a Human Capital Future for Canadians*. Montreal: Institute for Research on Public Policy, 2001.

Crompton, Susan. "The marginally literate workforce" *Perspectives on Labour and Income* 8 (Summer, 1996) 14-21.

Darch, Jamie. "Labour market outcomes for university co-op graduates" *Perspectives on Labour and Income* Autumn 1995, 20-23.

Davenport, Paul. "Deregulation and Restructuring in Ontario's University System" *Canadian Business Economics* 4 (Summer 1996) 27-36.

Davenport, Paul. "Universities and the Knowledge Economy" in David Laidler (editor), *Renovating the Ivory Tower: Canadian Universities and the Knowledge Economy*. Toronto: C.D. Howe Institute, 2002, pp. 39-59.

Davies, Jim. "Empirical Evidence on Human Capital Externalities" Paper prepared for Tax Policy Branch, Department of Finance, Government of Canada. Mimeo, Department of Economics, University of Western Ontario, February 2002.

Dee, Thomas S. "Are There Civic Returns to Education" National Bureau of Economic Research Working Paper # 9588, March 2003.

Department of Education, Science and Training. *The National Report on Higher Education in Australia (2001)*, Department of Education, Science and Training, Commonwealth of Australia, Canberra, 2003.

Ferrer, Ana and W. Craig Riddell. "The Role of Credentials in the Canadian Labour Market", *Canadian Journal of Economics* 35 (November 2002) 879-905.

Finnie, Ross and Saul Schwartz. *Student Loans in Canada: Past, Present and Future*. Toronto: C.D. Howe Institute, 1996.

Fortin, Nicole M. and Sophie Lefebvre. "Intergenerational Income Mobility in Canada" in Miles Corak (editor) *Labour Markets, Social Institutions, and the Future of Canada's Children*. Ottawa: Statistics Canada, 1998, pp. 51-63.

Frenette, Marc. "Too far to go on? Distance to school and university participation" Statistics Canada, Analytical Studies Research Paper Series No. 191, June 2002.

Gemmell, Norman. "Endogenous Growth, the Solow Model and Human Capital" *Economics of Planning* No. 28(2-3), 1995, 169-183.

Glaeser, Edward. L., Jose A. Scheinkman and Andrei Shleifer. "Economic Growth in a Cross-section of Cities" *Journal of Monetary Economics* 36 (No. 1, August 1995) 117-143.

Government of Ontario, Ministry of Training, Colleges and Universities. *Portals and Pathways: A Review of Postsecondary Education in Ontario*. Report of the Investing in Students Task Force. Toronto: February 2001.

Green, David A. and W. Craig Riddell. "Literacy and Earnings: An Investigation of the Interaction of Cognitive and Unobserved Skills in Earnings Generation" *Labour Economics* 10(2) (April 2003) 165-184.

Greenwood, Daphne T. "New Developments in the Intergenerational Impacts of Education" *International Journal of Education Research*. 27(6), 1997, 503-512.

Grogger, Jeff. "Market Wages and Youth Crime" *Journal of Labor Economics* 16(4), October 1998, 756-791.

Grossman, Michael and Robert Kaestner. "Effects of Education on Health" in *The Social Benefits of Education*, edited by Jere Behrman and Nevzer Stacey. Ann Arbor: University of Michigan Press, 1997.

Haveman, Robert and Barbara Wolfe. "Schooling and Economic Well-Being: The Role of Non-Market Effects" *Journal of Human Resources* 19 (Summer. 1984) 377-407.

Heckman, James J. "Policies to Foster Human Capital" *Research in Economics* 54 (2000) 3-56.

Heisz, Andrew and Arthur Sweetman. "Co-op Education and Earnings" paper presented at the conference "Education, Schooling and the Labour Market" sponsored by the Canadian Employment Research Forum, Carleton University, June 2003.

Heller, Donald E. "Student Price Response in Higher Education: An Update to Leslie and Brinkman" *Journal of Higher Education* 68 (November-December 1997) 624-59.

