

Access to Postsecondary Education: How Ontario Compares

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Abstract

This research uses the Youth in Transition Survey (YITS) to compare participation in postsecondary education (PSE) in Ontario to such participation in other Canadian regions. We begin by presenting access rates by region, which reveals some substantial differences. University participation rates in Ontario are in about the middle of the pack, while college rates are relatively high. We then undertake an econometric analysis, which reveals that the effects of parental income are quite strong in the Atlantic provinces but much weaker elsewhere, including within Ontario. We also find that the relationship between high school grades and Programme for International Student Assessment (PISA) test scores (measures of academic “performance” and “ability”) differ by region and are generally strongest in Ontario. From this perspective, Ontario would appear to have a relatively “meritocratic” system, where those who are more qualified are more likely to go to university and where overall attendance rates are less affected by family income. Interestingly, the effects of parental education, which are generally much stronger than family income, are similar across provinces. Understanding the reasons underlying these patterns might warrant further investigation.

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Table of Contents

I. Introduction	3
II. Methodology and Data	4
The Econometric Model	4
The YITS Data, the Samples Used and the Definition of Access to PSE	4
III. A Descriptive Analysis of PSE Pathways	5
IV. An Econometric Analysis of Differences in Access	10
Income Effects	11
Overall High School Grade and PISA Reading Score Effects	13
Separate Models by Region	23
Analysis of Fitted Values	24
Differences in Family Income, Overall High School Grade and PISA Reading Score by Region	32
V. Summary and Discussion	41
VI. References	44

I. Introduction

The research on access to postsecondary education (PSE) has made important gains in recent years. We now know, for example, that access appears to be much more strongly related to parental education and other “sociocultural” factors than to family income and other financial factors. We have also learned that academic preparation for PSE, as represented by high school grades and international Programme for International Student Assessment (PISA) test scores (which measure math, science and reading/writing when students are 15 years of age), is another important predictor of who will go to college or university and who will not. These various influences are probably interconnected, rooted in the family and start early in a young person’s life, well before the final years of high school, when they ultimately make their PSE choices. All this helps inform our understanding of PSE in important ways, including from a policy perspective.¹

One important and uniquely Canadian question remains largely unaddressed, however: How does access vary by region? Given the substantial variation among Canadian provinces in terms of provincial funding for PSE, tuition levels, student assistance, credit transfer policies and other important aspects of their PSE systems, as well as the importance of PSE to the future prosperity of each province and the life chances provided to their citizens, this represents an interesting and highly pertinent question.

The contribution of this paper is to exploit the extremely rich information contained in the Youth in Transition Survey, Cohort A (YITS-A) to present new empirical evidence on this issue from an Ontario perspective. We first provide a summary descriptive analysis of access by geographic region. We then carry out an econometric analysis, which probes the cross-Canada differences in terms of the determinants of access, focusing on the university level where the models generally have much more explanatory power, especially with respect to the key family background and grade and test score variables.

Our findings are interesting, and hold some real surprises. We reveal, first of all, that the effects of parental income on access are small at the national level (i.e., when estimated with all regions pooled together), and remain small when examined separately in Ontario, but turn out to be substantially greater in Atlantic Canada. The income effects are also found to be small in Quebec and Western Canada. We then find that the effects of high school grades and PISA test scores (roughly interpretable as measures of academic “performance” and “ability”) on access to PSE are stronger in Ontario than in other regions across the country.

Taken together, these results identify – for the first time as far as we are aware –substantial differences by region in the determinants of who goes to university (in particular) and who does not. Thus, in Ontario, family income matters less and grades and PISA scores are more important, while in some other regions, the opposite is true. Also interesting is the fact that the effects of parental education – perhaps the most consistently and uniformly important determinant of who goes to university – does *not* vary substantially by region. These correlates

¹ See Finnie, Sweetman and Usher (2009) for a recent review, as well as various other papers in Finnie, Mueller, Sweetman and Usher (2009). See also Mueller (2008 and 2009) for a general literature review of the access literature.

are interesting, and important, for any understanding of the challenges facing those concerned with access to PSE both within Ontario and across Canada.

The exact effects of demand side forces (i.e., who wants to go), supply (the number of spots available in the PSE system) and the related rationing mechanisms (who qualifies for a spot in the system) that determine who goes to college and particularly university in each region is not precisely identified in this analysis, but our research points to the existence of important differences and the potential value of further investigations to help answer those questions.

II. Methodology and Data

The Econometric Model

We use a multinomial logit model to estimate access to PSE, differentiating access to college, access to university or no PSE. The model may be expressed as follows:

$$Y = f(\text{Region}, X_1, X_2)$$

Y represents the access outcomes of interest (i.e., no PSE, college, university). Region represents the obvious set of indicators (0-1 dummy variables), which capture overall differences by region. X_1 represents a first set of control variables – including family type, an indicator of rural residence and so on – which are not interacted with region in our analysis except when fully separate models by region are estimated to check the main findings. The X_2 are the key covariates that influence Y that are – in different combinations and in different specifications – interacted with region in order to allow their effects to vary along this dimension. These include family income, overall high school grade and PISA reading score.

The multinomial logit approach has been previously used in Finnie and Mueller (2008, 2009) and in other studies, and treats the particular level of PSE as a jointly determined process, along with the decision to go to PSE. We believe this model represents both the conceptually and econometrically correct treatment (which various tests have further verified).² Furthermore, after the appropriate transformations, this model yields easily interpretable estimates, which provide a full perspective of the effects of the explanatory variables on access to college, access to university and the net effects on the two PSE outcomes relative to non-attendance.

The YITS Data, the Samples Used and the Definition of Access to PSE

The data used in the analysis that follows are taken from the Youth in Transition Survey, Cohort A (generally known as YITS-A). The YITS-A is ideal for this application, since it follows all young people born in 1984 (and thus age 15 as of December 31, 1999) through their high school years and beyond – and is rich in background data and other important determinants of access to PSE. The YITS-A are, in fact, arguably the best data of this type in the world, thus putting

² We have, for example, tested our model against an ordered probit and found that the multinomial logit is indeed appropriate.

Canadians in a privileged position regarding the study of access to PSE. The provincial sampling structure of the YITS-A further provides for representative samples at this level and adequate sample sizes for carrying out analysis by province (or region).

The YITS-A data used here consist of five cycles (corresponding to the surveys and interviews undertaken thus far, with one last cycle scheduled for 2010). The first cycle includes not only questionnaires that were completed by the 15-year-old student respondents, but also interviews that were completed with their parents and high school officials; it also contains the youths' "PISA" (Programme for International Student Assessment, an international standardized test in which Canada participated) test scores in the areas of reading, mathematics and science. Follow-up telephone surveys were carried out with respondents (but not parents or school officials) in 2002, 2004 and 2006.

We chose to use the respondents' PSE status in the 2006 (Cycle 4) survey as the optimal compromise between the ability to identify participation in PSE (which increases with age) and sample size (decreasing over time).³ In this wave of the survey, the young people were 21 years of age, a point at which most had made their initial choices about entering PSE, which is the basis of our analysis.⁴

The dependent variable in our study represents whether the individual enrolled in college or university at any point over the first four cycles of YITS-A, regardless of whether or not they continued in their studies. This is the standard definition of access to PSE used in the literature; continuing on to graduation and other aspects of "persistence" are normally thought of as being a separate process. We differentiate access to college and university, counting the latter (university) if the individual attended both.

All results shown below (except for the absolute sample sizes shown in one table) were generated using the weights constructed by Statistics Canada for the YITS-A, which are designed so that the samples, and any analysis based on them, should reflect the underlying population of youth born in 1984 and thus age 15 and living in Canada in December 1999.

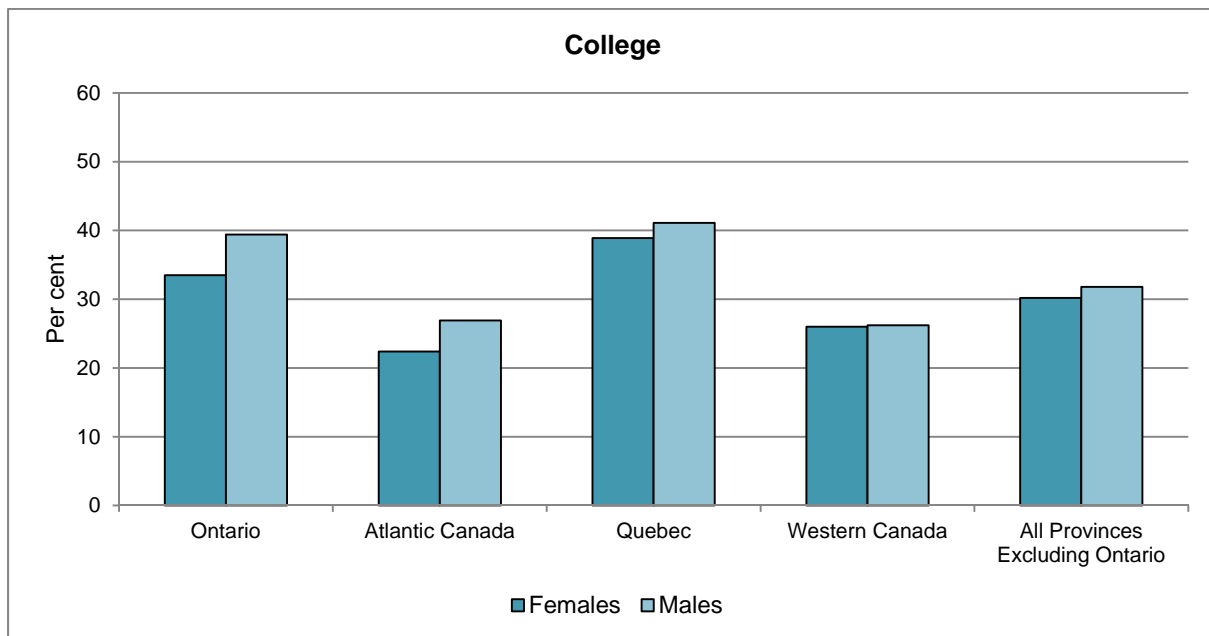
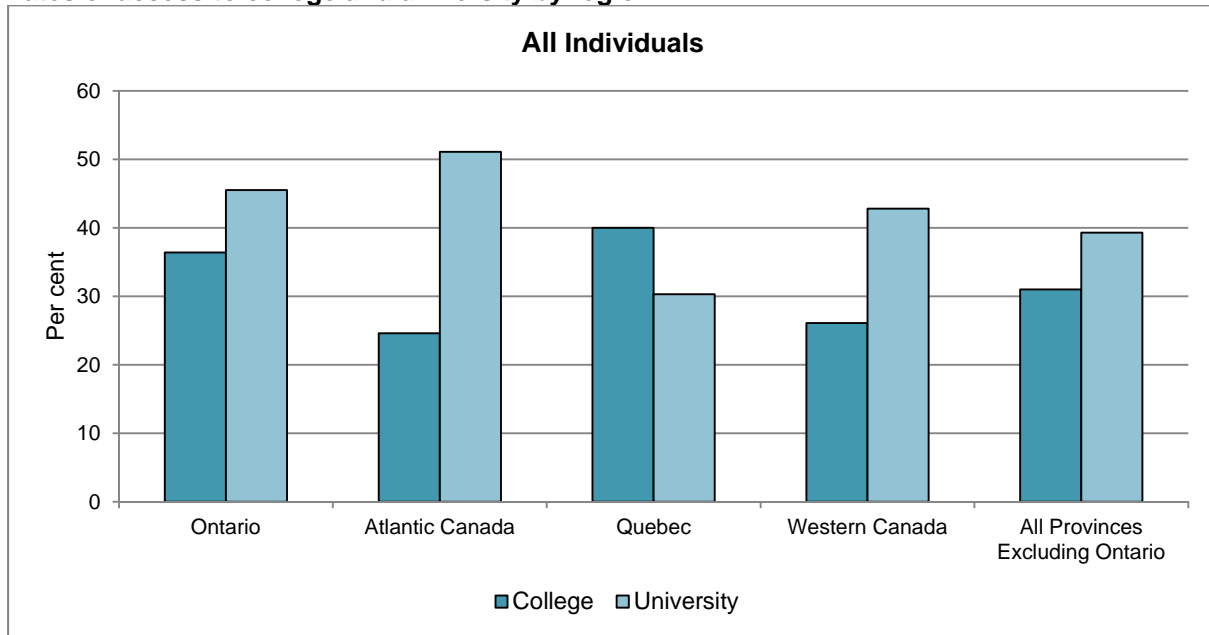
III. A Descriptive Analysis of PSE Pathways

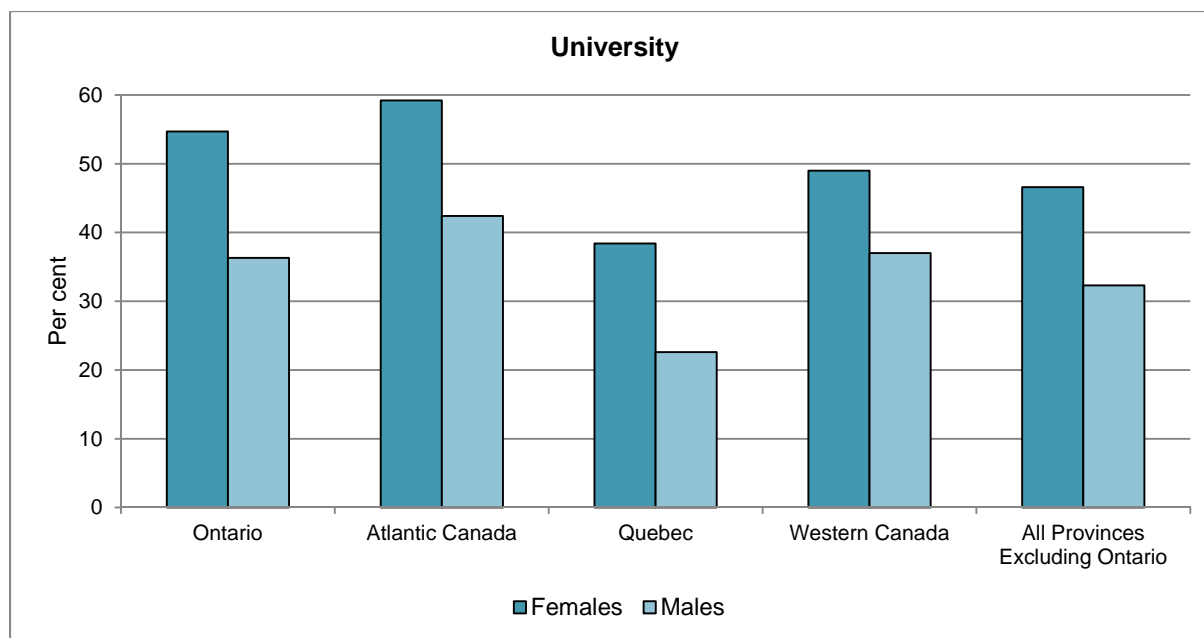
This first part of our analysis is based on a set of figures and tables (Figure 1 and Tables 1a, 1b and 1c) that show rates of participation in PSE in Ontario and other regions for comparison. (Sample sizes are shown in Appendix Table A1.) Rates are shown first for males and females pooled together and then separately.

³ It should be noted that an analysis carried out by the MESA Project indicates that the attrition from the YITS-A does not appear to be a problem, at least for the analysis of access to PSE, since the sample weights appear to do a good job of compensating for the attrition.

⁴ Tests indicate that although PSE access rates do increase over time, the structure of access with respect to background variables does not change in any important ways.

Figure 1
Rates of access to college and university by region





Source: Tables 1a, 1b and 1c.

Table 1a
Rates of access to college and university by income, HS grades and PISA reading scores, all students

	Ontario		Atlantic Canada		Quebec		Western Canada		All Provinces Excluding Ontario	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
All	36.4	45.5	24.6	51.1	40	30.3	26.1	42.8	31	39.3
Family income										
\$5,000 to \$25,000	33.7	38.7	26.6	28.3	40.8	18.1	25.2	33.5	31.4	26.6
\$25,000 to \$50,000	40.9	34.2	30.1	38.9	41.5	20.2	26.9	37.3	33.2	30.7
\$50,000 to \$75,000	36.7	42.7	24.8	56.3	43.2	27.6	28.6	39.5	33.7	37.2
\$75,000 to \$100,000	36.5	47.8	17.9	69.8	37.7	42.7	23.6	47.9	27.5	48.6
\$100,000 and up	31	61.9	10.9	82	31	54.8	24.7	54.4	25.5	57
HS overall grade										
Under 70%	50.5	7.5	30.7	11.6	27.8	5.1	30.6	12.6	29.8	10.4
70% -79%	48.7	33.3	34	39.2	49.8	20.1	32.6	35.2	39.7	29.6
80%-89%	20.4	73.4	16.7	75.4	37.3	49.7	18.4	69.9	25.6	62.7
90%-100%	9.8	88.5	5.5	90.9	18.6	63.3	7.3	87.3	10.6	80.3
PISA score										
< 400	48.2	2.3	30.7	9.6	20.6	3.7	28	8.8	26.4	7.5
400-500	51.7	19.2	35	31	36.2	9.5	30.1	22.4	33.1	19.2
500-600	36	52.3	22.1	63.2	46.3	30.7	29.5	42.9	35.2	40.6
600-700	16.3	77.4	9	85	38.2	56.3	17.6	68.7	24.2	65.8
>= 700	***	92.8	4.9	92.8	21.4	75.5	8.3	86.4	11.7	83.9

Note: *** indicates there was not a large enough sample size to report this rate.

