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Choice of University Major in Canada

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Abstract

This paper examines the determinants of the choice of field of study by university students. Specifically, we are interested in the impact expected post-graduation lifetime earnings have on this decision. We construct a variable for expected earnings as a function of the probability that students will be able to find employment corresponding to their field of study for each major. Using data from the Canadian National Graduate Survey (cohorts 1986, 1990 and 1995), we assess the probability that students of each cohort will find work in their discipline, and the corresponding earnings, using the data available for the preceding cohort. Subsequently, we use a mixed multinomial logit model to estimate the parameters of individuals' choices of field of study for seven broadly defined majors. Our results reveal that expected earnings are determinant in the students' choices, but that there are significant differences between genders in the impact of this variable. In general, women are less sensitive than men to income variations. We also conclude that substantial variations in income would be required to overcome the educational segregation evinced by the preponderance of a gender in certain fields of study. Finally, we conclude that parents' level of education has a significant influence on their children's choices, but that this choice is a function of both the parent's and the child's sex.

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I. Introduction

University education has expanded to a remarkable extent in Canada. According to Canadian census data, the proportion of the population aged 25 to 64 years (the working-age population) with a degree, certificate, or diploma from a university rose from 12.9% to 16.9% between 1981 and 1991, and then to 22.6% in 2001. Within this age group, the percentage of individuals with a bachelor's degree nearly doubled during the same period, from 6.7% in 1981 to 12.8% in 2001. Furthermore, the rates at which bachelor's degrees and first professional degrees[1] were awarded rose considerably, from 18% in 1976 to 28% in 1991, then to 32% in 1995, where it essentially held steady until 1998 (Canadian Education Statistics Council, 2003). Moreover, Canada is ranked fourth among OECD nations in terms of the proportion of the working-age population with a university degree. This proportion was 22% in Canada in 2003 (same as the Netherlands), versus 29% in the United States and Norway and 25% in Denmark (Education at a Glance 2005, OECD). Consequently, it appears vital for education policy in Canada to grasp individuals' university-related decisions, and their interaction with labour market conditions, if education is to continue to function as an engine of the country's socio-economic development.

According to the theory of human capital, individuals should continue to invest in education as long as marginal benefits exceed marginal costs. A large number of empirical studies support this position, demonstrating that high levels of education are associated with high income levels (see Card, 1999, for a recent review). Consequently, this positive pecuniary yield would be a primary element of investment in human capital. However, relatively fewer studies have addressed the issue of choice of field of study for a given education level (horizontal choice) rather the choice of number of years of education (vertical choice). In this study we will examine the process by which students in Canadian universities select a field of study. Specifically, we are interested in students' sensitivity to the expected income associated with each field of study when they make this decision. Although they do not account for the selection process, Boothby (1999) and Finnie (1999) show that wages gaps between university majors in Canada are substantial. Several existing studies stress the determinant role played by such wages gaps are determining in the choice of a

[1] Defined as the number of graduates as a percentage of the 22 year-old population, i.e. the typical age at which a bachelor's degree or a first professional degree is received.

major (see for example, Polachek, 1978, Berger, 1988, Paglin et Rufolo, 1990, Montmarquette, Cannings et Mahseredjian 2002, Arcidiacono, 2004, and Boudarbat, 2004). The choice of field of study is thus compatible with an income maximization problem. Berger (1988) shows that students are more strongly influenced by lifetime income than by initial income. Moreover, Polachek (1978) suggests that expectations regarding the extent of future labour-force participation also play a role in this choice. Individuals planning intermittent participation in the labour force avoid fields (such as the sciences) requiring a high level of on-the-job training. Blakemore and Low (1984) propose a similar argument, postulating that young women who expect to drop out of the labour force to have children tend to select disciplines that are less prone to atrophy or obsolescence. Fiorito and Dauffenbach (1982) reveal that the choice of field of study is also determined by individuals' abilities and preferences. Paglin and Rufolo (1990) and, more recently, Arcidiacono (2004) demonstrate that quantitative abilities are among the most important factors in the choice of field of study and the labour market outcomes. In Montmarquette, Cannings and Mahseredjian (2002), expected income in a particular field of study depends on the perceived probability of success in that field. The authors also find differences in the impact of expected earnings on the choice of discipline by gender and race. Women are less influenced by this variable than men. This is also true of "non-white" versus "white" students. Thomas and Montmarquette (2005) state that differences between men's and women's educational choices are more clearly delineated in terms of field of study than in the level of education. Finally, results for the impact of male-female income differentials are supported by the Boudarbat's (2004) study of community college students in Canada (Cégeps in Quebec). In addition, Boudarbat shows that youths having acquired work experience before attending college put more weight on earnings in their decisions.