Helliwell, John F. and Robert D. Putnam. "Education and Social Capital" NBER Working Paper # 7121, May 1999.

Jaeger, David A. and Marianne E. Page. "Degrees Matter: New Evidence on Sheepskin Effects in the Returns to Education" *Review of Economics and Statistics* 78(4) (November 1996) 733-40.

Jacobs, Jane. *The Economy of Cities*, New York, Random House, 1969.

Junor, Sean and Alexander Usher. *The Price of Knowledge: Access and Student Finance in Canada*. Montreal: The Canada Millennium Scholarship Foundation, 2002.

Kenkel, Donald S. "Health Behavior, Health Knowledge, and Schooling" *Journal of Political Economy* 99(2), April 1991, 287-305.

Kesselman, Jonathan R. "Squeezing Universities, Students or Taxpayers?" in *Ending the Squeeze on Universities*. Montreal: Institute for Research on Public Policy, 1993.

Krueger, Alan B. and William G. Bowen. "Income-Contingent College Loans" *Journal of Economic Perspectives* 7 (Summer, 1993) 193-201.

Laidler, David (editor). *Renovating the Ivory Tower: Canadian Universities and the Knowledge Economy*. Toronto: C.D. Howe Institute, 2002.

Lavoie, Marie and Ross Finnie. "Is It Worth Doing a Science or Technology Degree in Canada?" *Canadian Public Policy* 25 (March 1999) 101-122.

Lipsey, Richard G. *Economic Growth, Technological Change, and Canadian Economic Policy*. C.D. Howe Benefactors Lecture. Toronto: C.D. Howe Institute, 1996.

Lleras-Muney, Adriana "The Relationship Between Education and Adult Mortality in the United States" National Bureau of Economic Research Working Paper # 8986, June 2002.

Lleras-Muney, Adriana and Frank R. Lichtenberg "The Effect of Education on Medical Technology Adoption: Are the More Educated More Likely to Use New Drugs?" National Bureau of Economic Research Working Paper # 9185, September 2002.

Lochner, Lance. "Education, Work and Crime: Theory and Evidence" Rochester Center for Economic Research Working Paper No. 465, 1999.

Lochner, Lance and Enrico Moretti. "The Effect of Education on Crime: Evidence from Prison Inmates, Arrests and Self-Reports" National Bureau of Economic Research Working Paper # 8605, November 2001.

Maynard, Rebecca A. and Daniel J. McGrath. "Family Structure, Fertility and Child Welfare" in *The Social Benefits of Education*, edited by Jere Behrman and Nevzer Stacey. Ann Arbor: University of Michigan Press, 1997.

McMahon, Walter W. (guest editor) "Recent Advances in Measuring the Social and Individual Benefits of Education" Special issue of the *International Journal of Education Research*. 27 (No. 6, 1997) pp. 447-532.

McMahon, Walter W. *Education and Development: Measuring the Social Benefits*. Oxford: Oxford University Press, 1999.

McMahon, Walter W. "The Impact of Human Capital on Non-Market Outcomes and Feedbacks on Economic Development" in *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-being*, edited by John Helliwell. Vancouver: University of British Columbia Press, 2001.

Mehmet, Ozay. *Who Benefits From the Ontario University System: a benefit-cost analysis by income groups* (with Lawrence Tsang) Toronto: Ontario Economic Council, 1978.

Meng, R. and J. Sentance. "Canadian Universities: Who Benefits and Who Pays?" *Canadian Journal of Higher Education* 12 (No. 3, 1982) 45-58.

Milligan, Kevin, Enrico Moretti and Philip Oreopoulos. "Does Education Improve Citizenship? Evidence From the U.S. and the U.K." National Bureau of Economic Research Working Paper # 9584, March 2003.

Moretti, Enrico. "Social Returns to Education and Human Capital Externalities: Evidence from Cities" Center for Labor Economics, University of California, Berkeley, Working Paper # 9, November 1998.