Table 1b
Rates of access to college and university by income, HS grades and PISA reading scores, females

	Ontario		Atlantic Canada		Quebec		Western Canada		All Provinces Excluding Ontario	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
All	33.5	54.7	22.4	59.2	38.9	38.4	26	49	30.2	46.6
Family income										
\$5,000 to \$25,000	33.4	47.9	27.4	36.7	37.6	22	25.4	37	30.6	31.1
\$25,000 to \$50,000	41	40.5	27.7	48.3	44.9	24.1	28.9	41	35.1	35.5
\$50,000 to \$75,000	32	56.1	23.3	64.4	42.6	39	28.9	47.8	33.1	46.9
\$75,000 to \$100,000	33.8	55.7	13.1	78.1	33.6	52.6	20.7	55	24	56.7
\$100,000 and up	25.2	71.2	4.2	92.8	20.2	74.8	23.4	62.4	20.6	69.1
HS overall grade										
Under 70%	53.8	7.7	37.1	13.1	35.9	5.8	33	16.2	34.3	12.9
70%-79%	45.6	41.3	31.1	45.5	47.3	26.8	32.1	40	38.1	35.4
80%-89%	20.7	74.1	16.1	75.6	35.4	56.3	19.1	70.4	24.8	65.9
90%-100%	11.4	88.4	5.2	92.2	14.4	74	9.2	85.7	9.9	83.5
PISA score										
< 400	53.1	***	33.5	8	15.9	***	33.1	11.4	28	9.1
400-500	51.8	24.6	35.8	34.1	38.9	12.5	33.3	25.7	35.7	22.7
500-600	33.1	59.1	19.9	68.8	44.2	37.5	29	46.6	33.6	46.2
600-700	15	82.6	7.9	86	35	60	17.6	71	22.8	68.7
>= 700	***	95.7	7.3	92.7	19.5	80.5	7.4	84.9	11	84.4

Note: *** indicates that there was not great enough sample size to report this rate.

Table 1c
Rates of access to college and university by income, HS grades and PISA reading scores, males

	Ontario		Atlantic Canada		Quebec		Western Canada		All Provinces Excluding Ontario	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
All	39.4	36.3	26.9	42.4	41.1	22.6	26.2	37	31.8	32.3
Family income										
\$5,000 to \$25,000	34.2	26.1	25.5	17.4	44.3	13.8	25	30.2	32.3	21.8
\$25,000 to \$50,000	40.8	27.4	32.9	27.9	37.8	15.8	24.8	33.4	31.2	25.6
\$50,000 to \$75,000	41.6	28.6	26.2	48.4	43.7	18.1	28.3	31.7	34.2	28.5
\$75,000 to \$100,000	38.8	41.2	22.5	61.9	41.5	33.6	26.1	41.4	30.7	41.1
\$100,000 and up	37	52.5	17.3	71.5	39.7	38.8	25.8	47.2	29.8	46.4
HS overall grade										
Under 70%	49.1	7.4	27	10.7	22.6	4.7	29	10.3	27	8.9
70%-79%	51.6	25.7	36.4	33.8	52	14.2	33.1	30.7	41.2	24.4
80%-89%	19.8	72.3	17.8	75	39.4	42	17.5	69.2	26.7	58.5
90%-100%	***	88.6	5.9	88.3	23.9	49.9	4.7	89.5	11.5	75.7
PISA score										
< 400	46.2	2.8	29.3	10.4	22.8	***	26	7.8	25.8	6.9
400-500	51.6	14.7	34.4	28.5	34.5	7.5	27.9	20	31.3	16.7
500-600	39.3	44.5	25.1	55.8	48.5	23.7	30.1	39.1	37	34.7
600-700	18.1	70.6	11	83.1	42.9	50.8	17.6	65.4	26.1	61.8
>= 700	***	87.6	***	93.1	***	66.6	9.7	88.4	12.8	83

Note: *** indicates that there was not a large enough sample size to report this rate.

The overall rate of college participation in Ontario, 36.4 per cent, is surpassed only in Quebec, where students access college at a rate of 40 per cent, which reflects their unique CEGEP system. Turning to university participation, in Ontario we find that 45.5 per cent of all youth access university by age 21. Compared to those in Ontario, young people in Atlantic Canada enroll in university at a greater rate, 51.1 per cent, while university access rates in Quebec and Western Canada are lower than those in Ontario, at 30.3 and 42.8 per cent, respectively.

In Ontario, males access college at greater rates than females (Figure 1 and Tables 1b and 1c), and the same can be said for Atlantic Canada and Quebec, while in Western Canada, males and females access college at about equal rates.

In all regions, females access university at greater rates than males. In Ontario, females access university at a rate of 54.7 per cent, while only 36.3 per cent of males access university by the age of 21. These differences are obviously a large cause for concern, and worthy of their own analysis.

Tables 1a, 1b and 1c also show college and university access rates by parental income, high school grade and PISA reading score levels. In all regions, we see that parental income, overall

high school grades and PISA reading scores are generally positively associated with PSE access. These relationships are discussed further in the following econometric analysis, where the different effects of each of these influences, along with others (including parental education), can be separated out.

IV. An Econometric Analysis of Differences in Access

We have just seen that there exist substantial differences in access to PSE by region, and in this section, we will investigate how some of the major determinants of access – family income, overall high school grade and PISA reading score – differ by region.

It should be noted that we use the terms “determinants” of access, “effects” and so on advisedly, especially with respect to the PISA score and high school grade variables. The reason is that these variables, grades in particular, are likely to be endogenous to PSE access decisions, since those intending to go to PSE are likely to attempt to gain the higher grades that will ensure their acceptance in the postsecondary programs and at the postsecondary institutions in which they would like to enrol, and to succeed when they get there. PISA scores might also be higher for those wanting to go to PSE, since working hard in school would presumably also lead to better test results.

Nevertheless, the empirical relationships are interesting, and they point to potentially important differences in PSE systems across provinces in terms of (1) the role of family income in determining young people’s PSE choices, their preparation for being accepted into programs and their ability to pay for this education and (2) the role of high school grades and the academic capacity and achievement represented in PISA scores in these same processes. “Effects,” “determinants” and so on should be interpreted in this context, and not as necessarily representing strictly causal influences.

Family income (actually restricted to the parents’ income excluding all children’s income and given here in thousands of dollars) captures the effects of not only the family’s financial resources, but also other factors that are correlated with income and are not otherwise controlled for in the model but that also affect PSE access for young people. That said, our models also include parental education (measured as the highest credential earned by either parent). Not only should parental education be expected to capture a range of family characteristics and influences that income might pick up in the absence of the education variable, but it has also been found to be, overall, a substantially more important determinant of access to PSE (especially university) than income,⁵ a result which is again found here. While we are tempted to interpret the income variables as capturing true “income effects,” these do not necessarily work solely by making PSE more affordable for young people from those families, as we discuss further below.

The high school grade variable used here is the individual’s overall grade average, out of a hundred, measured during their last year in high school. This is given in grade ranges in the YITS survey (> 90, 80-90, 70-80, etc.), but we have converted these to a linear variable, using

⁵ See Finnie and Mueller (2008, 2009).

the relevant adjusted mid-points within each grade range (94, 85, 75, etc.), so as to reduce the number of parameters to be estimated and thus gain efficiency in the estimation of our model, which is especially important when grades are interacted with region.⁶

The PISA score is given in points, the score given in the YITS being normalized to have a mean of 500 and a standard deviation of 100 across all individuals in all countries participating in the test.

To make the grade and PISA scores more directly comparable in terms of the magnitudes of their effects, the average grade variable was divided by 10, thus yielding the effect of a 10-point difference in grades, while the PISA score was divided by 100, meaning the effect we report captures a difference of that much (i.e., one standard deviation). For similar reasons, the income variable we use is scaled to represent a \$10,000 difference in income. Of course, arbitrary scale adjustments do not affect the actual estimation in any meaningful way but make reading the results a little easier and interpretation perhaps a little more intuitive.

All regressions in our analysis, excluding (naturally) those in the separate models by region, include 0-1 regional indicators for Atlantic Canada, Quebec and Western Canada. We use Ontario as the baseline region for comparison. Also, all models include a set of controls that have been found to be significant in earlier work: gender, urban-rural location (high school), language, family type (two parents, single parent, etc.), parental education and visible minority and immigrant status. These controls are not interacted with region except (again implicitly) in the separate models by region that appear later.

Income Effects

Table 2a presents a set of models that capture our first explorations of the regional differences in access patterns. The column labelled “Separately, without Interactions” reports the results of three separate models where the family income, overall high school grade and PISA reading score variables are included by themselves with the aforementioned controls. These models are estimated at the national level (i.e., including individuals from all provinces and regions). The column “Jointly, without Interactions” reports the results when family income, overall high school grade and PISA reading score variables are included in the regression together.

These results show, first, that at the national level, the income effects are positive and statistically significant at the 1 per cent confidence level. That is, “family income matters.”

But the results also show that the income effects are not as large as some may have expected, given the attention income often receives in discussions regarding access to PSE. For every additional \$10,000 in family income (the unit of measure of the income variable included in the models, as explained above), the .009 effect indicated in the table means that, on average, university access rates would be only 0.9 percentage points higher in the “separately” model

⁶ We have tested using the categorical grade variables, and the results are consistent with those reported here. We use the individual's overall grade average instead of other specific grades (math, English/French, sciences) because past work (Finnie & and Mueller, 2008, 2009) has revealed the overall grade to be the strongest determinant of university access in the YITS data.

and just 0.5 percentage points higher according to the jointly estimated specification (i.e., where grades and PISA scores are also included).

That is, access rates would – again on average and holding other factors constant – differ by less than a single percentage point in two families having this \$10,000 difference in incomes. The effects of a difference in family income of, say, \$50,000 (e.g., one family having an income of \$50,000 and another \$100,000) are five times greater but still amount to only 4.5 percentage points in the “separately” model and 2.5 percentage points when income is treated jointly with grades and PISA scores. With overall university access rates of 45.5 percent in Ontario, these could perhaps be termed “significant” but “not especially large” effects.

The income effects may also be seen in contrast to the effects of parental education, where each additional year of parental schooling is associated with a difference of 3.1-3.3 percentage points in access rates in the jointly estimated models (shown below in the separate models by region); in other words, a single year of parental education has a greater impact on the likelihood of a son/daughter attending PSE than does an extra \$50,000 in parental income.

The differences in the “separately” “and jointly” models are due to the correlation of the relevant variables – family income, overall high school grade and PISA reading score – and their related effects on access. That is, individuals with higher family incomes also tend to have higher grades and higher PISA scores. Considering these variables in isolation (i.e., “separately”) will tend to result in each of these variables picking up some of the effects of the others, resulting in biased estimates of the individual effects. Treating them together, however, fails to take into account the fact that one manner in which income works to affect access is through grades and PISA scores. The “true” (independent) effect of each variable, including income, is likely to lie between these different estimates. Together, though, the results paint a useful empirical portrait of the effects of each variable and how they are related.

We then, in the third set of columns of Table 2a, add interactions of region with each of the three variables: family income, overall high school grade and PISA reading scores. Here, this is done in three separate models, where each model includes only one of the three variables, along with the associated regional interactions. The results are quite dramatic. The general, or baseline income, effect, which now represents the income effect for Ontario (since by design it is the only region without an income interaction) is 0.010 for university participation – very close to the 0.09 previously found at the national level, but for Atlantic Canada, we add to that an additional effect of 0.020, as captured by the relevant interaction term, or .030 in total. Otherwise put, the effect of a difference in family income of \$10,000 is one percentage point in Ontario (the .010 estimate). but around 3 percentage points (the .030 estimate) in Atlantic Canada – three times as great. (As indicated, the net effect for each region is arrived at by adding the region-specific effect to the baseline effect, as is standard for models of this type, which include such sets of interactions.) At larger income differences, these effects are obviously commensurately greater (always three times as great – the .010 and .030 effects for each \$10,000 of family income). The interaction terms for Quebec and Western Canada are not statistically significant, however, indicating that the income effects are no different from those in Ontario.

In the last equation of Table 2a, labelled “Jointly, with Interactions”, the interactions of each region with each of the three variables (family income, overall high school grades and PISA reading score) are all included in the same model. The estimated income effect for Ontario with

the interactions by region taken into account is again similar to what was found in the first jointly estimated model which did not have those interactions (Model 2 shown in the table), but the statistical significance of the estimate is reduced to the 10 per cent confidence level (i.e., it is not necessarily different from zero – at least partly because of the smaller sample size for Ontario alone as compared to the previous national estimate). By contrast, the Atlantic Canada income effect is again three times as great – .006 plus .012, or about .018, or just under 2 percentage points for every \$10,000 in income. The interaction terms for Quebec and Western Canada are again not statistically significant; in other words, the effects do not appear to be meaningfully different from those for Ontario.

In short, although family income has a rather small effect when estimated at the national level, this covers up some important differences at the regional level, and the effects are, in fact, quite strong in Atlantic Canada in particular.

From Table 2a, we can also see that the income effect as it relates to college access (See the “Coll” columns for each set of results) is, unlike the effect for university attendance, consistently small and insignificant in all specifications.

In response to recent interest in gender trends that are showing women attending universities in particular at much higher rates than men and in response to previous findings in related work by the authors that the effects of family income are greater for females than males (e.g., Finnie & Mueller, 2008, 2009), the above models were also estimated by gender. The results of those models are reported in Tables 2b and 2c. They generally mirror the regional patterns described above: there are stronger income effects in Atlantic Canada than in Ontario and elsewhere for both males and females. The only difference is that the income effects are generally stronger for females than males while following the same regional patterns in both cases. The pooled models previously seen thus essentially represent the average of these different effects for males and females. Of particular note, perhaps, is the fact that for males, the income effect is not statistically significant when grades and PISA reading scores are included in the model, except in Atlantic Canada.

Overall High School Grade and PISA Reading Score Effects

Grade and PISA score effects are also found in Table 2a. The overall effect of grades is strong (as found in earlier work at the national level). Throughout all model specifications, the grade variable is significant at the 1 per cent level. In the first equation, when the grade variable is included by itself (along with the usual controls), we find its effect on access to university to be 0.213. When the income and PISA reading score variables are added to the model, the effect is reduced to 0.152. A 10-point difference in grades (the unit of measure of the grade variable) is thus, on average, associated with a 15.2 higher percentage point probability of accessing university – a large effect.

In the third column of Table 2a, where the high school overall grade variable is included by itself, along with interactions with region (and the usual controls), we see that the grade effect differs significantly across regions. The estimates suggest that each 10-point difference in average grades translates into a 24.3 percentage point difference in the probability of university attendance for Ontario (again the baseline province in these models). Compared to Ontario, the effect of grades is about 5 percentage points smaller in Quebec and Western Canada. Atlantic

Canada's grade effect is not significantly different from that of Ontario, but the point estimate is also negative.

In the fourth column of Table 2a, where the interactions of each region with each of the three variables (family income, overall high school grade and PISA reading score) are included, the Quebec and Western Canada grade effects continue to be significantly weaker than Ontario's. Atlantic Canada's grade effect also becomes significantly smaller than that of Ontario in this specification, although only at the 10 per cent significance level, and the difference is only about three percentage points. One could postulate that the particularly small high school grade effects in Quebec reflect the fact that students normally attend CEGEP before accessing university, and CEGEP grades may reduce the impact of high school grades when it comes to that access. For the other provinces, no such explanation presents itself, and the results are intriguing. Is there something about the Ontario educational system – at either the secondary or the postsecondary level (or both) – that does a better job of sorting better students into university or encouraging them to go to university?

The overall effects of PISA reading scores are also strong throughout our models. Omitting the income and grade effects, the PISA score effect (on its own) on university attendance is found to be 0.214, while adding in the income and grades variables reduces the effect to 0.138. A one standard deviation difference in the PISA score thus translates (in the latter specification) into almost a 14 percentage point difference in the expected probability of accessing university. In all specifications shown in Table 2a, the effects of the PISA reading score variable are statistically significant.

With the regional interactions added to the model, the effects PISA reading score are again strong, here again with important regional differences. Omitting the income and grade effects, a 100-point (one standard deviation) difference in PISA scores is associated with a 26.2 percentage point difference in the probability of accessing university for an individual living in Ontario (the baseline), but the effects are significantly smaller in all other regions. The difference from the baseline Ontario effect is about 5 percentage points in Atlantic Canada, 4 percentage points in Quebec and 9 percentage points in Western Canada.

In the final column of Table 2a, where family income, overall high school grade and PISA reading score are included, along with all the regional interactions, we see roughly the same patterns. The effect of PISA scores is greatest in Ontario and weaker everywhere else. It is worth emphasizing that while high school grades and PISA scores might be expected to capture approximately the same thing, thus being highly correlated and difficult to sort out in a model, when included together, they in fact each remain statistically significant and substantial in magnitude and show some important differences across regions. For example, in the case of Ontario, 10 points on a high school grade average is associated with a 17.6 percentage point higher probability of university attendance, while 100 points on the PISA score is worth 18.5 percentage points, and in both cases, these effects are significantly greater than in other regions.

From Table 2a, we can also see the grades and PISA score effects as they relate to college access. We have seen that the positive effects of grades and PISA scores on university access are smaller (i.e., less positive) in other regions than in Ontario, but the negative effects of grades and PISA scores on college access are also smaller (i.e., less negative) in other regions than in Ontario.

