Tax Impacts on the Incentive to Invest in Human Capital: A Canada - US Comparison

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The impacts that the Canadian and U.S. tax systems have on the incentive to invest in human capital are examined. Also assessed are the implications that the respective tax systems have on North American integration. To illustrate the differences in the two systems effective tax rates (ETRs) and subsidy rates (ESRs) on human capital are calculated. Findings show that Canadian university graduates face greater human capital ETRs than their U.S. counterparts. Those impacted the greatest tend to be individuals at the upper end of the earnings distribution. Results also show that students in Canada face tax side incentives to move to the U.S. after graduation. At the same time, Canadian students whom are educated in the U.S. fail to have any such incentives to return to Canada. Both countries provide substantial incentives to invest in human capital on the expenditure side, as indicated by high ESRs. While the findings do not provide the full picture when it comes to migration decisions, they do provide further insight into an interesting problem for Canadian policymakers; namely, how to keep our best and brightest from leaving.

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I. INTRODUCTION

It is widely recognized that we live in a "knowledge based economy" and that human capital is the crucial input. Since the advent of endogenous growth theory in the 1980's (Romer (1986), Lucas (1988)), human capital has taken on new appeal. While the central role in the labour market has been understood since at least the early 1960's (Schultz (1962), Becker (1964)), today's models suggest that the externalities arising from human capital can have important spin-off's which we are only beginning to understand. Whether it is from education, formal training, or innovation, human capital can play a leading role in a country's economic advancement.

Motivated by this reality, the (dis)incentive effects created by the tax systems in Canada and the United States to invest in human capital for first time university graduates are examined. The work builds on Collins and Davies (2001) by extending the analysis to include a detailed discussion and quantitative assessment of the incentives for Canadian graduates to re-locate to the U.S. and vice versa. Attention is also paid to the role that North American integration can have on investment in and the stock of human capital.

Effective tax rates are used to analyze the incentive and disincentive effects created by the tax systems. Human capital ETRs are simply the proportional difference in before and after tax rates of return on investment in human capital. While ETRs have been used extensively to measure the effect of the tax system on all kinds of physical capital investment, the adoption for human capital has only recently begun to take shape. Recent estimates on the size of human capital ETRs show that Canadian graduates face substantially higher rates than their American counterparts. (Collins and Davies, 2001) Similarly, results differ based on whether individuals are male or female, full-time or part-time, single parents, have student loans, etc. (Collins and Davies, 2002)

Findings here show that those educated in Canada face strong tax-side incentives to relocate to the United States. Furthermore, the tax system provides no incentives for those Canadians educated in the U.S. to return once their tenure is complete. Both of these facts are troubling and present an interesting dilemma for policymakers. Is the brain drain phenomenon

significant enough to mandate a change in policy? If so, where should the changes come from – expenditures or taxation? We attempt to shed light on these and other questions.

Results show that those educated in Canada who move to the United States after graduation face some of the lowest effective tax rates of all graduates. The ETR for males and females is – 7.1% and – 5.6%, respectively.[1] Given the tax treatment of income and the potential for higher earnings in the U.S., Canadian graduates are effectively receiving a subsidy if they migrate; the net-of-tax rate of return is actually larger than the gross-of-tax rate of return. The stark contrast between leaving and staying in Canada is even more apparent when we compare these results to the base case results of 20.0% for males and 12.1% for females.[2]

The results are not any more encouraging for U.S. educated Canadians. While students who stay in the U.S. after graduating face lower rates of return than Canadian educated students, they are nonetheless treated more favorably by the tax system. U.S educated Canadian males and females face roughly the same ETRs at – 9.8%, although males have slightly higher rates of return, in large part, due to the difference in earnings after graduation. If U.S educated Canadian students return to Canada, they face ETRs which approximate the base case results.

Similar results are found for U.S. graduates thinking about moving to Canada.[3] Whether they are educated at private or public institutions the ETRs are exceedingly high. Males at four-year public institutions face ETRs of 25.4%, while those at private universities face ETRs of 36.6%. Compared to the base case ETRs for males of 8.1% for public universities and 13.9% for private, the unfortunate reality is there does not seem to be any tax-side incentive for these students to come to Canada after graduation. For females the results are slightly better. Women at four-year public universities face ETRs of 16.2%, compared to 6.4% if they stay in the U.S. At private schools this rate jumps to 23.9%, compared to 12.0%.

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[1] Results are reported for Case A in Table 4. See Results section for a description.
[2] Base Case results are based on students being educated and remaining in their home country.
[3] The difference between U.S. students moving to Canada and Canadian students who were educated in the U.S. moving back home after graduation is primarily the result of two items: the opportunity costs of the students while in school and the earnings of high school graduates once they enter the labour force full-time. U.S. high school graduates will generally make more than similar graduates in Canada.

While the tax treatment of human capital provides one reason for domestically educated Canadians to migrate, it obviously does not provide the full story. Similarly, even if the tax system was neutral in its treatment of human capital this would not guarantee that cross border migration would cease. Despite these points, the government still has a number of items at their disposal that can reduce the incentives for highly educated Canadians to leave, as well as increase the incentives for similar Americans to come to Canada. We address these points in the body of the paper.

In an attempt to provide a more complete analysis the impact of the expenditure system is also provided through the use of effective subsidy rates, or ESRs. Findings show both countries provide substantial incentives on the expenditure side to invest in human capital. The overall net effect of the expenditure and tax systems, as indicated by the *net* effective tax rate, *ETR – ESR*, is also largely positive.

The rest of the paper is organized as follows. In Section II we provide a description of the conceptual framework and some illustrative calculations. Section III provides some background to the Canadian and U.S. tax systems. The empirical results are provided in Section IV. Section V talks about the policy implications and finally, Section VI provides some concluding remarks and avenues for future research.

II. CONCEPTUAL FRAMEWORK

While there exists much qualitative work on human capital and taxation, surprisingly the quantitative literature is less well developed. Similarly, while marginal effective tax rates (METRs) have been used extensively to study investment decisions in all kinds of physical capital, the spillover into human capital has not taken place until quite recently. (See, e.g., Collins and Davies, 2001, 2002 and Mintz, 2000) Perhaps not surprisingly the tax system in Canada treats both types of capital investments similarly. Studies have found that the tax treatment of human and physical capital in Canada is highly nonuniform and varies depending upon the nature of the investment. For physical capital the type, industry, and method of finance all have significant impacts on the magnitude of the METR. (See, e.g., McKenzie et al., 1998)

For human capital whether the individual is male or female, studying full-time or part-time, their field of study, use of student loans, etc. have all shown to play a role in determining the (dis)incentive effects of the tax system. (See, e.g., Collins and Davies, 2002)

This paper examines the impact that taxation has on the incentive to invest in human capital for first time university graduates in Canada and the U.S. We look at the incentives for Canadian graduates to remain in Canada after graduation, their incentive to move to the United States, and vice versa for their American counterparts. Given the nature of the American education system we assess the implications of being educated at a private or public university.

