What Influences Young Canadians to Pursue Post-Secondary Studies?

Final Report

Julie Dubois
Applied Research Branch
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Abstract

This paper uses the theory of human capital to model post-secondary education enrolment decisions. The model is based on the assumption that high school graduates assess the costs and benefits associated with various levels of post-secondary education (college or university) and select the option that maximizes the expected net present value. Given the discrete nature of an investment choice, the theoretical model is estimated using a multinomial logit approach and data from the School Leavers Follow-up Survey, 1995.

The estimated coefficients identify the main determinants of post-secondary participation. The study indicates that parental education, parental financial support, and the student's individual abilities, marital status, parental status and immigration status were the factors that most heavily influenced the university enrolment decision. In terms of college studies, the factors that most heavily influenced the investment decision were the province of residence, gender, marital status and the father's level of education and occupation.

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1. Introduction

Structural changes such as increases in the dissemination of information and communications technologies and more pronounced international competition are currently transforming the global economy and significantly enhancing the value of knowledge-based skills. It follows that the education of human capital has become an important issue. This is why one of the objectives the Government of Canada set out in its innovation strategy was to guarantee all high school graduates access to high quality post-secondary education and increase the proportion of Canadians holding post-secondary diplomas. In order to achieve these objectives, the main financial and other obstacles faced by high school graduates have to be identified and the factors connected with post-secondary participation have to be assessed. A better understanding of these issues will enable us to better inform policy-makers about the transition of high school graduates to post-secondary and other activities and about ways of influencing these transitions.

Several Canadian studies have looked at the relationship between various socio-economic variables and post-secondary participation with the help of descriptive statistics and multivariate analyses.[1] Yet none of them has yet attempted to model the actual post-secondary education enrolment decision. Thus, none of the studies have jointly analyzed all of the socio-economic and financial variables that might influence post-secondary participation within a theoretical framework.

The objective of this paper is to develop a model of investment in post-secondary education that is built around the expectations of students at the time that they complete high-school. Such a model would help identify some of the key determinants influencing the post-secondary education enrolment decision and help select the policy options that would encourage Canadians to invest in post-secondary education.

The model developed in this study is based on the theory of investment in human capital and uses the approach developed by Catsiapis (1987). According to this approach, high school graduates assess the benefits and costs associated with various levels of post-secondary education (college or university) and select the option that maximizes the expected net present value. Given the discrete nature of an investment choice, the theoretical model is estimated using a multinomial logistic regression model. This model simultaneously estimates the probability of university enrolment in relation to the probability of not pursuing any post-secondary studies and that of college enrolment in relation to the probability of not pursuing any post-secondary studies. The estimated coefficients are analyzed to identify the main determinants of college or university participation. A separate study based on gender is also performed and used to identify the determinants that have different influences on the decisions made by men and women concerning the pursuit of post-secondary studies.

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[1] These studies include:
Christie, P. and M. Shannon (2001), who looked at the differences in educational attainment by gender. Nakhaie, M. (2000), who studied the effects of the parents' educational attainment and occupation on the educational attainment. Butlin, G. (1999), who studied the influences of several socio-economic variables and school variables on the probability of pursuing post-secondary studies. Guppy, N. and K. Pendakur (1989), who looked at the effects of parental education and student gender on the decision regarding full-time or part-time enrolment, the choice between college or university and the selection of a field of study. Guppy, N. (1984), who analyzed the differences in access to higher education by gender, mother tongue and socio-economic background.

This paper is structured as follows. The second part presents some of the U.S. studies that developed and estimated a model of investment in post-secondary education. The third one models the decisions concerning the pursuit of post-secondary studies in Canada on the basis of the approach developed by Catsiapis (1987). The following part presents the econometric model. The fifth one provides a description of the surveys used to estimate the educational investment model developed in the third part. The sixth part is dedicated to analyzing the results. The seventh part discusses the consequences of the findings for policy development. Finally, the conclusion summarizes the main findings and proposes a few options for research.

2. *Literature review*

This part summarizes a few studies that tried to model post-secondary education enrolment decisions using the theory of human capital. These studies can be classified into two categories: 1) those which developed a model of educational investment and 2) those which developed a simultaneous model of educational choice and labour supply. These studies differ in the specification of the models estimated and surveys used, which makes it difficult to compare the results.

2.1 A model of educational investment

The first category of studies includes, among others, those of Weiler (1989), Catsiapis (1987) and Fuller, Manski and Wise (1982). Their main objective was to identify the importance of certain determinants of post-secondary participation, including the direct costs of studies, financial assistance, personal abilities, socio-economic status and region.

In his study, Weiler (1989) posited that high school graduates had the following five choices of post-secondary activity: non-attendance, attendance at a community college, attendance at a vocational school, attendance at a public four year institution, and attendance at a private four year institution. Graduates chose the option that maximized their utility. The utility of an activity was defined as being a function of the student's characteristics (gender, race, abilities, socio-economic status, region), the high school's characteristics (percentage of students who pursued post-secondary studies, percentage of students in the school who are classified as disadvantaged, etc.) and the characteristics of the post-secondary activities (distance between the student's home and the closest institutions, tuition fees, financial assistance received, etc.).

The author then used logit regression models to estimate the probability that a student will choose one of the options, using U.S. longitudinal data on spring 1980 high school graduates.[2]

The main results of this estimation were as follows:

- The estimations of the personal characteristics suggested that the female members of a visible minority who had abilities and socio-economic status higher than average, and came from a school with a low proportion of disadvantaged students were more likely to pursue post-secondary studies, *ceteris paribus*.
- The probability of enrolling in college or vocational school was inversely proportional to distance and the probability of enrolling in a four year institution was directly linked to the financial assistance provided by these institutions.
- A direct, albeit weak, link was found between tuition fees and the probability of pursuing post-secondary studies. This relationship was explained by the author as being due to a positive correlation between tuition fees and the prestige and quality of the institutions.

[2] The data came from the U.S. survey entitled "High School and Beyond (HSB)".

Catsiapis (1987) designed and estimated a model in which high school graduates had a choice of enrolling in college or not. Their decision depended on the evaluation of the costs and benefits associated with one year of college. More specifically, students chose the option that maximized the expected net present value.[3] This value was expressed in terms of the following variables: financial assistance expected from the government, contribution expected from parents, scholarship won, type of high school attended, brothers or sisters in college, parental education, performance in high school, age, health, gender, race, religion and region.

The probability of enrolling in college was estimated using a probit model and longitudinal data on U.S. high school graduates from 1972.[4]

The main findings of this study were as follows:

- Among the financial variables, the contribution made by parents had the greatest impact on the probability of enrolling in college.
- The variables measuring high school performance had little impact on the probability of enrolling in college. In principle, good students had higher expectations of post-secondary studies but they also lost more income during their studies than did the relatively less good students. Thus, according to the author, the positive effect of abilities on the results expected from college education and the initial stock of human capital (i.e. on benefits) cancelled out as a result of the negative impact of abilities on the opportunity cost, thereby explaining the findings.
- The type of high school attended and the fact of having brothers or sisters in college had a significant impact on the probability of enrolling in college.
- Men and Blacks were more likely to enrol in college, whereas Jewish people and people who did not have any religious affiliation were less likely to enrol in college.
- The model developed by Catsiapis also helped provide an estimation of the expected net present value of a year of college for each individual. On average, individuals who enrolled in college had an expected net present value of $503, whereas those who did not had a negative expected net present value of $103. Once the average expected net present value has been calculated, Catsiapis' model also helped estimate the expected rate of return for various investment levels and discount rates. For discount rates between 0.08 and 0.12 and investments between $2,000 and $10,000, the author estimated expected rates of return of up to 8% or 15%.

In the selection model developed by Fuller, Manski and Wise (1982), high school graduates faced a set of possible post-secondary activities, including college, vocational school, labour force, military, domestic activities and part-time studies combined with work. Students chose the activity that maximized expected utility. An activity's expected utility is defined in terms of the expected costs (tuition fees / parental income – expected financial assistance / parental income + costs of living / parental income), loss of expected income, expected future income and unobservable variables. Lost income was estimated

[3] The expected net present value equals expected benefits discounted less expected costs.
[4] The data used come from the U.S. survey entitled "National Longitudinal Study of the High School Class of 1972".

on the basis of personal characteristics and the labour market conditions under which the individual would have to work. Expected future income was expressed in terms of the academic standards of the chosen activity and the gap between these standards and the individual's abilities. Finally, in order to take into account some of the unobservable variables, the authors included other variables in their utility function, including the percentage of students from a given graduating class who pursued post-secondary studies.