Table 2a
Multinomial estimates of access to college and university: Regions pooled, all students

	Separately, without Interactions		Jointly, without Interactions		Separately, with Interactions		Jointly, with Interactions	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
Parental income	-0.001 [0.002]	0.009*** [0.002]	-0.000 [0.002]	0.005*** [0.002]	-0.000 [0.004]	0.010*** [0.004]	0.001 [0.004]	0.006* [0.003]
Parental income* – Atlantic Canada					-0.008 [0.005]	0.020*** [0.005]	-0.006 [0.005]	0.012*** [0.004]
Parental income* – Quebec					-0.002 [0.005]	0.001 [0.005]	-0.002 [0.005]	0.001 [0.004]
Parental income* – Western Canada					-0.001 [0.004]	-0.007 [0.004]	-0.002 [0.004]	-0.003 [0.003]
HS overall grade	- 0.078*** [0.005]	0.213*** [0.004]	-0.057*** [0.006]	0.152*** [0.005]	- 0.105*** [0.011]	0.243*** [0.007]	- 0.074*** [0.012]	0.176*** [0.010]
HS overall grade* – Atlantic Canada					0.034** [0.016]	-0.027 [0.017]	0.031* [0.016]	-0.027* [0.016]
HS overall grade* – Quebec					0.067*** [0.017]	-0.053*** [0.019]	0.033* [0.018]	- 0.051*** [0.017]
HS overall grade* – Western Canada					0.030* [0.016]	- 0.049*** [0.016]	0.019 [0.016]	-0.036** [0.015]
PISA reading score	-0.070*** [0.006]	0.214*** [0.005]	-0.037*** [0.007]	0.138*** [0.006]	- 0.112*** [0.012]	0.262*** [0.010]	- 0.075*** [0.014]	0.185*** [0.013]
PISA reading score* – Atlantic Canada					0.023 [0.017]	- 0.048*** [0.017]	0.018 [0.018]	- 0.052*** [0.016]
PISA reading score* – Quebec					0.126*** [0.018]	-0.042** [0.020]	0.118*** [0.020]	-0.045** [0.019]
PISA reading score* – Western Canada					0.041** [0.017]	- 0.091*** [0.016]	0.037** [0.017]	- 0.084*** [0.015]
Observations	15,913		15,913		15,913		15,913	

Notes: Average marginal effects are shown. Standard errors appear in brackets. ***p < 0.01 **p < 0.05 * p < 0.1. The "Separately" columns report the results of three separate models run, where the income, grades and reading scores variables are included individually. The "Jointly" columns report the results with the parental income, overall high school (HS) grade and PISA reading score variables included together. The grade variable is the students' overall high school average divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00. All regressions included control variables which account for province/region, gender, the urban/rural location of students' high school, language minority status, family type, parental education, visible minority status and immigrant status.

The negative college effects reflect the net influence that grades and PISA scores (as well as income) have on two opposing processes: (1) positive effects on participation in PSE at any level (i.e., either college or university), thus implying a positive effect on college participation, and (2) a tendency to choose university over college for those who decide to go to PSE (hence a negative effect on college attendance per se).

As already referred to above, all models were also estimated for females and males separately. The results of those analyses are reported in Tables 2b and 2c and generally mirror the findings described above.

Table 2b
Multinomial estimates of access to college and university: Regions pooled, females

	Separately, without Interactions		Jointly, without Interactions		Separately, with Interactions		Jointly, with Interactions	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
Parental income	-0.003 [0.003]	0.016*** [0.004]	-0.001 [0.003]	0.010*** [0.002]	-0.003 [0.006]	0.014* [0.008]	-0.001 [0.006]	0.008** [0.004]
Parental income* – Atlantic Canada					-0.008 [0.007]	0.022** [0.009]	-0.005 [0.007]	0.014*** [0.005]
Parental income* – Quebec					-0.003 [0.007]	0.017* [0.009]	-0.002 [0.008]	0.012** [0.006]
Parental income* – Western Canada					0.003 [0.006]	-0.004 [0.008]	0.002 [0.006]	-0.001 [0.004]
HS overall grade	-0.091*** [0.008]	0.214*** [0.005]	-0.060*** [0.009]	0.144*** [0.007]	-0.104*** [0.017]	0.242*** [0.011]	-0.062*** [0.018]	0.163*** [0.014]
HS overall grade* – Atlantic Canada					0.002 [0.025]	-0.021 [0.024]	-0.002 [0.025]	-0.020 [0.022]
HS overall grade* – Quebec					0.039 [0.026]	-0.028 [0.028]	-0.003 [0.028]	-0.022 [0.026]
HS overall grade* – Western Canada					0.017 [0.025]	-0.054** [0.023]	0.006 [0.025]	-0.034 [0.021]
PISA reading score	-0.085*** [0.008]	0.229*** [0.006]	-0.048*** [0.010]	0.152*** [0.009]	-0.122*** [0.019]	0.295*** [0.014]	-0.082*** [0.022]	0.217*** [0.019]
PISA reading score* – Atlantic Canada					0.005 [0.027]	-0.054** [0.025]	0.006 [0.027]	-0.060** [0.024]
PISA reading score* – Quebec					0.132*** [0.027]	-0.084*** [0.030]	0.141*** [0.030]	-0.100*** [0.028]
PISA reading score* – Western Canada					0.030 [0.025]	-0.111*** [0.023]	0.022 [0.027]	-0.098*** [0.023]
Observations	8,154		8,154		8,154		8,154	

Notes: Average marginal effects are shown. Standard errors appear in brackets. ***p < 0.01 **p < 0.05 *p < 0.1. The "Separately" columns report the results of three separate models run, where the income, grades and reading scores variables are included individually. The "Jointly" columns report the results with the income, grades and reading score variables included together. The grade variable is the students' overall high school grade divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00. All regressions included control variables, which account for province/region, the urban/rural location of students' high school, language minority status, family type, parental education, visible minority status and immigrant status.

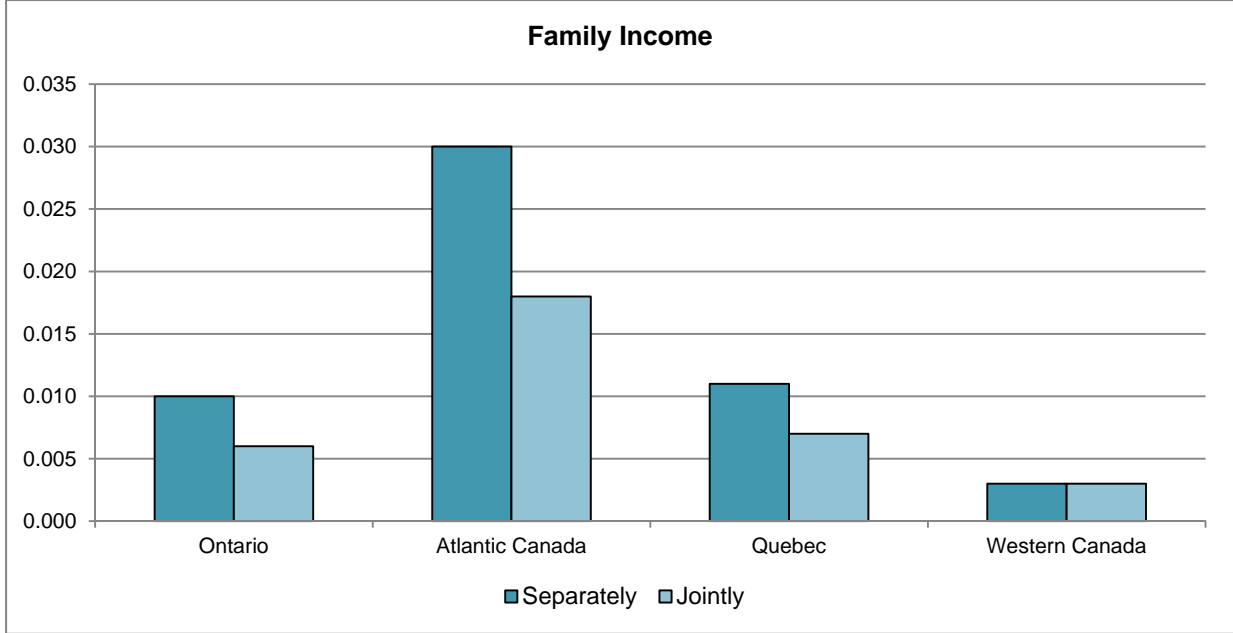
Table 2c
Multinomial estimates of access to college and university: Regions pooled, males

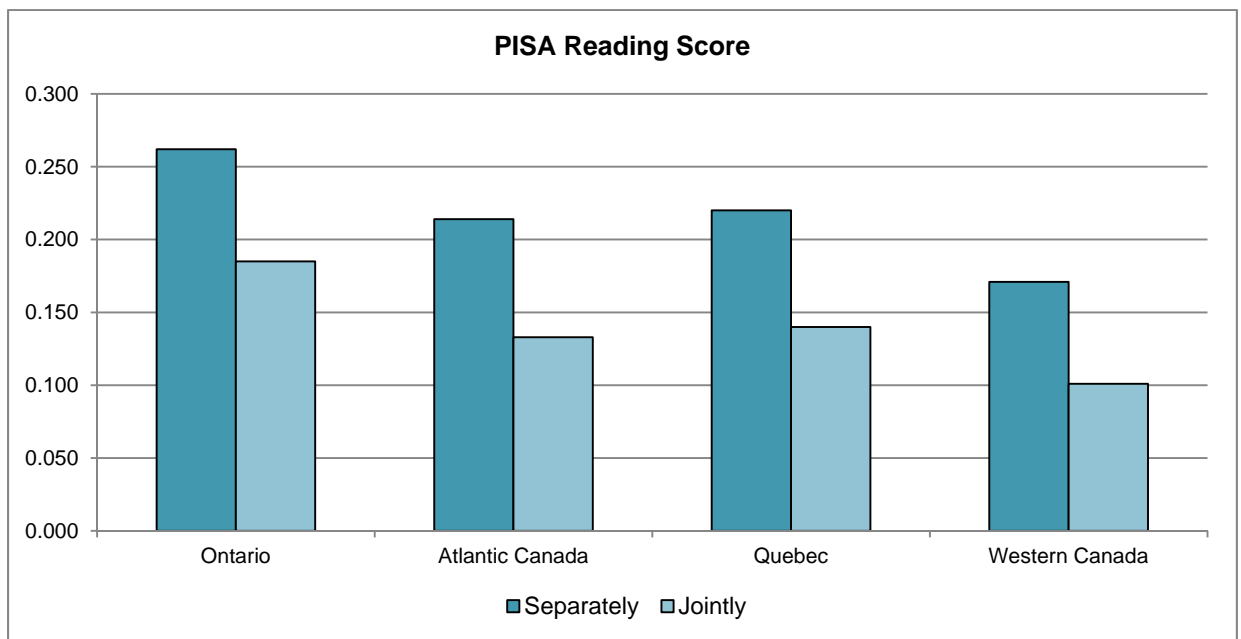
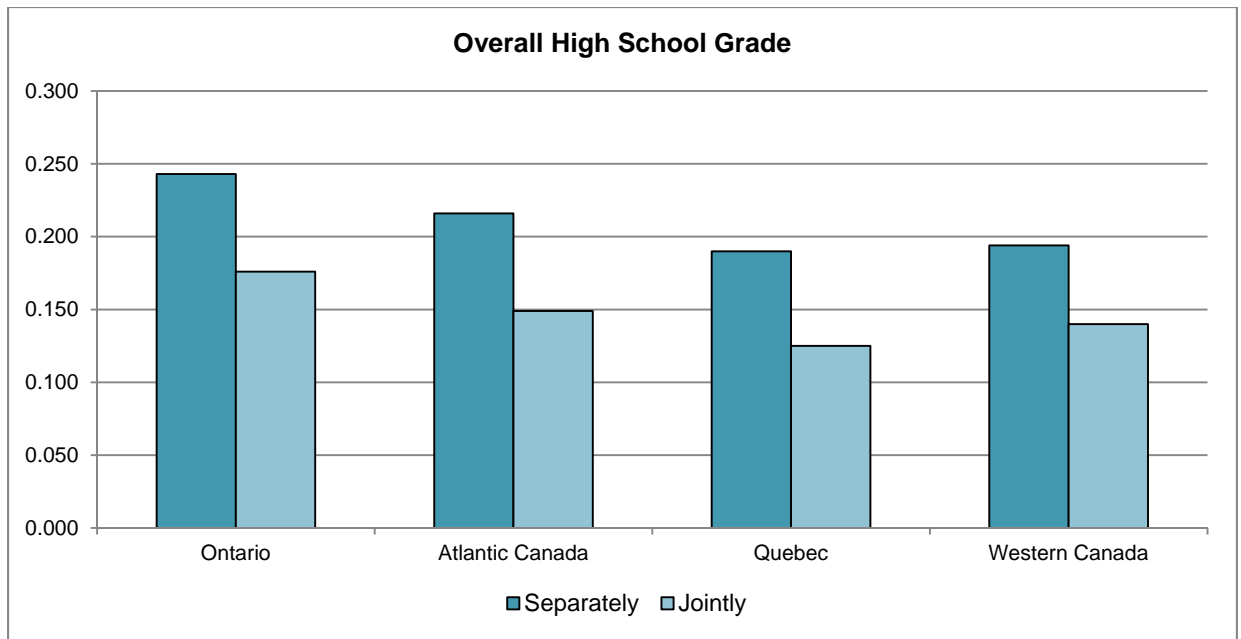
	Separately, without Interactions		Jointly, without Interactions		Separately, with Interactions		Jointly, with Interactions	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
Parental income	-0.000 [0.002]	0.005*** [0.002]	-0.000 [0.002]	0.002 [0.001]	0.002 [0.005]	0.009** [0.004]	0.003 [0.004]	0.004 [0.003]
Parental income* – Atlantic Canada					-0.007 [0.006]	0.018*** [0.005]	-0.007 [0.006]	0.011** [0.004]
Parental income* – Quebec					-0.002 [0.006]	-0.004 [0.005]	-0.002 [0.005]	-0.003 [0.004]
Parental income* – Western Canada					-0.003 [0.005]	-0.008** [0.004]	-0.003 [0.004]	-0.004 [0.003]
HS overall grade	-0.069*** [0.006]	0.217*** [0.006]	-0.057*** [0.008]	0.162*** [0.007]	-0.104*** [0.014]	0.248*** [0.010]	-0.083*** [0.015]	0.190*** [0.014]
HS overall grade* – Atlantic Canada					0.063*** [0.021]	-0.030 [0.024]	0.059*** [0.021]	-0.031 [0.023]
HS overall grade* – Quebec					0.092*** [0.021]	-0.075*** [0.025]	0.060*** [0.023]	-0.074*** [0.024]
HS overall grade* – Western Canada					0.036* [0.021]	-0.041* [0.023]	0.026 [0.022]	-0.033 [0.022]
PISA reading score	-0.055*** [0.007]	0.204*** [0.006]	-0.026*** [0.009]	0.127*** [0.009]	-0.095*** [0.016]	0.239*** [0.015]	-0.061*** [0.019]	0.161*** [0.018]
PISA reading score* – Atlantic Canada					0.031 [0.022]	-0.043* [0.023]	0.022 [0.023]	-0.046** [0.021]
PISA reading score* – Quebec					0.116*** [0.025]	-0.006 [0.028]	0.096*** [0.026]	-0.005 [0.025]
PISA reading score* – Western Canada					0.042* [0.022]	-0.075*** [0.022]	0.040* [0.023]	-0.076*** [0.020]
Observations	7,759		7,759		7,759		7,759	

Notes: Average marginal effects are shown. Standard errors appear in brackets. ***p < 0.01 **p < 0.05 *p < 0.1. The "Separately" columns report the results of three separate models run where the income, grades and reading score variables are included individually. The "Jointly" columns report the results with the income, grades and reading score variables included together. The grade variable is the students' overall high school grade divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00. All regressions included control variables, which account for province/region, the urban/rural location of students' high school, language minority status, family type, parental education, visible minority status and immigrant status.

In Figure 2a, we graph the average marginal effects of each of the three variables (family income, overall high school grade and PISA reading score) on the probability of university access for each region. These effects are taken from the final model in Table 2a (“Jointly, with Interactions”), and thus includes all three variables and all the regional interactions. Figures 2b and 2c show the results for the models run for females and males separately. These three sets of graphs nicely summarize the patterns seen and discussed above.