For each field of study, a key factor that may affect expected income, and one which has been ignored in existing studies, is whether the job to be held after graduation will be linked to the field of study. For all fields, graduates who have jobs that correspond to their studies earn more than those who don't (Boothby, 1999). Thus, a major contribution of our study is accounting for the probability that students will be able to find employment in their fields when determining the expected lifetime income in each major.

For the empirical study we use data from the National Graduate Survey (NGS) for Canadian public post-secondary institutions. We use data for three cohorts: 1986 (6,662 graduates), 1990 (6,787 graduates), and 1995 (5,259 graduates). The inclusion of data from different cohorts has the advantage of permitting account to be taken of variations across field of study and time. This allows the demand for various fields to react (adjustment) not only to interdisciplinary income gaps, but also to the intertemporal evolution of incomes within disciplines.

A major obstacle that arises with this kind of study is that individual-specific rates of returns to studies are plagued by a fundamental selection problem. The problem is that earnings are generally only observed after the schooling investment has been completed. Since earnings before schooling is completed are generally missing, the earnings gain from each field of study choice cannot be measured directly. Willis and Rosen (1979), as well as several subsequent studies, suggest using income estimates corrected for selectivity bias to predict the income associated with each field of study for all students. However, the reliability of this econometric technique is critically dependent on the availability of instruments that explain students' choices without affecting the returns to fields of study. We opt for a more practicable measure of income that is available to students when they are making their choices. In our model, 1990 graduates base their decisions on income data for the preceding NGS cohort, i.e. the class of 1986. Similarly, 1995 graduates refer to their predecessors, the class of 1990. Practically, this means that the coefficients used to predict incomes of the persons in a given cohort are estimated from data for the preceding cohort. The benefit of this approach is that the coefficients in question are independent of the sample for which we are analysing the decision process.

Our empirical results reveal that the expected lifetime income associated with each field of study is a decisive factor in students' choices. However, there are significant differences between the genders in the impact of expected lifetime income. In general, women are less sensitive than men to income variations. We further conclude that substantial shifts in income would be necessary to motivate a member of one gender to choose a field dominated by the other gender. Also, we find a significant relationship between parents'

education levels and their children's choices, but that this relationship is conditioned by the sex of both the parent and the child.

The remainder of this document is organized as follows. Section II presents a descriptive analysis of the NGS data. Section III describes the econometric approach, and Section IV discusses the main empirical results. Section V concludes.

II. Data and descriptive analysis

In this study we use data from the National Graduate Survey (NGS) for Canadian public post-secondary institutions. The survey, conducted every five years, examines graduates' access to jobs and working conditions, among other issues. Each cohort is canvassed twice: two and five years after graduation. The target population consists of individuals having obtained a degree or a certificate of postsecondary studies from a public Canadian postsecondary educational institution (university, college, trade school) in the reference calendar year, or having satisfied the requirements for such a diploma or certificate. The survey excludes graduates from private postsecondary educational institutions and those having completed a continuing education program (mature students), unless they received a diploma or a certificate. Individuals who completed part-time trade programs or professional training courses lasting less than three months, or who did not live in Canada or the United States at the time of the survey, were also dropped from the sample. The survey covered the classes of 1982, 1986, 1990, 1995, and 2000. For reasons of data availability and quality, only data for the 1986, 1990, and 1995 cohorts were used in the current study. Recall that we only retained graduates having obtained a bachelor's degree or a first professional degree.