The probability that an activity would be selected was estimated with a multinomial logit approach and U.S. longitudinal data on high school graduates from 1972.[5]

The main results of this study were as follows:

- The impact of the various expected cost components on the probability of pursuing post-secondary studies was practically the same, financial assistance having the greatest effect.
- The effect of lost income on the probability of pursuing post-secondary studies was slightly less than the effect of tuition fees for most students.
- The probability of pursuing post-secondary studies increased with academic standards. However, when the standards became much higher than the individual's abilities, the probability of enrolling fell.
- The probability that an individual will pursue post-secondary studies increased with the proportion of students in his/her high school group who pursued post-secondary studies. This outcome may indicate the existence of nonobservable characteristics linked to high school that influence post-secondary participation or a tendency for all students in the same high school to have similar unobservable characteristics relevant to the post-secondary activity decision.
- The authors also used results obtained with data on the class of 1972 to predict the distribution of graduates in 1977. The model, in general, correctly predicted the actual distribution of graduates from 1977 between the various post-secondary activities.

2.2 A simultaneous model of educational choice and labour supply

The second category of studies includes, among others, those of Blakemore and Low (1983) and Gustman and Steinmeier (1981). The main objective of these studies was to analyze the effect of labour market conditions on post-secondary participation.

Blakemore and Low (1983) developed a simultaneous model of enrolment in education and labour supply in an effort to study and predict the effect of a change in labour market conditions on the work vs. study choice. In theory, a high unemployment rate and low wages reduce the opportunity cost of studies but also reduce the family income available for funding education. The net effect of labour market conditions on the work vs. study choice is determined

[5] The data used come from the U.S. survey entitled "National Longitudinal Study of the High School Class of 1972".

empirically. The Blakemore and Low model is based on the assumption that individuals choose a combination of enrolment in education and labour supply that maximizes the expected net present value of income over their lifetime. This value is defined as being a function of the individual's characteristics, direct costs of study, financial resources, other than the income, available for covering the direct cost of studies, as well as the unemployment rate and wages.

The authors estimated two multinomial logit models. The first model estimated the probability of choosing various combinations of work and intensity of studies, while the second model estimated the probability of choosing various combinations of work and types of studies. These models were estimated through longitudinal data on U.S. high school graduates from 1972.[6]

The results of the logistic regressions were used to simulate the impact of an increase in the unemployment rate on the work vs. study choice. The authors found that an increase in the unemployment rate led to a reduction in the probability of pursuing studies. Therefore, the negative income effect of an increase in the unemployment rate cancelled out the positive effect of a decrease in the opportunity cost. The impact of an increase in wages on the work vs. study choice was also estimated. The income effect appeared to dominate once again since an increase in wages lead to an increase in the probability of pursuing studies even though students were also more susceptible of working part-time while they studied. Briefly, the results of this study suggest that labour market conditions influence the decision to enrol in education mainly because they affect family income.

Gustman and Steinmeier (1981) also estimated a simultaneous model for enrolment in education and labour supply to study the effect of wages and job opportunities on the work vs. study choice. Their theoretical model was based on the assumption that students maximize the utility function subject to a time and budget constraint. The solution to this problem, that is to say the optimal work-study combination, may be expressed as a function of the characteristics of the family environment (parental education and income, single parent family vs. two-parent family, employment status of the head of the family), the average salary of youth vs. the average salary of high school graduates aged 25 or over and the youth unemployment rate.

The probabilities that different work-study combinations will be selected were estimated using a multinomial logit model and cross-sectional data on American youth living in metropolitan areas.[7]

The results obtained indicate that in low unemployment rate areas, the probability of pursuing studies was lower for each of the groups studied except for visible minority women. And, in areas where wages were high, the probability of pursuing studies was lower for each of the groups studied. Thus, unlike the results obtained by Blakemore and Low (1983) the Gustman and Steinmeier study indicated that the negative effect of a low unemployment rate and high wages on the opportunity cost of pursuing post-secondary studies cancelled out the positive income effect. In other words, labour market conditions appeared to influence the decision to pursue education mainly by influencing the opportunity cost.

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[6] The data came from the U.S. survey entitled "National Longitudinal Study of the High School Class of 1972".
[7] The data came from the U.S. survey entitled "Survey of Income and Education, 1976".

As we have just seen, most studies attempting to model the individual decision to invest in human capital apply to the U.S. situation. In order to study the approach used by Canadian students in terms of deciding whether to pursue higher studies, we chose to adapt Catsiapis' 1987 model to the Canadian situation.

3. Theoretical model

The theoretical model used for this study was based on the theory of human capital and the approach developed by Catsiapis (1987).

It was assumed that every student *t* who has completed his/her high school studies faced a set of post-secondary activities *i*: no post-secondary enrolment, college/cégep or university.

The choice of post-secondary activity depended on the assessment of the expected benefits less the expected costs of each level of education, i.e. on the calculation of the expected net present value of each level of education. The expected benefits of post-secondary education may be expressed as the product of the rate of return expected from a unit of human capital (k^a) and total human capital *h(i, H)*. Total human capital depends on the individual's production function (*h*), the level of education chosen (*i*) and the initial stock of human capital (*H*). The expected costs of post-secondary studies were the sum of fixed costs (*CF*), direct costs (*CD*) and the opportunity cost (*COP*) minus expected financial assistance (S^a).

Thus, based on the assumption that the benefits of studies are lasting and that the costs are assumed over a single period, only the benefits were discounted and the expected net present value of post-secondary studies were expressed as follows:

(1) $$VPN_{ti}^{a} = [k_{ti}^{a} * h(i,H)/r] - [CF_{ti} - S_{ti}^{a} + CD_{i} + COP_{ti}]$$

where

k^a = expected rate of return for a unit of human capital

h(i, H) = human capital production function

i = post-secondary activity

H = initial stock of human capital

r = discount rate

CF = fixed costs

CD = direct costs

S^a = expected financial assistance

COP = opportunity cost

If the expected net present value was negative for both levels of post-secondary education, it was assumed that the student would choose not to pursue post-secondary studies. Otherwise, it was assumed that the student would choose the level of education that would maximize the expected net present value.

To move from the theoretical model to the empirical analysis, the expected net present value of post-secondary studies was expressed as follows:

(2) $VPN^{a}_{ti} = f(k^{a}_{ti}, H_{t}, CF_{ti}, CD_{i}, S^{a}_{ti}, COP_{ti})$

Then, the variables that were not directly observable (k^a, H, CF, S^a) were expressed as a function of observable explanatory variables.

- The expected rate of return (k^a) for a unit of human capital may be expressed as a function of the characteristics that determine productivity (abilities), those that determine labour market participation (health, gender, marital status and dependent children), job opportunities in the province of residence and all other characteristics that may have a value in the labour market (gender, immigrant status, marital status and dependent children).
- The initial stock of human capital (H) of an individual may be expressed as a function of his/her personal abilities and parental education and occupation. These last two variables in part determine the family's socio-economic status and thereby take into account the economic and social resources available to the student.
- The fixed costs (CF) are the costs of information, financial assistance and other costs of preparation related to post-secondary studies. It was assumed that these costs are lower for urban dwellers and individuals whose parents have a lot of education. Parents who pursued post-secondary studies may have better sources of information about educational institutions and the availability of financial assistance.
- Financial assistance expected (S^a) from the government[8] may be estimated in terms of the following variables: tuition fees, marital status, dependent children and parental education and occupation. To account for the financial assistance expected from the parents, an indicative variable was used, with a value of 1 if the student received financial assistance from his/her family during the last months and a value of 0 otherwise.

The variable costs of post-secondary education (direct costs and opportunity costs) are observable and, consequently, may be included directly into the VPN^a equation. Direct costs are tuition fees, whereas opportunity costs are the loss of income during post-secondary studies. Such a loss may be estimated from the data on the income of youth who left school after having earned their post-secondary diploma.

Table 1 provides the specific definition and a few descriptive statistics for the explanatory variables used to estimate the expected net present value of post-secondary studies. The next part describes the procedure used to estimate the model of investment in human capital that was previously described.

[8] Provincial student assistance offices assess the funding that a student may receive from a provincial government based on an estimation of their financial resources. The latter are based on available resources (student and parental income), study-related costs and living expenses. The latter expenses are a function of the individual's status in terms of presence of dependent children, marital status and whether he/she lives with parents. Since the *School Leavers Survey* does not contain information about parental income, a reduced form (education and profession) is used for this variable.

