MEASURING EFFECTIVE TAX RATES ON HUMAN CAPITAL: METHODOLOGY AND AN APPLICATION TO CANADA

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Abstract

This paper examines the impacts of a wide range of tax provisions on the incentive to invest in human capital, and shows how these effects can be quantified using effective tax rates, or *ETRs*. For individuals with median earnings, *ETRs* on the human capital formed in first-degree university study are sizeable, although not as large as those estimated by previous authors for physical capital in Canada. When the expenditure side and its direct subsidies are also taken into account, the net effective tax rate on human capital becomes negative. The taxation of human capital is far from uniform. *ETRs* vary by income level, gender, part-time vs. full-time study, whether students have loans, number of dependants, and use of RESPs. The most significant differences are those related to income level. Workers at higher percentile levels of the earnings distribution throughout life may face *ETRs* three times as high as those for low-income workers—a result of our progressive income tax system.

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I. Introduction

Over the last two decades there has been a considerable amount of research on effective tax rates on physical capital. It has been found that these are generally high, and that they vary across types of firms, industries, and types of capital. (See Boadway et al., 1984; King and Fullerton, 1984; and McKenzie et al., 1998.) While the *size* of the impact on investment and its composition is an important question that cannot be addressed simply by estimating tax wedges, these findings have helped to create concern about such impacts. This has added impetus to the movement to reduce capital taxation and to make it more uniform**.**

While there has also been considerable interest in recent years in the tax treatment of education and training[1], we do not have estimates of the effective tax rates on human capital. This is a problem since some features of the tax system, e.g. progressivity, tend to discourage human capital formation, while others, e.g. deductions or credits to support education, have the opposite effect. We do not know the net impact, and therefore do not know whether the tax system encourages or discourages human capital; how it treats human capital compared with physical capital; or how effective tax rates on human capital vary across the population.

This paper provides a conceptual framework for measuring effective tax rates (*ETRs)* on human capital, analyzing how the progressivity of personal income taxes interacts with other PIT features, other taxes, and student loan plans. It then provides estimates for the *ETRs* on human capital formed in first degree university studies in Canada.[2] We find that these are sizeable although not as large as effective tax rates on physical capital, and that they vary considerably across individuals. *ETRs* on human capital in Canada are, on average, greater for males than for females, and increase as we go up the income scale. *ETRs* are lower for individuals who take out student loans, and for those who take advantage of Registered Education Savings Plans (RESP's). There are also differences in *ETRs* created by a number of other tax features. The conclusion is thus that Canada has far from uniform tax treatment of human capital.

In assessing fiscal incentives or disincentives for human capital investment it is essential to take into account the encouragement that governments provide for such investment, on their expenditure side. For a more complete treatment one therefore needs to consider the effective subsidy rate, *ESR*, as well as the *ETR*.[3] The "bottom line" is given by the *net* effective tax rate, *ETR - ESR*. As we show, this net tax rate is on average negative.

Care must be taken in interpreting the results of our study. This is especially so if one wishes to draw normative implications. First there are some standard considerations from the economics of education. A negative net tax on human capital can, in principle, be justified by positive externalities of education or by capital market imperfections that make it hard for students to borrow. However, while earlier literature claimed to find evidence of large externalities, recent work tends to dispute this (see e.g. Heckman and Klenow, 1997; Acemoglu and Angrist, 2000; and the survey by Davies, 2002). Doubt

has also recently been cast on the importance of borrowing problems (see e.g. Shea, 2000; Cameron and Taber, 2000). Merit good arguments are sometimes also used. On the other side, to the extent that education represents private consumption rather than an investment the strength of subsidy arguments declines. Going further, if education pays off for individuals due to screening for ability, or because of the status it confers, it is wasteful from a social viewpoint, and should be discouraged. The bottom line that should be taken from economics of education considerations is thus unclear.

Turning to the public finance literature, there are several strands. A variety of studies have endogenized human capital in dynamic models, either in a neoclassical framework (see e.g. Davies and Whalley, 1991; Trostel, 1993; Perroni, 1995; Jones et al., 1997) or with endogenous growth (see e.g. Pecorino, 1993; Jones et al., 1993; Davies et al., 2002). It is well-known that the optimal tax rate on physical capital goes to zero in the long-run in perfect foresight infinite horizon dynamic models (Judd, 1985; Chamley, 1986). A similar result extends to human capital when it is endogenized (Jones et al., 1997). However, results of recent studies suggest that this need not imply zero labor income taxes. Bovenberg and Jacobs (2002) and Davies et al. (2002) both show that education subsidies can be used to counter the disincentive effect of labor income taxes on human capital formation. An important element in our study is to see how complete this offset is in practice. Another interesting recent insight is provided by Nielsen and Sorensen (1997) who show that if the imposition of capital income taxes cannot be avoided there may be excess investment in human capital, which can be combatted by levying progressive labor income taxes. In other words, if the effective tax rate on physical capital is unavoidably positive, then the optimal tax rate on human capital may be positive as well.

The remainder of the paper is organized as follows. Section II provides a description of the conceptual framework adopted. In Section III we examine the treatment of human capital under the Canadian tax system. Finally, Section IV presents our numerical results, and Section V concludes.

II. Conceptual Framework

A common approach in evaluating the impact of factor taxes is to juxtapose effective tax rates on physical capital with tax rates on labor. In this context, if labor income were taxed at a proportional rate of 30%, for example, and the EMTR for physical capital were, say, 20%, it would appear that the tax system discriminates in favor of physical capital. However, as is now well-known (see e.g. Davies and Whalley (1991), if the only private cost of education is forgone earnings, a proportional labor income tax is neutral with respect to human capital investment. (It implicitly subsidizes the costs at the same rate it taxes the benefits of education.) In the example given, the tax system would in fact heavily discriminate in favor of human capital. Thus, it is as important to include impacts on investment costs on the labor side as it is on the physical capital side. There is an increasing trend to do this (see e.g. Mintz, 2001, for Canada). Our purpose here is to highlight the impact of taking these investment aspects into account.[4]

How can one tell whether a tax system provides a net incentive or disincentive for investment? This problem has been analyzed by previous authors for the case of physical capital. Structures, equipment, and inventories are taxed in different ways, and there are also differences across industries and according to how investment is financed. In order to summarize these effects and see how they net out, it has proven fruitful to calculate hypothetical effective marginal tax rates (*EMTR*s) by type of capital, industry, and method of finance. (See, e.g., Boadway et al., 1984; King and Fullerton, 1984, and McKenzie et al. 1998.)

EMTR's on physical capital are high and non-uniform. Looking only at non-personal taxes, McKenzie et al. (1998), for example, find that EMTRs in Canada in 1997 averaged 29.0% on inventories, 19.0% on machinery, 18.9% on structures, and 15.6% on land. The overall average EMTR was 21.8%. Rates within industries ranged from 8.5% in agriculture, fishing and trapping, to 29.5% for public utilities. Largely due to their lower rate of corporate income tax, small firms on average faced an EMTR of only 13.3% while large firms paid 27.0%.

Personal taxation of capital income is also significant and highly non-uniform. Poddar and English (1999) estimate that about 75% of investment income is tax-free at the personal level in Canada - - due to various tax shelters (e.g. retirement savings plans) and other factors such as the non-taxation of imputed rent on owner-occupied housing. On the other hand, tax rates on the interest, dividends, and capital gains that are not sheltered can be quite high. There are no estimates of personal-level *EMTRs* on capital income for Canada. However, most investors would have paid tax on taxable elements of investment income at top marginal rates, which averaged about 46% in Canada in 1997, including provincial taxes. Applying the Poddar and English result, the average personal EMTR on investment income may then have been about 10%. Added to the McKenzie et al. figure, this suggests an average total (personal plus non-personal) EMTR on physical capital of at least 30%.

While the problem of measuring effective tax rates on human capital is formally the same as that for physical capital, there are measurement issues that make a different approach necessary in practice.[5] In the case of physical capital one can make plausible assumptions about the rate of return to a hypothetical marginal investment based on observed asset returns in capital markets. For human capital rates of return are not directly observable. For physical capital the fact that real-world investments are typically lumpy does not affect the results. Corporate taxes are levied at a flat rate, so the estimated effective tax rate does not depend on the size of the investment. For human capital the most important tax is the personal income tax, whose graduated rate structure makes the effective tax rate depend on the scale of the investment.

For human capital rates of return can be estimated using microdata on education and earnings over the lifetime. Tax treatment depends on individual circumstances and requires a comparison of the taxes that would be paid in the counterfactual, i.e. without additional education, vs. those paid if extra schooling is obtained. The most meaningful

calculation compares the before- and after-tax rates of return to participation in a complete education program, whether it be e.g. community college, undergraduate university study, M.A. or Ph.D. work.[6] These tax rates are similar to the EMTR's on physical capital in that they measure the effective tax rate on the last meaningful unit of education, but since these units are not small we speak in terms of "effective tax rates" (ETR's) on human capital rather than EMTR's below.

The *ETR* for human capital is defined as the gap between gross- and net-of-tax rates of return to a whole program of study, r_g and r_n, respectively:

$$(1) \qquad ETR = \frac{r_g - r_n}{r_g} = 1 - \frac{r_n}{r_g}$$

This definition, which is built on the use of internal rates of return, follows the methodology applied in computing *ETR*s on personal financial assets by Davies and Glenday (1990).[7]

Suppose that an individual aged t is planning to engage in a program of education that will take m years of study. We will assume that after this program is completed the individual will stay in the labor force until age T. Students may continue to earn while going to school. Their wage rates can vary over time, perhaps increasing while they are still in school, and likely rising in real terms over much of the lifetime after graduation. Actual earnings before-tax are given by E_t, which is the product of the wage rate and hours worked. Earnings before-tax in the absence of the educational program would have been E_t^*, where we assume that $E_t^* < E_t$ in the $T - m$ years after graduation. Forgone earnings costs of education, FE_t, are thus $E_t^* - E_t$ in the first m years. In addition to these costs, there are private direct costs of education, C_t. After-tax variables will be denoted E_t^a, E_t^{a*}, FE_t^a, and C_t^a. Initially we will assume that human capital investments are self-financed, that is that student loans are absent.