Some descriptive statistics relevant to our study are presented in Table 1. The data confirm the key role young people assign to income in the choice of field of study. Thus, nine out of ten graduates from 1990 and 1995 cohorts rank income prospects as important or very important in their choice of major. By field of study, graduates from "Fine arts and humanities" assign relatively less weight to income than graduates from "Commerce and business," virtually all of whom rank pecuniary considerations as very important. Similarly, a correspondence between field of study and employment was important or very important for

nine out of ten 1990 graduates. This ratio increased eight points between 1986 and 1990. Unfortunately, this information is not available for the class of 1995. Once again, graduates from "Fine arts and humanities" stand out from the herd, since only approximately 15 out of 20 of them assign importance to the job-field of study relationship, compared with about 19 of 20 in the fields of "Education," "Commerce and business," "Health," and "Sciences." Consequently, we see that market variables, as represented by income and the job-education skills match, remain globally important in students' decisions.

The NGS data also allows us to assess the relevance of young people's decisions. Thus, a little over two thirds of graduates maintain that they would make the same choice if they had to do it over again. Either these students made good forecasts, or factors that are invariant predominate in their decision functions. By field of study, graduates from "Social sciences" and "Agriculture and biological sciences" would be most inclined to reconsider their original choice. At the other end of the spectrum, those from "Education," "Health," and "Sciences" are relatively the most satisfied with their decision.

Table 1 also indicates the proportion of graduates who relied on the student loans program to finance their studies. Eligibility for student loans depends on parents' participation in the cost of education. The student must, in fact, demonstrate financial need to qualify. Thus, having recourse to a student loan can serve as a good proxy for the wealth of the graduate's family. A little over one half of the 1990 graduates borrowed money from the student loans program, while 42% of the class of 1995 described this means of financing as one of the two main sources of funding for their studies. A further indicator of the students' standard of living is their parents' level of education. We observe that the proportion of students with (at least) one parent having attended university is constantly rising, which is consistent with the upward trend in the proportion of the working age population pursuing university studies.

For one in five of the 1995 graduates, the main activity prior to starting their program was working. This proportion is down from its 1990 level, especially for "Education." The field "Health" is the only exception in this respect, reflecting the fact that it features the greatest number of graduates with previous professional experience. In light of these facts, it appears that, for many students, enrolling in university is more a matter of continuity than of returning to school. This is not the case for community college graduates,

over 40% of whom were on the job market before beginning their program. The age gap between these two education levels at the time of graduation corroborates this observation. Thus, even though college studies are shorter, graduates from those programs are older than those from bachelor's programs on average (a little over 27 years for the former, versus a little less than 25 years for the latter).

It is of some interest to note that barely half the graduates from the class of 1995 were holding a job closely related to their field of study two years after being awarded their diplomas. However, this proportion had risen significantly over time, since it was only 38% for the 1990 cohort. This latter group seems to have been stymied by the recession of the early 1990s. The least likely to find a job in their field are graduates from "Fine arts and humanities," followed by "Agricultural and biological sciences" and "social sciences." We note that these graduates assign the least importance to the job-education skill relationship. Conversely, the closest job-studies correspondence is found among "Health" and "Education" graduates.

Two years after graduation, the average annual earnings of the class of 1995 were $33,818 (in constant 2000 dollars) for full-time workers ($30,564 when part-time workers are included). This is 9.2% less than the corresponding mean for 1990 graduates. Nonetheless, three years later (i.e. five years after graduation), full-time workers from the 1995 cohort were earning $44,326 on average ($42,198 when part-time workers are included), or 4.7% more than their 1990 counterparts. Consequently, even though they started from lower salaries, the 1995 graduates subsequently benefited from greater wage increases allowing them to recoup their gap with respect to the 1990 cohort. By field of study, the highest mean salaries are in "Health" and "Sciences," and the lowest in "Fine arts and humanities" and "Agricultural and biological sciences."