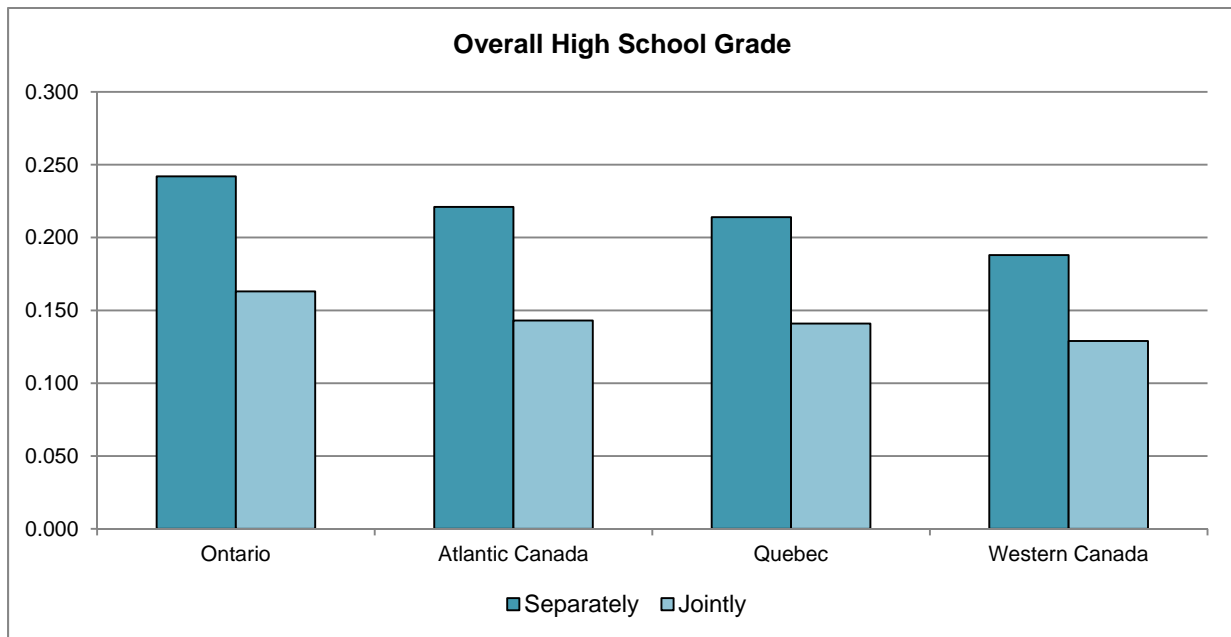
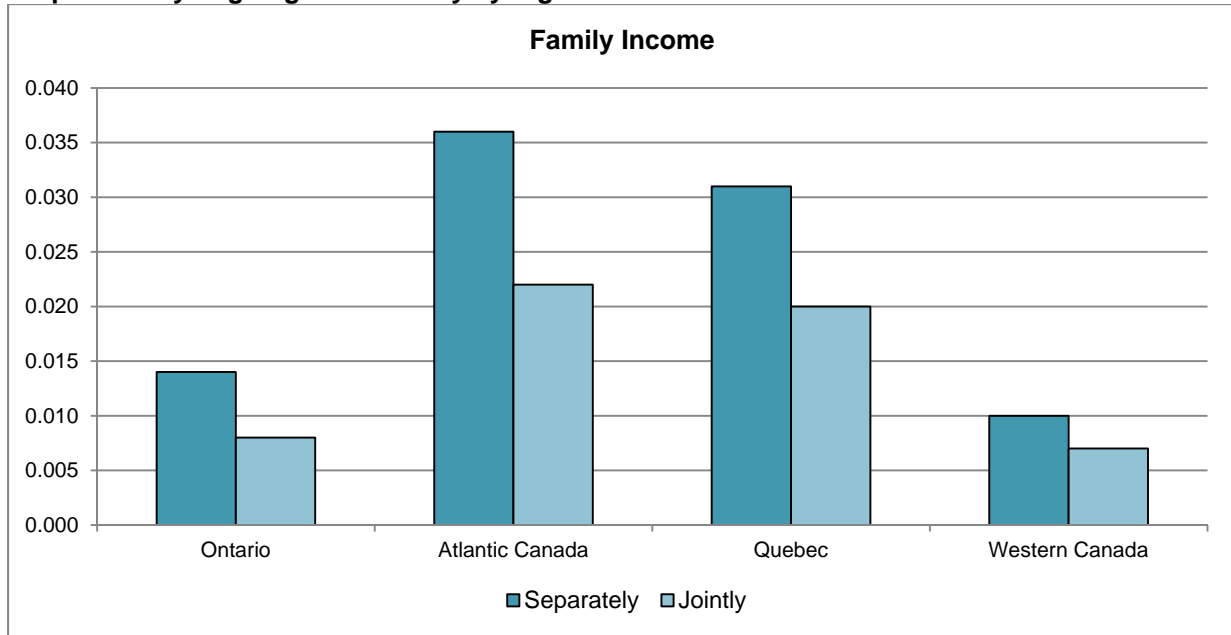
Figure 2a
Average marginal effects of family income, overall high school grade and PISA reading score on the probability of going to university by region: all individuals

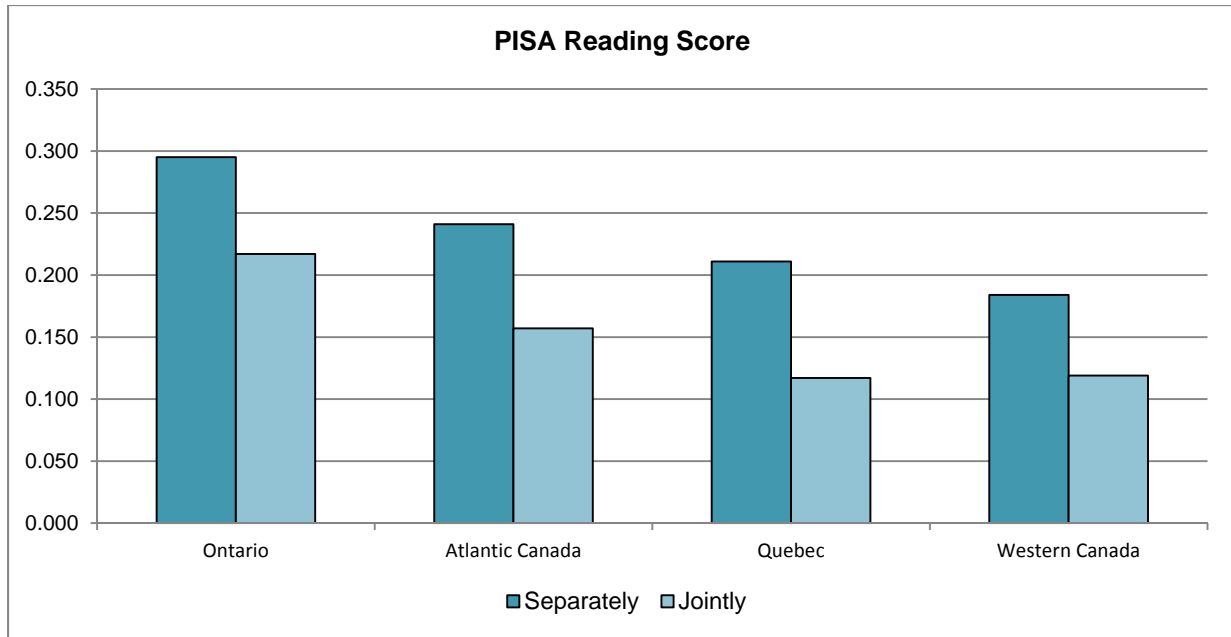




Source: Table 2a, columns “Separately, with Interactions” and “Jointly, with Interactions.” Each variable (family income, overall high school grade, PISA reading score) has an overall or baseline effect that relates to all students in Canada. Using interaction terms allows for the estimation of separate effects in each region relative to the overall effect (which on its own applies to Ontario, since it has no extra interaction). To calculate the effects in Atlantic Canada, Quebec and Western Canada, the effects associated with each region’s interaction term is summed with the overall effect or baseline effect. These graphs represent those effects.

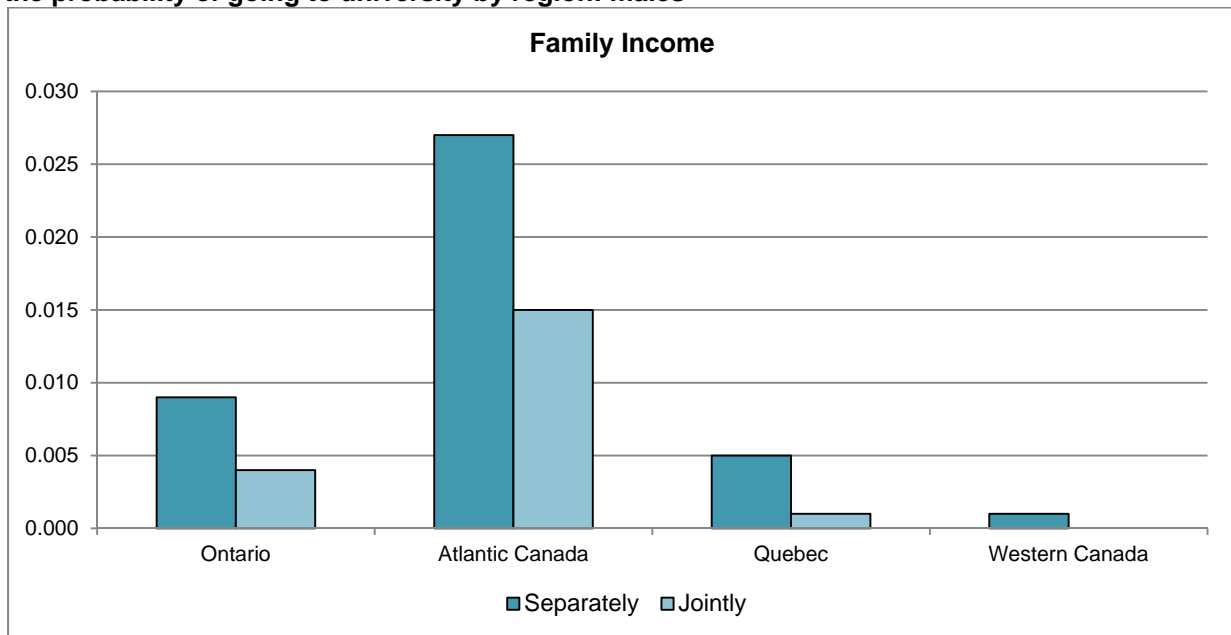
Figure 2b
Average marginal effects of family income, overall high school grade and PISA reading score on the probability of going to university by region: females

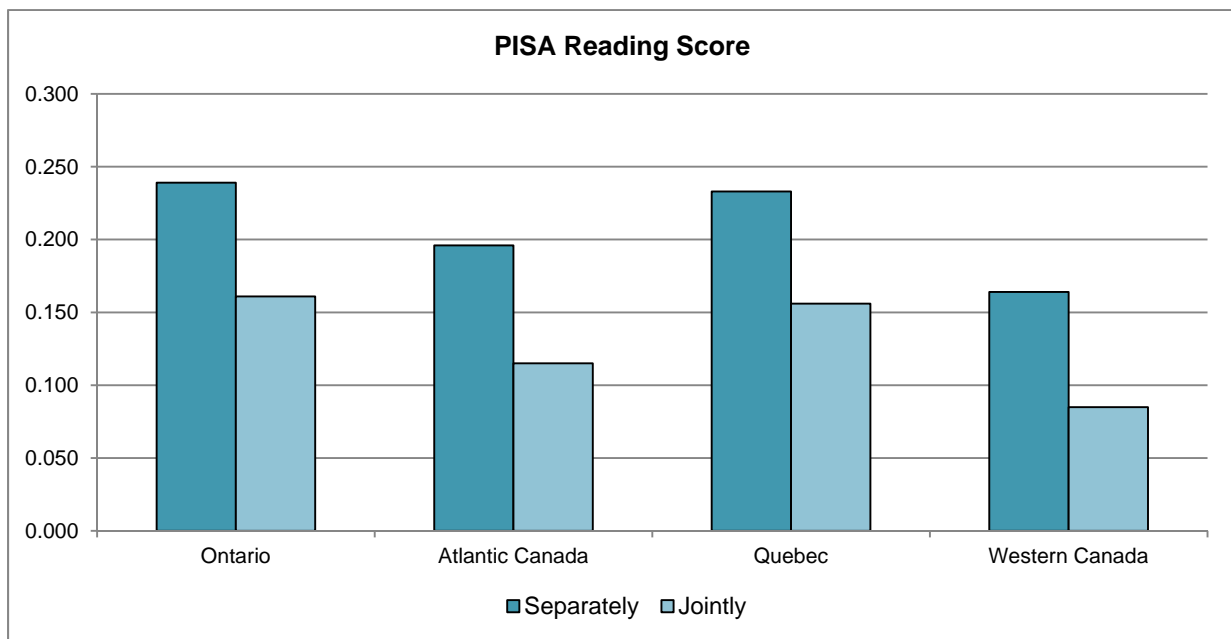
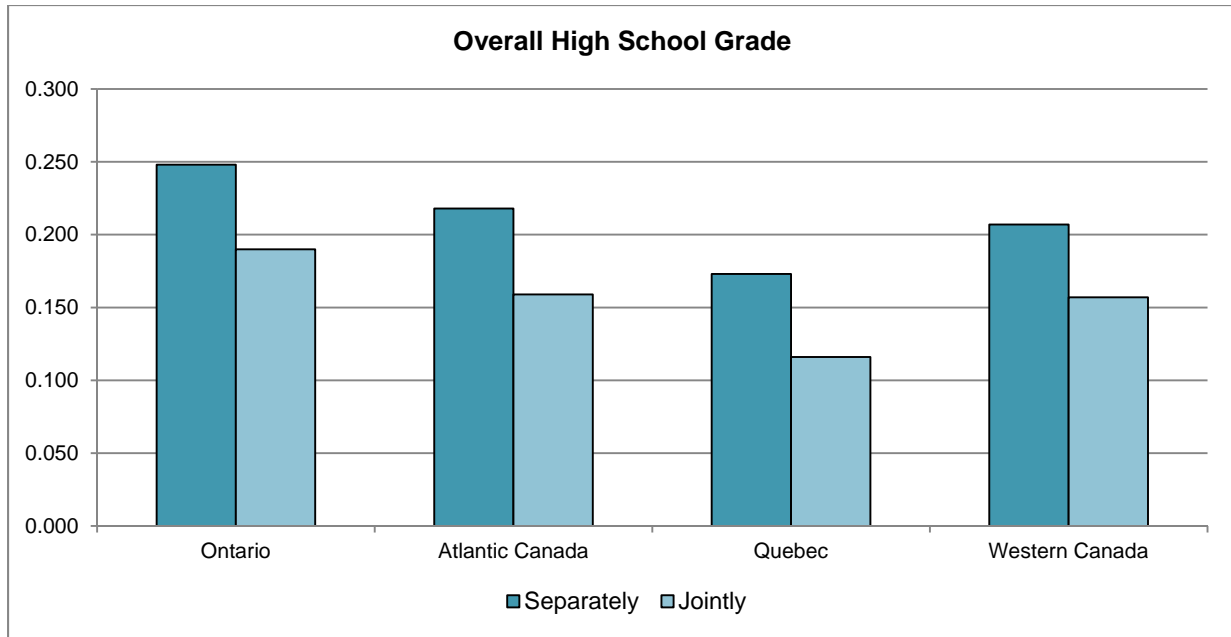




Source: Table 2b, columns “Separately, with Interactions” and “Jointly, with Interactions.” Each variable (family income, overall high school grade, PISA reading score) has an overall or baseline effect that relates to all students in Canada. Using interaction terms allows for the estimation of separate effects in each region relative to the overall effect (which on its own applies to Ontario, since it has no extra interaction). To calculate the effects in Atlantic Canada, Quebec and Western Canada, the effects associated with each region’s interaction term is summed with the overall effect or baseline effect. These graphs represent those effects.

Figure 2c
Average marginal effects of family income, overall high school grade and PISA reading score on the probability of going to university by region: males





Source: Table 2c, columns: “Separately, with Interactions” and “Jointly, with Interactions.” Each variable (family income, overall high school grade, PISA reading score) has an overall or baseline effect that relates to all students in Canada. Using interaction terms allows for the estimation of separate effects in each region relative to the overall effect (which on its own applies to Ontario, since it has no extra interaction). To calculate the effects in Atlantic Canada, Quebec and Western Canada, the effects associated with each region’s interaction term is summed with the overall effect or baseline effect. These graphs represent those effects.

Separate Models by Region

Table 3a shows the results when separate models are run for each region. The effects of family income, overall high school grade and PISA reading score are shown, along with the effects of the other control variables. Although the latter are not the focus of our analysis, it is interesting to notice the relative uniformity of the parental education effect, in particular, across regions. Thus, whatever the family income variable is capturing with respect to socioeconomic status, it appears to be distinctly different from what parental education is capturing, and while the one effect varies by region, the other does not. This makes the income findings, in particular, all the more interesting.

Table 3a
Multinomial estimates of access to college and university: Regions separately, all students

	Ontario		Atlantic Canada		Quebec		Western Canada	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
Female	-0.012 [0.022]	0.064*** [0.018]	-0.014 [0.012]	0.053*** [0.012]	-0.027 [0.020]	0.104*** [0.018]	0.013 [0.014]	0.045*** [0.013]
HS location – Urban (Rural)	-0.023 [0.029]	0.056** [0.026]	-0.080*** [0.012]	0.076*** [0.013]	0.004 [0.026]	0.020 [0.021]	-0.032** [0.015]	0.051*** [0.014]
French minority	-0.023 [0.033]	0.088*** [0.029]	-0.028* [0.016]	0.085*** [0.017]			-0.087** [0.038]	0.105*** [0.040]
English minority					0.045 [0.030]	0.062*** [0.021]		
Family type (Two parents)								
Mother only	0.002 [0.037]	-0.031 [0.028]	-0.017 [0.020]	0.010 [0.022]	-0.001 [0.033]	-0.010 [0.028]	-0.027 [0.023]	-0.016 [0.024]
Father only	0.103 [0.082]	-0.069 [0.069]	-0.066* [0.037]	0.033 [0.050]	-0.008 [0.054]	-0.041 [0.043]	0.039 [0.056]	-0.062 [0.052]
Other	-0.078 [0.109]	0.025 [0.110]	0.050 [0.077]	-0.101 [0.098]	0.149 [0.109]	-0.069 [0.097]	-0.080* [0.045]	-0.029 [0.052]
Visible minority/Immigrant status (Non-visible minority born in Canada)								
Visible minority born in Canada	-0.073* [0.038]	0.130*** [0.031]	-0.090** [0.040]	0.145*** [0.050]	0.007 [0.050]	0.191*** [0.042]	0.024 [0.026]	0.171*** [0.026]
Non-visible minority immigrant	-0.031 [0.064]	-0.016 [0.046]	0.008 [0.115]	0.049 [0.106]	0.097 [0.093]	-0.080 [0.073]	0.039 [0.050]	0.097** [0.043]
Visible minority immigrant	-0.084* [0.045]	0.197*** [0.042]	0.127 [0.104]	0.086 [0.103]	0.070 [0.075]	0.013 [0.062]	-0.009 [0.033]	0.243*** [0.035]

Parental education (# of years)	-0.012** [0.005]	0.031*** [0.004]	-0.011*** [0.003]	0.030*** [0.003]	-0.004 [0.005]	0.030*** [0.004]	-0.008** [0.003]	0.033*** [0.003]
Parental income	0.001 [0.004]	0.004 [0.003]	-0.005* [0.003]	0.019*** [0.003]	-0.002 [0.004]	0.006* [0.004]	-0.000 [0.002]	0.003* [0.002]
HS overall grade	-0.079*** [0.012]	0.160*** [0.010]	-0.052*** [0.007]	0.155*** [0.007]	-0.044*** [0.012]	0.121*** [0.010]	-0.044*** [0.008]	0.162*** [0.007]
PISA reading score	-0.085*** [0.015]	0.170*** [0.012]	-0.057*** [0.008]	0.133*** [0.008]	0.054*** [0.014]	0.119*** [0.012]	-0.030*** [0.009]	0.118*** [0.008]
Observations	2,354		5,440		2,463		5,656	

Notes: Average marginal effects are shown. Omitted categories are in parentheses. Standard errors are in brackets. ***p < 0.01 **p < 0.05 * p < 0.1. The grade variable is the students' overall high school grades divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00.