Table 1
Definition of variables used in the regressions and descriptive statistics

Variable	Definition	Average	(Variance)$^{1/2}$
Dependent variable	High school graduates who		
University studies (undergraduate)	enrolled in university	0.41	7.28
College studies	only enrolled in college	0.29	6.73
No post-secondary education	did not enrol in post-secondary studies	0.30	6.75
Independent variables			
Gender			
(Male)			
Female		0.51	7.39
Immigrant status			
(Born in Canada)			
Immigrant	Individuals who were not born in Canada	0.07	3.84
Marital status			
(Single, never married)			
Married or previously married	Married, common law, separated, divorced, widowed	0.03	2.50
Dependent children			
(No dependent children)			
Dependent children	Dependent children	0.03	2.42
Health			
(No limitations in activities)			
Limitations in activities	Chronic health problems	0.05	3.15
Abilities			
(Never failed a year)			
Failed one year	At least one year failed in elementary school	0.11	4.68
(No problems with math)			
Problems with math	Difficulties in math in high school	0.42	7.29
(No problems with science)			
Problems with science	Difficulties in science in high school	0.25	6.41
(No problems with literature)			
Problems with literature	Difficulties in English-French in high school	0.20	5.86
Average marks			
(Mainly As (80% or more))	Average in last high school term completed		
Mainly Bs (70% to 79%)		0.45	7.36
Mainly Cs (60% to 69%)		0.22	6.17
Ds and Es (50% or less)		0.02	2.11
Province			
(Ontario)	Province at the time of leaving high school		
Newfoundland		0.03	2.48
Prince Edward Island		0.01	1.07
Nova Scotia		0.04	2.80
New Brunswick		0.03	2.62
Quebec		0.23	6.18
Manitoba		0.04	3.01
Saskatchewan		0.04	2.96
Alberta		0.09	4.33
British Columbia		0.11	4.67
Rural or urban area			
(Urban)	Region at the time of leaving high school		
Rural		0.23	6.23

Table 1 (continued)
Definition of variables used in the regressions and descriptive statistics

Variable	Definition	Average	(Variance)$^{1/2}$
Financial support from family			
(Did not receive any financial support)			
Received financial support	Received financial support from family in the last 12 months	0.57	7.33
Mother's education			
(Did not complete high school)			
Completed high school	Higher level of education achieved by mother	0.29	6.68
Enrolled in or completed post-secondary		0.29	6.72
Father's education			
(Did not complete high school)			
Completed high school	Higher level of education achieved by father	0.20	5.88
Enrolled in or completed post-secondary		0.31	6.85
Mother's occupation			
(Trades, transport and equipment operators, primary or processing and manufacturing)	Standard occupation classification codes 7, 8, 9		
Management	Standard occupation classification code 0	0.06	3.57
Business, finance and administration, natural science	Standard occupation classification codes 1 and 2	0.18	5.69
Health, social sciences, education, government service	Standard occupation classification codes 3 and 4	0.15	5.35
Art, culture, recreation and sport, sales and services	Standard occupation classification codes 5 and 6	0.20	5.86
Father's occupation			
(Trades, transport and equipment operators, primary or processing and manufacturing)	Standard occupation classification codes 7, 8, 9		
Management	Standard occupation classification code 0	0.10	4.46
Business, finance and administration, natural science	Standard occupation classification codes 1 and 2	0.18	5.69
Health, social sciences, education, government service	Standard occupation classification codes 3 and 4	0.15	5.35
Art, culture, recreation and sport, sales and services	Standard occupation classification codes 5 and 6	0.20	5.86
Opportunity cost of studies	Income foregone in one year of studies, estimate based on the 1996 Census	6,882.18	17,236.93
Direct costs of studies	University tuition fees for two terms, 1995-96	2,639.38	8,732.64
	Community college tuition fees for two terms, 1995-96	500.99	3,139.25

Note: The variables in parentheses are reference groups.

4. Econometric model

Based on the theoretical model developed above, the post-secondary activity choice was directly linked to the VPN^a of different levels of education.

The VPN^a of post-secondary studies was first expressed as a linear function of the explanatory variables set out above[9] and the assumption was made that errors ε_t follow a multinomial logit function.

$$(3)\ VPN_{it}^{a} = X_{it}\beta_i + \varepsilon_{it}$$

where

i = 1 for university, 2 for college and 3 for high school

VPN_{it}^{a} = expected net present value of a year of study i for individual t

X_{it} = vector of explanatory variable for individual t[10]

β_i = vector of parameters

ε_{it} = error term

The error assumption and the link between the choice of studies y and the VPN^a enable us, with a multinomial logit regression model, to express the conditional probability of choosing a post-secondary activity as follows:

$$(4)\ P(y = i|X_{it}) = \frac{e^{X_{it}b_i}}{\sum_{i=1}^{3} e^{X_{it}b_i}}$$

The logarithm of relative probabilities of pursuing post-secondary studies are linear functions of X:

$$(5)\ \ln\left[\frac{P(y = i \mid X_{it})}{P(y = 1 \mid X_{it})}\right] = X_{it}b_i \text{ pour } i = 1, 2$$

These functions[11] are estimated simultaneously based on the maximum likelihood method with the help of a sample of $t = 1, \ldots, n$ high school graduates.[12] The next part discusses in greater detail the data used in the estimation of the logits.

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[9] The list of explanatory variables is provided in Table 1.

[10] Given the available explanatory variables, only one varies with the choice of studies i, and this is the annual cost of pursuing studies.

[11] There are 2 equations, one for the logarithm for each probability: university studies vs. no post-secondary education and college studies vs. no post-secondary education.

[12] For more information about logistic regression models, see Hosmer and Lemeshow (1989)

5. *The data used*

The estimation of the parameters of the previously-developed model of investment in education relays on the observations obtained from the following Statistics Canada surveys: *School Leavers Survey, 1991, School Leavers Follow-up Survey, 1995, 1996 Census, Financial Statistics of Community Colleges and Vocational Schools Survey, 1995-96* and *Tuition Fee and Living Accommodation Costs at Canadian Universities Survey 1995-96.*

The data on the individual characteristics[13] of high school graduates came from the *School Leavers Survey, 1991* and the data on post-secondary activities and place of residence of graduates came from the *School Leavers Follow-up Survey, 1995*. The first survey was carried out from April to June 1991 and collected socio-demographic data and information about the school experiences of 9,460 youth aged 18 to 20. The *School Leavers Follow-up Survey* was carried out four years later, from September to December 1995, on the same youth, by then aged 22 to 24. This second survey provided an opportunity to obtain from 6,284 respondents, up-to-date data on the transition from high-school to post-secondary studies and from high school to the labour market. Since we were trying to model the post-secondary education enrolment decisions of high school graduates, only data on high school graduates was used, which represented 85% of the 1995 respondents, or 4,375 individuals.[14]

The opportunity cost was estimated from the income data in the *1996 Census*. Foregone earnings of students based on their gender, age, immigrant status, region, parental and matrimonial status were estimated from the data on the 1995 earnings of youth aged 18 to 25 who left school after high school graduation.[15]

The data on the direct costs of college studies came from the *Financial Statistics of Community Colleges and Vocational Schools Survey, 1995-96*. This survey contains aggregate data at the provincial level on tuition fees paid by full-time and part-time students in community colleges. These data were divided by community college enrolment[16] to obtain average tuition fees per student and weighted to reflect tuition fees for two terms. The data on the direct costs of university studies came from the *Tuition Fee and Living Accommodation Costs at Canadian Universities Survey 1995-96.* More specifically, average tuition fees for two terms for full-time university students by province and field of studies were used.[17]

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[13] Gender, immigrant status, marital status, dependent children, health, abilities, urban vs. rural, financial assistance from family, parental education and occupation.

[14] The inhabitants of the Yukon and Territories and individuals who were outside the country at the time of the interview were excluded from the sample.

[15] For additional information about this estimation, see Appendix A.

[16] The data on community college enrolment came from *Education in Canada*, 1997, Catalogue No. 81-229, Statistics Canada.

[17] See Appendix B for the data on the tuition fees used.

Table 2 Surveys used	
Survey	**Variables used or estimated**
School Leavers Survey, 1991	Data on individual characteristics of high school graduates (gender, immigrant status, marital status, dependent children, health, abilities, province, urban vs. rural area, financial support from family, parental education)
School Leavers Follow-up Survey, 1995	Data on post-secondary activities of high school graduates
1996 Census	Estimation of opportunity cost
Financial Statistics of Community Colleges and Vocational Schools Surveys 1995-96	Estimation of community college tuition fees
Tuition Fee and Living Accommodation Costs at Canadian Universities Survey 1995-96	Data on university tuition fees

6. *Empirical analysis*

This last part of the study is dedicated to analyzing the findings of the application of the previously developed post-secondary education enrolment model. The applied model performed very well. Almost all of the independent variables were significant in both equations. Moreover, the value of the coefficients of the independent variables measuring the costs and benefits of post-secondary studies had the expected sign.

Part 6.1 analyzes the estimated coefficients in order to identify the main determinants of post-secondary participation. Part 6.2 discusses the differences between the determinants of college and university participation. Part 6.3 addresses the differences between the determinants of post-secondary participation by men and women.

6.1 The determinants of post-secondary participation

Table 3 presents the results of the application of the equations (5). For each equation, the first column of results presents the parameters estimated for each explanatory variable, whereas the second column presents the relative probability of pursuing post-secondary studies associated with each explanatory variable.

Since the estimated coefficients were used to calculate the VPN[a] of post-secondary studies, they may be interpreted as follows: a variable with a positive coefficient increases the VPN[a] of post-secondary education in relation to the reference variable (the variable in parentheses) while a variable with a negative coefficient reduces the VPN[a] of post-secondary education in relation to the reference variable.