As shown in Table 2, earnings are on average higher when employment is directly linked to the field of study. In the case of the class of 1995, the mean annual earnings (two years after graduation) were 20.2% higher when the job was directly related to the field of study. This premium was up considerably, since it was only 12.5% for 1990 graduates. If we only consider the 1995 cohort, the benefit of finding work in a field related to one's studies is greatest for graduates in the "Social sciences" (+25.6%) and "Education" (+22.0%), and least in "Health" (+3.0%) and "Sciences" (+5.8%). Thus, our approach, consisting of assessing the value

of expected income for each field of study while accounting for the job-studies relationship, proves to be well founded.

Finally, it is of some interest to note that the distribution of graduates across the seven fields of study, when the sexes are pooled, changed very little between 1990 and 1995, as borne out by Table 3. The observed variations fall within a one percentage point interval. However, we point that there was a 0.96 point increase in the share of "Social sciences" graduates and a 0.75 point decline in the share of "Health." By gender, we specifically note a 2.03 points increase in female graduates from "social sciences" versus a 0.93 point decline in males graduating from the same major. On the other hand, the data in Table 3 indicate that women's likelihood of choosing studies in "Sciences" is approximately one fifth of men's. Conversely, women are more liable to opt for "Health" studies —a widely known fact. This educational segregation translates into occupational segregation, which in turn perpetuates the former. Thomas and Montmarquette (2005) argue that occupations in which there are more men than women are associated with academic disciplines that are also dominated by men: to wit, the technical and scientific fields. The same applies to occupations dominated by women: principally the field of health. The authors add that it is relatively easier to find work in a field in which one's sex has greater representation than where it doesn't. For example, a woman having studied engineering is liable to encounter hurdles on the job market, owing to prejudices amongst employers and within the workplace. It is thus prudent, a safe investment, to study in a field in which one's sex is dominant or at least equally represented.

III. Econometric Specifications

Assume that there are J fields offered at university. Assume also that the reduced-form expected utility index in the field of study *j* can be expressed as follows (for convenience we omit the subscript i related to individuals):

$$U_j^* = \theta_j Z + \alpha E_j + \mu_j \text{ , } j = 1 \text{ to } J \qquad (1)$$

Z is a vector of observed individual-specific characteristics that influence students' choices, E_j is log lifetime earnings expected after graduation in field j, and μ_j is a random component that captures unobserved

variables. θ_j and α are parameters to be estimated. The utility of a field of study should increase as the expected earnings in this field increase implying α >0.

Lifetime earnings expected in a field of study may depend upon the relationship between this field and the job held after graduation. As shown in Section II, earnings are on average higher in jobs that are related to studies, and a large proportion of students attach importance to this relationship (see Table 1). We propose to account for this fact in the prediction of the lifetime earnings in each field of study.

Conditional on the field of study j being chosen, let Y_j^c be the expected lifetime earnings if the job obtained after graduation is related to this field, Y_j^n be the expected lifetime earnings if not, and p_j be the perceived probability to find a job related to her field of study. Then, the expected log of lifetime earnings in the field j is:

$$E_j = p_j \, ln\left(Y_j^c\right) + \left(1 - p_j\right) ln\left(Y_j^n\right) \qquad (2)$$

More correctly, this quantity is equal to $ln\left[p_j Y_j^c + \left(1 - p_j\right) Y_j^n \right]$, but we can show that the two specifications are almost equivalent.

A student chooses the field of study that maximizes her indirect utility. The latter is not observable; we rather observe the student's choice as given by the dummy variables: D_j , *j=1 to J*, with D_j =*1* (the student chooses field j) if $U_j^* = Max\left\{U_1^*, U_2^*, ..., U_J^*\right\}$, D_j =*0* otherwise and $\sum_j D_j = 1$ (the student chooses only one field).