It should also be pointed out that we are not examining the *marginal* investment in human capital, per se, when calculating human capital ETRs. That is, we do not look at the change in the effective tax rate brought about by the marginal change in human capital investment. The reason is that human capital tends to come in stages. For instance, high school, college, university and post-graduate work (M.A., M.Sc., Ph.D.).[4] Therefore, we are looking at the next stage or level of the investment as it pertains to higher education, rather than the marginal change.

The ETR is defined as the proportional difference between gross-of-tax (r_g) and net-of-tax internal rates of return (r_n),[5]

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

To calculate internal rates of return (IRRs), the difference between lifetime earnings from investing in human capital and not investing is used. As well, direct costs (e.g. tuition, books, and ancillary fees) and forgone earnings are taken into account. We can therefore write,

$$(2) \qquad \sum_{t=1}^{T} \frac{(E_t - E_t^*) - C_t}{(1+r_i)^{t-1}} = 0 \qquad i = n, g$$

[4] This is not to downplay or ignore the relevance of on-the-job training as a means of human capital investment. Its importance is without question, but unfortunately it is beyond the scope of this study. This would be an excellent avenue for future research.

[5] See Davies and Glenday (1990) for an explanation of the appropriateness of using internal rates of returns over other methodologies (e.g. present value calculations).

where E_t and E_t^* represent, respectively, earnings from investing in human capital and not. For the purposes of this study, E_t will refer to the earnings realized as a result of going to university and obtaining a four-year bachelors degree, while E_t^* will be the earnings from going to high school and then directly into the labor market. C_t is the direct costs to schooling.

The effective subsidy rate (ESR) can also be calculated in much the same way as the ETR. Replacing direct costs to education in (2) with public costs, the public rate of return, r_p, can be calculated. Then, by way of (1), we can write

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

Through the use of the ETR and the ESR we can determine whether or not the expenditure and tax systems, when combined, provide an incentive or disincentive for human capital investment. To do this we compute the *net* effective tax rate on human capital, *ETR – ESR*. We will have more to say about the ESR and the net effective tax rate later on when we talk about policy impacts.

Following Collins and Davies (2002) we perform some illustrative calculations to help clarify the impact of certain variables. In this illustrative case individuals go to school for one year, earnings over the life cycle are constant, and there is an infinite time horizon.[6] Making the appropriate modifications to (2) and allowing for student loans and tax credits, we can write the gross and net rates of return as,

$$(4) \qquad r_g \approx \frac{EI - iL}{FE + C - L}$$

and

$$(5) \qquad r_n \approx \frac{(1 - t_w)EI - i(1 - t_w d)L}{(1 - t_s)FE + C - L - A}$$

[6] See the appendix for a more detailed discussion of the derivations.

where *EI* is the earnings increment $(E_t - E_t^*)$, which is the difference between the wages you earn as a result of obtaining a four-year university education and that which you would have earned had you not gone to school. *FE* is the forgone earnings $(E_t^* - E_t)$, *A* is the tax credits on direct costs, *i* is the interest rate, *iL* is the loan payments, *d* is the credit allowed for interest on loan repayments, t_w and t_s are, respectively, the tax rates on labour and in-school (forgone) income. If interest paid on student loans is fully deductible, then $d = 1$ and interest is deductible at the marginal tax rate paid on the earnings increment, *EI*.[7] Similarly, if the direct costs to education are fully deductible then $A = t_s C$. That is, out-of-pocket expenses are deductible at the marginal tax rate on in-school earnings (*FE*). Substituting (4) and (5) into (1) we can write,

$$(6)\quad ETR = 1 - \frac{r_n}{r_g} = 1 - \left(\frac{(1-t_w)EI - i(1-t_w d)L}{(1-t_s)FE + C - L - A}\right)\left(\frac{FE + C - L}{EI - iL}\right).$$

Allowing direct costs and student loans to be zero for the time being, we see from (6) that an ETR = 0 could result from proportional labour income taxes.[8] The reason is that this results in a reduction in net-of-tax forgone earnings and labour market earnings after graduation by equal proportions. A zero ETR illustrates the important point that it is possible to have a tax system that does not distort the incentive to invest in human capital. The current progressive income tax systems in Canada and the U.S. are somewhat different from this setting. The earnings in both countries after graduation are taxed at a higher rate than in-school earnings. Of course, regressive taxes, like payroll taxes in Canada and the U.S., have the opposite effect for certain individuals. The likelihood that these taxes will offset the progressivity of the income tax for many individuals is small.

Another option to offset the positive ETRs that result from progressivity in the income tax is through non-tax measures. Subsidization of forgone earnings and direct costs (which includes tuition) to education requires less revenue than the tax system provides, while at the same time reducing ETRs. This illustrates another important point; namely, that positive ETRs

[7] At present, interest on student loans is creditable at a federal rate of 17%. When combined with provincial rates, this increases to about 26%. Therefore, $d < 1$ is the likely result.

[8] Alternatively, we could have a proportional sales tax on a comprehensive base, which exempted inputs from human capital or uniform MTRs with no borrowing and full creditability of direct costs.

on human capital are not necessary. That is, non-tax measures can offset and can even override the disincentive effects of the tax system. Given that people relocate based on, among other things, the tax system and the benefits realized from government spending (e.g. health care, public goods, education, etc.), then how the government spends its money is as important as how it taxes its constituents. (See, e.g., Mintz, 2001) The net impact of this is captured in the *ETR – ESR* calculation.

Another thing (6) illustrates is that certain tax measures are more efficient at lowering ETRs. For instance, deductibility for out-of-pocket expenses (i.e. direct costs to education) has a much greater impact in reducing ETRs then does interest deductibility on student loans.[9] This finding is consistent with that of Collins and Davies (2002) who find that the advent of interest deductibility in the 1998 federal budget provided little impact on ETRs.[10] Therefore, in the face of rising direct costs to education and greater participation in student loan programs it appears a government would do better to concentrate tax policy and subsequent relief on the direct costs to education, as opposed to interest on student loans.

Replacing direct costs with public costs in (4) and ignoring student loans we can write the ESR as,

$$(7)\quad ESR = \frac{C^P - C}{FE + C^P}$$

where C^P is public costs. Combining the ETR with the ESR, we can then calculate the *net* effective tax rate,

$$(8)\quad ETR - ESR = \frac{r_p - r_n}{r_g}.$$

Using (4), (5) and (7) in (8) we can write,

$$(9)\qquad ETR - ESR = (C + FE)\left(\frac{1}{C^P + FE} - \frac{1 - t_w}{FE(1 - t_s) + C - A}\right).$$

[9] The easiest way to see this is by comparing the ETRs under full interest deductibility and full direct cost deductibiity. The numerator is larger, while the denominator smaller for full deductibility of direct costs.
[10] The change was less than 1% in all cases.

Equation (9) allows us to examine the implications of supporting education versus changing the tax system on the net ETR. Without any change in the net ETR we can see that the expenditure and tax systems could be used to reduce the incentive to leave the country considerably by reducing government subsidies to tuition and reducing higher tax rates on income. In (9) this would be equivalent to reducing t_w and A. The reduction in t_w increases $1 - t_w$, which in turn decreases the net ETR. Conversely, a fall in A causes the second term in the brackets to fall, which increases the net ETR. Assuming that the reduction in t_w and A offset one another there will be no change in the overall value.