The relative probability of pursuing post-secondary studies associated with each explanatory variable was obtained by exponentiating the estimated coefficients. This is a "relative" probability since it involves evaluating the effect of different variables on the probability of pursuing post-secondary studies vs. not pursuing post-secondary studies. It should be understood that a relative probability greater than 1 corresponds to an increase in the relative probability in relation to the reference group, while a relative probability of less than 1 means a reduction in the relative probability in relation to the reference group.

Table 3
Coefficients obtained with the multinomial regression

	University studies vs. no post-secondary education		College studies vs. no post-secondary education	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Constant	-0.5024	0.61	-1.4527	0.23
Gender				
(Male)				
Female	0.4796	1.62	0.5059	1.66
Immigrant status				
(Born in Canada)				
Immigrant	0.5329	1.70	0.1198	1.13
Marital status				
(Single, never married)				
Married or previously married	-1.495	0.22	-0.7993	0.45
Dependent children				
(No dependent children)				
Dependent children	-1.2001	0.30	-0.2154	0.81
Health				
(No limitations in activities)				
Limitations in activities	-0.7984	0.45	-0.2881	0.75
Abilities				
(Never failed a year)				
Failed one year	-1.3524	0.26	-0.1704	0.84
(No problems with math)				
Problems with math	-0.5211	0.59	-0.2015	0.82
(No problems with science)				
Problems with science	-0.0267	0.97	0.0246	1.02
(No problems with literature)				
Problems with literature	-0.7119	0.49	-0.316	0.73
Average marks				
(Mainly As (80% or more))				
Mainly Bs (70% to 79%)	-0.7276	0.48	-0.045	0.96
Mainly Cs (60% to 69%)	-1.4254	0.24	0.0446	1.05
Ds and Es (50% or less)	-2.2502	0.11	-0.3889	0.68
Province				
(Ontario)				
Newfoundland	-0.3948	0.67	-0.699	0.50
Prince Edward Island	0.6215	1.86	-0.2141	0.81
Nova Scotia	-0.2113	0.81	-1.1798	0.31
New Brunswick	-0.4649	0.63	-0.9814	0.37
Quebec	-0.4412	0.64	0.1612	1.17
Manitoba	-0.301	0.74	-0.9886	0.37
Saskatchewan	0.3079	1.36	-0.7602	0.47
Alberta	-0.5621	0.57	-1.2161	0.30
British Columbia	-0.5293	0.59	-0.8448	0.43

Table 3 (continued) Coefficients obtained with the multinomial regression				
	University studies vs. no post-secondary education		College studies vs. no post-secondary education	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Rural or urban area				
(Urban)				
Rural	-0.2392	0.79	0.179	1.20
Financial support from family				
(Did not receive any financial support)				
Received financial support	0.8384	2.31	0.3831	1.47
Mother's education				
(Did not complete high school)				
Completed high school	0.0155	1.02	-0.2294	0.80
Enrolled in or completed post-secondary	0.6256	1.87	-0.0214	0.98
Father's education				
(Did not complete high school)				
Completed high school	0.2171	1.24	0.1652	1.18
Enrolled in or completed post-secondary	0.9588	2.61	0.4606	1.59
Mother's occupation				
(Trades, transport and equipment operator, primary or processing and manufacturing)				
Management	0.2022	1.22	0.3935	1.48
Business, finance and administration, natural science	-0.00965	0.99	0.104	1.11
Health, social sciences, education, government service	0.1837	1.20	0.00984	1.01
Art, culture, recreation and sport, sales and services	-0.00394	1.00	-0.0378	0.96
Father's occupation				
(Trades, transport and equipment operator, primary, processing and manufacturing)				
Management	0.1509	1.16	0.0276	1.03
Business, finance and administration, natural science	0.5065	1.66	0.4467	1.56
Health, social sciences, education, government service	0.2525	1.29	-0.0216	0.98
Art, culture, recreation and sport, sales and services	0.3005	1.35	0.137	1.15

Table 3 (continued)
Coefficients obtained with the multinomial regression

	University studies vs. no post-secondary education		College studies vs. no post-secondary education	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Opportunity cost of studies	-0.0001		-0.0001	
Direct costs of studies				
University	-0.0003		-0.0004	
College	0.0007		0.0003	

Notes: The variables in parentheses are reference groups
Number of observations: t = 4,375
The model is significant at p = 0.0001
All of the coefficients are significant at 1% except:
* significant at 5%
** significant at 10%
*** not significant at 5 or 10%

Analysis of the impact of the student characteristics on the choice of pursuing post-secondary studies.

In our model, a positive sign for the coefficients estimated from the "female" variable indicates that female high school graduates have a higher expected rate of return than male high school graduates and, hence VPN[a], for post-secondary education than males. Consequently, they have a 62% higher chance of enrolling in university and 66% higher chance of enrolling in college. These results are compatible with the recently published rates of return. For instance, Vaillancourt (1998) and Vaillancourt and Bourdeau-Primeau (2001) evaluated the rates of return on education in Canada by gender, education and field for 1985, 1990 and 1995, and found that the rates of return for women tended to be higher than for men.

The coefficient estimated for the "immigrant" variable in the university equation suggests that high school graduates who were born outside Canada had a higher VPN[a] for university studies than high school graduates who were born in Canada. However, the coefficient estimated for the "immigrant" variable in the college equation assumed that immigrants and individuals born in Canada had the same VPN[a] for college studies since these two groups were equally likely to enrol in college (relative probability close to 1). The link between place of birth and post-secondary participation could be explained by the fact that some parents of immigrants were selected according to their qualifications[18] and that they therefore had a higher human capital than the average native Canadian. The children of these parents would also have a higher human capital than their peers and, consequently, greater benefits from post-secondary studies compared to native Canadians. Many studies comparing the returns to immigrants on the labour market to those of individuals born in Canada confirmed this hypothesis about the "quality" of immigrants. Chiswick and Miller (1988),

[18] Canada receives *independent class immigrants*, who are selected on the basis of their knowledge, abilities and experience, *business class immigrants*, who have the experience and resources needed to contribute to Canada's economy and *refugees* as well as *family class immigrants*.

Meng (1987), Akbari (1987) and Fagnan (1995) estimated that immigrants tended to outclass native Canadians in the area of annual earnings during their working life.

The coefficients estimated for the "married" and "dependent children" variable suggest that these variables had a negative effect on the VPN[a] of post-secondary studies. Thus, married high school graduates were 78% less likely to enrol in university and 55% less likely to enrol in college than those who were single. High school graduates with dependent children, for their part, were 70% less likely to enrol in university and 19% less likely to enrol in college than graduates without children. Married high school graduates with children may lean towards occupations that enable them to spend less time in the labour market and are, consequently, lower paid. The expected return on post-secondary studies could be lower for these individuals. Another possible explanation of the lower probability of finding married individuals with children pursuing post-secondary studies is that these high school graduates assign a higher value than their peers to foregone earnings since they have higher living expenses than the latter.

The negative sign for the coefficients estimated for the "activity limitation" variable indicated that, according to our model, individuals who declared having a chronic health problem that limited their activities had a lower expectation of returns and, hence, VPN[a] for post-secondary education than individuals who had not indicated any chronic health problems. Consequently, individuals who were limited in the type or amount of activity they could do had a 55% lower chance of enrolling in university and a 25% lower chance of enrolling in college than individuals who had no activity limitation. The returns expected from education may be lower for individuals with disabilities since this problem may limit their participation in the labour market. A Statistics Canada report[19] drew up the profile of the first labour market experiences of individuals with disabilities who received post-secondary diplomas in 1990, and noted that these individuals were more likely to be unemployed and less likely to be part of the labour force than the other students in their graduating class. The lower expected rate of return among individuals with disabilities might also explain the fact that they expected to be victims of discrimination in terms of earnings in the labour market. However, the Statistics Canada study did not find any evidence of earnings discrimination towards graduates who were limited in their daily activities. Likewise, Hum and Simpson (1996) studied the 1989 labour market performance of Canadians with disabilities and did not find any evidence of income discrimination towards this group.

Analysis of the impact of students' abilities on the post-secondary education enrolment decision.

In general, the coefficients of the different measurements of abilities confirmed the assumption that the benefits expected from university studies are higher among individuals who do well in elementary and high school. Individuals who did not fail any years in elementary school and those who did not encounter any problems in math and literature and who had good marks in high school had a higher probability of enrolling in university than those who had difficulties in school. However, how they did in science had little effect on the

[19] A look at employment-equity groups among recent post-secondary graduates: visible minorities, aboriginal peoples and the activity limited, Statistics Canada, Catalogue No. 11F0019MPF, 1994.

probability of enrolling in university. In terms of college, the abilities-related variables had less of an impact on the probability of enrolling. For instance, failing a year in elementary school reduced the probability of enrolling in university by 74% and college by only 16%. Moreover, individuals who got a D or E average in their last term of high school had a 90% lower chance of enrolling in university and only a 32% lower chance of enrolling in college compared to students who got an A average. It should be noted that the effect of low average marks on the probability of enrolling in university was partly due to the eligibility criteria in universities.