Rates of return on the investment described are calculated as internal rates of return. For example, we can compute the gross private rate of return, r_g, from:

$$(2) \qquad \sum_{t=1}^{T} \frac{E_t - C_t}{(1+r_g)^{t-1}} = \sum_{t=1}^{T} \frac{E_t^*}{(1+r_g)^{t-1}}.$$

By replacing E_t, E_t^*, and C_t with the after-tax variables E_t^a, E_t^{a*}, and C_t^a, we could compute the net after-tax rate of return, r_n, using this same equation. Note that in the case of a flat tax with tuition and other direct costs of education deductible $r_n = r_g$, and $ETR = 0$. This is because with such a tax levied at the rate, say, τ, we have $E_t^a = (1-\tau)E_t$, $E_t^{a*} = (1-\tau)E_t^*$, and $C_t^a = (1-\tau)C_t$. That is, the three variables have the same relative values after- as before-tax. We shall refer to this type of tax system as *neutral* with respect to human capital.[8] It imposes a zero *ETR* because the forgone

earnings and direct costs of education are implicitly subsidized at the same rate, τ, at which the gains from education are taxed.

Note that "neutrality" is used here in a special, and very limited, sense. It is simply a benchmark. There is no implication that a zero *ETR* on human capital is the optimal rate. Externalities of human capital, or capital market imperfections that make it difficult for students to finance their studies, could call for a negative *ETR*. Absent such factors, a non-zero *ETR* could be needed in the second-best solution if there were a positive *EMTR* on physical capital. In that case, while a low ETR would avoid depressing investment it would also tilt the playing field away from physical capital investment, causing a distortion in the composition of investment. Clearly, optimal design of the tax treatment of human capital is contingent on any constraints (political or otherwise) on the tax treatment of physical capital.

By replacing private costs with public costs, C_t^p, we can use (2) to compute the public rate of return, r_p. Given r_p we can define the effective subsidy rate (*ESR*) on human capital:

$$(3) \qquad ESR = \frac{r_g - r_p}{r_g} .$$

Whether the tax and expenditure systems combined have an incentive or disincentive effect on human capital investment can be investigated by computing the *net* effective tax rate on human capital, *ETR – ESR*. We proceed here by first analyzing the behaviour of *ETRs*, and returning to *ESRs* at the end of the section.

The behaviour of *ETRs* can best be illuminated if we assume, for the sake of illustration, that the length of the schooling program, *m*, is just one year. Rearrange (2) so all the *t = 1* terms are on one side and the remaining terms on the other:

$$(4) \qquad E_1^* - E_1 + C_1 = \sum_{t=2}^{T} \frac{E_t - E_t^*}{(1 + r_g)^{t-1}}$$

The left-hand side of (4) represents the private costs of the education program, made up of foregone earnings, $E_1^* - E_1$, and direct costs, C_1. The right-hand side is the present value of future earning increments due to education, $E_t - E_t^*$.

Again for the sake of illustration, suppose that the yearly benefits of additional education, $E_t - E_t^* - C_t$, are constant. Then because *T* is typically large we have:

$$E_s^* - E_s + C \approx \frac{E_w - E_w^*}{r_g}$$

where we use subscripts *s* and *w* to denote the schooling and working periods. We now have a simple expression for the before-tax rate of return r_g and a parallel expression for the after-tax rate of return, r_n:

$$(i) \qquad r_g \approx \frac{E_w - E_w^*}{E_s^* - E_s + C} = \frac{EI}{FE + C}$$

(5)

$$(ii) \qquad r_n \approx \frac{E_w^a - E_w^{a*}}{E_s^{a*} - E_s^a + C^a} = \frac{(1-\tau_w)EI}{(1-\tau_s)FE + C^a}$$

where *FE* is forgone earnings and *EI* is the "earnings increment" achieved due to the extra education. Both *FE* and *EI* are before-tax. The tax rates τ_s and τ_w represent the fraction of *FE* that *would* have been paid in tax, and the fraction of *EI* that *is* paid, respectively.

If we ignore direct costs for the time being and let $T \to \infty$ for simplicity we have:

$$\text{(i)} \qquad r_g\big|_{C=0} = \frac{EI}{FE}$$

(6)

$$\text{(ii)} \qquad r_n\big|_{C=0} = \frac{(1-\tau_w)EI}{(1-\tau_s)FE}$$

Applying (1) the effective tax rate on human capital in this case is:

$$(7) \qquad ETR\big|_{C=0} = \frac{r_g - r_n}{r_g} = \frac{\tau_w - \tau_s}{1-\tau_s}$$

This simple expression has some interesting implications. It indicates that, in the absence of direct costs, the effective tax rate on human capital is directly related to the gap between τ_s and τ_w. The most obvious possibility is that the graduated rates under personal income tax will make $\tau_s < \tau_w$, resulting in a positive *ETR*. The gap between τ_s and τ_w will tend to be largest for those education programs that have the biggest impact on earnings. This is one reason that first-degree university education is of particular interest. Not only is it a very important element in our education system, but it is well-known to increase earnings substantially. In contrast, incomplete university education, or graduate education, have smaller effects on earnings, which will result in a smaller gap between τ_s and τ_w. Equation (7) gives reason to expect smaller *ETR's* in these cases.

Of course other taxes also affect the *ETR*. Since social security and unemployment insurance contributions are capped at maximum insurable earnings, their

schedules are regressive. To the extent that contributions represent pure taxes (i.e. not offset by expected benefits), these schemes work towards $\tau_s > \tau_w$ for workers whose *EI*'s fall entirely or partly above maximum insurable earnings. It should also be borne in mind that sales taxes reduce real earnings. In the absence of any other taxes, proportional sales taxes on a comprehensive base would give $\tau_s = \tau_w$, that is neutrality. However, some necessities are widely exempt from sales tax in North America and elsewhere (food, children's clothing etc.) or taxed at a lower rate, which reinforces the tendency for $\tau_s < \tau_w$, and a positive *ETR*.

Expressions (6) and (7) also make possible a number of other insights. We note that:

Result 1: If $\tau_s < \tau_w$, equal absolute or equal proportional increases in τ_s and τ_w will reduce $r_n|_{C=0}$ and increase $ETR|_{C=0}$.

This result hinges on the fact that with $\tau_s < \tau_w$, we have $(1 - \tau_s) > (1 - \tau_w)$. Equal absolute or proportional changes in τ_s and τ_w have a greater proportional impact on $(1 - \tau_w)$ than on $(1 - \tau_s)$. The effect is of course stronger in the case of equal proportional changes in the tax rates.

Result 1 is of interest when more than one tax is levied. It points out e.g. that even if a tax would be neutral on its own, when added to an existing system that imposes a positive tax rate on human capital it will increase the size of the tax wedge. If one perhaps thought of the federsl personal income tax as the basic element in the system, then adding even uniform sales taxes or flat-rate provincial income taxes raise the ETR.

Moving to the more general case, we need to take into account tuition and other direct costs; the student loan amount, *L*; student loan repayments, *iL*, where *i* is the interest rate; the rate of tax relief on student loan payments, *d*; and credits for tuition and other expenses, *A*.[9] Making the appropriate adjustments to the costs and returns we have:

$$(8) \qquad ETR = 1 - \frac{r_n}{r_g} = 1 - \left[\frac{(1-\tau_w)EI - i(1-d)L}{(1-\tau_s)FE + (C - L - A)}\right]\left[\frac{FE + C - L}{EI - iL}\right]$$

From (8) we have immediately:

Result 2: Increases in tuition credits, *A*, or in interest deductibility, *d*, unambiguously reduce the *ETR*.

Note also from (8) that the *ETR* is affected by several *non-tax* policy variables, e.g. tuition fees, student loan amounts, and interest rates on student loans. These interaction effects are perhaps unexpected, and therefore particularly interesting. It should be emphasized that they are independent of the impact of these non-tax variables on the effective subsidy rate on education. We summarize these effects in Results 3 and 4. (Proofs are available in an appendix that may be obtained from the authors.)

Result 3: A rise in tuition and other direct costs, C, raises the *ETR*.

The intuition for this result is that if C rises, with education credits A constant, the implicit rate of subsidy to direct costs of education in the tax system has fallen. The result is of topical interest in Canada and other countries, like the U.S., where tuition fees have been rising rapidly in recent years. In the absence of offsetting action in the tax system, such increases raise the tax distortion affecting human capital. Rising tuition fees may also reflect a reduced rate of public subsidy to colleges and universities, meaning that the *ESR* has been falling. Thus the net effective tax rate on human capital, *ETR – ESR* tends to rise *a fortiori*.

In the next section we set out the many steps that have been taken at the federal level in Canada in recent years to ease the tax treatment of human capital. These initiatives will have acted to offset the rise in *ETRs* caused by increasing tuition fees and other direct costs.

The following result reflects the effect of student loans:

Result 4: If $d \geq \tau_w$ the *ETR* is strictly decreasing in L. If $d < \tau_w$ the sign of the effect of L on the *ETR* is ambiguous.

Thus, a sufficient condition for an increase in student loans to reduce the effective tax rate on human capital is that the fraction of student loan interest that is creditable should exceed the tax rate on the earnings increment due to education. In the calculations reported in Section IV below we find that this is the direction of the effect in most cases we consider.