Therefore, without any change in the overall value of *ETR – ESR*, the expenditure and tax systems can be used to reduce migration incentives without impacting the overall incentives to invest in human capital. The implication is that individual incentives can be impacted positively, without any likely significant change in the budget balance of the government. Therefore, through careful planning policymakers can "tweak" taxation and spending initiatives to stem migration without sacrificing much (if any) revenue.

Through (9) we are also able to see that a move to a more flat income tax structure would have the added benefit of increasing the incentive to invest in human capital, while still reducing the incentive to migrate. If we let t represent a flat tax where $t_w > t > t_s$, then $(1 - t_w) < (1 - t) < (1 - t_s)$. The second term in (9) has a larger numerator and smaller denominator with the flat tax t than with the graduated income tax system. Therefore, *ETR – ESR* is reduced to a greater extent under the flat tax regime; as a result, the incentive to invest in human capital is increased and the incentive to migrate, which is impacted largely by the tax structure after graduation, is reduced. With Mario Dumont in Quebec proposing a flat tax, on top of the Alberta initiative, the move to such a regime is becoming more of a live proposition and with the benefits surrounding such a move, policymakers would be wise to investigate.

Before moving on to discuss the Canadian and U.S. tax systems it should be mentioned that one problem critics often have with these types of studies dealing with post secondary education is that they feel that individuals who go off to university are on average more able than

high school graduates. Therefore, to use the median (or mean) high school graduate's income in the calculation of foregone earnings (or the earnings increment) could be seen as misleading and likely to bias the results. The solution they see is that there should be some sort of "ability adjustment" in estimating how much university graduates would have earned if they had stopped their education after high school. The size of the required ability adjustment remains in question though, as does how exactly it should be measured. While we do not include any ability adjustment in our calculations, the implications of such an experiment can be illustrated with the use of equations (4), (5) and (6). Taking ability into account would result in an increase in forgone earnings, *FE*, and a decrease in the earnings increment, *EI*. The reason being that high school earnings, used to calculate *FE* and *EI*, have now increased, while university earnings have remained constant. An increase in *FE* or a decrease in *EI* will result in a reduction in the net of tax rate of return by a smaller margin than the gross of tax return; as a result, ETRs would marginally decline. Since it is the magnitude of the ability adjustment that is the crux of this argument and its measurement remains in question, we choose to leave it out of our calculations.

III. COMPARISON OF CANADA-U.S. TAX SYSTEMS

III.a. Personal Income Tax (PIT)

In this section we briefly discuss some of the differences between the Canadian and U.S. tax systems.[11] Most of the major components of the two tax systems, such as the personal income tax and payroll taxes, have implications for the incentive to invest in human capital and as such are relevant for this study. Given the rising participation in student loan programs, we also discuss the current treatment in the two countries. We gear our discussion to the state of the tax system in 1998, the year of our data, but also discuss the relevance of recent changes.

Until the 1998 budget in Canada there was no relief for the interest paid on student loans, but the PIT system did provide relief for certain direct costs to education (e.g. tuition, fees, and an education amount). In 1998 the interest paid on student loans became creditable at the 17%

[11] For a more in depth discussion the reader is directed to Collins and Davies (2001).

federal rate.[12] Contrary to the Canadian system, the U.S. system traditionally provided relief for interest on student loans in the form of a deduction or credit, but failed to provide any support for direct costs. Recent developments in both systems have since eroded this difference.

The PIT systems on both sides of the border allow parents to oversave by means of registered savings programs, RRSPs in Canada and IRAs in the U.S., to fund their children's education. Both countries also have sheltered savings dedicated strictly to education: Canada has the Registered Education Savings Plan (RESPs) and the U.S. has Education IRAs. Canadian contribution limits are higher on sheltered savings strictly for education ($4,000 compared to $2,000 USD in the U.S.) and are encouraged by a subsidy in the form of the Canada Education Savings Grant, which equals 4% of annual contributions to a maximum of $400. Annual contribution limits for RRSPs of $13,500 or 18% of income are generally higher than IRAs; the exception to the rule is for low income individuals.[13]

It is generally believed that the Canadian PIT system is more progressive, due to its graduated rate structure, than that of the U.S. One reason is that in Canada we move more quickly into the upper tax brackets than people in the United States. This is partly because the U.S. tax brackets are wider and partly because their standard deductions and exemptions are more generous. Combine this with the fact that high-income Americans make heavy use of their more liberal itemized deductions and the U.S. system becomes substantially less progressive than the Canadian.

To put this into perspective, in 2000 a Canadian earning total income of $60,009 would be in the third and top tax bracket of 29%, while a single taxpayer in America would have to earn $70,750 USD (or, approximately, $110,000 CDN) to be in the third tax-bracket in the U.S. Even with the 2 % difference (the third tax-bracket in the U.S. is 31%), it is easy to see that there is a dramatic difference between the two countries – and this is without the use of itemized deductions. If we were to take into account all itemized deductions available to American taxpayers the difference between the two countries would become even greater.

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[12] The value of the credit is enhanced when provincial income taxes are taken into account. There is no limit on the amount of interest that may be claimed. Unused credits may be carried forward for up to five years, but are not transferable to other taxpayers.

Recent developments in the PIT system in both countries should help to promote investment in human capital. In Canada, for instance, the three-bracket structure has been extended to add a fourth and the rates reduced.

Canada Federal Marginal Tax Rates by Taxable Income Pre- and Post-2000 Change

Before		After	
Income	Rate	Income	Rate
0	17%	0	16%
30,004	25%	30,755	22%
60,009	29%	61,510	26%
		100,000	29%

While the reduction in the rates is positive for Canadian taxpayers, their effect on ETRs is not as encouraging. The impact on ETRs is greatest for earners at the 75th quantile and lowest at the 25th quantile. In terms of equity this is a rather unsettling result.

As if to keep pace with changes in Canada, President Bush also unveiled a new proposal for tax relief. The rate structure is summarized in the following table as it was in 2000 and as it will be once the changes proposed by Bush have been fully phased in.[14]

United States Federal Marginal Tax Rates by Taxable income in 2000, Pre- and Post-Bush Tax Cuts

Before			After		
Single	Couples*	Rate	Single	Couples*	Rate
0	0	15%	0	0	10%
26,250	43,850	28%	6,000	12,000	15%
63,550	105,950	31%	27,050	45,200	25%
132,600	161,450	36%	136,750	166,500	33%
288,350	288,350	39.6%			

Note: * -- Couples filing jointly

As in the Canadian case the largest reduction in MTRs is for the middle-income taxpayers. But unlike Canada, there is also a substantial reduction in the bottom bracket. How

[13] For a Canadian taxpayer with an income below $17,000 CDN, the RRSP contribution limits is less than that for a single U.S. taxpayer.

will the changes affect ETRs? Again, it appears that the overall results are positive; most people should see a reduction in their ETRs as a result of the changes. Once again it should be pointed out that we are ignoring the fact that a number of middle and, particularly, low income earners are eligible for tax relief in the U.S. either in the form of deductions or credits that would reduce their ETRs. For instance, the Earned Income Tax Credit generates a large negative marginal tax rate for the lowest earners.