Analysis of the impact of the student's region of residence on the post-secondary education enrolment decision.

The estimated coefficients of the provincial dummy variables suggest that the inhabitants of Prince Edward Island, Saskatchewan, Ontario, Nova Scotia, Manitoba and Newfoundland were the most likely to enrol in university (compared to the inhabitants of the other provinces), while residents of Alberta and British Colombia were the least likely. In terms of college, Quebec and Ontario had the highest probability of enrolment, while those from the east and west were 20% to 70% less likely to enrol in college than residents from central Canada. These probabilities reflect the provincial disparities in post-secondary enrolment rates and may be explained by institutional factors. The important university enrolment rates (higher than the national average) in the Atlantic provinces may be explain by the fact that until recently, the collegial system wasn't very developed leaving many youths with the choice between "university or nothing".[20] On the other hand, Quebec, where there is a well establishes college system and where a college diploma is needed to enter university, has had the highest college enrolment levels in Canada. As in regard to the weak university enrolment rates in Alberta and British Colombia, they may be due in part to the fact that these provinces have restricted financing to the universities over the last years in order to invest heavily in colleges. Provincial variations in the rates and probabilities of post-secondary enrolment may also be explained by factors that were not taken into account in this study, such as cultural and industrial factors and individual preferences.

The "rural" variable had a negative effect on the probability of enrolling in university. The inhabitants of rural areas had an approximately 21% lower chance of enrolling in university than the inhabitants of urban areas. According to our model, this means that the fixed costs of university studies were higher for rural inhabitants than for those in urban areas. In terms of college, the inhabitants of rural areas were slightly more likely to enrol. Frenette (2002) obtained similar results in his study on the impact of the distance between the student's residence before graduating from high school and the closest university on post-secondary participation. He found that students who lived too far from the closest university to make the trip every day were distinctly less likely to go to university than students who lived close to a university. Yet, these students were more likely to enrol in a non-university post-secondary teaching establishment than students living close to a university.

[20] The Price of Knowledge: Access and Student Finance in Canada, p. 46.

Analysis of the impact of parental characteristics and their financial contribution on the post-secondary education enrolment decision.

The estimated coefficients show that financial assistance from the parents had a significant effect on the post-secondary education enrolment decision. High school graduates who received financial assistance from their families in the twelve months preceding the interview had twice as much of a chance of enrolling in university and approximately 50% more of a chance of enrolling in college than graduates who did not receive any financial assistance from their families.

Parental education was also very important. However, the impact on the probability of enrolling in university was much greater than on the probability of enrolling in college. Moreover, the father's education seemed to have a much greater effect on the decision to invest in education than the mother's education. A student whose father "had attended or completed post-secondary studies" was 2.6 times more likely to enrol in university and 1.6 times more likely to enrol in college than students whose fathers were not high school graduates. A student whose mother "had attended or completed post-secondary studies" was 87% more likely to enrol in university but just as likely to attend college than a student whose mother was not a high school graduate.

In general, as with parental education, the mother's occupation seemed to play a less important role than the father's. Students whose mothers worked in management were 48% more likely to enrol in college than students whose mothers worked in the following sectors: trades, transport and equipment operators, primary industry, processing and manufacturing. Other occupations of the mother had practically no impact on the probability of enrolling in university or college in comparison to the reference group.[21] Students whose fathers were in business, finance, administration or natural sciences had a 66% higher chance of enrolling in university and 56% higher chance of enrolling in college than students whose fathers worked in one of the reference groups. The fact that the father worked in the health or social science, education, government service sectors[22] or in the art, culture, recreation and sport or sales and service[23], increased the student's probability of enrolling in university somewhat (29% and 35% respectively) but had practically no effect on the probability of enrolling in college in comparison to the reference group. Finally, unlike the case where the mother worked in management, the fact that the father worked in management had but a slight influence on the post-secondary education enrolment decision in relation to the reference group. However, as the separate analysis of men and women showed, young men whose fathers worked in management were far more likely to pursue post-secondary studies than the reference group.

[21] National Occupational Classification (NOC) codes 7, 8 and 9: trades, transport and equipment operators, primary industry occupations and processing, manufacturing and utilities.
[22] National Occupational Classification (NOC) codes 3 and 4
[23] National Occupational Classification (NOC) codes 5 and 6

Analysis of the impact of the cost of studies on the post-secondary education enrolment decision.

As expected, the effect of the opportunity cost on the probability of pursuing post-secondary studies was negative. University tuition fees also had a negative effect on enrolment. However, there was a positive correlation between college tuition fees and the probability of enrolling in college. This result is attributed to the fact that college enrolment rates were generally higher in provinces where tuition fees were higher.[24]

A simple simulation presented in table 4 gives an idea of the potential effects on post-secondary participation of increases in the cost of studies. The results show that the roles played by tuition fees and foregone earnings in the determination of university enrolment decision are equally important. Indeed, a 10 % increase in university tuition fees reduced the probability of enrolment by 0.9% while the same increase in the opportunity cost of studies (foregone earnings) reduced the probability of enrolling in university by 0.8%.

Table 4
Effects of a 10% increase in the cost of studies on the probability of enrolment

	in university studies	in college studies
Foregone earnings	-0.76%	-0.25%
University tuition fees	-0.89%	-0.42%
College tuition fees	0.47%	0.04%

Note: Effects on the probabilities evaluated at the mean of the explanatory variables.

Summary of the key determinants of post-secondary participation

In summary, the key determinants of university participation were parental education, financial support by parents, student's abilities, marital status, parental status and student's immigrant status. In terms of college, the factors that most strongly influenced the decision to enrol were province of residence, gender, father's education and occupation and student's marital status.

6.2 Differences between the determinants of college and university participation

Most of the variables had a similar influence on the decision to enrol in college or university.

- *Women* were more likely than men to enrol in college or university.
- *Married* individuals, those with *dependent children* and those with *limitations on activities* were less likely than their counterparts to enrol in college or university.
- *Ontario's inhabitants* were more likely to enrol in college or university than the inhabitants of the other provinces, with the exception of Prince Edward Island, Quebec and Saskatchewan.

[24] See Table B3 in Appendix B.

- Students who had received *financial support from their families* had a greater chance of enrolling in college or university than those who had not.
- Students whose fathers *had completed high school* and those whose *fathers had pursued post-secondary studies* had a greater chance of enrolling in college or university than those whose fathers had not completed high school.
- Students whose *mothers worked in management* were more likely to enrol in college or university than students whose mothers worked in another sector.
- Students whose fathers *worked in business, finance and administration or natural sciences*, were more likely to enrol in college or university than students whose fathers worked in other sectors.

However, some variables had a different impact on the probability of enrolling in college or university.

- *Immigrants* were much more likely than native Canadians to enrol in university (70%), but they had practically the same likelihood of enrolling in college.
- The variables linked to *abilities* had a much greater impact on the probability of enrolling in university than on the probability of enrolling in college.
- The residents of *Prince Edward Island* and *Saskatchewan* were more likely to enrol in university but less likely to enrol in college than the residents of Ontario. *Quebec* residents were more likely to enrol in college but less likely to enrol in university than Ontario residents.
- The inhabitants of *rural areas* were slightly less likely to enrol in university than the inhabitants of urban areas, but were slightly more likely to enrol in college.
- Students whose *mothers had pursued post-secondary studies* were more likely to enrol in university than those whose mothers had less education, but just as likely to enrol in college as the latter.

6.3 Differences between the determinants of post-secondary participation among women and men

The previous findings reveal that the probability of pursuing post-secondary studies varied greatly depending on gender. A separate analysis for men and women was done[25] to identify the variables that affect post-secondary participation differently for men and women. The effects of most of the variables on the probability of pursuing post-secondary studies differed between men and women: areas where the differences were greatest were examined.

[25] The tables in Appendix C present the results of the applications of the equations (5) to women and men. As with Table 3, for each equation, the first column of results presents the parameters estimated for each explanatory variable, whereas the second column presents the relative probability of enrolling in post-secondary studies associated with each explanatory variable.

Differences in university participation

- The mother's level of education seems to affect women more than men in their decision to enrol in university. Women whose mothers had pursued post-secondary studies were twice as likely to enrol in university[26] whereas men whose mothers had pursued post-secondary studies were approximately 60% more likely to enrol in university. Yet, the effect of the father's education on the decisions of men and women varied according to the level of education. Men and women whose fathers had pursued post-secondary studies were 2.7 times more likely to enrol in university.[27] However, men whose fathers had a high school diploma were 40% more likely to enrol in university, whereas women whose fathers had such a diploma were just as likely to enrol in university as those whose fathers had not completed high school.

- The father's and mother's occupation also affected the decisions of men and women differently. The mother's occupation was a relatively significant determinant in the decision of women to enrol in university, but this variable barely affected the likelihood of men enrolling in university. However, the father's occupation was one of the key determinants in the decision to enrol in university among men and barely affected the decisions of women in this regard.