We should say a few words about the effective subsidy rate, *ESR*, which was defined in (3). Note that the *ESR* depends only on r_g and r_p. It is thus independent of any aspects of the tax system (in a partial equilibrium framework). It can, however, be affected by the presence of student loans, since as we saw in (8) these affect r_g . (Student loans have no effect on r_p , however.)[10]

Let $\sigma = 1 - C/C^p$ be the rate of subsidy on the direct costs of education. Then, in the absence of student loans, the wedge between r_g and r_p , and therefore the *ESR*, will be greater the larger σ or C^p , as we can see from:

$$(9) \qquad ESR|_{L=0} = \sigma \, [C^p /(FE + C^p)]$$

which is derived from (3) and 5(i), noting that 5(i) yields r_p if C is replaced by C^p. Introducing student loans will tend to raise r_g if the student loan interest rate is less than r_g (which is plausible). This is likely to raise r_g relative to r_p and increase the *ESR*.

III. Treatment of Human Capital under Canadian Tax and Student Loan Systems

The calculations in the next section incorporate the effects of both the personal income tax system (federal and provincial) and payroll taxes, as they applied after the federal budget of 1998, which made a number of important changes in the tax treatment of education.[11] Here we describe the relevant features of the PIT and payroll tax systems, noting the reforms introduced in 1998 (as well as changes leading up to those reforms) and developments since. We also describe the student loan system as it existed in 1998, and note more recent changes.

Personal Income Tax

A useful benchmark for describing how PIT impinges on human capital is a flat tax system under which direct costs of education or training are fully deductible. Interest on student loans would not be deductible. Under such a neutral system, $ETR = 0$. Canadian PIT departs from neutrality by levying graduated marginal tax rates, in its treatment of direct costs, and (since 1998) by allowing a credit for interest on student loans.

Both federal and provincial PIT are levied on individuals, unlike the U.S. where most married couples are taxed jointly. In 1998, basic federal marginal rates of 17%, 26 % and 29% were levied on taxable income in the ranges 0 - $29,590, $29,591 - $59,180, and $59,181+. (These rates and brackets were in force from 1993 to 1999.) Adding in surtaxes and provincial income tax, the full marginal rates in the three brackets came to about 26, 40, and 46% in 1998 (Canadian Tax Foundation, 1999, Table 3.5). Important deductions made in arriving at taxable income included those for Registered Retirement Savings Plan (RRSP) and Registered Pension Plan (RPP) contributions and child care expenses. Rather than providing personal allowances or exemptions as in most other countries, a system of personal credits was applied. These gave all taxpayers the same relief as if they had received personal deductions but were in the 17% marginal tax bracket. On that basis, the credits given were equivalent to deductions of $6,456 for the taxpayer and $5,380 for a dependent spouse or child over 18.

Refundable tax credits for children under 18 were provided via the Canada Child Tax Benefit (CCTB) and the National Child Benefit Supplement (NCBS). The latter were clawed back on family net incomes above $25,921 and $20,921 respectively. These programs have little impact on costs of education, since relatively few students have children, but they increase marginal tax rates for many graduates, and will therefore drive up the *ETR* on human capital somewhat.[12]

The tax relief on tuition and other direct expenses provided by the PIT comes in the form of various credits, not as a deduction. In 1998 a credit was given for 17% of tuition and additional mandatory fees paid to approved post-secondary institutions. A further credit equal to 17% of an "education amount" was provided. The education amount was $80 per month prior to 1996, but was raised in steps to $200 per month by 1998. Since most students have low incomes, these credits would in many cases not be

very valuable if they were only available to reduce the student's own tax liability. Their value is enhanced by the fact that any unused portion can be transferred to a spouse, parent or grandparent.[13] Also, in 1997 a carryforward provision for unused education credits was introduced that would allow students to obtain tax relief themselves in later years. These measures ensure that the effective implicit federal subsidy on direct costs of education via PIT is close to being uniform at a 17% rate. Adding in provincial tax, the average rate of relief is about 26%.

Note that the "education amount" credits are not related to actual expenditures, but are simply paid as a lump sum. They are thus similar to a system of student grants. This form of assistance would not have a tax-side rationale under a flat tax, but with progressivity might be advocated as a rough offset to the effect of graduated marginal tax rates on human capital *ETRs*.

The PIT system also provides assistance for education and training via registered savings plans. First, Canadians are able to withdraw funds from their RRSP's without penalty two years after contributions are made. This means that, assuming contribution limits are not binding, parents could save for their children's post-secondary education via their RRSP's. While this avenue is no doubt sometimes chosen, it is not as attractive as it might be since RRSP contribution limits have been held at relatively low levels.[14] Also, withdrawals are taxed. Parents will typically be in their peak earning years when their kids go to college, and will therefore face high tax rates on withdrawals. This will also make the RRSP saving route less attractive.

Parents are encouraged to save for their kids' education via Registered Education Saving Plans (RESP's). In contrast to an RRSP, contributions to an RESP are not tax deductible. However, income earned within the plan is tax free, and if the proceeds are spent on the child's education withdrawals of accrued income enter the child's income for tax purposes. Given that post-secondary students are generally in low tax brackets, the result is that the net of tax rate of return on RESP saving generally exceeds that on non-sheltered saving.[15] While RESP's provide a higher rate of return than on non-sheltered saving, in the pre-1998 regime they were not sufficiently attractive to induce much use. This may have been due to the opportunities for fully sheltered saving (e.g. via RRSPs) or because a higher rate of return could be achieved by paying down mortgages and consumer debt.[16]

The 1996, 1997 and (especially) 1998 federal budgets introduced a number of changes intended to reduce burdens on post-secondary students and to stimulate education and training in Canada. The following were the principal changes:

1. The 1996 and 1997 budgets announced that the education amount would be raised from its original $80 per month to $150 per month in 1997 and $200 per month in 1998.
2. The education amount was extended to part-time post-secondary students in the 1998 budget, at $60 per month. Part-time students also became eligible to claim child care expense deduction (CCED) for the first time, up to $2,200 per year.

3. Canada Study Grants (CSG's) of up to $3,000 per year were created in the 1998 budget for both full- and part-time students in financial need who had children or other dependants.

4. Interest on student loans became eligible for a tax credit at the 17% rate in the 1998 budget.

5. Tax-free withdrawals of up to $10,000 per year ($20,000 in total) from RRSPs were introduced in the 1998 budget to finance full-time training or education (or part-time for disabled people). These withdrawals must be repaid within 10 years.

6. The 1996 and 1997 budgets raised the annual contribution limits on RESPs from $1,500 to $4,000 per student, and also increased the lifetime limit on contributions from $31,500 to $42,000. The 1998 budget introduced Canada Education Saving Grants (CESGs) equal to 20% of RESP contributions up to a limit of a $400 annual grant per student. CESG amounts become part of the RESP. The 1998 budget also made it possible to transfer an RESP balance to an RRSP if the student did not go on to qualifying study after leaving high school.

All of these provisions act to increase the net-of-tax expected return to planned or actual human capital investment for some taxpayers.[17] Note, however, that the incidence of the increased returns varies greatly. Increased education amounts raise r_n for almost all students. On the other hand, interest credits only benefit those with student loans, and the RESP/RRSP provisions have similarly limited incidence. Note also that the value of the RESP/RRSP measures will vary substantially even among those who make use of these savings plans. CESG's are proportional to RESP contributions; the benefit of RESP saving depends on how attractive is the after-tax rate of return on the next-best saving vehicle; the value of the option to rollover unused RESP funds into an RRSP depends on how likely it is that education plans will fall through; and the benefit of being able to take money out of an RRSP temporarily to finance education depends on the size of the tax rate thereby avoided.

Since 1998 the most important PIT changes affecting human capital have been (i) a doubling of the education amounts in the 2001 tax year (to $400 and $120 per month for full-time and part-time students respectively), (ii) reductions in federal tax rates and changes in the rate structure, and (iii) the freeing-up of provincial PIT rate structures.[18] By the 2001 tax year the federal government had moved from its sharply graduated three bracket rate structure to more gradual progressivity. Federal rates were applied at the rates of 16, 22, 26, and 29% on taxable income in the ranges 0 - $30,754, $30,755 - $61,509, $61,510 - $100,000, and $100,000+. All federal surtaxes had been removed. Including provincial taxes, full marginal rates in the four brackets were 24%, 33%, 40%, and 44%. The reduced progressivity should reduce human capital ETR's somewhat.

Prior to the 2001 tax year all nine provinces that were signatories to the federal-provincial tax collection agreements were bound to levy their basic PIT as a flat % of the basic federal tax. Quebec levied and collected its own separate PIT. Under this arrangement, federal surtaxes did not affect provincial PIT, and the provinces were free to enact their own surtaxes and credits additional to those provided by Ottawa. While in the 1970s and 80s provincial PIT payments could broadly be thought of as proportional to

federal, by 1998 this approximation was becoming strained. Some provinces, notably Ontario, levied surtaxes, and a wide range of provincial credits were provided, e.g. for provincial political contributions, qualifying investments, property and sales taxes, and dependent children. Finally, the Quebec rate structure was somewhat less progressive than the federal structure, featuring marginal rates of 17%, 21.25%, and 24.5% on taxable incomes of 0 - $26,000, $26,001 – $52,000, and $52,000+ in 2001, for example.

Beginning in 2001 provinces covered by the tax collection agreements are free to levy tax as a function of federal taxable income rather than basic federal tax. This has already led to significant differences in rate structure across the provinces, and divergence from the federal structure. While six provinces kept the three-bracket structure for 2001, New Brunswick followed the federal lead to create a new $100,000+ bracket. Alberta introduced a flat tax at a 10% rate. British Columbia introduced five brackets, with the top one beginning at $85,000.