While tax relief in the form of credits and deductions, as well as reductions in the marginal tax rates, are positive for the economy as a whole, their impact on ETRs of university students is likely to be rather small. The reason is that most of the provisions in the tax system are designed to benefit families with children. The majority of individuals in university are without families; as a result, much of the relief doesn't apply. The relief for students comes largely in the form of government sponsored loan programs and, for a small percentage of students, grants.

III.b. Payroll Taxes

Payroll taxes have a regressive rate structure, unlike the PIT, since they are typically defined with a flat rate for contributions up to some limit, defined as "maximum insurable earnings," and fall to zero thereafter. The implications of the unemployment and pay-as-you-go social security schemes in both countries on investment in human capital would seem to be that payroll taxes decrease the incentive to invest during the "schooling years," while the impact after schooling depends upon the earnings of the individual. If earnings after education are above maximum insurable earnings, the rate structure becomes regressive. As a result, the ETR will likely decline.

Social security is relatively more important in the U.S. This fact is reflected in much larger maximum insurable earnings.[15] The impact of social security on U.S. ETRs is therefore greater than it is for Canada. The higher contribution limits in the United States lead to increases in the tax rate on labor income while the individual is in school and after graduation of

[14] The changes in the marginal rate structure will be fully phased in by 2006.
[15] In 2000 the Canadian limit was $37,600 CDN while the U.S. had a limit of $76,200 USD, respectively.

approximately equal magnitude; as a result, ETRs increase. For those Canadians whose earnings are above maximum insurable earnings the increase in t_w is less than that in t_s, due to CPP contributions. Therefore, ETRs are likely to decrease.

While the regressive nature of payroll taxes for middle and high income individuals in Canada offsets the progressivity of the PIT system to some extent and lowers ETRs, this is not the case for all Canadians. Low income Canadians, those that fall below the limit of maximum insurable earnings, experience a mildly *progressive* rate structure. This progressivity is due to the fact that the first $3,500 of earnings are not subject to CPP contributions. Combined with the PIT system, the structure of the payroll tax exacerbates the disincentive effects of the tax system to invest in human capital for these individuals. Once again, this brings up the question of equitable treatment.

III.c. Student Loan Programs

Both Canada and the United States help students to finance their education by providing guaranteed student loans. Due in part to rising tuition costs the participation in such programs has been increasing. Perhaps even more unsettling than the rise in participation rates is the startling debt load some students are accumulating. In 1998 the Department of Finance estimated that the average debt of students participating in student loan programs was approximately $14,000 upon graduation. For the same time period in the U.S., the average loan amount was about $13,845 USD.[16]

In Canada, students rely on the Canada Student Loan Plan (CSLP), while in the U.S. options are somewhat more diversified. U.S. students have the option of participating in the Ford Direct Student Loan Program (FDSLP) or the Federal Family Education Loan Program (FFELP).[17] Loans from these programs may be subsidized or unsubsidized. If they are subsidized they are similar to student loans in Canada. The government pays the interest that accumulates on the loan as long as the student meets some minimum requirements (usually full-time status

[16] This value is derived from the College Boards, "*Trends in Student Pricing*," Table 4b by calculating the average value for Stafford Subsidised student loans over the years 1994/5 – 1997/8.
[17] The FDSLP allows students to borrow directly from the government through the school they are attending. FFELP loans are administered by private lending institutions and guaranteed by the government.

suffices). Both the CSLP and the subsidized portion of the FDSLP are dispensed on a needs basis.

Unsubsidized loans were introduced during the 1992-3 school year in the U.S. and have seen their participation rates steadily rise. The reason is in part that they are not administered on a needs basis. Interest accumulates while the student is in school and gets added to the principle amount of the loan. This is similar to the case of part-time students in Canada. While participation by part-time students in the CSLP and other provincial plans is permitted, the interest that accumulates must be paid by the individual from the time the loan is taken up.

The effect of student loans on the accumulation of human capital comes largely from the fact that they are subsidized.[18] The benefits provided tend to have larger impacts on net IRRs than gross and as a result ETRs fall. (Collins and Davies, 2002) The unsubsidized loans have less leveraging benefit; as a result their impact on ETRs is somewhat limited. Both types of student loans help to ease the burden of paying for school by stretching the payment out over a number of years. In Canada, for instance, students have up to 9 1/2 years to repay their loans. The silver lining in these rising participation rates is that studies have shown that almost 40% of students who have loans have repaid them within two years after graduation. (Finnie, 2001. Figure 4)

IV. EFFECTIVE TAX RATES ON FIRST TIME UNIVERSITY GRADUATES

IV.a. Data and Assumptions

Using the 1998 Statistics Canada Survey of Consumer Finances (SCF) and the U.S. Census Bureau's Current Population Survey (CPS) for the same year, we construct a measure of the rates of return for first time university graduates and their effective tax rates. Sample sizes are 68,633 and 253,044 for the SCF and CPS, respectively. Earnings and tax information are reported for the year preceding the survey and are used to create hypothetical lifetime earnings and tax scenarios. To accomplish this the assumption is made that graduates with a certain level of education earn at the same earnings quantile throughout life. Through the smoothing

[18] Critics may claim that this ignores the fact that student loans may fill a market that would otherwise be missing. Without such a market some students may not be able to finance their education. While no doubt relevant for the discussion of student loans in general, it is the subsidization of student loans that impacts the calculation of human capital ETRs and not the fact that a market is being filled.

procedures devised by Burbidge et al. (1988) and Magee et al. (1991) we project the life-cycle path of earnings using quantile age-profiles. Earnings include only wages and salary income.

We constrain our sample to include only full-time, full-year workers in an attempt to capture the full returns to human capital. In other words, only those individuals who have indicated that they were employed for 52 weeks during the year of the survey, and who worked full-time during this period are considered. We define university graduates as those individuals who have *completed* only a bachelor's degree.[19] High school graduates include only those who have completed high school, and *not* gone on to complete or attend any further schooling.

Our first step is to impute tax payments on the wage and salary component of total income. First, an average tax rate (ATR) is calculated. For those in the SCF, the ATR is calculated by dividing total tax paid by total income. This ratio is then multiplied by total wages and salary to compute the imputed tax burden faced by each individual on their labor earnings.[20]

For the CPS there is an important distinction between those filing as single taxpayers and those filing jointly with a spouse. For those who file separately (i.e. as a single taxpayer) the ATR is calculated in much the same way as with the SCF; the total tax paid (both federal and state) is divided by total personal income. For individuals who file jointly, we compute the ATR as total tax paid over total family income.[21] The ATR is then multiplied by total wages and salary of the individual to arrive at a tax liability value. In short, we compute the couple's joint ATR and subsequently apply this to the husband's and wife's individual labour incomes to compute their respective tax liabilities.[22]

Individuals are admitted to university when they are 19, earn a four-year bachelor's degree, and then enter the labor force at 23. During their tenure at university individuals forgo

[19] Specific areas of study within the chosen degree are not identified in the data. For a study of rates of return to different fields see, e.g., Appleby et al. (2000).
[20] Due to the small probability that the tax liabilities may be outliers, we use a weighted average centered around the respective income value.
[21] It should be noted that due to the nature of the survey it was necessary to avoid any income that may come from other family members, who are not dependants. Therefore, families with more than two individuals who had no children under the age of 18 were dropped from the calculation, since they may in fact be contributing to the data in immeasurable ways.
[22] While some might suggest that the secondary earner's income should be treated as marginal, we are of the view that it has now become exceedingly difficult to identify whose earnings are marginal in a marriage.

the income they would have earned in the labor market, less summer earnings.[23] Forgone earnings are based on the earnings of the median high school graduate. Sensitivity analysis around these results is also performed.