Using discrete time like in Berger (1988), Y_j^k , *k = c, n*, is given as follows :

$$Y_j^k = \sum_{t=0}^{\infty} \frac{R_{jt}^k}{\left(1+r\right)^t} \qquad (3)$$

where R_{jt}^k represents earnings at time t, and r is the individual discount rate. If we assume that earnings increase at a constant rate g_j^k , then Y_j^k can be written as follows:

$$Y_j^k = R_{j0}^k \sum_{t=0}^{\infty} \left(\frac{1+g_j^k}{1+r} \right)^t \qquad (4)$$

where R_{j0}^k represents initial earnings. For the quantity in (4) to be finite, the condition $g_j^k < r$ is required. In this case, this quantity simplifies to:

$$Y_j^k = R_{j0}^k \frac{1+r}{r-g_j^k} \qquad (5)$$

Then,

$$ln\left(Y_j^k\right) = ln\left(R_{0j}^k\right) - ln\left(r-g_j^k\right) + ln(1+r) \qquad (6)$$

Two important empirical facts are ignored in computing the lifetime earnings as given by Equation (5): the horizon is finite and the earnings profile is not linear toward the end of the life cycle. The consequences of ignoring these empirical facts at this point are, however, lightly weighted for non-negligible values of the discount rate (See Willis and Rosen, 1979, for a similar approach). Notice also that the term $ln(1+r)$ is common to all fields of study and to both types of jobs (i.e, related or not related to the field). Thus, it is cancelled when computing the earnings gaps. Therefore, this term can be ignored. A Taylor series approximation to the nonlinear term $ln\left(r-g_j^k\right)$ in (6) around its population mean values $(\bar{g},\bar{r})$ yields:

$$ln\left(Y_j^k\right) \approx ln\left(R_{0j}^k\right) + \delta\left(g_j^k - r\right) \qquad (7)$$

with $\delta = 1/(\bar{r}-\bar{g})$. Once again, the constant term $-\delta r$ can be ignored since it does not intervene in the earnings gaps between the fields of studies. By combining Equations (2) and (7), the expected log of lifetime earnings in the field of study j becomes:

$$\begin{aligned} E_j &= p_j\left[ln\left(R_{0j}^c\right) + \delta\, g_j^c - \delta\, r\right] + \left(1-p_j\right)\left[ln\left(R_{0j}^n\right) + \delta\, g_j^n - \delta\, r\right] \\ &= p_j\, ln\left(R_{0j}^c\right) + \left(1-p_j\right) ln\left(R_{0j}^n\right) + \delta\left[p_j g_j^c + \left(1-p_j\right) g_j^n\right] - \delta\, r \\ &= E\left(R_{0j}\right) + \delta\, E\left(g_j\right) - \delta\, r \end{aligned} \qquad (8)$$

Finally, substituting (8) into (1) yields:

$$U_j^* = \theta_j Z + \alpha_1 E(R_{0j}) + \alpha_2 E(g_j) + \mu_j, j = 1 \text{ to } J \qquad (9)$$

In practice, a student can only select a single field of study. Consequently, R_{j0}^k and g_j^k are censored for the fields that the student did not choose. One solution to this selection problem would be to estimate income equations corrected for selectivity bias and then to use these estimates to forecast individual earnings for each field of study Lee, 1978; Willis et Rosen, 1979; Berger, 1988; et Boudarbat, 2004).[2] However, the reliability of this econometric technique depends crucially on the availability of instruments suitable for predicting the choice of field of study without having any impact on individual incomes (exclusion conditions). Though it is possible to identify and provide a rationale for some instruments, it is far from clear that they will be found in survey data. In their discussion of the identification problem, Willis and Rosen (1979) assert that variables relative to family background are good instruments for investment in education. For our purposes, we find the NGS to be particularly poor in this type of data. Aside from parents' education and recourse to the student loans program, the survey provides no information on the socio-economic background of the graduates.

Furthermore, our model introduces a second level of selectivity owing to the fact that, for each field of study, graduates may, or may not, find corresponding employment. This adds further complications to the correction for selectivity bias.