Payroll Taxes

In 1998 employees and employers each paid Canada Pension Plan (CPP) contributions at a rate of 3.2 % on earnings, with a cap reached at maximum pensionable earnings of $36,900. Employment insurance (EI) contributions were paid at a rate of 2.7% by the employee and 3.78 % by the employer, on earnings up to $39,000. For workers whose earnings did not exceed $36,900 the payroll rate structure was mildly progressive, since the first $3,500 of earnings were not subject to CPP contributions. However, for middle and high earners, the system was clearly regressive. This regressivity should offset the positive effect of PIT progressivity on human capital *ETRs* to some extent.

Student Loan Plans

Both the provinces and the federal government help students to finance their education by providing guaranteed student loans. The provinces are responsible for administration. Attempting to take into account variations in provincial plans is beyond the scope of this study. Here we have modelled the effects of the Canada and Ontario Student Loan Plans (CSLP and OSLP). The results should be reasonably representative for the country as whole since the federal and provincial governments instituted reforms in 1995/96 to achieve a fairly high degree of standardization. (See e.g. Finnie and Schwartz, 1996.)

The CSLP/ OSLP system allows students to take out loans up to a limit which equals allowable education expenses minus the student's expected contribution. The latter is calculated taking family resources and dependants (e.g. children of a single parent) into account. Maximum loan amounts are $165 per week from the federal government and about $110 per week from provincial governments, for a total of $9,350 over a 34 week school year. Importantly, interest is paid by the government sponsors of the plan until six months after graduation. Beyond that point the loans must normally be paid back within a period of 9½ years. Finnie (2001) finds that graduates, on average, pay the loans back quite quickly. Statistics Canada's National Graduate Survey (NGS)

found that for 1995 first-degree university graduates (the latest cohort for which figures are available) about 40% of debt had been repaid after two years (Finnie, 2001, Figure 4).

In recent years student loans have become controversial, for two reasons. First, the default rate has been growing, and there have been concerns that defaulters are treated too leniently. Second, there has been some alarm at reports of substantial accumulated debts. A wide range of average amounts of debt have been reported in the media, with differences depending on which students are included, whether the average is taken for just those students in debt or for all students, and so on. According to the Department of Finance (1998), for a typical graduate with student loans, debt loads following a four-year post-secondary program averaged $13,000 in 1990-91, and could be expected to rise to $25,000 in 1998-99. On the other hand, the NGS results show average debt of only about $10,000 for 1990 grads with loans and $13,600 for 1995 grads. The incidence of debt in the NGS was about 46% for both the 1990 and 1995 graduates. (See Finnie, 2001, Figure 1.)

In order to prevent students defaulting on their loans, prior to 1997 those who could demonstrate financial hardship received up to 18 months of interest relief. In 1997 relief was extended to 30 months. The February 1998 budget extended the maximum period of interest relief to 54 months. In order to qualify for full interest relief gross earnings had to be less than $22,300 as of April 1998.[19] (Prior to this the cutoff had been $20,460.) And in order to go from 30 to 54 months' relief individuals had to qualify as still being in financial hardship after their loans had been rescheduled to cover a 15 year period. Finally, for those individuals who still remain in financial difficulties, the government will reduce the loan principal if annual payments exceed, on average, 15 % of income. Maximum assistance is limited to the lesser of $10,000 or 50% of the loan. To qualify, five years must have passed since the completion of study and normal interest relief must have been exhausted.[20]

Together with the tax provisions discussed earlier, the CSLP changes in the 1998 budget substantially increased support for post-secondary students. The modified CSLP can be viewed as a crude income contingent student loan plan. The expectation is that the majority of students will pay off their loans in full, but very sizeable reductions in the effective burden of student loans will be provided to a significant group with low incomes.

IV. Effective Tax Rates on Undergraduate University Education in Canada

Data and Assumptions

In order to gauge the typical size of *ETR's* in Canada we compute representative values of the net- and gross-of-tax rates of return, r_n and r_g. To do this we use Statistics Canada's 1995 Survey of Consumer Finance (SCF) to model actual and potential earnings, E_t and E_t^*, before- and after-tax. We perform our calculations as if the 1995 cross-section was a snapshot from an economy in steady state.[21] From this dataset we

took median earnings (and other quantiles) of full-time male and female workers conditioned on the highest completed level of schooling being high school or a bachelor's degree, as the basis for E_t^* and E_t respectively.[22] We have used median rather than mean earnings since we wish to investigate rates of return and *ETRs* for an "average" student. Since earnings are positively skewed the mean is above the median and is not representative for the typical student.

The estimation of E_t, E_t^*, and their differential is clearly critical. This requires specification of a counterfactual scenario. How much would the university graduate have earned if he/she had stopped formal education after high school? Our counterfactual says they would have received the median amount earned by high school graduates of the same age and gender. Some authors have argued that university graduates have greater ability and that an ability differential (typically 10 or 15%) therefore needs to be applied to the earnings of high school graduates when forming the counterfactual. (See e.g. Stager, 1994) We take a comparative advantage view, in which it is not necessarily clear that the median university graduate would have earned more than the median high school grad if his/her education had been terminated after high school.[23]

An alternative to our approach would be to estimate human capital earnings equations, and to form the counterfactual by reducing the value of the years of schooling variable for university graduates. This approach would allow more variables that affect earnings to be held constant than are controlled in our approach. We hold constant age, gender, and hours of work. The additional variables that could be controlled for in a regression approach could include e.g. occupation, industry, region, union membership, marital status, and fertility. While the results of such an exercise would be of interest, we believe there is reason to prefer our approach. Holding these additional variables constant would be inappropriately restrictive. High school and university graduates differ in occupation, industry, region, and so on, in part *because of* their different levels of education. The reason for obtaining a university degree is often to enter an occupation that would otherwise be inaccessible, and reaping the advantage of one's degree often means moving to a different industry or region. Thus, we do not see being able to hold constant a set of additional characteristics in comparing high school vs. university graduate earnings as an advantage. We are interested in the total, rather than the partial impact of education.

We have specified costs and tax features, as far as possible to be those prevailing in the academic year 1997-98.[24] In 1997-98 undergraduate Arts tuition (representative for core university programs and likely for median graduates) averaged $3,253, and additional fees $342, according to Statistics Canada. Other direct expenses (books, supplies, and return transportation to the educational institution) were assumed to be $1,000 per year. Thus we estimate total direct expenses to have averaged $4,595.

In addition to distinguishing between men and women, the calculations we report below consider part-time and full-time students separately. Full-time students are assumed to work the equivalent of four months per year, during which they would earn the same amount as a high school graduate. As in previous studies we reduce these

earnings somewhat (by 20%) to allow for unemployment and job search.[25] Part-time students are assumed to earn their degrees in six years, as opposed to four for full-time students. We assume that they work year-round - - part-time during the winter months and full-time during the summer. They are assumed to earn half as much as if they were employed full-time year round.

In modelling the taxes paid by workers after graduation we have assumed that they do not claim a credit for a dependant spouse, and in the main results ignore the tax consequences of children. The incidence of dependant spouses has been declining rapidly in recent years, and we expect will be very low over the lifetimes of recent graduates. Ignoring the tax consequences of children leads to an overstatement of tax burdens over the working lifetime, but only a small error in the calculation of the taxes paid on the incremental earnings due to education, as we argued in the last section. We do take the tax treatment of children into account when considering the situation of single parents.

We make no allowance in our main results for deductions from income after graduation. (Personal credits and credits for interest on student loans where appropriate are taken into account.) The principal deduction that could potentially be modelled is that for RRSP/RPP contributions. However, this would be misleading since our calculations only consider earnings over the working lifetime. If we took the tax relief on RRSP/RPP contributions into account we would have to also model the tax paid on withdrawals. Ignoring both contributions and withdrawals should be approximately offsetting. Deductions for RESP contributions are taken into account when we model the impact of CESGs.

Results

Results from our base case are shown in Table 1. This case uses the 1998 tax system (i.e. as modified by the 1998 federal budget) and assumes a single student with no dependants who finances his/her education without the help of a student loan or an RESP. The estimated rates of return are lower than those found by Vaillancourt (1997) and Stager (1994) using 1991 Census data. Whereas we find the net-of-tax private rate of return was 7.9% for male full-time university students, and 12.6% for female, Vaillancourt found figures of 12.3 and 16.1%. Stager obtained private rates of return of 13.8% for men and 17.6% for women. Aside from using more recent earnings data, and incorporating the effects of higher tuition fees, our study differs from the two earlier studies by using median rather than mean earnings, and by assuming retirement after age 60 rather than 64 (in order to reflect the move to earlier retirement). These differences act to produce lower estimated rates of return.[26]

Table 1

Rates of Return and Effective Tax Rates for First University Degree Graduates: 1998 Tax System, No Student Loans, No Dependants (Base Case)

	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)
Males			
Full-Time	7.94	9.84	0.193
Part-Time	7.06	9.00	0.215
Females			
Full-Time	12.63	14.34	0.119
Part-Time	11.52	13.29	0.133

Notes: IRR = internal rate of return
ETR = effective tax rate

Source: Authors' calculations using 1995 Statistics Canada Survey of Consumer Finance data.

A notable feature of these results is that, as in previous studies, the rate of return is considerably higher for females than for males. The reason is that the earnings of women with a university degree are much closer to those of their male counterparts than is the case for workers with only high school. We also find somewhat lower rates of return to part-time than to full-time study. This difference is due mainly to the delay by two years of the earnings benefits of study for the part-timers (since they remain in school that much longer).

Table 1 shows a relatively small difference between gross and net private rates of return for university graduates. The proportional difference is, of course, the effective tax rate. At 19.3% and 11.9% for full-time male and female students respectively, the *ETRs* indicate that, in the no-loan no-RESP case, human capital investment is not taxed as heavily as physical capital. (Recall our earlier discussion of the McKenzie et al., 1998, results.) The difference in *ETR*s for men and women reflects the impact of progressivity. Male university graduates still earn more than women, and on their earnings increments due to education are therefore taxed more heavily on average. *ETRs* for those who attend part-time are lower because they spend more time working while going to school, leading to a higher marginal tax rate (i.e. a higher implicit subsidy) on their forgone earnings.