Statistics Canada data is used to compute values for tuition and additional expenses for Canadian students. The average tuition and fees reported are based on Arts programs across Canada for the 1997-8 academic year. A figure of $3,253 was obtained for tuition, $342 for fees, and we assume that additional direct costs were $1,000. By way of the College Board's *Trends in College Pricing (2000)*, we obtain similar results for the U.S. Given that the U.S. has a large number of private, as well as public, institutions we provide results on both types of education. Tuition and fees for four-year public institutions for the 1997-8 academic year averaged $3,111 USD and for four-year private institutions $13,644 USD. It is also assumed that U.S. students face additional direct costs to education of $1,000 USD.

Students in both countries are assumed to make full use of the relief provided by the tax system. In 1998 in Canada students received a $200/month education amount creditable at a federal rate of 17%. When combined with the provincial system this rate rises to around 26%. They also claim the full amount of their tuition and fees (again creditable at around 26% when we combine federal and provincial rates). This of course ignores the possibility that some students may not need the full amount to reduce their tax liability to zero and would carry forward any unused portion (or transfer it to a spouse or parent). The impact of this assumption on ETRs is likely negligible.

For students in the U.S. there are two mutually exclusive tuition credits at their disposal: the Hope Scholarship Tax Credit and the Lifetime Learning Credit. The Hope Credit provides a 100% credit on the first $1,000 of tuition and fees, and 50% on the next $1,000 for the first two years of post secondary education. The Lifetime Learning Credit is levied at a 20% rate on the first $5,000 of tuition and fees. Students are assumed to make full use of these credits.

[23] Summer earnings are defined as being equivalent to 4 months of forgone earnings less 20% for search costs and uncertainty.

IV.b. Results

Results from the base case are shown in Table 1. This case uses the 1998 tax systems for Canada and the U.S., assumes that the student is single with no dependents and finances her education through savings. For the U.S. we report results from four-year public and private institutions – the main difference being the amount of tuition and fees students face. Results show that students in the U.S. face lower ETRs than do Canadians and that female ETRs are less than males. For U.S. students at private schools high tuition costs have a significant impact on rates of return, as well as the ETRs they face. In fact, the tuition difference is so great that the rates of return of Canadian students are greater than U.S. students at private institutions. U.S. males at private universities face ETRs roughly 42% greater than their public school counterparts, whereas females face rates approximately 47% greater.

An interesting result from this analysis is that higher tuition at private universities has a stronger impact on females than on males. That is, the increase in the direct costs of education is enough to offset any advantage the females have in the public school case which allows them to realize higher rates of return than males. The reason for this turnaround may be that males have higher forgone earnings and so an increase in direct costs, which are increasing at a decreasing rate, have less of an impact on ETRs. Put another way, the gap between the gross and net of tax rates of return is smaller for males than for females as we increase tuition and as a result the male ETR is affected less by the change.

Consider the illustrative case with increasing marginal tax rates, no loans and less than full deductibility of out-of-pocket expenses, $A < t_s C_s$. Equation (6) becomes,

$$(10) \qquad ETR = 1 - \left(\frac{(1 - t_w)(FE + C)}{(1 - t_s)FE + C - A} \right).$$

Taking the derivative with respect to costs we find,

$$(11) \qquad \frac{\partial ETR}{\partial C} = \frac{(A + FEt_s)(1 - t_w)}{(FE(1 - t_s) + C - A)^2} > 0 .$$

If *C* increases, the impact on males and females is determined by the magnitude of forgone earnings, *FE*, since *A* and t_s are assumed to be roughly identical for all individuals. Therefore, taking the derivative of (11) with respect to *FE* will determine how forgone earnings impact ETRs as direct costs to schooling change. Doing so yields,

$$(12) \qquad \frac{\partial^2 ETR}{\partial C \partial FE} = \frac{(1-t_w)\left(t_s\left(C-(1-t_s)FE\right)-A\left(2-t_s\right)\right)}{\left(FE(1-t_s)+C-A\right)^3} < 0 .$$

Providing after-tax forgone earnings are greater than the direct costs to schooling then (12) will be negative. Male *FE*'s are typically greater than females. Therefore the impact on ETRs will be proportionately smaller for men.[24] As a result, any increase in the direct costs to schooling, *C*, will increase the ETR by less for males than for females. Therefore, an increase in direct costs to education appears to have a greater disincentive effect on females to invest in human capital than males. This presents an interesting dilemma for policymakers.

Table 2 illustrates the impact of expenditure and tax systems in both countries on individual incentives to invest in human capital. For the most part, subsidy rates are enough to offset effective tax rates. The exception is for males who undertake private school education in the U.S. For these individuals the ETR is greater than the ESR, due in part to the high tuition costs of education at private universities. Canadian students face significantly higher ESRs than U.S. students. The net ETRs (i.e. *ETR – ESR*) are more negative for females than males, which would imply a greater overall incentive to invest in human capital. This may counteract the aforementioned disincentive effect associated with direct costs to education for females. When the expenditure and tax systems are combined there appears to be an overall incentive for students to pursue higher education, a conclusion which is in line with results from earlier studies.

Table 3 repeats the base case analysis, but for people at the 25th and 75th quantiles of the earnings distribution. These results are based on a "clone" calculation. That is, a comparison is made between the Xth quantile high school earner and a university graduate earning at the same

[24] This assumes that the smaller MTRs faced by females do not offset the higher forgone earnings of males.

quantile. The results are then used to calculate forgone earnings and the earnings increment as described previously.[25] In all cases the ETRs at the 75th quantile are greater than those at the 25th. Canadian males at the 75th quantile face the highest ETRs of 21.2%, while males in the 25th quantile who go to four-year public universities in the United States face the lowest at 5.1%. Rates of return and ETRs are also nonuniform, making them consistent with their physical counterparts.

Treating rates of return by quantile as a proxy for the rates of return to different fields of study the results in Table 3 suggest interesting implications for public policy. If we consider the fact that high rates of return come from fields such as engineering or business then having the highest effective tax rates on these individuals may be somewhat troubling, particularly if we are concerned with things like migration. As tables 4 – 6 show, those seeking relief from the Canadian tax system can indeed find it south of the border.