- Men living in a rural area when they completed high school were approximately 40% less likely to enrol in university than men living in urban areas. However, women living in rural and urban areas were equally likely to enrol in university.

- Women living in Saskatchewan were 72% more likely to enrol in university than women living in Ontario, whereas men living in Saskatchewan were just about as likely to enrol in university as men living in Ontario. In Newfoundland, women were 50% less likely to enrol in university than women living in Ontario, whereas men were just about as likely to enrol in university as their Ontario counterparts.

Differences in college participation

- As with university, the father's occupation had a much greater impact on the probability of men enrolling in college than women.

- Men living in Quebec were 4 times more likely to enrol in college than those living in Ontario, whereas women living in Quebec were 60% less likely to enrol in college than women living in Ontario. The reverse was true in Prince Edward Island. Women living there were approximately 3 times more likely to enrol in college than those living in Ontario, whereas the men were approximately 80% less likely to enrol in college than their counterparts in Ontario. There was also a significant difference between men and women in British Columbia. Women living there were just as likely to enrol in college as those living in Ontario, whereas the men were 86% less likely to enrol in college than those living in Ontario.

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[26] Still in relation to the reference variable, in terms of those whose mothers did not complete high school.
[27] Still in relation to the reference variable, in terms of those whose fathers had not completed high school.

7. Policy implications

Four key findings emerge from this study. They can help better explain the transition of high school graduates into post-secondary studies and, therefore, guide policies designed to encourage the pursuit of studies and make post-secondary education more accessible.

1. The socio-economic status of parents and their financial support

Parental education, occupation and financial support were the key factors influencing the decision to invest in post-secondary education.

Thus, limited access to educated people (who pursued post-secondary studies) who held positions of influence (in management, business, finance and administration or science) and to financial resources were significant obstacles to post-secondary participation.

In 1999, approximately 11% of youth aged 15 to 17 lived in low-income families.[28] These youth were less likely to receive financial assistance from their families, which, according to the results of our study, considerably reduced their chances of pursuing post-secondary studies. In order to achieve national post-secondary education objectives, one of the important policy issues remains to make post-secondary education accessible to low income Canadians who are disadvantaged by their family's socio-economic status and to give them access to resources (social networks, learning resources).

2. School success in elementary and high school

School success measured by achievement in elementary school (failure or otherwise) and high school (in math, science, literature and grade average) are also among the key determinants of the post-secondary education enrolment decision.

The lack of competencies, mainly in reading and writing, represent a major obstacle to post-secondary participation.

Compared to students in most other countries, 15 year-old Canadian students have done well. They placed second in reading, sixth in math and fifth in science among students from 31 countries.[29] Nonetheless, one quarter of high school graduates did not have the required competencies in reading and writing to pursue their studies.[30] In order to achieve the national post-secondary education objectives, it is important that we ensure that high school graduates have the necessary competencies, mainly in reading and writing, to pursue post-secondary studies.

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[28] *Survey of Labour and Income Dynamics* (SLID), Statistics Canada. A "low-income" family is defined as a family unit whose income is lower than the after-tax low-income cut-off (LOC).

[29] OECD, *Programme for International Student Assessment* (PISA), 2000.

[30] Statistics Canada and OECD, *The International Adult Literacy Survey*, 1994-1995.

3. The student's marital and parental status

The student's marital and parental situation were also key factors influencing the decision to enrol in post-secondary studies. Married students and those with dependent children were much less likely to enrol in university or college than their single and childless peers.

Family responsibilities represented a significant obstacle to post-secondary participation, especially among women.

In order to achieve the national post-secondary education objectives, it is important to ensure that married students with dependent children receive the assistance needed to pursue post-secondary studies.

4. Post-secondary participation by gender

There was a significant gender difference in post-secondary participation. Women were 62% more likely to enrol in university and 66% more likely to enrol in college than men.

In order to increase the proportion of Canadian post-secondary graduates, it is important to maintain strong female participation but it is also important to ensure that the male contingent does not fall. This study demonstrated that young men are particularly sensitive to their own school success in high school as well as to their father's occupation and education. Thus, it is important to ensure that these young men do well in high school so they can acquire the abilities needed to pursue their studies. Moreover, since young men consider their father's occupation and education in their post-secondary education enrolment decision (young men whose fathers had an occupation that did not require post-secondary education were less likely to pursue post-secondary studies), it is important to educate youth about the changes in employment prospects according to education.

8. Conclusion

In this study, we developed and estimated a model of investment in education that helped identify the determinants of post-secondary participation.

The model presented was based on the theory of investment in human capital and based on the approach developed by Catsiapis (1987). According to this approach, high school graduates evaluate the costs and benefits of investing in post-secondary education and choose the level of education that maximizes their expected net present value. Given the discrete nature of an investment choice, the theoretical model is estimated using a multinomial logistic regression model. The estimated parameters helped identify the key determinants of the post-secondary education enrolment decision. The variables that played a key role in the decision concerning university participation were parental education, financial support from parents, student's abilities, student's marital status, student's parental situation and student's immigrant status. In terms of college studies, the variables that most strongly affect the investment decision were the province of residence, gender, education and father's profession, as well as marital status. The separate analysis for men and women helped add the father's occupation to the list of the key determinants of university participation among men. This gender-based analysis also demonstrated that the mother's socio-economic status (education and occupation) had a stronger influence on the investment decisions of young women, while the father's socio-economic status played a more important role in the decisions of young men. Finally, the separate analysis of men and women demonstrated that the probability of pursuing post-secondary studies depending on gender varied greatly in certain provinces.

The findings in this study helped identify the significant factors and obstacles to post-secondary participation. In order to attain the national post-secondary education objectives, it is important to reduce these obstacles by focusing on 1. Making post-secondary education accessible to low-income Canadians and providing resources to students who are disadvantaged because of their family's socio-economic status. 2. Ensuring that high school graduates have the necessary competencies, mainly in reading and writing, to pursue post-secondary studies. 3. Helping young adults reconcile their school aspiration and family responsibilities. 4. Encouraging young men to pursue post-secondary studies, while ensuring that they do well in high school and are well informed about the job prospects by level of education.

Finally, the following would be a few interesting research options to explore. In this study, we looked at the probability of pursuing post-secondary studies. The choice of not pursuing studies included participation in the labour market and other activities outside the labour market. It would be interesting to break down this choice in order to jointly study the factors that influence the choice to study, work, do both or engage in other activities. Moreover, among those who choose to pursue post-secondary studies, a significant proportion will abandon their studies before they graduate. In order to identify the determinants of dropping out at the post-secondary level, it would be useful to model the behaviour of students at this level with the help of a model similar to those developed by Manski (1989) and DesJardins et al. (1999).

Appendix A: Estimation of the Opportunity Cost

According to the following system of equations:

(1) $Y_t = X_{1t}\beta_1 + U_{1t}$ the income function of individual *t*

(2) $EMP_t = X_{2t}\beta_2 + U_{2t}$ the probability function that individual *t* is working in relation to being unemployed or inactive

We only observe Y_t if individual *t* is working, i.e. only if $EMP_t > 0$. Thus, when equation (1) is to be estimated for the whole population, the data on *Y* are missing for some observations.

The income function of a *population* is given by

(3) $E(Y_t | X_{1t}) = X_{1t}\beta_1$

so the income function of a *sample* of workers is given by

$$E(Y_{1t} | X_{1t}, \text{selection rule}) = X_{1t}\beta_1 + E(U_{1t} | X_{1t}, \text{selection rule})$$

$$E(Y_{1t} | X_{1t}, EMP_t > 0) = X_{1t}\beta_1 + E(U_{1t} | X_{1t}, X_{2t}\beta_2 + U_{2t} > 0)$$

Using Heckman's results (1979), we get

(4) $$E(Y_{1t} | X_{1t}, EMP_t > 0) = X_{1t}\beta_1 + \frac{\sigma_{12}}{(\sigma_{22})^{1/2}}\lambda_t$$

where $\sigma_{12} = cov(U_{1t}U_{2t})$

$\sigma_{22} = var(U_{2t})$

$$\lambda_t = \frac{\varphi(Z_t)}{1 - \phi(Z_t)} \equiv mill\ ratio$$

$$Z_t = -\frac{X_{2t}\beta_2}{(\sigma_{22})^{1/2}} = -X_{2t}\beta_2^*$$

$$\beta_2^* = \frac{\beta_2}{(\sigma_{22})^{1/2}}$$

φ is the density function of an N(0,1)

ϕ is the distribution function of an N(0,1)

Consequently, in order to use a sample of workers to estimate a function of population income to obtain a measure of the income that students could have earned if they had not pursued post-secondary studies, it is necessary to take into account variable λ_t or there would be a selection bias. Hence, we used the two-stage estimation method proposed by Heckman (1979) to estimate a function of income adjusted to take the selection bias into account. The estimation was done from a 1996 Census sample containing observations on individual income and characteristics for youth aged 18 to 25 with a high school diploma and no other education.