Turning to Table 2 we see the effects not only of taxes, but also of subsidies to universities. The second column shows, again, the gross-of-tax private rate of return, which does not take subsidies into account. The first column figures in the direct costs of university education which are funded by government and which do not enter the private calculation.[27] An effective subsidy rate (*ESR*) can be calculated as the proportional difference between these rates of return. We find that the subsidy rates obtained are

greater than the effective tax rates shown in Table 1 for all cases.[28] We thus find a negative net effective tax rate, *ETR – ESR*, as shown in the last column of the table. This would imply that overall the public sector *encourages* human capital investment - - a conclusion that is in line with the results of earlier studies and that will be strengthened by taking into account student loans and other forms of special assistance to post-secondary students analyzed below.

Table 2

Base Case Rates of Return, Effective Subsidy Rates, and Tax Minus Subsidy Rate

	IRR (%) Public (1)	IRR (%) Gross-of-Tax Private (2)	ESR [(2) – (1)]/(2)	ETR – ESR
Males				
Full-Time	7.37	9.84	0.251	-0.058
Part-Time	6.86	9.00	0.238	-0.023
Females				
Full-Time	10.39	14.34	0.276	-0.157
Part-Time	9.85	13.29	0.259	-0.126

Notes: Definition of base case is as in Table 1.
ESR = effective subsidy rate
ETR, IRR – see Table 1.

Source: See Table 1.

Next we take into account the impacts of student loan financing on private rates of return and *ETR's*. As Table 3 shows, both gross and net private rates of return increase with the student loan amount. The reason for this increase lies mainly in the fact that interest is not paid until graduation, providing a subsidy that of course increases with the size of the loan.[29] The net rate of return is more strongly affected because the implicit subsidy is larger relative to after-tax than before-tax earnings. The result is that, even without interest deductibility, providing student loans would reduce the effective tax rate significantly. This aspect is reinforced by the provision of interest deductibility on student loans. Both effects are present in Table 3. For males the tax rate declines from 19.3% in the no loan case to just 17.2% with $15,000 in loans. For females, the drop is even larger: from 11.9% to 8.3%.

Table 3

Rates of Return and Effective Tax Rates for Full-Time Students, 1998 Tax System With Student Loans

Sex and Dependants	Value of Loan ($)	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)	ESR*	ETR - ESR
Male,	0 (base case)	7.94	9.84	0.193	0.251	-0.058
No Dependants	5000	8.15	10.03	0.187	0.265	-0.078
	10000	8.39	10.24	0.180	0.280	-0.100
	15000	8.66	10.46	0.172	0.296	-0.124
	30000	10.31	11.77	0.124	0.374	-0.250
Female,	0	12.63	14.34	0.119	0.276	-0.157
No Dependants	5000	13.20	14.83	0.110	0.299	-0.189
	10000	13.88	15.38	0.098	0.324	-0.226
	15000	14.70	16.03	0.083	0.352	-0.269
	30000	20.49	19.81	-0.034	0.475	-0.509
Female,	0	11.59	14.34	0.192	0.276	-0.084
Single Parent	5000	12.04	14.83	0.188	0.299	-0.111
With one child	10000	12.56	15.38	0.184	0.324	-0.140
	15000	13.16	16.03	0.179	0.352	-0.173
	30000	16.99	19.81	0.142	0.475	-0.333

Notes: 1) The zero loan case without dependants is the same as the base case considered in Tables 1 and 2.
2) The female single parent is assumed to have had a child at age 18. This child will generate a child care expense deduction until the parent is aged 25. Canada Study Grants, which were offered starting in 1999, are not included.
3) For the $30,000 loan, $2,000 of the principal qualifies for loan forgiveness. See Appendix B.
4) * ESR = [(2) - (appropriate entry from col. 1 of Table 2)]/(2)

Source: See Table 1.

Table 3 illustrates another interesting point. As we increase the loan amount up to $15,000 there is a roughly linear decrease in the *ETR*. But, when the loan is raised to $30,000 there is a larger decline in the *ETR*. In the female case, for example, the *ETR* becomes negative, falling to –3.4%. The reason is that in Ontario a student with a $30,000 loan would qualify for loan forgiveness on $2,000 of the principal. Once again, the effect on the estimated rates of return is higher for the net- than for the gross-of-tax return. In fact, the difference in these impacts is so large that we obtain a negative effective *ETR*.

The single female parent case reported in Table 3 shows that family status may significantly affect tax impacts on education in Canada. The gross rates of return for a single female parent are taken to be the same as those for a woman without children, but the net rates of return are lower since after-tax forgone earnings are enlarged by the child care expense deduction. The result is that the *ETR* is higher for a single parent. Also note that the *ETR* falls less rapidly as the student loan amount is increased than in the case without dependants. This is because before- and after-tax forgone earnings are more similar for the single parent, so that loan benefits do not differ greatly in relative importance between gross vs. net of tax calculations.

The second last column of Table 3 shows the impact of student loans on the expenditure side. The *ESR* rises quite strongly with the loan amount, increasing from 25.1% without loans to 29.6% with a $15,000 loan for males, and from 27.6% to 35.2% for females. Putting the impacts on the *ETR*s and *ESR*s together, a $15,000 student loan decreases the net effective tax rate, *ETR – ESR*, from – 5.8% to – 12.3% for males and from – 15.6% to – 26.9% for females. At a rough guess, these numbers suggest that the median *ETR – ESR* for all students may have been about – 9% for males and – 21% for females in 1998.[30] For males and females together median *ETR – ESR* may then have been around – 15%. This represents fairly significant encouragement of human capital investment, especially when we bear in mind our earlier conclusion that the average *EMTR* for physical capital in Canada likely totalled at least 30%.

Table 4 shows part-time results corresponding to the full-time case shown in Table 3. In the part-time case we find that the size of loan has little impact on the *ETR*. This is because part-timers pay interest on their student loans from the time they are taken out, rather than benefiting from zero interest payments until six months after graduation like full-time students.

Table 4

Rates of Return and Effective Tax Rates for Part-Time Students, 1998 Tax System With Student Loans

Sex and Dependants	Value of Loan ($)	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)	ESR*	ETR - ESR
Male,	0	7.06	9.00	0.215	0.238	-0.023
No Dependants	5000	7.02	8.98	0.218	0.236	-0.018
	10000	6.97	8.95	0.221	0.233	-0.012
	15000	6.92	8.92	0.224	0.231	-0.007
Female,	0	11.52	13.29	0.133	0.259	-0.126
No Dependants	5000	11.58	13.35	0.133	0.262	-0.129
	10000	11.63	13.42	0.133	0.266	-0.133
	15000	11.70	13.49	0.133	0.270	-0.137
Female,	0	11.17	13.29	0.159	0.259	-0.100
Single Parent	5000	11.21	13.35	0.160	0.262	-0.102
With one child	10000	11.25	13.42	0.161	0.266	-0.105
	15000	11.30	13.49	0.162	0.270	-0.108

Notes: 1) The zero loan case without dependants is the same as the base case considered in Tables 1 and 2.
2) The female single parent is assumed to have had a child at age 18. This child will generate a child care expense deduction until the parent is aged 25. The amount claimed during study is subject to the restrictions imposed in the 1998 federal budget. (See Appendix B.) Canada Study Grants, which will be offered starting in 1999, are not included.
3) * ESR = [(2) - Appropriate entry from col. 1 of Table 2]/(2)

Source: See Table 1.

Table 5 shows results for full-time university students with interest relief. In order for individuals in our calculations to qualify for 18 or 30 months of interest relief it is sufficient that their earnings should be 2/3 of median after graduation. Rates of return are accordingly lower for this group than for the median achievers studied in Tables 6.1 – 6.3. We see that providing interest relief has relatively little impact on the calculated effective tax rates. A similar outcome is found for part-time students (see Collins and Davies, 2002).

Table 5

Rates of Return and Effective Tax Rates for Full-Time Students, 1998 Tax System With $10,000 Student Loan and Interest Relief

Sex and Dependants	Interest Relief (months)	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)
Male, No Dependants	0	6.54	7.45	0.122
	18	6.66	7.55	0.118
	30	6.72	7.60	0.116
Female, No Dependants	0	10.86	11.37	0.045
	18	11.04	11.51	0.041
	30	11.14	11.59	0.039
Female, Single Parent With one child	0	10.06	11.37	0.115
	18	10.18	11.51	0.116
	30	10.24	11.59	0.116

Notes: 1) Assumptions on the female single parent are as in Table 3.
2) Earnings equal 2/3 of median.

Source: See Table 1.

Next we study the effects of Canada Education Savings Grants (CESG's).[31] As of Jan. 1, 1998, Canada Education Saving Grants (CESGs) add 20% to RESP contributions annually, up to a grant limit of $400 per child. Net-of-tax rates of return rise and effective tax rates decline. In the case of full-time male university students, for example, Table 6 indicates that the ETR drops from 19.3% to 15.9% when parents make $650 annual contributions over a 15 year period. If maximum contributions ($2,000) are made, the ETRs fall much further - - to just 7.9% for full-time males and – 2.3% for full-time females. Effects for part-time students are also large. These results show that CESGs may have a very powerful effect as they accrue over the coming years.