Table 4 shows the results for Canadian students who upon graduating decide to move to the U.S. Two different scenarios are considered. Case A illustrates the case where a university education opens doors in the United States and presents the Canadian student with more opportunities after graduation. If this student did not go to university then he/she ends up working in Canada after high school. Hence, we calculate the earnings increment as the difference between U.S. university earnings (transformed into Canadian dollars) less Canadian high school earnings.[26] Summer earnings are calculated as the median high school earner's income for four months, discounted by 20% for search costs and uncertainty. The results from Case A show that Canadian graduates who move to the U.S. after graduation face ETRs which are *negative.* The rates of return based on Case A assumptions are also the some of highest in the study; well into the 20% range.

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[25] An alternative approach is to treat every high school student going to university as equal. Therefore, the forgone earnings of all university students would be equivalent to the median high school student's earnings. In university students differentiate themselves by field of study, which can be approximated by the rate of return, ability, etc. and as a result earn at different levels of the earnings distribution. Hence, after graduation you would compare X^{th} quantiles to calculate the earnings increment as in the clone case. Performing this calculation does not significantly impact the conclusions reached. For a discussion and quantitative assessment of the two approaches see Collins and Davies (2001)

[26] At the time of this analysis the exchange rate was $1.53046. An exchange rate of $1.50 is used to convert American earnings to Canadian dollars.

Case B is identical to Case A, but with one significant difference. It is assumed here that the Canadian student is going to move to the U.S. after high school, unconditionally. Therefore, we compare high school earnings of students in the U.S. with university earnings in the U.S. The change has a significant impact on IRRs and ETRs, but in all cases the rates of return are still quite high, all are over 16.5%, and the ETRs marginal – with males at 4.0% and females 2.9%. The conclusion, therefore, seems to be that there are substantial tax side incentives to invest in an education in Canada and look to the U.S. labor market after graduation.

As for U.S. students thinking about moving to Canada after graduation, the results are just the opposite. For these cases earnings of U.S. high school students, converted to Canadian dollars, are compared with those of university students in Canada. U.S. students face higher ETRs and lower rates of return when compared to the base case. For instance, private school ETRs for males and females are 36.6% and 23.9%, respectively, compared with 13.9% and 12.0% from the base case.

Table 5 continues the Case A story from Table 4 for Canadians, as well as the U.S. cases, but for the 25^{th} and 75^{th} quantiles. Canadian males and females receive marginally lower rates of return then they did at the median. Despite this, the ETRs follow suit with Table 4. Canadian graduates at all levels are encouraged by the tax system to move to the United States. Perhaps most discouraging for Canadian policymakers is that it is the 75^{th} quantile graduate who receives the largest incentive with ETRs of –7.8% for males and –5.7% for females. Conversely, U.S. graduates at the upper end of the earnings distribution face significantly higher ETRs, which provides substantial encouragement to remain in the U.S.

In table 6, we examine Canadian students who are educated in the United States. The idea here is to see how the tax system treats these students if they decide to return and work in Canada after graduating. It is assumed that these students work in Canada over the summer and go to school in the United States from September to April. The biggest difference being that they pay much higher tuition (converted to Canadian dollars) than in our earlier cases. This case is also interesting since in Canada tuition fees have been rising steadily over the last number of years.

Case I looks at those Canadian students educated at four-year private universities in the U.S. For those that stay in the U.S. we compare Canadian high school earnings with U.S. university earnings. Case II examines those Canadian students who decide to move back after graduating from a U.S. private university. Here we compare Canadian high school earnings with Canadian university earnings. As is evident from the results, remaining in the U.S. after graduation is the better option in terms of tax side incentives.

Perhaps more importantly, we see that if tuition increases reach those of private institutions in the U.S. rates of return are hit quite dramatically. For instance, net rates of return go from 8.76% to 4.86% for males and from 12.31% to 7.28% for females. The impact on the ETRs is not as significant. Surprisingly, the low earnings of the 25^{th} quantile individual combined with the significant increase in tax credits actually causes ETRs to be marginally reduced.[27] Unfortunately the same cannot be claimed for high earners. Once again, those at the upper end of the earnings distributions are (negatively) affected the most; ETRs rise from 21.2% to 25.9% for males and 15.3% to 17.1% for females.

Table 7 explores a number of policy experiments that are in line with recent changes in the Canadian education system. For instance, tuition increases and expenditure reductions have been a large part of the education system over the last number of years. Recently education amounts have also been increased and progressivity in the income tax, reduced. The results from table 7 allow us to examine the implications these changes may have had on the incentive to invest in human capital for Canadian students, as well as their incentive to relocate after graduation. All comparisons are made with respect to the base case results.

Results show that if tuition is increased without the requisite allowances for tuition credits that ETRs rise and rates of return fall for both males and females. Perhaps surprisingly, when credit allowances for tuition are maintained at their current levels the results approximate our base case. This shows that increases in direct costs to education can be offset by establishing the appropriate credits. The downside is that the change is still accompanied by a reduction in rates of return.

[27] We assume no limit on the credit.

Table 7 also illustrates the positive aspects of increasing education amounts and decreasing progressivity of the income tax system. While doubling the education amount increases rates of return and lowers effective tax rates, the impact is far less than that realized as a result of implementing a flat income tax. Recall that the latter also has the added bonus of stemming migration, unlike the former as explained earlier. This lends credence to the belief that how students are treated after graduation is just as important, if not more so, than how they are treated while in school.

Finally, table 7 shows the impact on the ESR and net ETR of reducing expenditures to education by 20%. Notice that while the reduction leads to a decrease in ESRs and subsequent increase in net ETRs, the net effect is still negative. The implication being that perhaps the Canadian system is still spending too much on its education system. Of course, while the reduction in expenditures would have no direct effect on rates of return it may have an indirect effect through the increased inability of Canadian schools to retain and recruit professors. It is possible that this indirect effect may be quite large. This would be a good avenue for future research to explore.

V. HUMAN CAPITAL POLICY IMPLICATIONS

The incentives to invest in human capital can have important implications for public policy. In this section we concentrate on two issues: emigration decisions and domestic incentives. In both of these cases the tax treatment of human capital is important. The first considers the treatment of taxation as a catalyst for cross border migration (e.g. the brain drain phenomenon), while the latter considers the implications taxation can have on the incentive to invest in human capital over other alternatives, such as physical capital.

We have seen that Canadian students face disproportionately higher ETRs than their American counterparts. We have also seen that the tax incentives to move to the U.S. after graduation are significant and that higher income individuals face greater incentives. So why isn't there a mass exodus? The obvious response is that there is more to migration than tax treatment alone. People have family considerations, ties to the community in which they live,

friends, etc. There is also the fact that not all individuals, whether skilled or otherwise, have the same opportunities.[28]

While Canadians have seen an increase in emigration from doctors, nurses and natural scientists the averages for the most part have been steady and when considered as a percentage of the total workforce, remain quite small. Therefore, the outflow of human capital to the U.S. appears to be small overall and the impact on existing stocks minimal. Although, with an aging population and the state of health care should these trends continue the flows in health related disciplines could become significant. Combine this with the fact that temporary emigration tends to make the above numbers higher and the loss of skilled labour could become even larger.