Moretti, Enrico "Estimating the Social Return to Higher Education: Evidence from Longitudinal and Repeated Cross-Sectional Data" National Bureau of Economic Research Working Paper # 9108, August 2002. Forthcoming in *Journal of Econometrics*.

Moretti, Enrico "Workers' Education, Spillovers and Productivity: Evidence from Plant-Level Production Functions" University of California at Los Angeles, Working Paper, January 2003a.

Moretti, Enrico "Human Capital Externalities in Cities" Forthcoming in the *Handbook of Regional and Urban Economics*. North Holland-Elsevier, March 2003b.

Murphy, Kevin M., W. Craig Riddell and Paul M. Romer "Wages, Skills and Technology in the United States and Canada" in *General Purpose Technologies and Economic Growth* edited by Elhanan Helpman. Cambridge: MIT Press, 1998, pp. 283-309.

Organisation for Economic Cooperation and Development. *Human Capital Investment: An International Comparison*. Paris: OECD, 1998.

Organisation for Economic Cooperation and Development. *Education at a Glance: OECD Indicators 2001*. Paris: OECD, 2001.

Organisation for Economic Cooperation and Development. *Education at a Glance: OECD Indicators 2002*. Paris: OECD, 2002.

Organization for Economic Cooperation and Development and Statistics Canada. *Literacy, Economy and Society: First Results from the International Adult Literacy Survey*. Paris: OECD and Ottawa: Statistics Canada, 1995.

Organization for Economic Cooperation and Development and Statistics Canada. *Literacy in the Information Age: Final Report of the International Adult Literacy Survey*. Paris and Ottawa: OECD and Statistics Canada, 2000.

Poterba, James M. "Government Intervention in the Markets for Education and Health Care: How and Why?" NBER Working Paper 4916, December 1995.

Rauch, James E. "Productivity Gains from Geographic Concentration of Human Capital: Evidence from the Cities" *Journal of Urban Economics* 34(3), November 1993, 380-400.

Rathje, Kelly Ann and J.C. Herbert Emery. "Returns to University Education in Canada Using New Estimates of Program Costs" in David Laidler (editor), *Renovating the Ivory Tower: Canadian Universities and the Knowledge Economy*. Toronto: C.D. Howe Institute, 2002.

Raymond, Melanie and Maud Rivard. "Have Tuition Fee Hikes in the Late 1990s Undermined Access to Post-Secondary Education in Canada?" Department of Finance, Economic Studies and Policy Analysis Branch, 2003.

Riddell, W. Craig. "Human Capital Formation in Canada: Recent Developments and Policy Responses" in *Labour Market Polarization and Social Policy Reform* edited by Keith G. Banting and Charles M. Beach. Kingston: School of Policy Studies, Queen's University, 1995, pp. 125-172.

Riddell, W. Craig. "Education and Skills: An Assessment of Recent Canadian Experience" in *The State of Economics in Canada: Festschrift in Honour of David Slater* edited by

Patrick Grady and Andrew Sharpe. Montreal and Kingston: McGill-Queen's University Press, 2001, pp. 485-517.

Riddell, W. Craig. "Is There Under- or Over-Investment in Education?" in *Towards Evidence-Based Policy for Canadian Education* edited by Patrice de Broucker and Arthur Sweetman. Montreal and Kingston: McGill-Queen's University Press and John Deutsch Institute for Economic Policy, 2002, pp. 473-96.

Riddell, W. Craig. "Education, Skills and Labour Market Outcomes: Exploring the Linkages in Canada" in *Educational Outcomes for the Canadian Workplace*, edited by Jane Gaskell and Kjell Rubenson. Toronto: University of Toronto Press, forthcoming, 2003.

Riddell, W. Craig and Arthur Sweetman. "Human Capital Formation in a Period of Rapid Change" in *Adapting Public Policy to a Labour Market in Transition* edited by W. Craig Riddell and France St-Hilaire. Montreal: Institute for Research on Public Policy, 2000, pp. 85-141.

Romer, Paul M. "Should the Government Subsidize Supply or Demand in the Market for Scientists and Engineers? NBER Working Paper 7723, June 2000.