The first stage of the procedure developed by Heckman involved estimating the equation (2) through the probit method in order to obtain an estimate of β_2^* to then calculate λ_t. The probit was estimated with the full sample of T = 11,366 observations. The probability of working, which is to say the probability that $EMP>0$, was estimated as a function of the following explanatory variables (X_2): gender, marital status, immigrant status, dependent children, age, school attendance and region.

The second stage involved estimating equation (1) using λ_t as the regressor in addition to X_1. The dependent variable (Y) that was used was the logarithm of wages and benefits and the independent variables included in vector X_1 are the following: gender, marital status, immigrant status, dependent children, weeks worked, hours worked and region. This income function was estimated on the basis of a subset of the first sample in which Y was observed (T_1= 9,005 observations).

It should be understood that there is another bias to selection for which we are not correcting in the interest of simplification. This bias is the one due to the fact that the incomes observed in our sample (individuals with high school diplomas and no other training) do not necessarily represent those of an entire population. Individuals who stand to gain a lot from obtaining no more than a high school diploma are more likely to fall into this category. This possibility rests on the theory of comparative advantage according to which individual abilities may affect potential income differently depending on different levels of education. For instance[31], a plumber (with a high school diploma) may have limited potential and, therefore, limited benefits as a lawyer (university diploma) but the potential and benefits for lawyers as plumbers may be less than those for individuals who chose to work as plumbers.

[31] Willis and Rosen (1979)

Table A1
Probit model estimation

Variables	Average	Estimated Coefficients	Odds ratio
Independent variables			
Constant	1.0000	1.0972	3.0
Gender and marital status			
(Married male)			
Single male	0.4840	-0.2282	0.8
Single female	0.3222	-0.2126	0.8
Married female	0.1143	-0.3413	0.7
Dependent children			
(No dependent children)			
Dependent children	0.2498	-0.1319	
Age	20.8779	0.0141*	
Immigrant status			
(Born in Canada)			
Immigrant	0.0986	-0.1883	0.8
Attendance			
(Did not attend any educational establishment in the past eight months)			
Attended an educational establishment full time or part time in the past eight months	0.3167	-0.5081	0.6
Area			
(Census metropolitan area)			
Non-metropolitan area	0.4051	-0.1362	0.9
(Ontario)			
Atlantic provinces	0.0839	-0.3523	0.7
Quebec	0.1678	-0.1891	0.8
Prairie provinces	0.1846	0.0237**	1.0
British Columbia	0.1385	-0.0012**	1.0
Dependent variable			
(Unemployed, inactive)			
Employed	0.7923		
Sample	Workers, unemployed and inactive, aged 18 to 25, who have a high school diploma and no other education		
Number of observations	11,366		

Note: All of the coefficients are significant at 5% except:
* significant at 10%
** not significant at 5 or 10%

Table A2
Estimation of the income function

Variables	Average	Estimated Coefficients
Independent variables		
Constant	1.0000	7.9301
Gender and marital status		
(Married male)		
Single male	0.4817	-0.1169
Single female	0.3166	-0.3273
Married female	0.1136	-0.2142
Dependent children		
(No dependent children)		
Dependent children	0.2520	0.0654
Age	20.9749	0.0954
Immigrant status		
(Born in Canada)		
Immigrant	0.0938	-0.0892
Weeks worked		
(49 to 52 weeks)		
0 to 13 weeks	0.1174	-1.4690
14 to 26 weeks	0.1665	-0.6970
27 to 39 weeks	0.1158	-0.3760
40 to 48 weeks	0.1324	-0.1728
Hours worked		
(35 hours or more)		
0 to 19 hours	0.2326	-0.5181
20 to 29 hours	0.1437	-0.4291
30 to 34 hours	0.0836	-0.2648
Area		
(Census metropolitan area)		
Non metropolitan area	0.3950	0.0747
(Ontario)		
Atlantic provinces	0.0752	-0.1782
Quebec	0.1592	0.0409**
Prairie provinces	0.1937	-0.1175
British Columbia	0.1433	0.0694
"Mill's Ratio" (Lambda)	0.3462	-1.0209
Dependent variable		
ln (wages and salaries)	8.8528	
Sample	Individuals aged 18 to 25 with income and high school diplomas and no other education	
Number of observations	9,005	
R^2	0.43	

Notes: All of the coefficients are significant at 5% except:
* significant at 10%
** not significant at 5 or 10%

Appendix B: Tuition Fees

Table B1
Community college tuition fees

	1995-96
Newfoundland	566
Prince Edward Island	1,277
Nova Scotia	234
New Brunswick	532
Quebec	172
Ontario	608
Manitoba	387
Saskatchewan	912
Alberta	561
British Columbia	677

Note: Tuition fees for two terms estimated with the help of data from the Financial Statistics of Community Colleges and Vocational Schools Surveys 1995-1996 and data on college attendance from Education in Canada, 1997

Table B2
University tuition fees

	1995-96
Newfoundland	2,457
Prince Edward Island	2,867
Nova Scotia	3,208
New Brunswick	2,616
Quebec	1,711
Ontario	2,697
Manitoba	2,519
Saskatchewan	2,827
Alberta	3,595
British Columbia	3,236

Note: Average tuition fees for full time students for two terms calculated with the help of the Tuition Fee and Living Accommodation Costs at Canadian Universities Survey 1995-96

Table B3
Tuition fees and attendance at community colleges

	Tuition Fees[1]	Percentage[2]
Prince Edward Island	1,277	26.6
Saskatchewan	912	18.5
British Columbia	677	27.2
Ontario	608	33.8
Newfoundland	566	24.2
Alberta	561	20.5
New Brunswick	532	20.2
Manitoba	387	18.7
Nova Scotia	234	17.0
Quebec	172	34.5

Note: 1 Tuition fees for two terms estimated with the help of data from the Financial Statistics of Community Colleges and Vocational Schools Surveys 1995-1996 and data on college attendance from Education in Canada, 1997
2 Percentage of individuals who enrolled in college in our sample

Appendix C: Results of the Model's Estimations for Women and Men

Table C1
Descriptive statistics by gender

Variable	Men		Women	
	Average	(Variance)$^{1/2}$	Average	(Variance)$^{1/2}$
Dependent variable				
University studies (undergraduate)	0.375	7.388	0.445	7.150
College studies	0.286	6.898	0.299	6.585
No post-secondary education	0.339	7.223	0.256	6.282
Independent variables				
Immigrant status				
(Born in Canada)				
Immigrant	0.075	4.028	0.070	3.668
Marital status				
(Single, never married)				
Married or previously married	0.012	1.694	0.045	2.997
Dependent children				
(No dependent children)				
Dependent children	0.010	1.529	0.044	2.951
Health				
(No limitations in activities)				
Limitations in activities	0.044	3.126	0.051	3.178
Abilities				
(Never failed a year)				
Failed one year	0.162	5.624	0.066	3.579
(No problems with math)				
Problems with math	0.375	7.388	0.456	7.165
(No problems with science)				
Problems with science	0.238	6.496	0.264	6.341
(No problems with literature)				
Problems with literature	0.242	6.538	0.151	5.153
Average marks				
(Mainly As (80% or more))				
Mainly Bs (70% to 79%)	0.427	7.548	0.474	7.184
Mainly Cs (60% to 69%)	0.285	6.886	0.167	5.364
Ds and Es (50% or less)	0.029	2.571	0.013	1.618

Table C1 (continued)
Descriptive statistics by gender

Variable	Men		Women	
	Average	(Variance)$^{1/2}$	Average	(Variance)$^{1/2}$
Province				
(Ontario)				
Newfoundland	0.023	2.265	0.024	2.180
Prince Edward Island	0.005	1.034	0.005	0.973
Nova Scotia	0.036	2.843	0.034	2.592
New Brunswick	0.036	2.843	0.031	2.506
Quebec	0.222	6.342	0.233	6.078
Manitoba	0.039	2.950	0.042	2.893
Saskatchewan	0.035	2.806	0.033	2.578
Alberta	0.108	4.734	0.094	4.195
British Columbia	0.134	5.207	0.121	4.691
Rural or urban area				
(Urban)				
Rural	0.231	6.434	0.230	6.053
Financial support from family				
(Did not receive any financial support)				
Received financial support	0.553	7.587	0.578	7.106
Mother's education				
(Did not complete high school)				
Completed high school	0.309	7.053	0.262	6.330
Enrolled in or completed post-secondary	0.277	6.832	0.304	6.619
Father's education				
(Did not complete high school)				
Completed high school	0.210	6.221	0.183	5.567
Enrolled in or completed post-secondary	0.315	7.089	0.309	6.646
Mother's occupation				
(Trades, transport and equipment operators, primary or processing and manufacturing)				
Management	0.067	3.823	0.057	3.348
Business, finance and administration, natural science	0.188	5.968	0.174	5.452
Health, social sciences, education, government service	0.146	5.389	0.163	5.320
Art, culture, recreation and sport, sales and services	0.197	6.075	0.193	5.679
Father's occupation				
(Trades, transport and equipment operators, primary or processing and manufacturing)				
Management	0.095	4.484	0.106	4.433
Business, finance and administration, natural science	0.105	4.686	0.080	3.902
Health, social sciences, education, government service	0.069	3.870	0.075	3.790
Art, culture, recreation and sport, sales and services	0.138	5.256	0.111	4.522

Table C1 (continued)
Descriptive statistics by gender

Variable	Men		Women	
	Average	(Variance)$^{1/2}$	Average	(Variance)$^{1/2}$
Opportunity cost of studies	7,614.20	15,629.93	6,191.83	11,757.97
Direct costs of studies				
University	2,656.03	9,067.69	2,623.67	8,437.24
College	503.57	3,229.81	498.56	3,061.54

Note: The variables in parentheses are reference groups.