These estimates mirror the findings already discussed, as one would expect.⁷ In Ontario, the average marginal effect of income is small and insignificant, while in other regions (Quebec and the West), it is only marginally significant, and Atlantic Canada's income effect is again by far the strongest.

Grade and PISA reading score effects are significant in all regions. Ontario's grade effect is now more similar to what is found in Atlantic Canada and Western Canada, but it is still greater than what is found in Quebec. Ontario's greater PISA reading score effect again holds in these disaggregated models, and it is stronger than the effects found in all other regions.

The separate regional models were also run for females and males separately, with the results of these regressions found in Tables 3b and 3c. The main stories they tell are again the same as in the pooled regressions.

⁷ By estimating separate models, all the model parameters are allowed to differ by region, whereas in the pooled regressions, only the variables upon which we were focusing (family income, overall high school grade, PISA reading score) were allowed to differ, along with the intercept. Results could therefore differ if allowing that greater flexibility of functional form makes a difference, while statistical efficiency is lost due to the smaller sample sizes associated with running separate models.

Table 3b
Multinomial estimates of access to college and university: Regions separately, females

	Ontario		Atlantic Canada		Quebec		Western Canada	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
HS location – Urban (Rural)								
	-0.084** [0.041]	0.075** [0.036]	-0.085*** [0.016]	0.051*** [0.017]	-0.020 [0.036]	0.047 [0.031]	-0.031 [0.022]	0.022 [0.020]
French minority	0.001 [0.045]	0.070* [0.037]	-0.050** [0.021]	0.123*** [0.021]			-0.105** [0.050]	0.138** [0.055]
English minority					0.003 [0.046]	0.080** [0.034]		
Family type (Two parents)								
Mother only	0.056 [0.052]	-0.044 [0.038]	-0.008 [0.027]	0.032 [0.028]	-0.008 [0.044]	0.015 [0.039]	-0.032 [0.034]	-0.006 [0.034]
Father only	0.088 [0.105]	-0.008 [0.085]	-0.069 [0.054]	-0.013 [0.072]	-0.050 [0.075]	0.015 [0.071]	0.174** [0.088]	-0.130* [0.075]
Other	0.014 [0.165]	-0.151 [0.107]	0.015 [0.093]	-0.016 [0.118]	0.218 [0.150]	-0.090 [0.148]	-0.049 [0.069]	-0.035 [0.070]
Visible minority/Immigrant status (Non-visible minority born in Canada)								
Visible minority born in Canada	-0.044 [0.050]	0.160*** [0.045]	-0.088* [0.053]	0.195*** [0.063]	-0.072 [0.069]	0.199*** [0.060]	0.005 [0.038]	0.172*** [0.037]
Non-visible minority immigrant	-0.154* [0.082]	0.070 [0.062]	-0.006 [0.147]	0.199 [0.146]	0.111 [0.162]	0.027 [0.144]	0.038 [0.071]	0.036 [0.057]
Visible minority immigrant	-0.077 [0.059]	0.218*** [0.057]	0.104 [0.114]	0.089 [0.112]	0.048 [0.118]	0.010 [0.113]	-0.053 [0.048]	0.296*** [0.053]
Parental education (# of years)	-0.011 [0.007]	0.027*** [0.006]	-0.010** [0.004]	0.025*** [0.005]	-0.002 [0.007]	0.020*** [0.006]	-0.009** [0.005]	0.029*** [0.005]
Parental income	-0.000 [0.007]	0.006* [0.003]	-0.006 [0.004]	0.024*** [0.004]	-0.009 [0.006]	0.022*** [0.005]	0.001 [0.003]	0.009*** [0.003]
HS overall grade	-0.067*** [0.019]	0.144*** [0.015]	-0.061*** [0.010]	0.139*** [0.010]	-0.076*** [0.019]	0.143*** [0.017]	-0.039*** [0.013]	0.146*** [0.010]
PISA reading score	-0.090*** [0.022]	0.191*** [0.017]	-0.069*** [0.011]	0.149*** [0.011]	0.063*** [0.020]	0.106*** [0.018]	-0.050*** [0.014]	0.135*** [0.012]
Observations	1,208		2,897		1,216		2,833	

Notes: Average marginal effects are shown. Standard errors are in brackets. ***p < 0.01 **p < 0.05 * p < 0.1. The grade variable is the students' overall high school grades divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00.

Table 3c
Multinomial estimates of access to college and university: Regions separately, males

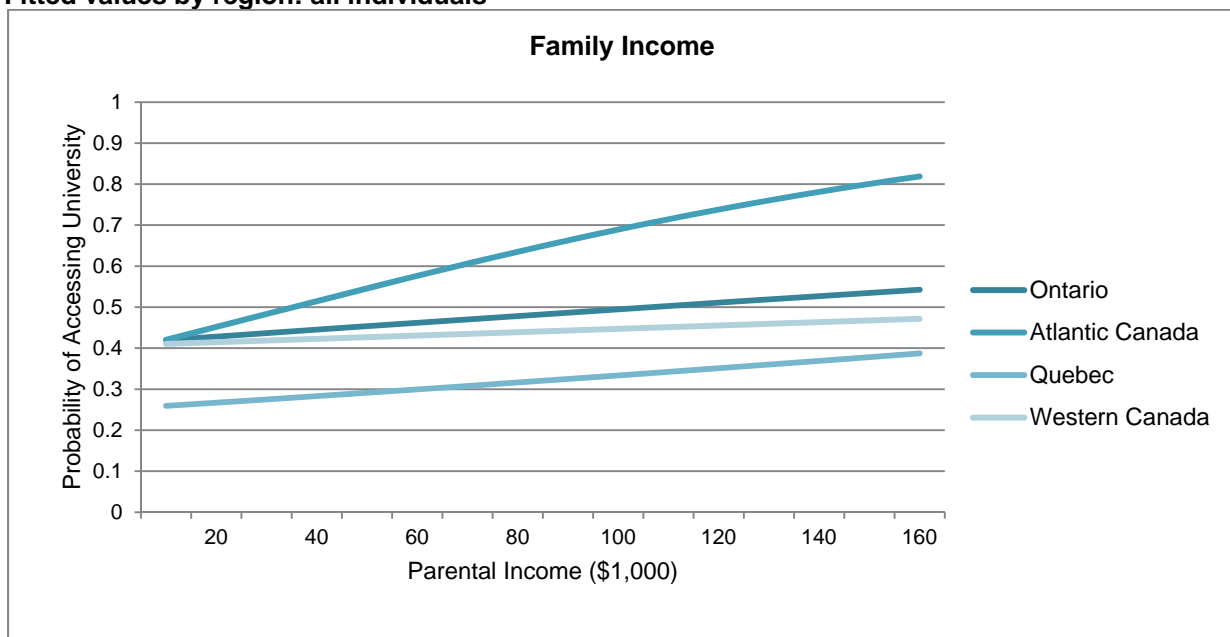
	Ontario		Atlantic Canada		Quebec		Western Canada	
	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.	Coll.	Univ.
HS location – Urban (Rural)	0.033 [0.040]	0.030 [0.034]	-0.081*** [0.017]	0.101*** [0.019]	0.028 [0.036]	-0.008 [0.029]	-0.042** [0.020]	0.085*** [0.021]
French minority	-0.047 [0.048]	0.122*** [0.046]	0.008 [0.025]	0.028 [0.027]			-0.052 [0.060]	0.038 [0.049]
English minority					0.085** [0.040]	0.043 [0.027]		
Family type (Two parents)								
Mother only	-0.065 [0.049]	-0.009 [0.038]	-0.022 [0.030]	-0.019 [0.034]	-0.008 [0.046]	-0.004 [0.038]	-0.022 [0.032]	0.001 [0.033]
Father only	0.110 [0.112]	-0.123 [0.091]	-0.073 [0.049]	0.091 [0.060]	0.024 [0.074]	-0.076* [0.045]	-0.095 [0.060]	0.042 [0.061]
Other	-0.195** [0.087]	0.203* [0.106]	0.182 [0.125]	-0.338*** [0.114]	0.100 [0.141]	-0.056 [0.098]	-0.105* [0.061]	0.005 [0.079]
Visible minority/Immigrant status (Non-visible minority born in Canada)								
Visible minority born in Canada	-0.092 [0.057]	0.083* [0.045]	-0.093* [0.055]	0.094 [0.072]	0.064 [0.070]	0.198*** [0.060]	0.041 [0.037]	0.173*** [0.035]
Non-visible minority immigrant	0.070 [0.095]	-0.126* [0.070]	0.000 [0.166]	-0.096 [0.097]	0.098 [0.116]	-0.116 [0.087]	0.048 [0.072]	0.169*** [0.063]
Visible minority immigrant	-0.095 [0.068]	0.181*** [0.058]	0.166 [0.156]	0.063 [0.154]	0.082 [0.095]	0.025 [0.066]	0.030 [0.044]	0.204*** [0.046]
Parental education (# of years)	-0.015** [0.007]	0.037*** [0.006]	-0.014*** [0.004]	0.037*** [0.005]	-0.005 [0.006]	0.037*** [0.006]	-0.007 [0.004]	0.037*** [0.004]
Parental income	0.001 [0.004]	0.004 [0.003]	-0.004 [0.003]	0.015*** [0.003]	0.001 [0.003]	0.001 [0.002]	-0.000 [0.001]	0.001 [0.001]
HS overall grade	-0.086*** [0.016]	0.177*** [0.014]	-0.046*** [0.010]	0.171*** [0.011]	-0.018 [0.017]	0.102*** [0.014]	-0.047*** [0.010]	0.181*** [0.010]
PISA reading score	-0.069*** [0.019]	0.153*** [0.017]	-0.046*** [0.010]	0.119*** [0.011]	0.051*** [0.019]	0.131*** [0.014]	-0.014 [0.012]	0.101*** [0.012]
Observations	1,146		2,543		1,247		2,823	

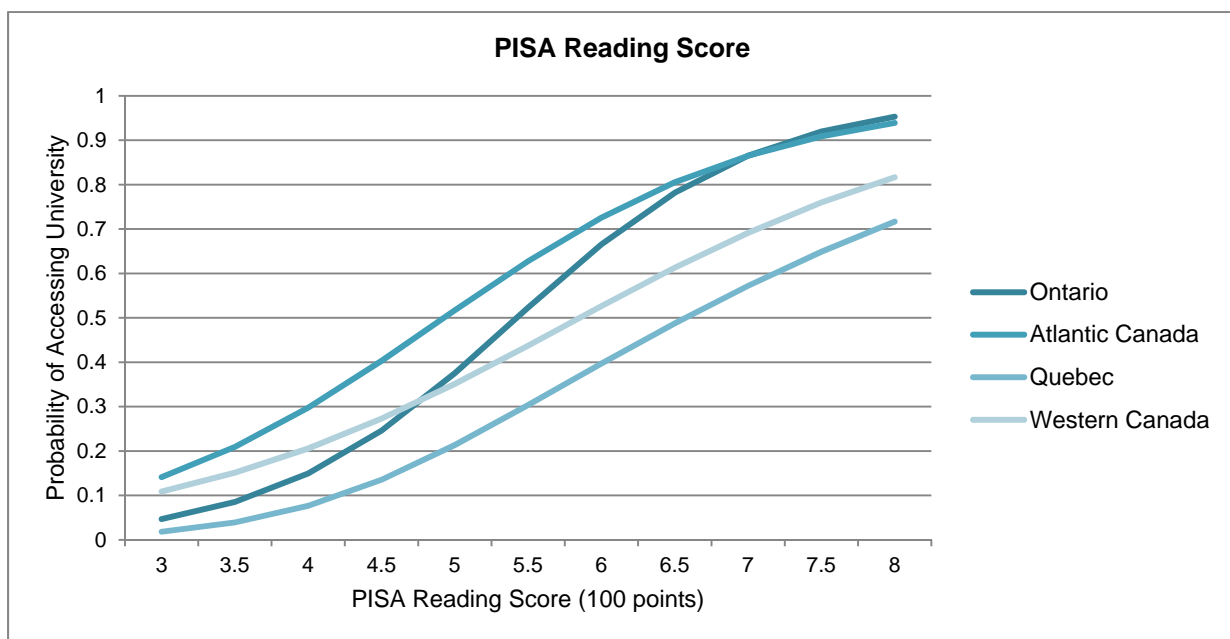
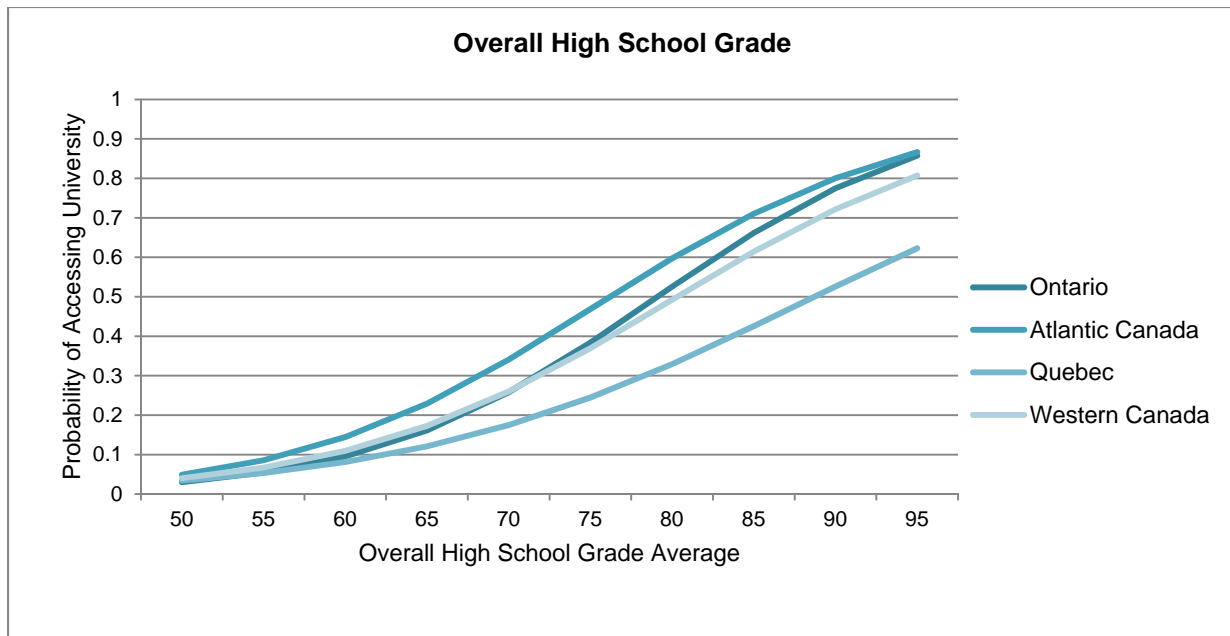
Notes: Average marginal effects are shown. Omitted categories are in parenthesis. Standard errors are in brackets. ***p<0.01 **p<0.05 *p<0.1. The grade variable is the students' overall high school grades divided by 10. The reading variable used is the students' PISA reading score divided by 100. The income variable shows the effects associated with an increase in parental income of \$10,000.00.

Analysis of Fitted Values

Figure 3a presents the results by showing a different set of fitted values associated with the estimates reported above. The model used to generate these figures is the final one in Table 2a, where family income, overall high school grade and PISA reading score variables are all included, along with all the regional interactions. To generate the region-specific fitted values, all variables except the specific variable of interest (either parental income, overall high school grade or PISA reading score) were set to their region-specific means, and the predicted probabilities generated at those values and the relevant coefficient estimates generated by the model are taken into account. We then plot the predicted probability of attending university at the different levels of our variables of interest – family income, overall high school grade, PISA reading score – for each province and region, based on the region-specific estimates associated with those variables, along with their separate “baselines” as just described. The graphs thus differ from each other in two ways – the general levels and the way in which they differ from the variables of interest.

Figure 3a
Fitted values by region: all individuals





Predicted probabilities are calculated at the region-specific means for all variables except the variable treated in each graph. See the text for further details.