Sabot, Richard and John Wakeman-Linn. "Grade Inflation and Course Choice" *Journal of Economic Perspectives* 5 (Winter 1991) 159-170.

Spence, A. Michael. *Market Signaling: Informational Transfer in Hiring and Related Screening Processes*. Cambridge, Mass.: Harvard University Press, 1974.

Sweetman, Arthur. "Ontario's Kindergarten to Grade 12 System: Some Thoughts for the Future" Background paper prepared for the Ontario Panel on the Role of Government, June 2003.

Task Force on Competitiveness, Productivity and Economic Progress. *Closing the Prosperity Gap*. Institute for Competitiveness and Prosperity, Toronto, November 2002.

Tomkowicz, Joanna, Lisa Shipley and Sylvie Ouelette. "Perception of Barriers to Education in a Group of 18 to 20 Year Olds: For Whom Does Money Matter?" paper presented at the conference "Education, Schooling and the Labour Market" sponsored by the Canadian Employment Research Forum, Carleton University, June 2003.

Vaillancourt, Francois. "The private and total returns to education in Canada, 1985" *Canadian Journal of Economics* 28 (August 1995) 532-54.

Vaillancourt, Francois and S. Bourdeau-Primeau. "The Returns to University Education in Canada, 1990 and 1995" in David Laidler (editor), *Renovating the Ivory Tower: Canadian Universities and the Knowledge Economy*. Toronto: C.D. Howe Institute, 2002.

West, Edwin G. *Ending the Squeeze on Universities*. Montreal: Institute for Research on Public Policy, 1993.

Witte, Ann D. "Crime", in *The Social Benefits of Education*, edited by Jere Behrman and Nevzer Stacey, Ann Arbor: University of Michigan Press, 1997.

Wolfe, Barbara and Robert Haveman. "Accounting for the Social and Non-Market Benefits of Education" in *The Contribution of Human and Social Capital to Sustained Economic Growth and Well-being*, edited by John Helliwell. Vancouver: University of British Columbia Press, 2001, pp. 221-250.

Wolfe, Barbara and Samuel Zuvekis. "Nonmarket Outcomes of Schooling" *International Journal of Educational Research*, 27(6), pp. 491-502, 1997.

Zucker, Lynne G., Michael R. Darby, and Marylinn B. Brewer. "Intellectual Human Capital and the Birth of U.S. Biotechnology Enterprises" *American Economic Review* 88(1), March 1998, 290-306.

Table 1 Expenditure per student on public and private institutions

	University	Non-univ	PSE total	University	College	PSE total
a) Can\$	1995			1999-2000		
Newfoundland	12,439	13,074	12,724	19,701	5,024	14,847
P.E.I.	13,133	8,799	13,770	19,771	11,747	16,493
Nova Scotia	12,443	16,788	13,463	18,941	13,714	17,949
New Brunswick	13,221	11,410	12,532	17,708	11,833	16,420
Quebec	14,818	9,635	12,687	21,816	12,213	16,953
Ontario	15,055	11,007	13,122	20,746	13,105	17,979
Manitoba	15,113	16,889	15,615	22,824	17,688	21,795
Saskatchewan	14,370	16,349	15,051	22,686	20,711	22,485
Alberta	15,263	10,662	12,994	21,913	14,897	19,319
British Columbia	18,929	10,888	14,738	29,297	9,875	20,295
CANADA	15,105	12,899	14,182	21,985	12,616	18,277
b) US\$ (PPP)	1995			1999-2000		
Canada	12,217	10,434	11,471	18,475	10,602	15,359
France	n.a.	n.a.	6,569	7,709	8,458	7,867
Germany	9,001	6,817	8,897	11,209	5,495	10,393
Japan	9,337	6,409	8,768	10,749	7,649	10,278
United Kingdom	n.a.	n.a.	7,225	n.a.	n.a.	9,554
United States	19,965	7,973	16,262	n.a.	n.a.	19,220
Australia	n.a.	n.a.	n.a.	12,588	7,993	11,725
OECD average	8,781	6,016	8,134	n.a.	n.a.	11,422

Sources: 1. 1995 data from Council of Ministers of Education, Canada and Statistics

Canada (2000) and Organisation for Economic Cooperation and Development (2002).