Of course, even if ETRs were zero this would not make us brain drain proof. The reason is that it is not the treatment of direct costs to education that affects the emigration decision, but rather the tax treatment of earnings after graduation. While subsidization is beneficial in reducing ETRs, we have seen that it does not have the impact on emigration decisions that, say, a reduction in marginal tax rates could have. It is the way in which policy goes about reducing ETRs (or *net* ETRs) that is of crucial importance. For instance, policy initiatives aimed at reducing human capital ETRs can only play a role in the emigration decision if they are directed at taxing returns less. Additional education credits or relief while an individual is in school are successful at reducing ETRs, but have no impact on individual decisions once the student has graduated.

It is also important to realize that higher human capital ETRs in Canada need not necessarily imply a relative lack of investment compared with the United States. While investment in human capital does depend on human capital ETRs, it also depends on the tax treatment of personal savings and investment. The upper-middle class in both countries could therefore be seen as having an incentive to invest in physical rather than human capital, due to high positive ETRs on human capital. For high-income earners the consumption tax regime no longer applies, since personal investment income faces positive taxation. With the higher marginal tax rates in Canada, high-income earners can be expected to invest less in physical capital. So while middle to upper-middle income Canadians have an incentive effect that

[28] Helliwell (2000) provides other explanations.

encourages investment in physical as opposed to human capital, this result may change when personal investment income becomes taxable.[29]

It is also important to realize that whether or not people have an incentive to invest in human as opposed to physical capital does not necessarily determine which country will be more human capital intensive. Again, the reason is due to migration. While there may be an incentive to invest in physical capital at the individual level this result may be eroded at the economy level because physical capital can move to a more favorable tax environment. This presents an interesting dilemma for Canada in particular. For instance, it might be that Canadian policy is encouraging a physical to human capital ratio that is too low, which could be contributing to our lag in productivity growth in the economy, while at the individual level distorting investment away from human capital. Combine this with the fact that investment in Canadian businesses has been relatively low over the last decade and Canada's position becomes even less favorable.

VI. CONCLUDING REMARKS

This paper has shown how the incentive to invest in human capital can be assessed using effective tax rates (ETRs) and subsidy rates (ESRs). The approach was illustrated for undergraduate university education in Canada and the United States by way of the 1998 Survey of Consumer Finances and Current Population Survey, respectively. Our results have concentrated on the relative magnitude of ETRs and ESRs in Canada and the U.S., as well as the incentives for recent graduates to migrate.

We have seen that ETRs vary considerably among individuals and can be quite large. Results show that Canadian students face much higher ETRs than their American counterparts. Canadian students also face greater incentives to migrate after graduation. Both of these facts are lessened when the expenditure system is taken into account. ESRs counteract the disincentive effect created by the tax system and promote human capital investment. Canadian males tend to face higher ETRs than females due in large part to higher earnings. This latter result may help to explain why we have seen lower male/female ratios in university and college enrolment.

[29] This has to do with the fact that roughly 70% of personal investment income in Canada has been calculated to be tax-free. (Poddar and English, 1999)

While lower ETRs are beneficial from the standpoint of creating greater incentives to invest in human capital, we have shown that a reduction for its own sake is not the best policy. Policy initiatives aimed at reducing taxation of returns to education, as opposed to increasing the benefits to the student while in school (e.g. tuition credits, education amounts), are far more promising. While both policies unambiguously reduce ETRs, the latter has no effect on emigration decisions. Furthermore, policy initiatives designed to increase the benefits of the student while in school may cause more harm than good if such benefits are enacted without any subsequent relief on returns. The reason is that such policy only enhances the benefits of migration. Should the government find policies designed to lower the taxation of returns unpalatable, cross border migration will continue at a rate equal to the elasticity of migration with respect to the tax differential.[30] What this means for Canada's long term economic position remains to be seen.

Over the last several years Canada and the U.S. have made some significant changes to higher education. Whether these changes come on the expenditure side in the form of less funding for institutions or on the tax side their effects are complex. While tax credits have been made more generous in both countries, tuition and other direct costs to education have been rising. These changes have opposite effects on human capital ETRs and would seem to indicate a somewhat counter productive human capital policy. Perhaps the most important policy change in Canada and the U.S. is the reduction in marginal rate structures for income tax. The changes while undoubtedly leading to a reduction in observed ETRs and increasing the incentives to invest in human capital have but one problem for Canadians. The parallel reduction in MTRs by the U.S. will unlikely impact migration decisions to any great extent.

While the empirical analysis focused on the PIT, many other taxes have an effect on human capital ETRs as well. For example, payroll taxes in Canada have a much lower earnings threshold at which marginal rates go to zero, which offsets the effects of the graduated marginal rate structure for income taxes. Since rates in Canada are lower than those of the U.S. they tend to offset income taxes to a greater extent and reduce ETRs more. Sales taxes are also much more important in Canada than in the U.S. The greater reliance in items such as the broad-based goods

[30] What this rate is exactly is a good question for future research.

and services tax as well as provincial taxes, all result in greater ETRs in Canada. We also talked about how student loans affect the results. Through the use of illustrative calculations we showed that the tax credit provided for interest on student loans is in fact not as valuable as the credit for direct out-of-pocket expenses. The credit for out-of-pocket expenses leads to a larger reduction in ETRs, than the interest credit.

While ETRs have been used to study the incentives on physical capital investment created by the tax system, the work on human capital investment is in its infancy. This study has attempted to shed some light on tax side incentives for investing in human capital in Canada and the United States by examining cross border migration and domestic investment decisions. The insights in this paper provide only a small glimpse into the research possibilities. More work is needed on the incentive effects of additional forms of taxation and different types of human capital accumulation (e.g. OJT, College, Vocational programs, etc.). Disaggregation by field of study or program would also prove useful, since it would allow a more accurate assessment of how different students are impacted by the tax system. Finally, how the earnings of private university students compare with those of public university students in the U.S. would allow a more accurate depiction of how ETRs vary among these individuals.

VII. APPENDIX

In this section we work through the derivation of the illustrative equations. The derivation follows closely that of Collins and Davies (2001). We start by assuming the length of schooling is just one year, *t = 1*. The calculations are first performed for the gross-of-tax rate of return and then repeated for the net-of-tax rate of return. Including loans in (2), the IRR equation, we find,

$$\text{(A1)} \quad \sum_{t=1}^{T} \frac{(E_t - E_t^*) - C_t - iL_t}{(1+r_j)^{t-1}} = 0 \ .$$

Moving all the *t = 1* terms to the LHS results in,

$$\text{(A2)} \quad E^* - E + C - L = \sum_{t=2}^{T} \frac{E_t - E_t^* - iL_t}{(1+r_i)^{t-1}} .$$

Notice that since our education program lasts only one year that direct costs, *C*, appear only on the LHS of A2. Forgone earnings are represented by $E_1^* - E_1$, while the RHS is the future value of the earnings increment. The interest rate *i* is assumed to be constant and *L* represents student loans. *iL* is loan repayments.