These figures nicely summarize the results of the analysis, those in Figure 3a in particular. In the top panel, we see how Ontario, Atlantic Canada and the West all have similar university access rates at low income levels but that while the Ontario and Western Canada rates rise only slightly with income, reflecting the weak income effects discussed above, those in Atlantic Canada rise quite sharply, reflecting the much stronger income effects found there. Thus, the higher overall university participation rates in Atlantic Canada (see Table 1) can be seen to be

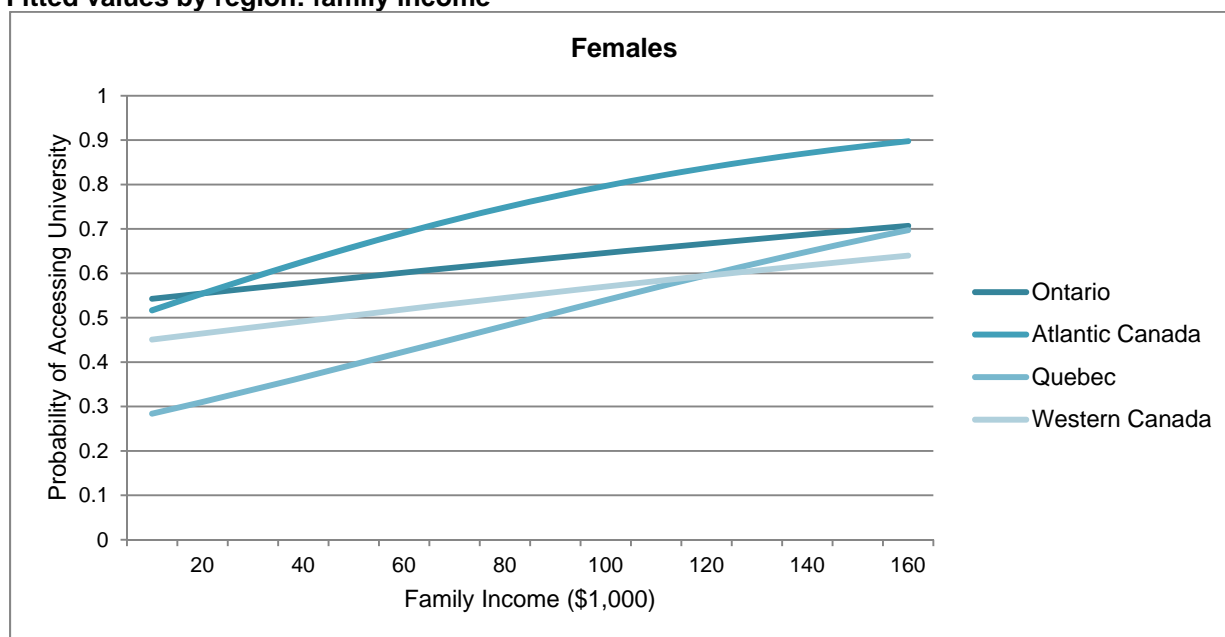
driven principally by those at higher income levels attending university to a significantly greater extent than is the case in Ontario and elsewhere. In Quebec, the rates are low and relatively flat, although not quite as flat as in Ontario or Western Canada.

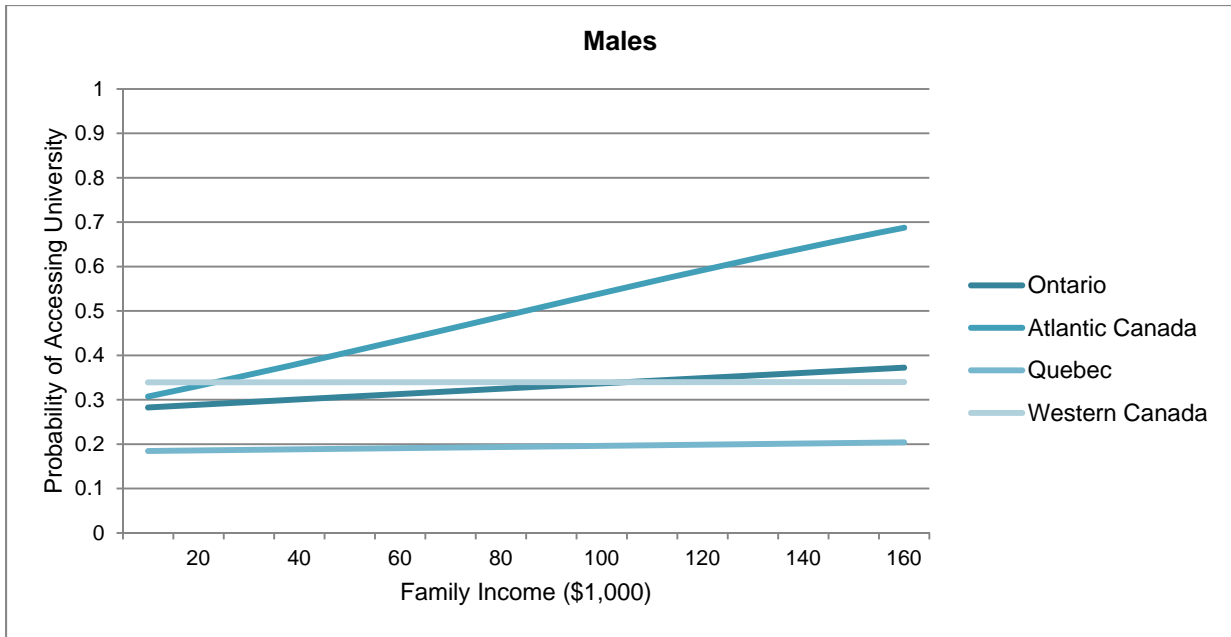
The second panel of Figure 3a repeats this exercise for high school grades. University access rates rise with grades everywhere, but the steeper slope of this graph for Ontario reflects the stronger grade effects described above. The graphs also show that while those with lower grades are less likely to go to university in Ontario than in Atlantic Canada in particular, those with very high grades are equally likely to go in the two provinces. Grades are also a better marker of university attendance in Ontario than in Western Canada and Quebec. Thus, to the degree these represent causal effects (and not just capturing other influences with which they are correlated), grades seem to be the most important ticket to university attendance in Ontario, where income matters little, while in Atlantic Canada income is a more important factor than it is in Ontario, and grades are a less important influence than in Ontario.

The graph of the PISA score effects is quite similar to those for grades. Again, Ontario is the province most marked by “ability” – to the degree that the PISA test scores do, in fact, reflect this – separating who goes to university and who does not, with the effects not being as strong in the other regions.

Figures 3b, 3c and 3d repeat this exercise for females and males. The same general regional patterns hold, with the biggest differences again being (1) the generally much higher access rates on the part of females over males and (2) the stronger income effects for females. Thus, females are much more likely to go to university overall, but they are at the same time more vulnerable to not attending as a result of being in a low-income family. This, however, deflects us from our focus on regional patterns, and investigating these other patterns must be left to another analysis.

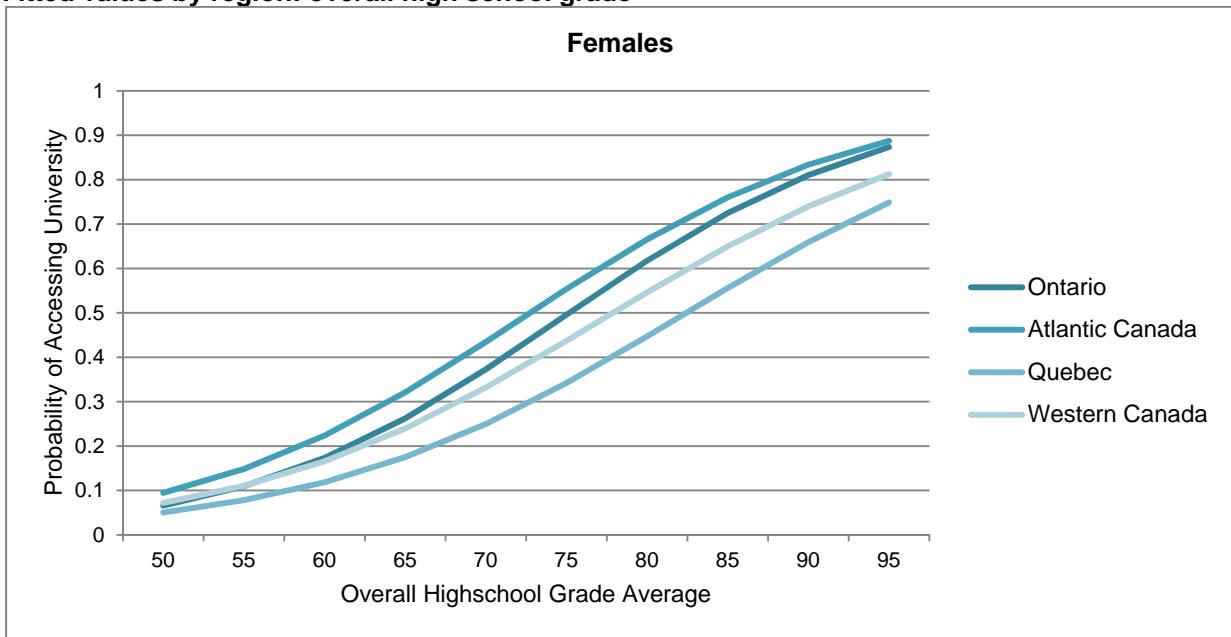
Figure 3b
Fitted values by region: family income

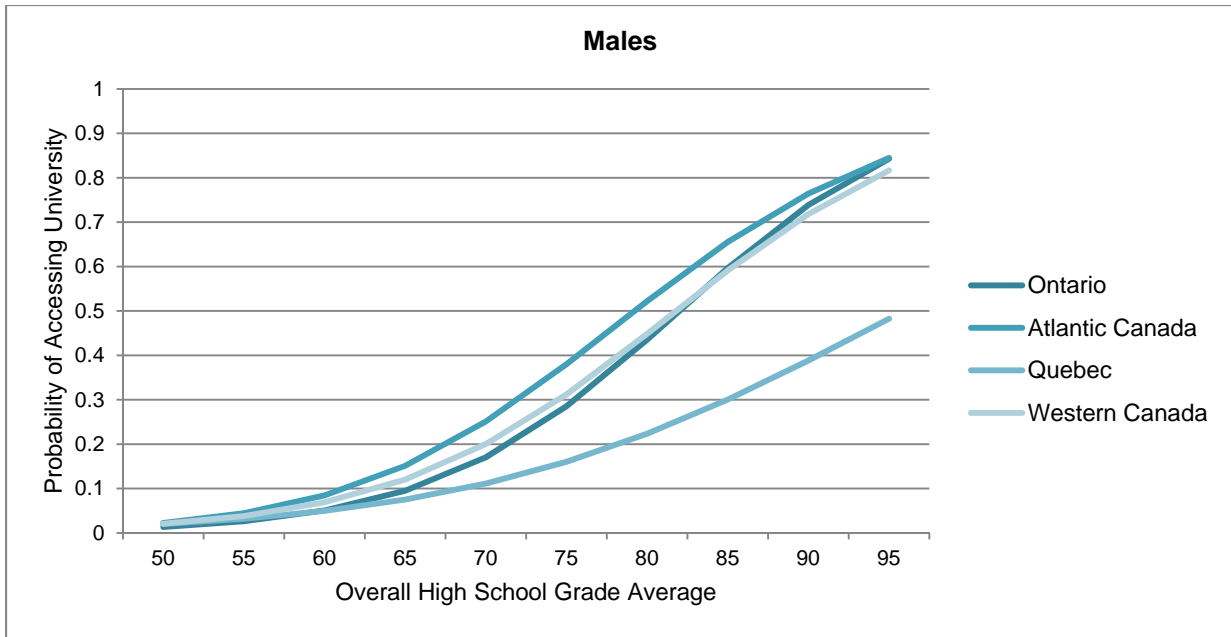




Predicted probabilities are calculated at the region-specific means for all variables except the variable treated in each graph. See the text for further details

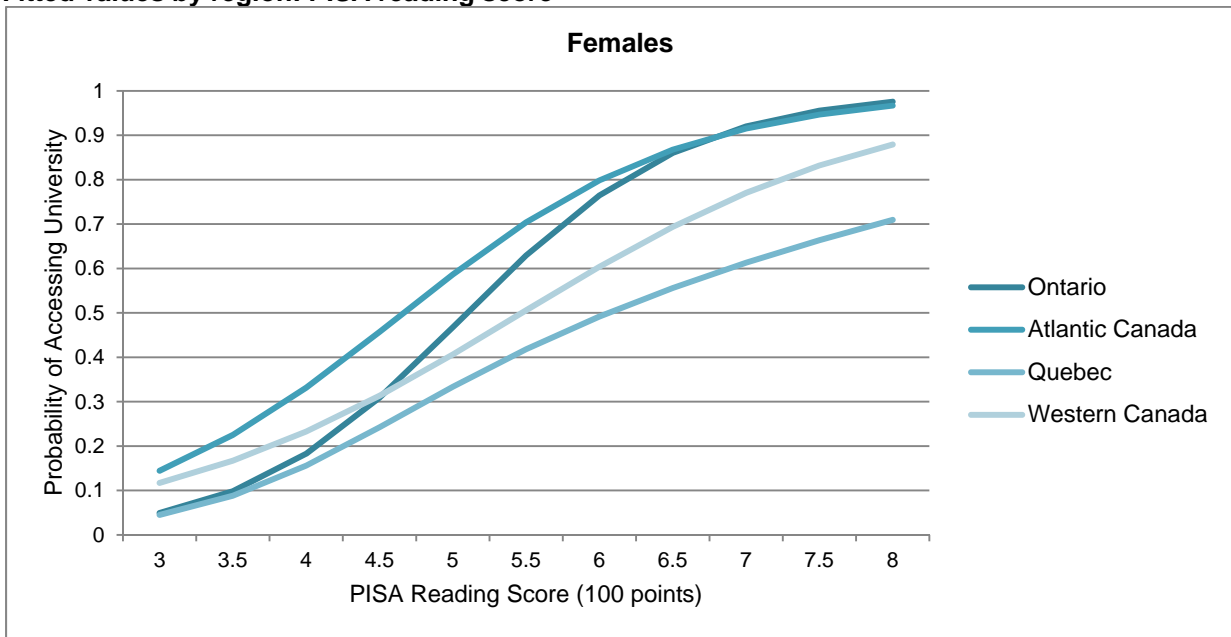
Figure 3c
Fitted values by region: overall high school grade

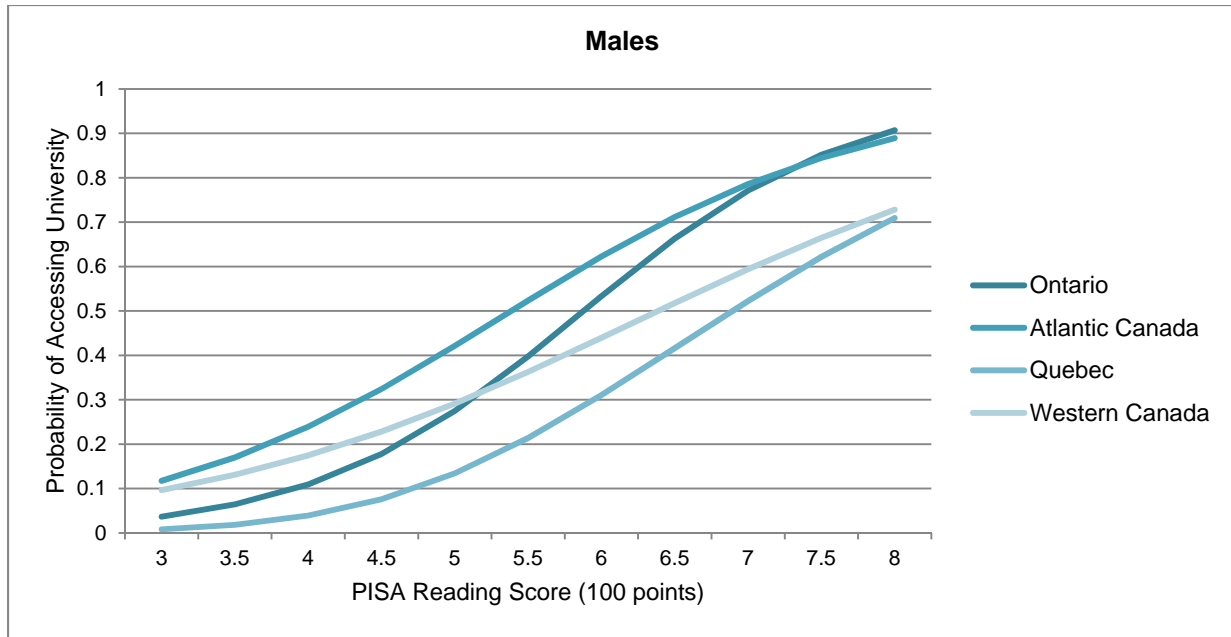




Predicted probabilities are calculated at the region-specific means for all variables except the variable treated in each graph. See the text for further details