2. 1999-2000 data were supplied by Statistics Canada. Note that 1995 data for non-university includes trade and vocational plus community college whereas 1999-2000 data includes only community colleges.

Table 2**Expenditure on post-secondary education as a percent of GDP**

	University	Non-univ	PSE total	University	Non-univ	PSE total
a)	1995			1999-2000		
Newfoundland	2.1	1.8	3.9	2.0	1.1	3.1
P.E.I.	1.6	1.2	2.9	1.8	1.2	3.0
Nova Scotia	2.1	0.9	3.0	2.7	0.7	3.4
New Brunswick	1.8	1.1	2.9	1.8	1.2	3.0
Quebec	2.1	1.0	3.1	1.5	1.3	2.8
Ontario	1.2	0.8	2.1	1.3	0.6	1.9
Manitoba	1.6	0.7	2.3	1.6	1.0	2.6
Saskatchewan	1.6	0.9	2.5	1.8	1.0	2.8
Alberta	1.1	0.8	1.9	1.2	0.8	2.0
British Columbia	1.5	0.9	2.5	1.6	0.8	2.4
CANADA	1.5	0.9	2.5	1.4	0.9	2.3
b)	1995			1999-2000		
Canada	1.5	0.9	2.5	1.4	0.9	2.3
France	n.a.	n.a.	1.1	0.9	0.3	1.1
Germany	1.0	n.a.	1.1	1.0	0.1	1.1
Japan	0.9	0.1	1.0	0.9	0.1	1.0
United Kingdom	n.a.	n.a.	1.0	n.a.	n.a.	1.1
United States	2.0	0.4	2.4	n.a.	n.a.	2.3
Australia	n.a.	n.a.	1.2	1.3	0.2	1.5
OECD average	1.1	0.2	1.3	n.a.	n.a.	1.6

Sources: 1. 1995 data from Council of Ministers of Education, Canada and Statistics Canada (2000) and Organisation for Economic Cooperation and Development (2002).

2. 1999-2000 data were supplied by Statistics Canada.

Table 3 **Public expenditure on post-secondary education as a proportion of total public expenditure**

a)	1995	1999-2000
Newfoundland	8.9	5.2
P.E.I.	4.4	4.3
Nova Scotia	3.7	4.2
New Brunswick	3.9	4.9
Quebec	5.8	4.9
Ontario	4.0	4.0
Manitoba	3.9	4.1
Saskatchewan	4.7	5.2
Alberta	4.7	5.0
British Columbia	4.5	4.4
CANADA	4.8	4.5
b)	1995	1999-2000
Canada	4.8	4.5
France	2.0	2.0
Germany	2.2	2.3
Japan	1.2	1.2
United Kingdom	n.a.	2.6
United States	3.6	n.a.
Australia	n.a.	3.4
OECD average	2.7	2.8

Sources: 1. Council of Ministers of Education, Canada and Statistics Canada (2000)
 2. Organisation for Economic Cooperation and Development (2001)
 3. 1999-2000 provincial data were supplied by Statistics Canada.

Table 4 Student/faculty ratios in Canadian provinces and OECD countries

	University	Non-univ	PSE total	University	Non-univ	PSE total
a)	1993/94			1997/98		
Newfoundland ¹	13.1			12.8		
P.E.I. ¹	13.1			12.8		
Nova Scotia	12.6			12.9		
New Brunswick ¹	13.1			12.8		
Quebec	13.3			12.5		
Ontario	14.7			15.5		
Manitoba	12.2			12.7		
Saskatchewan	13.7			14.2		
Alberta	14.7			15.6		
British Columbia	12.9			13.2		
CANADA	13.8			14.0		
b)	1996			1999		
Canada	16.4	12.8	14.6	n.a.	14.5	n.a.
France	17.2	n.a.	17.1	15.8	21.4	16.9
Germany	12.5	12.3	12.5	12.0	13.9	12.3
Japan	13.5	10.8	12.4	13.0	9.1	11.5
United Kingdom	n.a.	n.a.	16.7	n.a.	n.a.	18.5
United States	14.1	19.4	15.4	15.4	9.8	14.0
Australia	15.4	n.a.	n.a.	11.8	n.a.	n.a.
OECD average	16.7	13.1	15.7	16.2	15.7	15.3