Table C2 Coefficients obtained with the multinomial regression for women				
	University studies vs. no post-secondary education		**College studies vs. no post-secondary education**	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Constant	0.455	1.58	0.8566	2.36
Immigrant status				
(Born in Canada)				
Immigrant	0.5625	1.76	0.2341	1.26
Marital status				
(Single, never married)				
Married or previously married	-1.5952	0.20	-0.8145	0.44
Dependent children				
(No dependent children)				
Dependent children	-1.4192	0.24	-0.3156	0.73
Health				
(No limitations in activities)				
Limitations in activities	-1.1775	0.31	-0.2064	0.81
Abilities				
(Never failed a year)				
Failed one year	-1.7838	0.17	-0.4083	0.66
(No problems with math)				
Problems with math	-0.6244	0.54	-0.1876	0.83
(No problems with science)				
Problems with science	0.1557	1.17	0.2127	1.24
(No problems with literature)				
Problems with literature	-0.7992	0.45	-0.2277	0.80
Average marks				
(Mainly As (80% or more))				
Mainly Bs (70% to 79%)	-0.5873	0.56	0.0252*	1.03
Mainly Cs (60% to 69%)	-1.3934	0.25	0.1771	1.19
Ds and Es (50% or less)	-1.4526	0.23	0.2678	1.31
Province				
(Ontario)				
Newfoundland	-0.6708	0.51	-0.8548	0.43
Prince Edward Island	0.6641	1.94	1.129	3.09
Nova Scotia	-0.318	0.73	-0.9449	0.39
New Brunswick	-0.4608	0.63	-0.828	0.44
Quebec	-0.6529	0.52	-0.921	0.40
Manitoba	-0.3991	0.67	-1.2472	0.29
Saskatchewan	0.5411	1.72	-0.1032	0.90
Alberta	-0.4058	0.67	-0.5156	0.60
British Columbia	-0.508	0.60	-0.0098***	0.99

Table C2 (continued) Coefficients obtained with the multinomial regression for women				
	University studies vs. no post-secondary education		**College studies vs. no post-secondary education**	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Rural or urban area				
(Urban)				
Rural	0.0521	1.05	0.3438	1.41
Financial support from family				
(Did not receive any financial support)				
Received financial support	0.7947	2.21	0.3669	1.44
Mother's education				
(Did not complete high school)				
Completed high school	0.0195**	1.02	-0.2283	0.80
Enrolled in or completed post-secondary	0.7896	2.20	0.0616	1.06
Father's education				
(Did not complete high school)				
Completed high school	0.0794	1.08	0.1326	1.14
Enrolled in or completed post-secondary	0.9751	2.65	0.5427	1.72
Mother's occupation				
(Trades, transport and equipment operator, primary or processing and manufacturing)				
Management	0.504	1.66	0.4015	1.49
Business, finance and administration, natural science	0.3725	1.45	0.3308	1.39
Health, social sciences, education, government service	0.3715	1.45	-0.0515	0.95
Art, culture, recreation and sport, sales and services	0.3214	1.38	0.1773	1.19
Father's occupation				
(Trades, transport and equipment operator, primary, processing and manufacturing)				
Management	-0.2343	0.79	-0.3695	0.69
Business, finance and administration, natural science	0.0936	1.10	-0.5404	0.58
Health, social sciences, education, government service	-0.1807	0.83	-0.0715	0.93
Art, culture, recreation and sport, sales and services	0.012***	1.01	-0.4007	0.67

Table C2 (continued) Coefficients obtained with the multinomial regression for women				
	University studies vs. no post-secondary education		**College studies vs. no post-secondary education**	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Opportunity cost of studies	-0.0001		-0.0002	
Direct costs of studies				
University	-0.0001		0.0003	
College	0.0012		0.0017	

Notes: The variables in parentheses are reference groups
Number of observations: t = 2,380
The model is significant at p = 0.0001
All of the coefficients are significant at 1% except:
* significant at 5%
** significant at 10%
*** not significant at 5 or 10%

Table C3 Coefficients obtained with the multinomial regression for men				
	University studies vs. no post-secondary education		**College studies vs. no post-secondary education**	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Constant	-0.6978	0.50	-4.0529	0.02
Immigrant status				
(Born in Canada)				
Immigrant	0.4391	1.55	-0.0722	0.93
Marital status				
(Single. never married)				
Married or previously married	-1.4354	0.24	-1.5198	0.22
Dependent children				
(No dependent children)				
Dependent children	-0.7526	0.47	-0.4735	0.62
Health				
(No limitations in activities)				
Limitations in activities	-0.4648	0.63	-0.5744	0.56
Abilities				
(Never failed a year)				
Failed one year	-1.1991	0.30	-0.0401	0.96
(No problems with math)				
Problems with math	-0.3835	0.68	-0.2627	0.77
(No problems with science)				
Problems with science	-0.1705	0.84	-0.1808	0.83
(No problems with literature)				
Problems with literature	-0.6327	0.53	-0.3553	0.70
Average marks				
(Mainly As (80% or more))				
Mainly Bs (70% to 79%)	-0.8675	0.42	-0.0508	0.95
Mainly Cs (60% to 69%)	-1.5396	0.21	0.0265*	1.03
Ds and Es (50% or less)	-2.7401	0.06	-0.6186	0.54
Province				
(Ontario)				
Newfoundland	-0.1412	0.87	-0.3962	0.67
Prince Edward Island	0.7581	2.13	-1.5888	0.20
Nova Scotia	-0.1326	0.88	-1.4271	0.24
New Brunswick	-0.5183	0.60	-1.0851	0.34
Quebec	-0.3585	0.70	1.3812	3.98
Manitoba	-0.2533	0.78	-0.6954	0.50
Saskatchewan	0.1634	1.18	-1.4792	0.23
Alberta	-0.7008	0.50	-2.0519	0.13
British Columbia	-0.5034	0.60	-1.9796	0.14

Table C3 (continued) Coefficients obtained with the multinomial regression for men				
	University studies vs. no post-secondary education		**College studies vs. no post-secondary education**	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Rural or urban area				
(Urban)				
Rural	-0.5221	0.59	0.0732	1.08
Financial support from family				
(Did not receive any financial support)				
Received financial support	0.916	2.50	0.4068	1.50
Mother's education				
(Did not complete high school)				
Completed high school	0.0202**	1.02	-0.198	0.82
Enrolled in or completed post-secondary	0.4845	1.62	-0.0172***	0.98
Father's education				
(Did not complete high school)				
Completed high school	0.3453	1.41	0.1152	1.12
Enrolled in or completed post-secondary	1.0087	2.74	0.4227	1.53
Mother's occupation				
(Trades. transport and equipment operator. primary or processing and manufacturing)				
Management	-0.1236	0.88	0.4047	1.50
Business. finance and administration. natural science	-0.3614	0.70	-0.0452	0.96
Health. social sciences. education. government service	-0.0896	0.91	0.1221	1.13
Art. culture. recreation and sport. sales and services	-0.3139	0.73	-0.2202	0.80
Father's occupation				
(Trades. transport and equipment operator. primary. processing and manufacturing)				
Management	0.4554	1.58	0.3904	1.48
Business. finance and administration. natural science	0.8216	2.27	1.1836	3.27
Health. social sciences. education. government service	0.7448	2.11	-0.1766	0.84
Art. culture. recreation and sport. sales and services	0.5429	1.72	0.6963	2.01

Table C3 (continued)
Coefficients obtained with the multinomial regression for men

	University studies vs. no post-secondary education		College studies vs. no post-secondary education	
	equation 5.1		equation 5.2	
Independent variables	*Estimated Parameter*	*Odds ratio*	*Estimated Parameter*	*Odds ratio*
Opportunity cost of studies	-0.0001		-0.0001	
Direct costs of studies				
University	-0.0004		-0.0011	
College	0.0003		-0.0012	

Notes: The variables in parentheses are reference groups
Number of observations: t = 1,995
The model is significant at p = 0.0001
All of the coefficients are significant at 1% except:
* significant at 5%
** significant at 10%
*** not significant at 5 or 10%

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