Table 6

Rates of Return and Effective Tax Rates with CESGs, 1998 Tax System, No Student Loans, No Dependants

Sex	Yearly Contribution ($)	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)	ESR*	ETR - ESR
Male						
Full-Time	650	8.27	9.84	0.159	0.251	-0.092
Part-Time	650	7.34	9.00	0.184	0.238	-0.054
Female						
Full-Time	650	13.22	14.34	0.078	0.276	-0.198
Part-Time	650	12.01	13.29	0.096	0.259	-0.163
Male						
Full-Time	2000	9.06	9.84	0.079	0.251	-0.172
Part-Time	2000	7.98	9.00	0.114	0.238	-0.124
Female						
Full-Time	2000	14.67	14.34	-0.023	0.276	-0.299
Part-Time	2000	13.18	13.29	0.008	0.259	-0.251

Notes: 1) CESG = Canada Educational Study Grant. CESG benefits incorporated here are based on an example provided by Department of Finance (1998, p. 35). Contributions are made over a 15 year period and earn a 5 % rate of return.
2) * ESR = [(2) - Appropriate entry from col. 1 of Table 2]/(2)

Source: See Table 1.

Table 7 replicates the Table 1 case (no student loans and no RESP's), assuming alternatively that the graduate earns at the 25th or the 75th percentile of the earnings distribution, rather than at the median.[32] We see that for males there is a drop in rates of return and the *ETR* of going to the 25th percentile case from the median; and there is an increase in going to the 75th percentile. The net-of-tax rate of return varies from 5.4% for

the 25th percentile earner to 9.9% at the 75th percentile, compared with 7.9% for the median male in Table 1. The *ETR* ranges from 10.9% to 24.1%, compared to 19.3% for the median.

Table 7

Rates of Return and Effective Tax Rates for 25th and 75th Quantiles: 1998 Tax System, No Student Loans, No Dependants

Sex	Quantile	IRR (%) Net-of-Tax (1)	IRR (%) Gross-of-Tax (2)	ETR [(2) - (1)] / (2)
Male				
Full-Time	25th	5.35	6.00	0.109
Part-Time	25th	4.29	4.92	0.129
Female				
Full-Time	25th	8.46	9.09	0.070
Part-Time	25th	8.69	9.49	0.081
Male				
Full-Time	75th	9.88	13.02	0.241
Part-Time	75th	9.16	12.19	0.248
Female				
Full-Time	75th	12.42	15.25	0.186
Part-Time	75th	12.95	16.22	0.202

Source: See Table 1.

For women, rates of return are also lower at the 25th percentile than at the median. The net-of-tax rate of return for full-time students is 8.5%, for example, vs. 12.6% at the median. The *ETR* is also lower, at 7.0% vs. 11.9% in the base case. However, when we move to the 75th percentile the rates of return rise less, proportionally, than for males, reflecting a less skewed distribution of earnings (and therefore lower peak tax rates on earning gains) among female graduates. The *ETR* rises only to 18.6% at the 75th percentile, compared to 24.1% for males.

The Table 7 results indicate the impact of the graduated rates in the tax system. Effective tax rates on human capital investment rise with the lifetime earnings of graduates. Another way of putting this is that the net-of-tax rates of return on human capital investment are depressed more for high earners.

In order to get a complete assessment of the incentive effect on human capital formation one must of course deduct the *ESR* from the *ETR*. Looking back at Table 2 we see that if the graduates at the 75th percentile had the same *ESRs* as median workers, the

ETR – ESR figures for males would be – 1.0% and 1.0% for full-time and part-time students respectively. Those for females would be – 9.0% and – 5.7% for full-time and part-time. However, the assumption that the *ESRs* at higher percentiles are the same as at the median may be incorrect. The highest paid graduates are those in professional programs like engineering and medicine, which in 1997-98 were still more heavily subsidized than general arts and science programs. Vaillancourt (1997) finds that the difference is sufficient that the net subsidy rates (i.e. *ESR - ETR*) in 1990 were highest in science, engineering and medicine and lowest in the humanities and social science.[33]

Finally, we have generated results (not shown) corresponding to Tables 6.1, 6.3, and 6.4 for the tax system as it existed in 1997, that is prior to the major changes of the February 1998 federal budget. We found that the difference in 1997 vs. 1998 results for full-time students without student loans or RESPs were small. These differences come from the fact that the education amount was just $150 per month in 1997 for full-timers compared to $200 per month in 1998. After-tax rates of return were slightly lower, and ETRs slightly higher, in 1997 for part-timers however, since they received no education amount tax credit. A monthly credit of $60 was introduced for part-timers in the 1998 budget.

We also found that the effects of the interest credit on student loans introduced in 1998 are quite small. For loans of up to $10,000 net-of-tax rates of return are less than 0.1 % points lower under the 1997 system, and the difference in *ETR's* is correspondingly small. Compared to the impacts of CESGs, the credit for interest on student loans has a relatively weak effect.

V. Conclusion

We have argued that effective tax rates are a useful device for summing up the effects of the tax system on the incentive to invest in human capital, and have illustrated the approach for undergraduate university level education in Canada. Our analysis has concentrated on two broad features of effective tax rates - - how high they are for the median person, and how they vary across individuals.

We have found that there is a notable difference between the effective tax rate on human capital coming from the tax system *per se* (the *ETR*) and the net effective tax rate, which subtracts the effective subsidy rate (the *ESR*) on the expenditure side. For median earners, *ETRs* on human capital are sizeable, although lower than effective marginal tax rates for physical capital in Canada. This is true even in the wake of the federal budgets of 1996, 1997 and 1998, which introduced a wide range of measures that reduced *ETRs.* On the other hand, *ETR - ESR* at the median is about – 9% for males and – 21% for females. Thus, government provides more incentive on the expenditure side for investment in university education than disincentive on the tax side.

Whether a net effective tax rate on human capital that averages about –15% across the sexes is appropriate is an interesting question. For this to be supported on efficiency grounds it is likely that one would have to appeal to externality arguments. Students' liquidity constraints could also help to justify the negative *ETR – ESR,* although the potential importance of this factor is significantly eroded by Canada's quite generous system of student loans. In view of the substantial positive effective tax rates on physical capital, there is certainly a possibility that, from an efficiency standpoint, as of the late 1990's Canadian governments provided too much encouragement for university study. Since tuition fees have risen quite significantly in the last four or five years, one must caution, however, that if this was indeed a problem its correction may already have occurred.

We have also found that the taxation of human capital is far from uniform in Canada. This raises the possibility of distortions in the supply of human capital, with too much investment taking place in programs, or by individuals, with low *ETRs,* and too little occurring where *ETRs* are high. We have found that *ETRs* differ depending on income after graduation, full-time vs. part-time study, receipt of student loans, gender, presence of dependants, and use of RESPs. For example, we found that *ETRs* for full-time students who go on to earn at the 75th percentile of the earnings distribution throughout their lifetimes are higher than for those earning at the 25th percentile. In view of the strong association between earnings and area of university studies this may have interesting implications for the composition of human capital investment. Other things equal, the highest *ETRs* will be felt by graduates in areas such as business, engineering, and medicine. At the opposite extreme are graduates in the humanities. We have seen that in some of the high tax areas there has in the past been an offsetting effect in the form of heavy direct subsidies. However, the tendency to allow tuition fees to rise in recent years, especially in more specialized programs, may be eroding that offset.

It is possible that the provisions of the 1998 federal budget, and the doubling of the education amount tax credit in 2001, may not only have reduced the tax-side disincentive for human capital investment, but may also have reduced non-uniformity in *ETR*s. Increases in the education amount have a broadly based impact that has lowered *ETRs* for the majority of students. The special provisions for part-time students and those with dependants reduce *ETRs* for people whose human capital investments were less-favored by the tax system. And in the future, as higher income taxpayers take increasing advantage of Canada Education Savings Grants (CESGs) they should see some reduction in their *ETRs*.

While the analytical framework we have introduced can be applied to human capital investment at any level, our numerical results have been confined to the case of first-degree university graduates. It would be interesting to extend the results in order to compute *ETRs* on completed high school, community college, incomplete college and university studies, post-graduate work and on-the-job training (OJT). We expect that effective tax rates are lower for high school completion, community college, and incomplete post-secondary studies than for undergraduate university degrees. This result is likely in view of the importance of income level in determining *ETRs*. Results for post-graduates are harder to anticipate since rates of return to graduate study are much lower than for undergraduate programs, and *ETRs* could be very sensitive to small absolute differences in gross and net rates of return.

Attention to the *ETR* on OJT would be valuable since it is clear that a large element of human capital is formed on the job. There is good reason to expect much lower *ETRs* than for formal schooling. In general firms and workers share the costs of such training. Workers do so by receiving lower wages or salaries during training. But progressivity effects are likely to be much less serious than for formal schooling, since it is only a portion of earnings that is being given up and the tax rate on foregone earnings may not be much less than that on the earnings increments due to training. On the employer's part, at least for corporations the tax rate is constant, so that there is no progressivity effect at all. Hence *ETRs* for OJT, like effective subsidy rates, may be quite small.

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Appendix A

This appendix provides the general form of the basic problem presented in Section II of the paper. In that section we illustrated the calculation of the *ETR* for the case where the length of the schooling period, *m*, was just one year, and the length of life, *T*, went to infinity. If we do not make those assumptions analytic solutions for the gross and net-of-tax rates of return r_g and r_n, and thus for the *ETR*, do not exist. The purpose of this appendix is to take the analysis up to the point where numerical solutions must be sought.

The starting point is equation (2) in Section II, which can be used to compute r_g in the case where the tax system takes no account of education and there are no student loans:

$$\sum_{t=1}^{T} \frac{E_t - C_t}{(1+r_g)^{t-1}} = \sum_{t=1}^{T} \frac{E_t^*}{(1+r_g)^{t-1}}. \tag{2}$$

As explained in Section II, this equation can also be used to compute the public rate of return, r_p, if C_t is replaced by the full direct costs of education, C_t^p. And it can be used to compute r_n if E_t and E_t^* are replaced by the after-tax earnings E_t^a and E_t^{a*}.