Figure 3d
Fitted values by region: PISA reading score





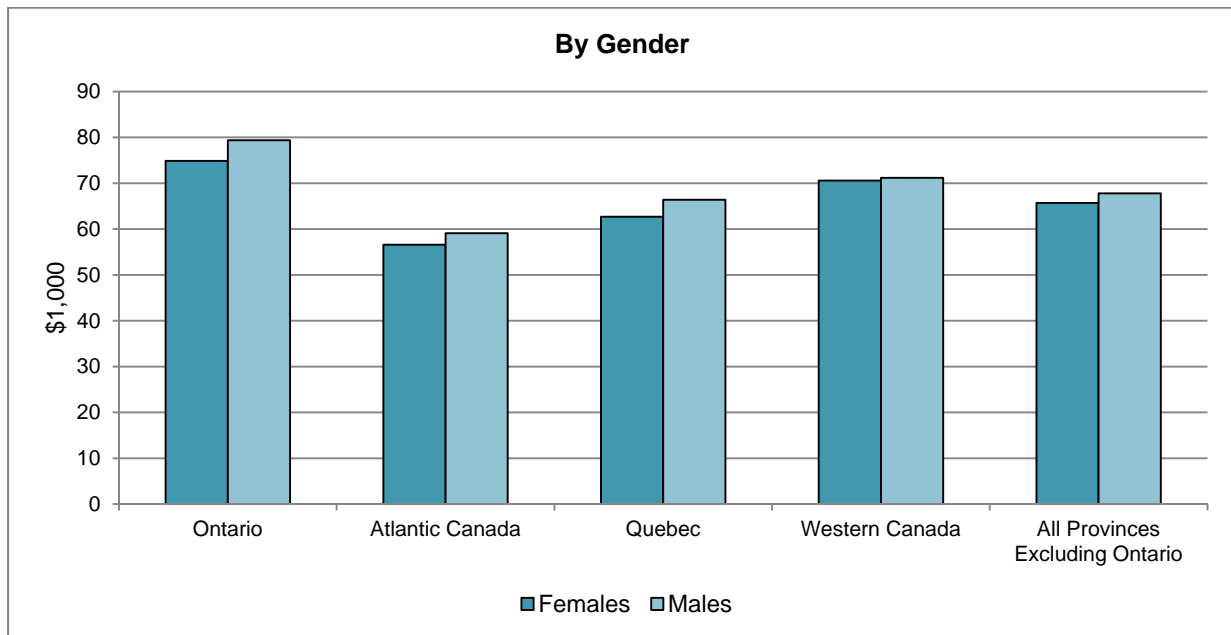
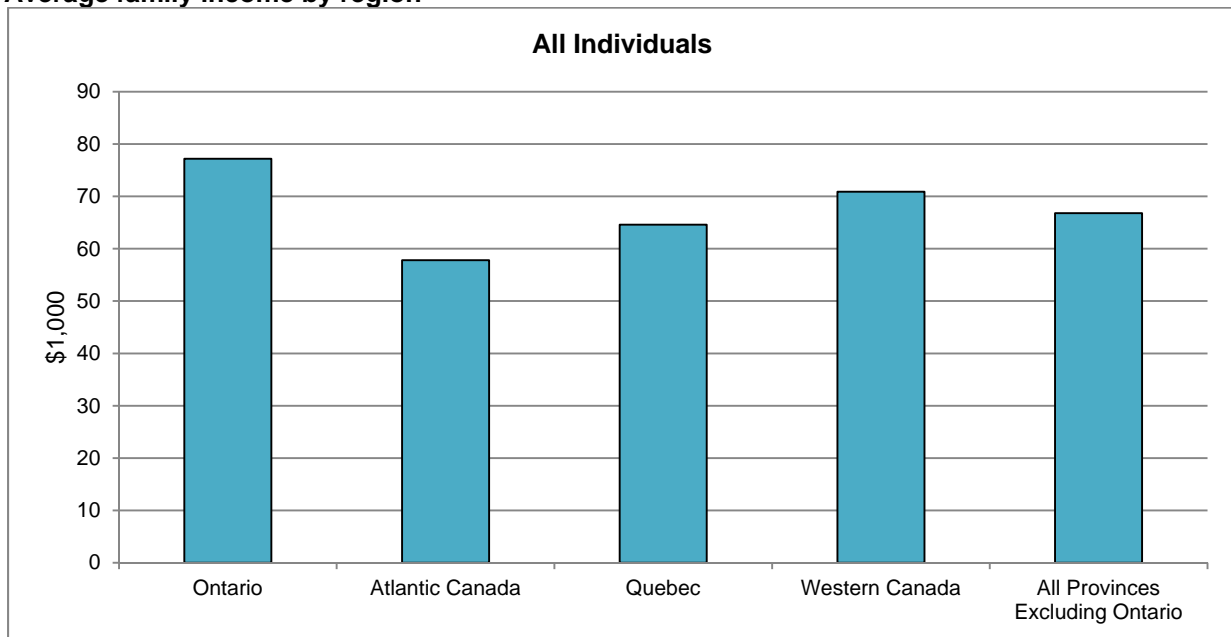
Predicted probabilities are calculated at the region-specific means for all variables except the variable treated in each graph. See the text for further details

In a nutshell, it is tempting to summarize the results as suggesting that Ontario has the most “meritocratic” system, where grades and PISA scores matter most when it comes to determining who goes to university and income matters little, while in other regions, either grades and PISA scores matter less or income matters more, or both. While our analysis is far from proving such a dynamic, and more work would be required to test this idea and explain why this might be the case, these findings at least provide a starting point for any such investigations.

Differences in Family Income, Overall High School Grade and PISA Reading Score by Region

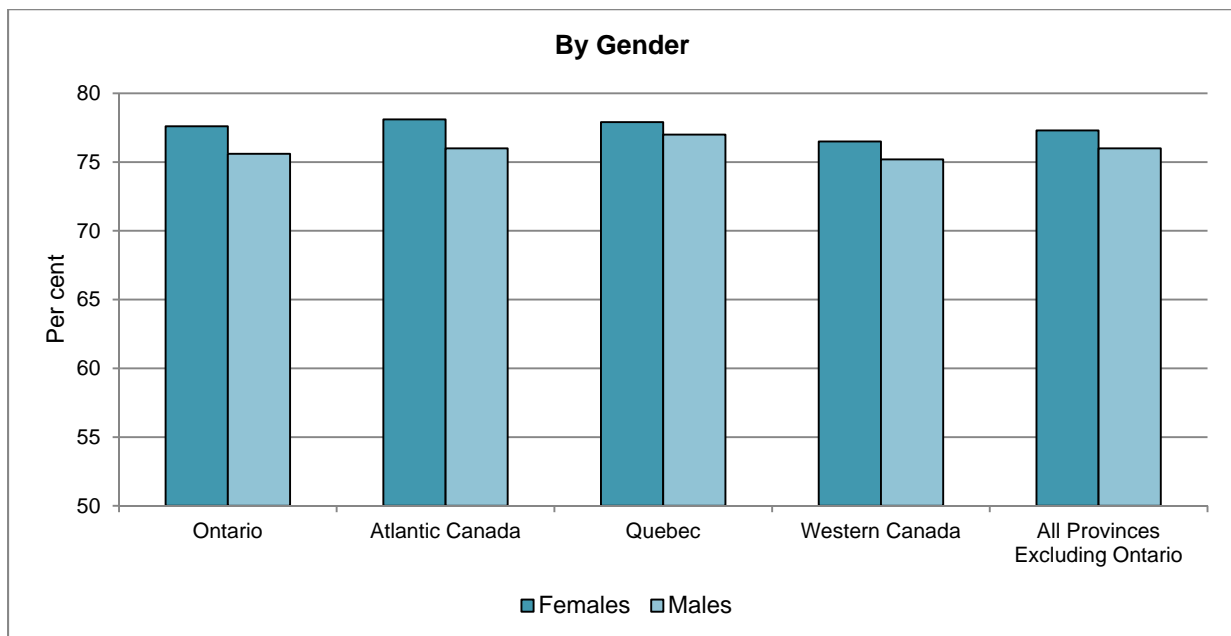
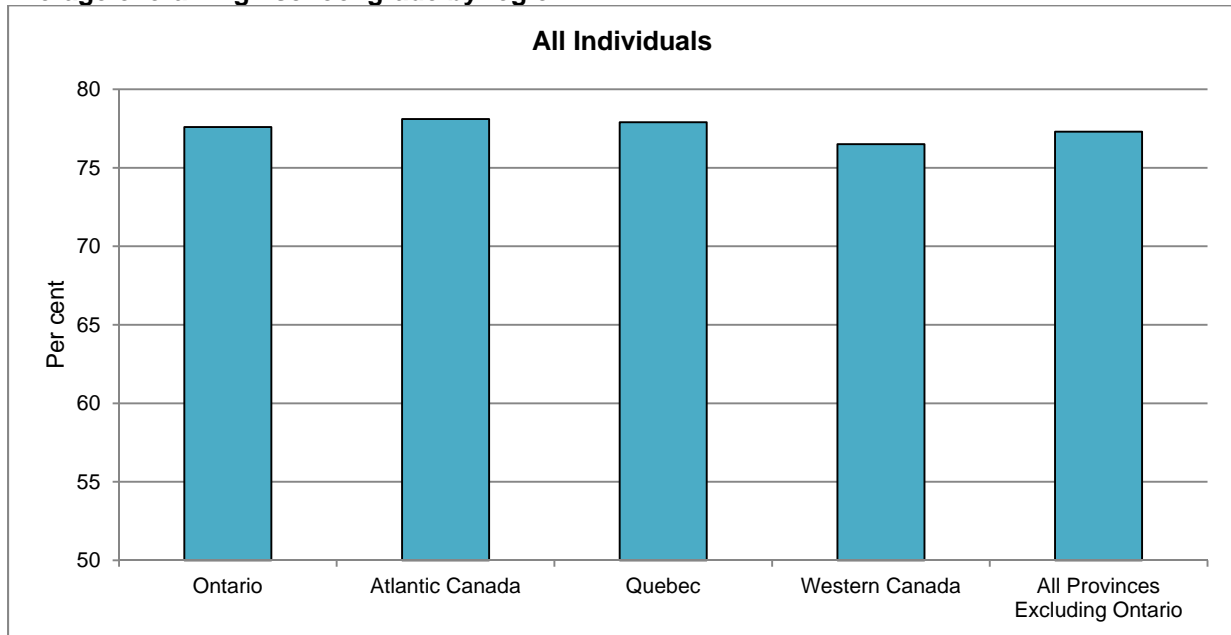
In the context of these different effects, it is instructive to briefly look at the distribution of family incomes, overall high school grades and PISA reading scores by region. In Figures 4, 5 and 6, we see some substantial differences across regions. Ontario has the highest average income, followed by Western Canada. Reported high school grades in Ontario are lower than those in Atlantic Canada and Quebec but are somewhat higher than those in Western Canada. PISA scores in Ontario are somewhat higher than those in Atlantic Canada but somewhat lower than those in Quebec and Western Canada. Interestingly, Western Canada has the highest PISA scores but the lowest overall high school grades. We might thus conclude that students in Western Canada are relatively strong academically but that their teachers do not give high marks. In other regions, very different patterns hold: for example, PISA scores are among the lowest in Atlantic Canada but grades are the highest.

Figure 4
Average family income by region



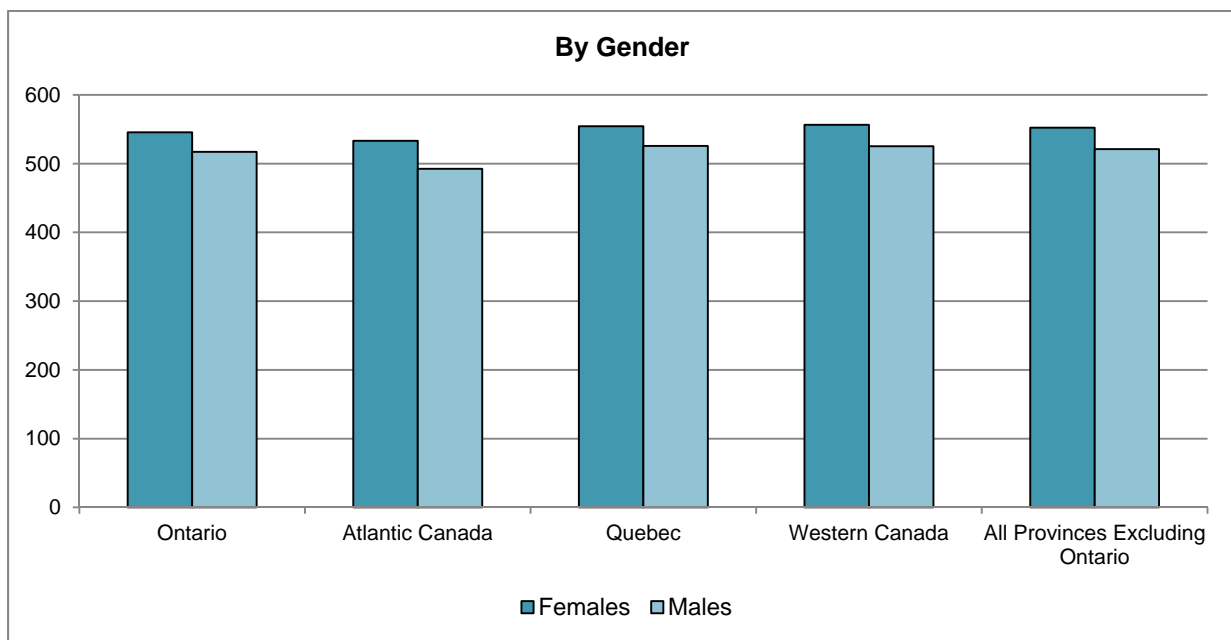
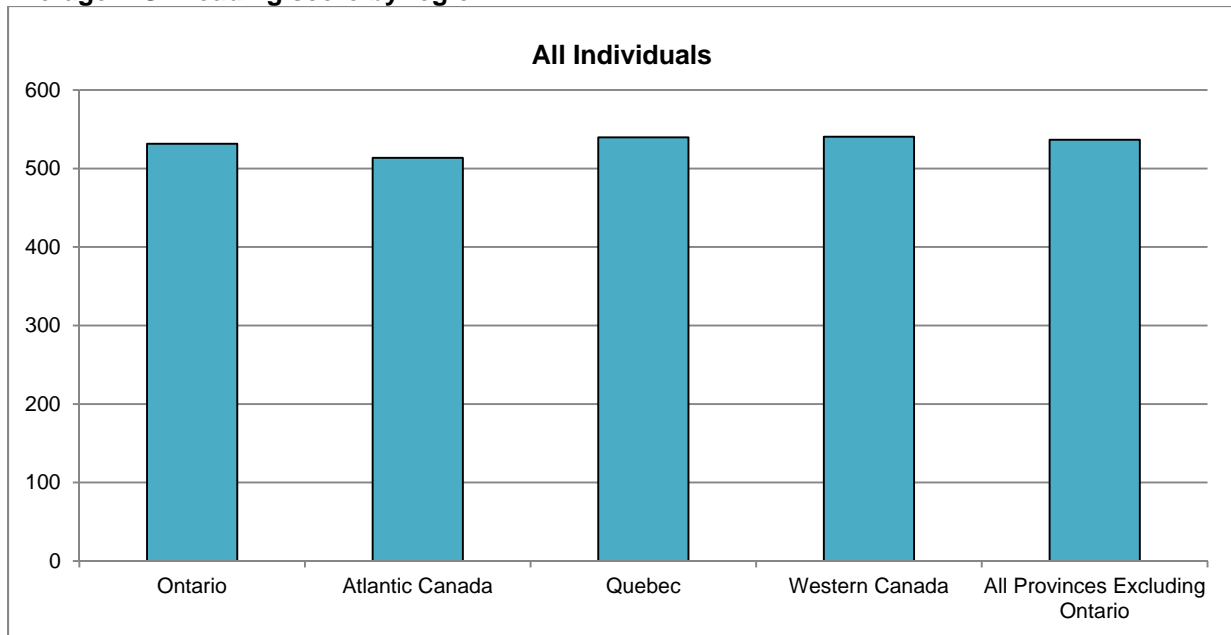
Source: Tables 4a, 4b and 4c.

Figure 5
Average overall high school grade by region



Source: Tables 4a, 4b and 4c.

Figure 6
Average PISA reading score by region



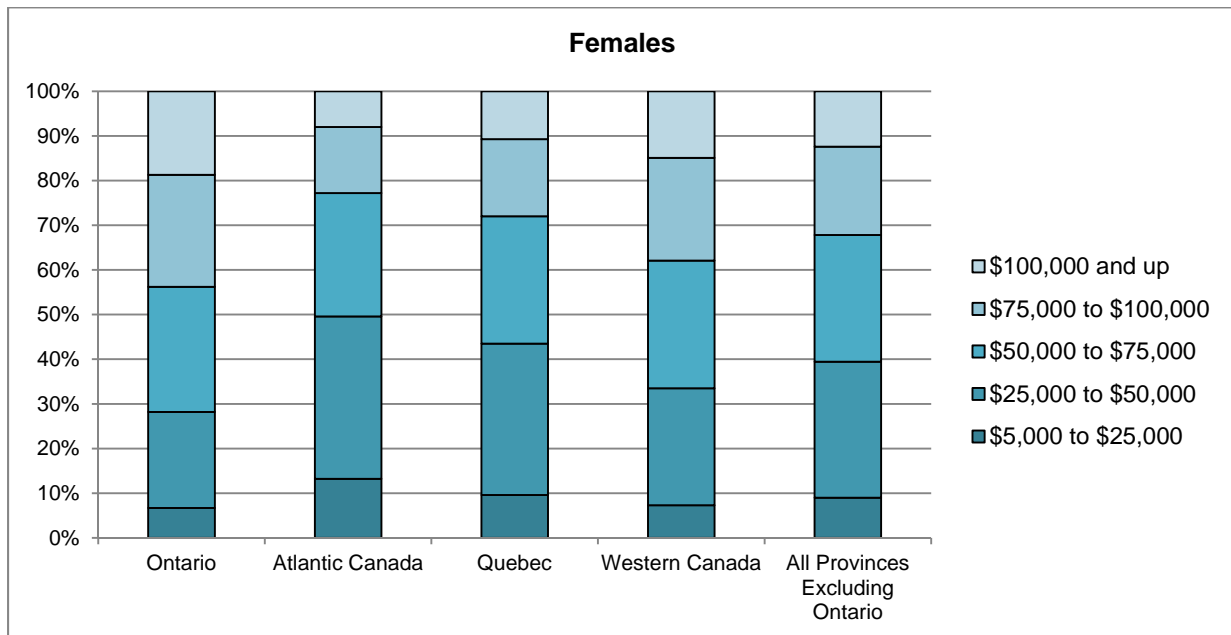
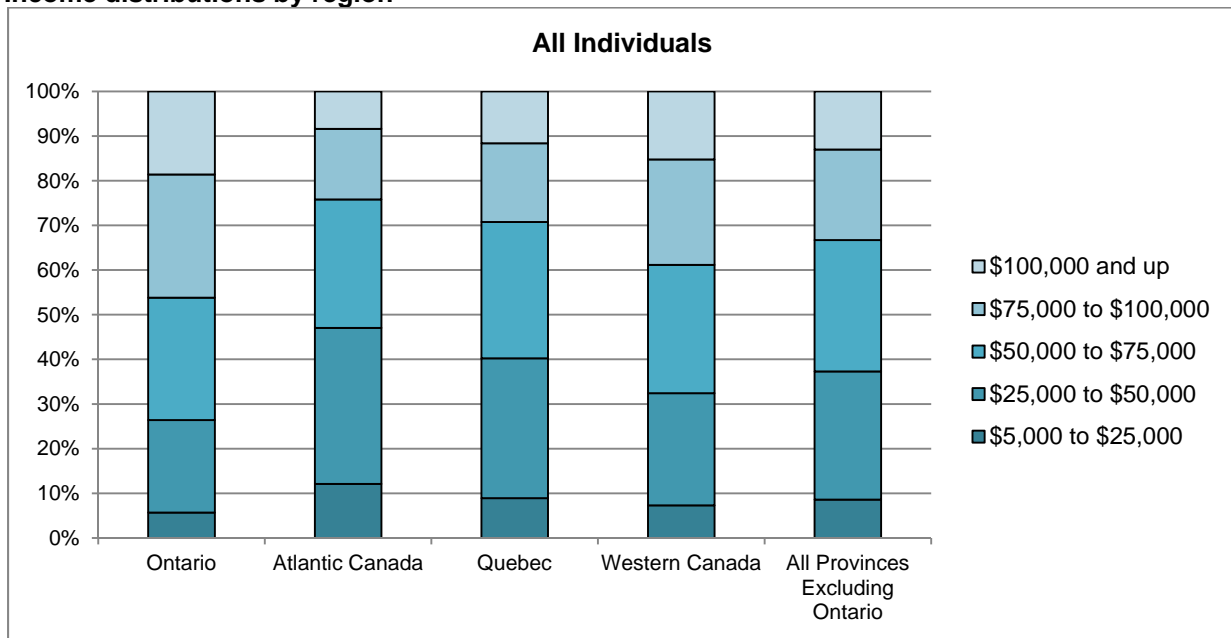
Source: Tables 4a, 4b and 4c.