Assuming that the yearly benefits of additional education and cost of student loan repayments are constant and that *T* is large, we can write A2 as,

$$\text{(A3)} \quad E_s^* - E_s + C_s - L_s \cong \left(E_w - E_w^* - iL_w\right)\sum_{t=2}^{T} \frac{1}{(1+r_g)^{t-1}} = \frac{E_w - E_w^* - iL_w}{r_g}$$

where we adopt the subscript *s* and *w* to denote the periods for school and work. Rewriting A3 in terms of r_g, we find

$$\text{(A4)} \quad r_g \cong \frac{E_w - E_w^* - iL_w}{E_s^* - E_s + C_s - L_s} = \frac{EI - iL}{FE + C - L}$$

where *EI* is the earnings increment and *FE* is forgone earnings. Performing the same calculations for after-tax returns and assuming that tax rates are constant with $t_w \geq t_s$, we get

$$\text{(A5)} \qquad r_n \cong \frac{(E_w - E_w^*)(1-t_w) - i(1-t_w d)L_w)}{(E_s^* - E_s)(1-t_s) + C_s - A_s - L_s} = \frac{EI(1-t_w) - i(1-t_w d)L)}{FE(1-t_s) + C - L - A}$$

where t_w and t_s are, respectively, the marginal tax rates on labour (i.e. earnings increment) and forgone earnings, *A* is the credit provided for direct out-of-pocket expenses for education, and *d* is the deductibility of interest paid on student loans. If we have full deductibility, then *d = 1* and interest is deductible at the marginal tax rate on labour income t_w. We parallel this with the deductibility of direct costs for education, which we assume is $A \le t_s C$. If we have full deductibility of out-of-pocket expenses then $A = t_s C$. Replacing A4 and A5 in our ETR equation we can write,

$$\text{(A6)} \qquad ETR = 1 - \frac{r_n}{r_g} = 1 - \left(\frac{(1-t_w)EI - i(1-t_w d)L}{(1-t_s)FE + C - L - A}\right)\left(\frac{FE + C - L}{EI - iL}\right).$$

It is A6 which provides us with the illustrative capabilities presented and discussed in the paper.

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Table 1
Rates of Return and Effective Tax Rates for First University Degree Graduates (Base Case)

	Net-of-Tax IRR	Gross-of-tax IRR	ETR
Canada			
Male	8.76	10.94	0.200
Female	12.31	14.01	0.121
U.S.			
Public			
Male	13.03	14.17	0.081
Female	14.06	15.03	0.064
Private			
Male	8.48	9.85	0.139
Female	8.54	9.71	0.120

Source: Authors calculations using 1998 Statistics Canada Survey of Consumer Finances and 1998 Current Population Survey data

Table 2
Base Case Rates of Return, Effective Subsidy Rates and Net Effective Tax Rates

	Gross-of-tax IRR	Public IRR	ESR	ETR-ESR
Canada				
Males	10.94	8.28	0.243	-0.043
Females	14.01	10.71	0.235	-0.114
U.S.				
Public				
Male	14.17	12.28	0.133	-0.052
Female	15.03	12.65	0.159	-0.095
Private				
Male	9.85	8.61	0.126	0.013
Female	9.71	8.27	0.149	-0.029

Source: See Table 1

Table 3
Rates of Return and Effective Tax Rates for First University Degree Graduates at the 25th and 75th Quantiles

	Quantile	Net-of-Tax IRR	Gross-of-tax IRR	ETR
Canada				
Male	25th	10.14	11.71	0.134
Female	25th	14.06	15.81	0.111
U.S. Public				
Male	25th	13.13	13.81	0.051
Female	25th	13.21	14.12	0.065
Private				
Male	25th	7.68	8.58	0.106
Female	25th	7.13	8.24	0.135
Canada				
Male	75th	6.69	8.49	0.212
Female	75th	10.16	11.99	0.153
U.S. Public				
Male	75th	13.88	15.35	0.096
Female	75th	14.09	15.59	0.096
Private				
Male	75th	10.03	11.62	0.137
Female	75th	9.30	10.97	0.152

Source: See Table 1

Table 4
Rates of Return and Effective Tax Rates for Cross Border Migration by Domestically Educated Individuals

	Net-of-Tax IRR	Gross-of-tax IRR	ETR
Canada - U.S.			
Case A			
Male	23.22	21.69	-0.071
Female	24.05	22.78	-0.056
Case B			
Male	16.53	17.21	0.040
Female	17.70	18.23	0.029
U.S. - Canada			
Public			
Male	6.51	8.72	0.254
Female	9.75	11.63	0.162
Private			
Male	3.51	5.54	0.366
Female	5.80	7.62	0.239

Source: See Table 1

Note: Case A – student stays in Canada after high school graduation, but moves to the U.S. after university.
Case B –student moves to the U.S. after high school or university graduation in Canada.

Table 5
Rates of Return and Effective Tax Rates for Cross Border Migration of Domestically Educated Individuals for the 25th and 75th Quantiles

	Quantile	Net-of-Tax IRR	Gross-of-tax IRR	ETR
Canada				
Male	25th	21.61	20.69	-0.044
Female	25th	23.77	23.18	-0.026
U.S. Public				
Male	25th	8.15	9.72	0.162
Female	25th	10.83	12.55	0.137
Private				
Male	25th	4.26	5.84	0.269
Female	25th	5.82	7.50	0.223
Canada				
Male	75th	22.83	21.17	-0.078
Female	75th	22.74	21.51	-0.057
U.S. Public				
Male	75th	5.14	7.21	0.287
Female	75th	8.28	10.55	0.215
Private				
Male	75th	3.02	5.06	0.403
Female	75th	5.17	7.32	0.295

Source: See Table 1

Table 6
Rates of Return and Effective Tax Rates for Canadians, Educated at Private Universities in the U.S.

	Quantile	Net-of-Tax IRR	Gross-of-tax IRR	ETR
Case I- Stay in U.S.				
Male	25th	13.08	11.86	-0.103
	Median	15.15	13.80	-0.098
	75th	16.50	15.14	-0.089
Female	25th	13.13	12.08	-0.087
	Median	14.71	13.40	-0.098
	75th	15.44	14.38	-0.073
Case II - Move Back				
Male	25th	5.44	6.28	0.134
	Median	4.86	6.23	0.220
	75th	4.12	5.57	0.259
Female	25th	7.43	8.20	0.093
	Median	7.28	8.26	0.119
	75th	6.43	7.76	0.171

Source: See Table 1

Table 7
Canadian Education System Experiments

	Net-of-Tax IRR	Gross-of-tax IRR	ETR	ETR - ESR
Male				
100% increase in tuition, no change in credits	7.42	9.63	0.230	-0.013
100% increase in tuition, credit changes	7.72	9.63	0.199	-0.044
Double education amount	8.95	10.94	0.181	-0.062
Flat Income Tax	11.12	10.94	-0.016	-0.259
Female				
100% increase in tuition, no change in credits	10.53	12.37	0.148	-0.087
100% increase in tuition, credit changes	10.93	12.37	0.117	-0.118
Double education amount	12.58	14.01	0.102	-0.133
Flat Income Tax	14.23	14.01	-0.016	-0.251

	Public IRR	Gross-of-Tax IRR	ESR	ETR - ESR
Male				
Cut Expenditures by 20%	8.71	10.94	0.204	-0.004
Female				
Cut Expenditures by 20%	11.24	14.01	0.198	-0.077

Source: See Table 1.