To bring in the tax treatment of education and student loans we need to modify (2) to take account of (i) amounts L_t borrowed in the form of student loans in the schooling period, (ii) repayment of those loans at the interest rate *i*, with tax relief via a credit for a fraction *d* of interest payments, and (iii) tax credits for tuition and education expenses, A_t. Introducing these elements will modify both r_g and r_n, but makes no difference to the public rate of return, r_p.

As explained in Section III of the paper, the scheduling of student loan repayments is flexible in Canada, but they must normally be repaid within 10 years of graduation. Here we let annual payments during this period of *l* years equal $i\theta(L_t,t)$, where $\theta(L_t,t)$ gives the amount on which interest must be paid each year. This amount is less than the principal in the first year of loan repayment for all student borrowers in Canada, since loans are interest free for the first 6 months after graduation. Also, as explained in Appendix B, in some cases there is interest relief for low-income graduates, which would also reduce the effective amount on which interest is paid below principal. In the calculations reported in our tables we assume principal is paid off on a straight-line basis, but other assumptions could clearly be made.

Finding the internal rates of return r_g and r_n requires solving the general form of (2) numerically, which can be done with a variety of computer packages, including standard spreadsheets. Note that the RHS is not altered by taking tax

relief for education or student loans into account, since it shows the present value of the earnings stream without the education in question. Thus we focus on the LHS of (2), which we denote *PV* in the before-tax case. Taking student loans, but not tax relief on education, into account we have:

$$\text{(A.1)} \quad PV = \sum_{t=1}^{m} \frac{E_t - C_t + L_t}{(1+r_g)^{t-1}} + \sum_{t=m+1}^{m+l} \frac{E_t - i\theta(L_t,t) - R_t}{(1+r_g)^{t-1}} + \sum_{t=m+l+1}^{T} \frac{E_t}{(1+r_g)^{t-1}}.$$

where R_t is the repayment of student loan principal in year t.

Turning to after-tax values, we have:

$$\text{(A.2)} \quad PV^a = \sum_{t=1}^{m} \frac{E_t^a - C_t + A_t + L_t}{(1+r_n)^{t-1}} + \sum_{t=m+1}^{m+l} \frac{E_t^a - i(1-d)\theta(L_t,t) - R_t}{(1+r_n)^{t-1}}$$

$$+ \sum_{t=m+l+1}^{T} \frac{E_t^a}{(1+r_n)^{t-1}}$$

Again, r_n is found numerically, by setting PV^a equal to the RHS of (2) where E_t^* is replaced by the after-tax value E_t^{a*}.

Appendix B details the tuition and "education amount" credits that compose A_t in the Canadian case, as well as the rules on student loans.

Appendix B

B.1 Basic Data

1) Our estimates of tuition and additional expenses are based on Statistics Canada data for 1997-8. See http://www.statcan.ca/Daily/English/970825/d970825.htm#art2. An average was taken over arts degrees across the country.

2) Data on "other expenses" were taken from a variety of sources- Statistics Canada databases, university web sites, and university calendars. "Other expenses" refers to items that are only required for schooling (e.g. books and supplies for schooling).

3) The earnings data come from Statistics Canada's 1995 Survey of Consumer Finance microdata tape.

B.2 Assumptions on Earnings

1) Part-time earnings for full-time students are assumed to be summer earnings and therefore comprise a maximum of four months of earnings potential. To account for unemployment and job search the value is reduced by 20%.

2) We assume that part-time students work part-time during the regular school year and full-time in the summer. This motivates the further assumption that their annual earnings are half of full-time earnings. A part-time student is assumed to take, on average, 3.3 courses a year. This assumption allows for a part-time student to get a four-year degree in approximately six years. Taking more than three courses in a normal school year would qualify a person as full-time. Therefore, it is assumed that a part-time individual works, as mentioned, year round and goes to school year round. He/she takes 2.5 courses during the school year and 1 during the summer, accordingly, to finish his/her degree (requiring 20 credits in a 5 credit/year school).

B.3 Public Rates of Return

1) Data on government spending and enrollment for male and female, full-time and part-time students were obtained from the Statistics Canada website. The most recent data available at this site were expenditure values on education and enrollment figures for 1995-96. It is these figures that are used to calculate the public rate of return.

2) Current and capital expenditures on undergraduate instruction are assumed to to equal one half of operating expenditures. The justification for this assumption is given in the text of the paper.

3) Public expenditures per student are calculated as in Vaillancourt (1995). Operating expenditure on universities is divided by full-time equivalent (FTE) enrollment, where a part-time student counts as one third of a full-time student.

4) Public expenditures per part-time student are assumed to be one third of those for full-time students, in line with point 3.

B.4 Tax Features

B.4.i) Tax Credits

In addition to basic personal amounts, students are eligible for non-refundable credits on tuition and certain additional fees. They may also be eligible for non-refundable credits in the form of the education amount, and on interest paid on student loans. As outlined in the paper, the education amount was $150 per month in 1997 and $200 per month in 1998 for full-time students. Part-time students did not receive the education amount in 1997, but could claim $60 per month in 1998. The taxpayer earns a net credit applicable to federal tax equal to 17% of the amount claimed, and there is a further credit against provincial tax. We assume that the sum of the two equals 25%, as it did in Ontario in 1998.

B.4.ii) Child Care Expense Deduction (CCED)

1) In 1998, the government allowed taxpayers to deduct from taxable income child care expenses of up to $7,000 for each eligible child under seven years of age. A deduction of up to $4,000 was allowed for children aged 7 to 16.

2) For full-time students we assume that child care expenses equal $4200 ($350 * 12 months), and that these expenses only last until the child is seven years old. We assume that the child is one year old when the parent is 19. Therefore, child care expenses are only deducted up until the age of 25.

3) Most part-time students were not eligible to claim CCED prior to the 1998 budget. The latter allowed part-time students to deduct up to $2200. We assume that a part-time student with a dependant would be at this maximum.

B.4.iii) Registered Education Savings Plans (RESPs) and Canada Education Savings Grants (CESG's)

1) In both 1997 and 1998 the federal government allowed taxpayers to contribute up to $4,000 per child to an RESP.

2) Since January 1, 1998 the federal government has been providing a CESG, equal to 20% of the first $2,000 of RESP contributions per child. We assume alternative RESP contribution values of $650/year and $2000+/year in calculating the amount of CESG awarded.

3) The calculation for the CESG amount is based on an example in the 1998 Budget documents, which assumed a 5% rate of return and a contribution rate of $650/year. For a contribution rate of $2000/year the CESG amount increases proportionally.

B.5 Canada Student Loan Plan

B.5.i) Basic CSLP Repayment Features

1) Students have a choice upon consolidating their Canada Student Loans. They can either choose a maximum fixed interest rate equal to the bank's prevailing unsecured consumer loan rate, which cannot exceed prime plus 5%, or a maximum floating interest rate of prime plus 2.5%. For Ontario Student Assistance Program (OSAP) loans students pay an interest rate of prime plus 1%.

2) Data on interest rates were taken from the Globe and Mail web site (http://www.globeandmail.ca) on Tuesday, June 30th, 1998. The Canadian prime interest rate on this date was equal to 6.50%. Being dependent upon the loan held, the interest rate that a student actually faces may vary significantly. For example, using a prime interest rate 6.5% would result in an interest rate of anywhere between 7.5-11.5%, which would have a dramatic effect on the type of repayment plan chosen. For the purposes of this study a middle rate of 9% is used.

3) Information on CSL and OSAP loans was taken from the following web sites: CSL - (http://www.hrdc-drhc.gc.ca/student_loans/), OSAP - (http://osap.gov.on.ca).

4) The regulations on loan forgiveness under OSAP were taken from the above Government of Ontario address. As of 1997-8, loan forgiveness was only available on loans that exceeded $7,000 for two terms of study; two terms being defined as 21-40 weeks of schooling (i.e. any amount of loan exceeding $7000 for one eight-month school year was forgiven). For our purposes loan forgiveness only figures into the $30,000 loan case, as it is assumed that the loan is broken into four equal parts to coincide with the four years of full-time study. Thus, $7500/year is being borrowed of which $500 is forgiven each year. It should also be noted that part of the loan is forgiven only after the loan(s) is (are) consolidated (meaning that a payment schedule has been agreed upon and signed at a bank). For example, upon graduation $2,000 of the $30,000 loan will be forgiven and interest payments will be calculated therefore on the remaining $28,000, not the entire $30,000. Part-time students receive no loan forgiveness, as they do not

qualify for OSAP loans; one must have at least a 60% course load (i.e. 3 out of a maximum of 5 courses) to be eligible for such loans.

5) Net-of-tax and gross-of-tax private benefits/costs are calculated taking into account that accruing interest is paid for by government during full-time studies. If individuals are studying part-time they do not benefit from having the interest that accrues on their loan paid off by the government. Part-time individuals must pay the interest on their loan from the moment it is acquired.

6) A part-time student is assumed to be working (approx. 20 hrs/week). Therefore, it is assumed that he/she will not accumulate as much debt as someone who is not working. Thus a part-time person only faces loan amounts that range from $2500-$15000 in our calculations.

B.5.ii) Interest Relief under CSLP

1) For individuals to be able to qualify for interest relief a reduction in median earnings is necessary. For the purposes of this study we use two thirds of median earnings to ensure that individuals fit the specified criteria set forth in the 1998 Budget. As of April 1998, full-time students are able to benefit from full interest relief provided their gross earnings are less than $22,300 (prior to this change the value was $20,460).

2) As recently as 1996 interest relief was only available for up to 18 months, but this was changed in 1997 with an extension of the period to 30 months. Once again in 1998 this period has been extended; it is now a maximum of 54 months, although the extension only includes those who are in dire straits financially. To qualify for the extended 54-month period an individual must have exhausted the 30 months of interest relief and still be in financial hardship once the repayment period is extended to 15 years. All of this must take place during the first five years upon leaving school.