1. For confidentiality reasons, a common ratio is reported for the provinces of Newfoundland, P.E.I. and New Brunswick.

Sources: Part (a) is based on Statistics Canada data on full-time and part-time university enrolment and full-time and part-time university faculty. The student/faculty ratio was constructed on a full-time equivalent basis by assuming that 3.5 part-time students represent 1 FTE and that part-time faculties are assigned a FTE provided by the institutions.

Part (b) is based on Organisation for Economic Cooperation and Development (1998) and Organisation for Economic Cooperation and Development (2002).

Table 5 Educational attainment of the working age population (ages 25 to 64)

	Less than high school	High school graduate	Non-university post-secondary	University graduate
a)				
Newfoundland	26	22	39	13
P.E.I.	22	25	38	16
Nova Scotia	21	22	38	19
New Brunswick	23	28	34	15
Quebec	23	23	35	19
Ontario	15	29	32	24
Manitoba	20	30	32	18
Saskatchewan	18	31	34	17
Alberta	14	29	36	20
British Columbia	13	33	33	21
CANADA	17	28	34	21
b)				
	Less than upper secondary	Upper secondary graduate	Non-university post-secondary	University graduate
Canada	18	28	34	20
France	36	41	11	12
Germany	17	54	15	13
Japan	17	49	15	19
United Kingdom	17	57	8	18
United States	12	50	9	28
Australia	41	30	10	19
OECD average	34	41	11	15

Sources: Part (a) is based on calculations by the author from the Statistics Canada, Labour Force Survey 2002.

Part (b) is based on Organisation for Economic Cooperation and Development (2002).

Table 6 Literacy skills in Canadian regions and G-7 countries**(a) Mean scores and scores at 25th and 75th percentiles of prose, document and quantitative literacy scales**

Literacy scale	25th	mean	75th	25th	mean	75th	25th	mean	75th	25th	mean	75th
	Atlantic Canada			Quebec			Ontario			Western Canada		
Prose	240	274	311	234	264	303	243	281	333	260	288	327
Document	229	269	310	232	265	303	248	284	332	252	286	336
Quantitative	239	273	311	234	266	299	253	287	332	255	288	329
	Canada			Germany			UK			US		
Prose	243	279	322	245	276	308	233	267	311	237	274	320
Document	243	279	326	256	285	318	230	268	314	230	268	316
Quantitative	247	281	323	265	293	324	231	268	314	237	275	322

(b) Percent of adults with low literacy skills (1)

Literacy age scale	Atlantic Canada	Quebec	Ontario	Western Canada
16-65 Prose	45	48	42	37
16-65 Document	49	51	38	39
16-65 Quantitative	49	55	38	37
16-25 Document	42	32	35	27
46-55 Document	64	69	55	38
	Canada	Germany	UK	US
16-65 Prose	42	49	52	47
16-65 Document	43	42	50	50
16-65 Quantitative	43	33	51	46
16-25 Document	33	34	44	56
46-55 Document	54	42	53	50

(c) Mean document literacy score and educational attainment

Education	Atlantic Canada	Quebec	Ontario	Western Canada
Less than High School	228	217	226	240
High School graduate	283	277	287	298
Post-secondary graduate	303	322	319	318
ALL adults	269	265	284	286
	Canada	Germany	UK	US
Less than High School	227	276	247	200
High School graduate	288	295	286	266
Post-secondary graduate	318	315	312	303
ALL adults	279	285	268	268