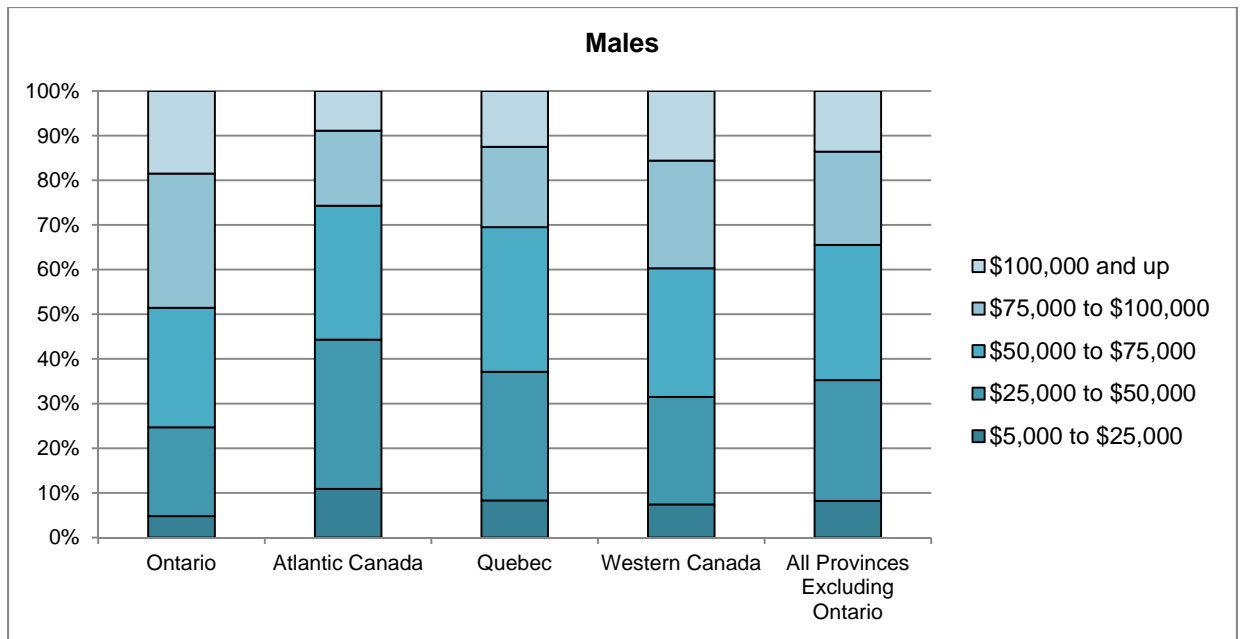
The relevance of these findings to PSE access patterns, and to the associations between access and grades, PISA scores and income, may be that those regions with “grade inflation” might have more difficulty identifying the truly more “able” students and otherwise rationing the places available in the system based on academic “ability.” Thus, other determinants may

operate more strongly in such regions, including, for example, those related to family income. We turn to further discussions along these lines in the concluding part of the paper.

More detailed information on family income, overall high school grade and PISA reading score distributions, by region and gender, can be found in Figures 7, 8 and 9, and Tables 4a, 4b and 4c.

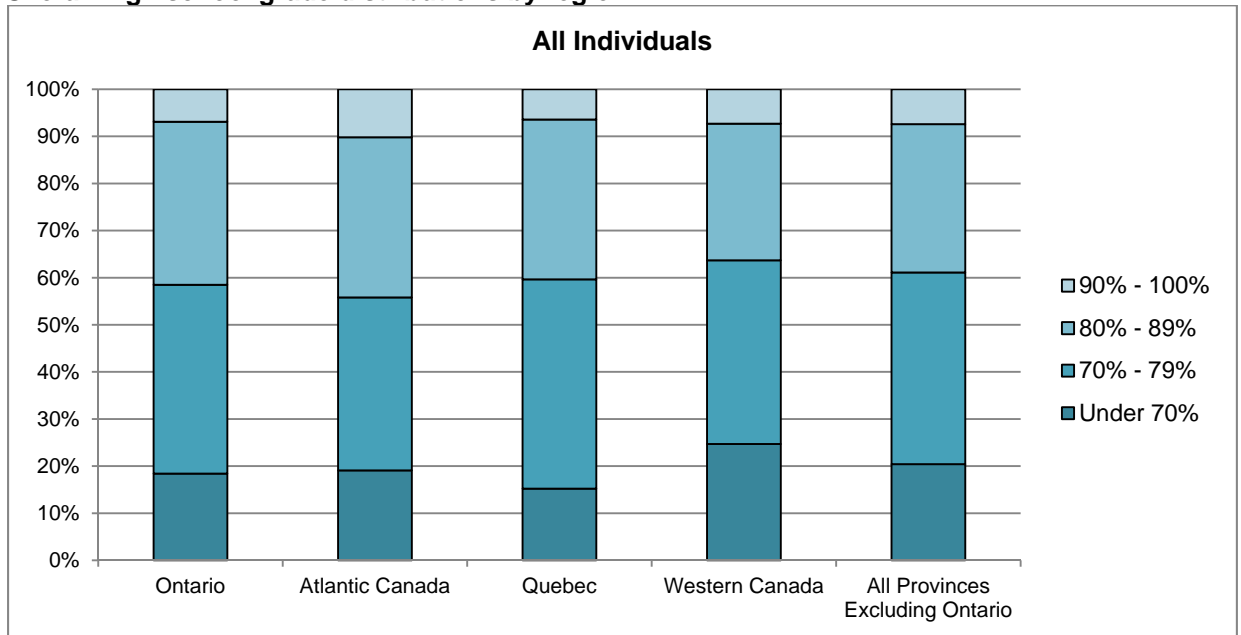
Figure 7
Income distributions by region





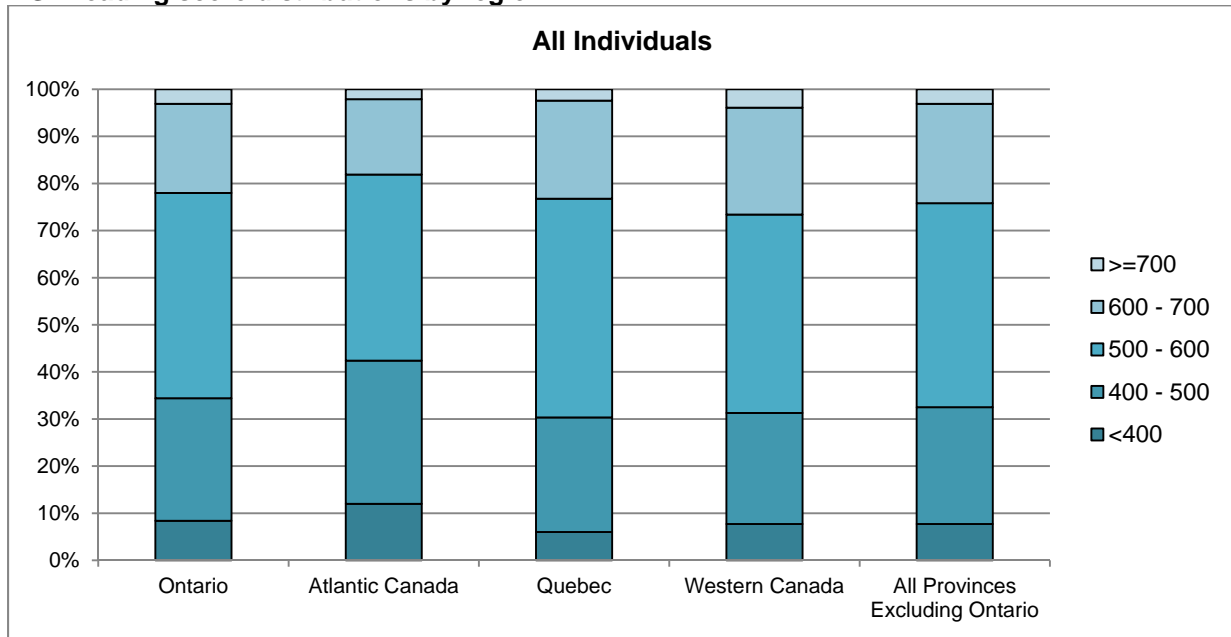
Source: Tables 4a, 4b and 4c.

Figure 8
Overall high school grade distributions by region



Source: Tables 4a, 4b and 4c.

Figure 9
PISA reading score distributions by region



Source: Tables 4a, 4b and 4c.

Table 4a
Income, HS grades and PISA reading scores: distributions and means by region, all students

	<u>Ontario</u>	<u>Atlantic Canada</u>	<u>Quebec</u>	<u>Western Canada</u>	<u>All Provinces Excluding Ontario</u>
Family income levels					
\$5,000 to \$25,000	5.7	12.1	8.9	7.3	8.6
\$25,000 to \$50,000	20.7	35	31.3	25.1	28.7
\$50,000 to \$75,000	27.4	28.8	30.5	28.7	29.4
\$75,000 to \$100,000	27.6	15.8	17.6	23.6	20.3
\$100,000 and up	18.6	8.4	11.6	15.2	13
Total	100	100	100	100	100
Average family income (\$1,000)					
	77.2	57.8	64.6	70.9	66.8
Overall HS grade					
Under 70%	18.4	19.1	15.2	24.7	20.4
70%-79%	40.1	36.7	44.4	39	40.7
80%-89%	34.6	34	33.9	29	31.5
90%-100%	6.9	10.2	6.4	7.3	7.4
Total	100	100	100	100	100
Average overall HS grade					
	77.6	78.1	77.9	76.5	77.3
PISA reading score					
< 400	8.4	12	6	7.7	7.7
400-500	26	30.4	24.3	23.6	24.8
500-600	43.6	39.5	46.4	42.1	43.3
600-700	18.9	16	20.8	22.7	21.1
>= 700	3.1	2.1	2.4	3.9	3.1
Total	100	100	100	100	100
Average PISA reading score					
	531.5	513.6	539.7	540.5	536.6

Table 4b
Income, HS grades and PISA reading scores:
Distributions and means by region, females

	Ontario	Atlantic Canada	Quebec	Western Canada	All Provinces Excluding Ontario
Family income levels					
\$5,000 to \$25,000	6.7	13.2	9.6	7.3	9
\$25,000 to \$50,000	21.5	36.4	33.9	26.2	30.5
\$50,000 to \$75,000	28	27.6	28.5	28.6	28.4
\$75,000 to \$100,000	25.1	14.8	17.3	23	19.8
\$100,000 and up	18.7	8	10.7	14.9	12.4
Total	100	100	100	100	100
Average family income (\$1,000)					
	74.9	56.6	62.7	70.6	65.7
Overall HS grade					
Under 70%	10.8	13.6	12.2	19.4	16
70%-79%	38.7	32.3	43	38.5	39.2
80%-89%	42.1	41.2	37.4	33.3	35.9
90%-100%	8.4	12.9	7.4	8.8	8.9
Total	100	100	100	100	100
Average Overall HS grade					
	79.5	80.1	78.9	77.9	78.6
PISA reading score					
<400	4.9	7.5	3.9	4.4	4.7
400 - 500	23.4	26.3	19.7	20	20.8
500 - 600	46.4	43.6	47.8	44.1	45.4
600 - 700	21.3	19.9	25.5	26.9	25.4
>=700	4	2.7	3.1	4.6	3.8
Total	100	100	100	100	100
Average PISA reading score					
	545.6	533.3	554.5	556.5	552.4

Table 4c
Income, HS grades and PISA reading scores:
Distributions and means by region, males

	Ontario	Atlantic Canada	Quebec	Western Canada	All Provinces Excluding Ontario
Family income levels					
\$5,000 to \$25,000	4.8	10.9	8.3	7.4	8.2
\$25,000 to \$50,000	19.9	33.4	28.8	24.1	27.1
\$50,000 to \$75,000	26.8	30	32.4	28.8	30.3
\$75,000 to \$100,000	30.1	16.8	18	24.1	20.9
\$100,000 and up	18.5	8.9	12.5	15.6	13.6
Total	100	100	100	100	100
Average family income (\$1000)					
	79.4	59.1	66.4	71.2	67.8
Overall HS grade					
Under 70%	26	25.1	18	29.8	24.8
70% - 79%	41.5	41.4	45.8	39.4	42.1
80% - 89%	27.1	26.1	30.6	24.8	27.1
90% - 100%	5.4	7.4	5.6	6	6
Total	100	100	100	100	100
Average overall HS grade					
	75.6	76	77	75.2	76
PISA reading score					
< 400	11.9	16.8	8	10.9	10.6
400-500	28.6	34.9	28.7	27.1	28.7
500-600	40.7	35.1	45.1	40.2	41.4
600-700	16.5	11.7	16.5	18.7	17
>= 700	2.2	1.4	1.7	3.2	2.4
Total	100	100	100	100	100
Average PISA reading score					
	517.2	492.5	525.7	525.3	521.2

V. Summary and Discussion

This analysis has used the uniquely rich Canadian YITS-A data to provide a new and original perspective on PSE participation patterns in Ontario as they compare to other regions. The initial descriptive analyses first showed some important differences in overall access rates across regions. We then focused on three key drivers of access to PSE: family income, overall high school grade and PISA reading score because (1) these variables are significantly related to who goes to university in particular (the effects on college are smaller and/or offsetting) and (2) the effects vary in important ways between Ontario and other regions. We also included a

set of control variables in our analysis, including the very important parental education variable, which – very interestingly – does *not* appear to have significantly different effects by region.

Our main findings are as follows:

- (1) family income effects are relatively small in Ontario but are much greater for the Atlantic provinces;
- (2) grade effects are particularly strong in Ontario compared to most other regions; and
- (3) a similar result holds for PISA scores: the effects are stronger in Ontario than in other regions.

It is now useful to step back and think about how Ontario's PSE system – perhaps especially the university system – operates and how this differs from the systems in other regions. (Although the college system must be part of any general analysis, the focus here is on the university system because of the stronger effects found for the background variables covered.) An individual's participation in PSE depends on three main things. First, the person must want to go, presumably based on the perceived benefits and costs of doing so. The relevant considerations are potentially broad and diverse and include not just the job market rate of return to PSE credentials, but also non-financial benefits (and costs), societal/parental/peer pressures and more. Second, the person must have the financial means of attending, with the student financial aid system clearly playing an important role here. Third, the individual must qualify for a program in which they are interested, and there must, in fact, be a place for them in the system.

In short, access to PSE is the result of demand side factors (i.e., who wants to go and can afford to do so), the supply side (the total number of places available) and the means by which the available places are rationed or otherwise controlled (including grades and other elements of the selection system).⁸ Too often, access studies have assumed that there is essentially only a demand side and that it is differences in the demand for PSE that are being observed when access rates – at the individual or aggregated level – are, for example, related to a range of factors including not only personal characteristics (e.g., family background variables such as family income and parental education), but also system-wide variables (tuition and other cost-side measures in particular). The reality is that access – and the access outcomes included as the dependent variables in such studies – is the outcome of these different factors: demand, supply and the rationing mechanism.

While this is generally true and should be taken into consideration in any analysis of access rates, it is especially important to do so in the case of looking at differences in access rates by region because, at least at the level at which we have approached the problem here, we must be cognizant of the fact that we are estimating the overall outcomes of these different factors and – in the case of this study at least – how they relate to family income, overall high school grade and PISA reading score.

The issue is further complicated by the endogenous nature of these measures – grades and PISA scores in particular – in the sense that those young people who have decided early on that

⁸ See Finnie (2005) for an exposition of such a model and the related dynamics. See also Coelli (2009), and Neill (2009) for related discussions.

they want to go to university will presumably attempt to get the grades they need to do so and may obtain better PISA scores as well.

The underlying model is admittedly complex, and the variations by region we observe in these data are the result of all those complexities. We thus emphatically state that we have only begun to understand regional differences in participation in PSE and that more analysis is necessary to more fully understand these differences.

That said, we believe our paper might provide some useful empirical information for thinking about such issues. In particular, some regions seem to do a “better” job of ensuring that it is “higher ability” or “higher achieving” individuals (as measured by grades and PISA scores) who go to university, while family income plays a much more important role in some regions than in others. More specifically, Ontario seems to have the system that appears to be best at guiding those with high grades and high PISA scores, which may be thought of as indicating academic ability and achievement, towards university, while – and this is perhaps a related factor – family income matters less than in other provinces and regions. Ontario may thus have the most “meritocratic” system, although we cannot say if this is because of the PSE system, the secondary schooling system, other broader socioeconomic or policy factors or another factor or other factors.

We suspect these effects are related to different aspects of the demand, supply and rationing elements involved in determining who goes to PSE in each province, and we look forward to further research that that will tell us more about these factors and their policy implications.

VI. References

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