3) For those in the most difficulty, the federal government introduced debt reduction in 1998. Upon exhausting all relief and having five years pass since the completion of schooling, if an individual is still in financial hardship he/she can have his/her loan principal reduced if annual payments exceed, on average, 15% of his/her income.

Notes

[1] See e.g. Boskin, 1975; Dupor et al., 1996; Kaplow, 1996; and Heckman et al., 1999.

[2] It would of course be interesting to study *ETRs* on other levels of education, as discussed briefly in the conclusion. These would include the *ETR* on incomplete university education. Estimation of these other *ETRs* is beyond the scope of the present study.

[3] Note that tax and expenditure systems may have effects on human capital investment apart from those via tax and subsidy rates. For example, if students are liquidity constrained, taxes that are incurred more after graduation - - e.g. income and payroll taxes - - will encourage human capital investment compared with e.g. consumption taxes. Future research may allow us to take these other aspects into account, and also to investigate the quantitative impact of ETRss e.g. on students' propensity to obtain university education.

[4] In the investment context tax burdens may be evaluated on a stock or flow basis. We do our analysis on a stock basis since this facilitates comparisons with the effective tax rate on physical capital. An alternative is to annualize the impacts and express them as a fraction of unit labor costs, that is to put the analysis on a flow basis. Mintz (2001) partially implements this latter approach.

[5] The problems faced when dealing with human capital are quite different than in the study of physical capital. For example, in calculating *EMTR's* for physical capital one must specify a scenario concerning the determination of market rates of return. It might be assumed, for example, that Canada is a small player in a perfectly competitive world capital market. In order to pay the world interest rate, a corporation would have to earn a gross rate of return on a debt-financed project sufficient to pay both tax and interest at the world rate. By observing market rates and tax parameters one can infer the before-tax rate of return on a marginal investment. The after-tax return is then found by deducting all taxes. As we shall see, the procedure for human capital is quite different.

[6] The situation for on-the-job training is different. (This is one of the reasons that we do not deal with OJT in this paper. It would require a separate study.) One can imagine OJT being provided in quite small units, and the sensitivity of results to the size of the investment becomes less of a problem. This is because the relevant tax on the employer's side, i.e. the corporate tax, is levied at a flat rate, and provided investments are not too large individuals' marginal tax rates will also not be strongly affected by OJT.

[7] An alternative is to define the ETR as the ratio of the present value of net taxes on labour income over the lifetime to the present value of lifetime earnings. (See Mintz, 2001.) While the two approaches will often produce similar results, this is not always the case. We prefer the approach followed here in part because it does not require any assumption to be made about individuals' discount rates.

[8] Note that "neutral" is used here in a special sense. We do not imply, e.g., that a tax system that is neutral with respect to human capital is non-distortionary in its treatment of human vs. physical capital. That depends on the effective tax rate on physical capital, and also on whether there are any relevant non-tax distortions (e.g. capital market imperfections).

[9] How tax relief for education and student loan aspects can be incorporated in the finite lifetime, multi-year schooling case is set out in Appendix A. Analytic results are not available for r_g, r_n, or the *ETR* in that case. The rates of return must be computed from more general versions of equation (2).

[10] The public rate of return is similar to the social rate of return. (The only difference is that the public rate of return omits external costs or benefits of education.) From a social viewpoint, whether students take out loans or not has no effect on the costs of, or returns to, education.

[11] In a more comprehensive investigation some other taxes would also be taken into account. In the previous section we remarked on the impact of sales taxes. In addition, corporate income taxes have impacts on human capital formed via on-the-job training. See Collins and Davies (2002).

[12] The NCBS was clawed back at rates ranging from 12.1% for one-child families to 26.8% for a family with three or more children. This means that the credit was already clawed back completely for most families at net income of $25,921, where the CCTB clawback kicked in at rates from 2.5% to 5.0%. The latter relatively low rates mean that the CCTB clawback range is very wide. The clawback affects families with incomes up to $67,000 - $75,000. However, since the CCTB clawback rates are relatively low, their impact on human capital *ETRs* would be fairly small.

[13] That is, up to a limit of $5,000 minus the part of the credit used by the student to reduce his/her tax liability to zero.

[14] The current contribution limit for RRSPs plus Registered Pension Plans is the lesser of $13,500 or 18% of earnings per year. The dollar limit is slated to rise to $14,500 in 2004 and to $15,500 in 2005, after which it will be indexed to the average industrial wage. These levels represent a significant retreat, however, from those promised by earlier federal budgets. The 1984 and 1985 budgets promised a limit of $15,500 by 1990, with subsequent indexation.

[15] Since withdrawals are generally taxed at a low rate, RESP's approximate Roth IRA plans in the U.S., which have non-deductible contributions and tax-free withdrawals. Greater use of this type of sheltered saving has been urged for Canada by e.g. Kesselman and Poschmann (2001).

[16] In Canada interest on mortgages and consumer debt is not tax deductible. This makes paying down these forms of debt a popular form of saving for those in the age range of about 25 – 45.

[17] The RESP and RRSP provisions might be seen as raising the rate of return to financial assets. However, the benefits in question are only realized as a result of planned or actual human capital investment. They are therefore regarded here as increasing the net expected return on *human* capital.

[18] A further change that could have a significant effect on human capital ETR's in the long-run was the re-indexation of federal brackets, credits and deductions announced in the February 2000 budget. Lack of indexation erodes the progressivity of the tax system over time, as more and more taxpayers' rising nominal incomes push them into the top tax brackets. This may create a tendency for human capital ETR's to fall over time in a non-indexed system.

[19] The budget also introduced partial interest relief on a sliding scale for those whose incomes exceeded the threshold for full relief by a small amount.

[20] The February 1998 budget also announced a billion dollar Millenium Scholarship Fund, which may reduce the need for student loans somewhat. Finally, in view of the provisions to assist repayment, it was ruled that student loans would survive bankruptcy for 10 years after the completion of studies.

[21] While this assumption is not completely innocuous, the Canadian earnings distribution was in fact very stable in the 1990's. There was little per capita earnings growth, and relative dispersion trended upward only mildly. Under these circumstances, students' forecasts of the earnings gains from education at later ages might not have been markedly different from current differentials.

[22] We also examined individuals with "some post-secondary" education. This group includes those obtaining a community college diploma, but also students who attend university for some time without graduating. Due to difficulty in estimating costs and the fact that this group is not representative of community college graduates we do not show results for this group.

[23] Studies have shown that skill-levels among university graduates are not equivalent and that many have ended up taking jobs which were predominantly held by high school graduates previously. (See, e.g. Pryor and Schaffer, 1997) Therefore, to assume a positive ability differential could be somewhat misleading.

[24] Using 1997-98 for this purpose allows us to capture the large increases in tuition fees, and the major tax changes that occured over the period 1996 - 1998. When we performed this research the most recent SCF data we could obtain on earnings were for 1995. We do not regard the slight mismatch in dates as a significant problem since male earnings in Canada were changing very slowly in the mid 1990s. Our detailed assumptions, as well as references to data sources, are set out in Appendix B.

[25] Morisette (1998, p. 32) reports that the unemployment rate for all men aged 17 to 24 in 1996 was 14.8%. In addition, 5.3% had involuntary part-time employment, for a total of 20.1% who did not have full-time employment.

[26] The use of medians tends to give lower estimated rates of return because the gap between median and mean earnings rises, both absolutely and proportionally, over the lifetime. Thus our estimates of forgone earnings are closer to those of Vaillancourt and Stager than our estimates of the earnings gain accruing over the working lifetime.

[27] In estimating direct costs one must keep in mind that part of universities' costs are incurred for graduate education, research, and other non-instructional purposes. No estimates are available that separate these functions from undergraduate education. Tenure-track university professors are typically expected to devote 40 - 50% of their time to teaching, including graduate teaching. We think a reasonable guess is that about 30% of operating costs are incurred for undergraduate education. Estimates are also not available for capital costs (interest, depreciation etc.) on a national basis, but Stager (1994) estimates that capital costs are about 60% of operating costs. On this basis we have a figure of 50% ($\cong$ 1.6 X 30%) of operating costs as an estimate of total direct costs of undergraduate university education.

[28] The significance of the small variations in the subsidy rate across cases in Table 2 should not be exaggerated. We assume the same tuition fees for male and female students, and are simply pro-rating in our treatment of part-time students. There are no doubt differences in programs of study across these different groups that imply further differences in subsidy rates. Capturing these effects is beyond the scope of our study.

[29] We assume a student loan interest rate of 9%, which is at the centre of the range of rates paid in June 1998 (see Appendix). Since this rate is of similar magnitude to our estimated rates of return to a university degree, the benefit of student loans does not come principally via a low interest rate after graduation.

[30] The discussion in the last section indicated that by 1998 it would be reasonable to expect about half of graduates to have had student loans and the average amount to have been about $15,000. We take an average of the *ETRs* for zero vs $15,000 debt.

[31] We do not attempt to estimate the impact of RESP's *per se* on the *ETR's* since the effects vary greatly across taxpayers depending on their use of RESP's vs. other saving vehicles. Also, prior to the introduction of CESG's. RESP's were not very popular. Thus we believe the most important effect to study is that of CESG's.

[32] Our counterfactual remains that the university graduates would have earned the median amount if they had finished their formal education after high school. It is possible that this exaggerates both rates of return and ETRs somewhat for those at the 75th percentile and has the opposite effect at the 25th percentile. For this reason the results by income level may be less reliable than those at the median.

[33] The net subsidy rates implied by Vaillancourt's 1990 results for males are 17.6% in medicine, 10.6% in engineering , 6.0% in natural science, 2.2% in social science and 0.6% in humanities. These figures represent the difference between private and public rates of return in Panel B of Vaillancourt's Table 3, p. 6.

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