Table 7 **Determinants of literacy skills for adult Canadians**

Variable	CANADA	Atlantic	Quebec	Ontario	Western
Female	6.18 (1.91)	0.84 (3.31)	19.65 (4.76)	-0.53 (3.23)	-0.20 (4.81)
Experience	0.66 (0.36)	2.60 (0.60)	2.17 (0.91)	-0.21 (0.68)	0.67 (0.95)
Experience squared	-0.03 (0.01)	-0.06 (0.01)	-0.05 (0.01)	-0.01 (0.01)	-0.02 (0.02)
Less than High School	-41.26 (2.63)	-44.35 (4.44)	-25.70 (6.22)	-51.03 (4.76)	-48.63 (6.25)
Non-univ post-secondary	19.93 (2.75)	13.64 (4.64)	37.64 (7.09)	15.47 (4.77)	14.67 (6.60)
University graduate	38.52 (3.11)	32.69 (5.54)	59.44 (10.64)	35.43 (4.85)	29.26 (6.86)
Mother less than HS	-8.55 (2.48)	-25.18 (4.72)	-6.94 (7.36)	-7.79 (4.14)	2.59 (5.80)
Mother non-univ PSE	2.30 (3.80)	-15.12 (8.24)	18.32 (13.69)	4.23 (5.56)	-5.00 (8.16)
Mother univ grad	-22.75 (4.52)	-24.88 (8.90)	34.64 (31.33)	-18.84 (6.12)	-43.96 (10.00)
Father less than HS	-3.01 (2.62)	-12.70 (5.26)	-4.83 (7.52)	2.81 (4.01)	-5.84 (6.18)
Father non-univ PSE	7.43 (4.61)	4.45 (11.10)	-7.35 (13.37)	-0.23 (7.52)	27.04 (9.92)
Father univ grad	13.62 (4.10)	8.74 (8.27)	-5.64 (12.18)	18.43 (5.71)	26.70 (11.53)
Constant	293.62 (5.02)	288.67 (9.25)	250.86 (15.59)	307.28 (8.16)	301.21 (13.08)
R-squared	0.41	0.52	0.49	0.38	0.35
observations	2257	676	342	817	422

Source: author's estimates based on data from Statistics Canada's International Adult Literacy Survey carried out in 1994.

Notes: 1. sample restricted to native-born Canadians aged 26-65.

2. figures in parentheses are standard errors.

Table 8
Estimates of the Private Returns to Education in Canada, With and Without
Credential Effects

	Males	Females
(i) Years of schooling (without credential effects)	5.9	8.6
(ii) Years of schooling (with credential effects)	3.3	5.5
High school graduate	5.2	6.1
College diploma/trade certificate without high school	7.6	8.4
<u>Marginal effect over high school:</u>		
College/trade with high school	6.6	5.9
Bachelor's degree	22.8	25.2
<u>Marginal effect over BA:</u>		
Medicine, dentistry	34.1	30.0
Master's degree	4.6	7.0
<u>Marginal effect over MA:</u>		
Ph.D.	4.2	0.8

Source: Ferrer and Riddell (2002)

Table 9 continued

Log hourly wage regressions

Variable	Males	Females
Married	0.078 (0.002)	0.024 (0.002)
Full-time worker	0.299 (0.004)	0.155 (0.002)
Newfoundland	-0.219 (0.007)	-0.292 (0.007)
P.E.I.	-0.289 (0.013)	-0.240 (0.012)
Nova Scotia	-0.208 (0.006)	-0.225 (0.005)
New Brunswick	-0.217 (0.006)	-0.234 (0.006)
Quebec	-0.079 (0.004)	-0.078 (0.004)
Manitoba	-0.119 (0.005)	-0.142 (0.005)
Saskatchewan	-0.094 (0.006)	-0.150 (0.005)
Alberta	0.031 (0.004)	-0.056 (0.004)
British Columbia	0.014 (0.004)	0.024 (0.004)
Constant	2.344 (0.005)	2.307 (0.004)
R-squared	0.234	0.315
observations	254,007	251,096