The approach we propose here differs from the one based on adjusting for selectivity bias. We assume that, at the moment of the choice of field of study, students evaluate their expected lifetime income on the basis of data on graduates who are already on the market. In the context of NGS data, this is tantamount to assuming that 1990 graduates used data on the 1986 cohort as a reference, while the class of 1995 used data for that of 1990. Econometrically, the coefficients used to predict the expected incomes of the young people in a given cohort are estimated from data on the preceding cohort. The benefit of this approach is that the coefficients in question are independent of (exogenous to) the sample for which we are analysing

[2] The adjustment procedures are those proposed by Heckman (1979) or Lee (1983). Montmarquette, Cannings and Mahseredjian (2002) question the pertinence of such approach in the non linear context introduced by the concept of expected earnings.

the discipline selection process. Furthermore, combining the 1990 and 1995 cohorts improves the level of identification of the model, since shifts in the choices made by youths that are associated with variations in income are also captured.

Subsequently, three sets of equations are added to model (9):

$$I_j^* = \lambda_j X_1 + \xi_j \qquad (10)$$

$$ln\left(R_{j0}^k\right) = \beta_j^k X_2 + \varepsilon_j^k \qquad (11)$$

$$g_j^k = \phi_j^k X_3 + \tau_j^k \qquad j = 1 \text{ to } J\,;\ k = c, n \qquad (12)$$

X_1, X_2 et X_3 are vectors of observed characteristics, I_j^* is a latent variable that allows the switching between the two situations $k = c$ ($I_j^* \geq 0$, the job is related to the field of study) and $k = n$ ($I_j^* < 0$, the job is not related to the field of study). The probability of finding a job related to the field of study if the field j is chosen is $p_j = Prob(k = c) = Prob\left(I_j^* \geq 0\right)$. The quantities $\ln\left(R_{j0}^k\right)$ an g_j^k are respectively log initial earnings and the earnings' rate of growth of situations k and n.

Estimation of the model (9) occurs in two stages. In the first stage the coefficients of the equations (10) to (12) are estimated using data from the 1986 (resp. 1990) cohort. The first equation is estimated using a probit model, and the other two equations with OLS. To account for differences between men and women, each equation includes a dummy representing women, which, in addition, is crossed with all other explanatory variables in X_1, X_2 and X_3.[3]. The coefficients thus estimated are used to generate predictions of $ln\left(R_{j0}^k\right)$, g_j^k and p_j, which in turn yield predictions of $E\left(R_{0j}\right)$ and $E\left(g_j\right)$ (Equation 8) for graduates in the 1990 (resp. 1995) cohort. The predicted values $\hat{E}\left(R_{0j}\right)$ and $\hat{E}\left(g_j\right)$ are subsequently substituted for $E\left(R_{0j}\right)$ and $E\left(g_j\right)$ in Equation (9).

[3] Estimating Equations (10) to (12) separately for each gender has almost no effect on estimated coefficients of Equation (9).

In the second stage, we estimate (9) using a multinomial logit model. We assume that the stochastic terms μ_j are independent and that they follow a Gumbell (or Type I extreme-value) distribution. In this event the probability of choosing discipline *j* is:

$$Prob\left(D_j = 1 \mid Z, \hat{E}(R_{0k})_{k=1,\ldots,J}, \hat{E}(g_j)_{k=1,\ldots,J}\right) = \frac{exp\left(\theta_j Z + \alpha_1 \hat{E}(R_{0j}) + \alpha_2 \hat{E}(g_j)\right)}{\sum_{k=1}^{J} exp\left(\theta_k Z + \alpha_1 \hat{E}(R_{0k}) + \alpha_2 \hat{E}(g_k)\right)} \quad (13)$$

This corresponds to the *multinomial logit* (mixed) model of McFadden (1973).[4] In order to identify field-specific parameters, the parameters of a (reference) field should be set to 0.

In order to improve model identification, we have incorporated a variety of variables into vector *Z*. These are: age at the beginning of the program of study, marital status (single or not), mother's level of education, father's level of education, recourse to student loans to finance studies, duration of studies, the time allocated to school (full- or part-time), the importance imputed to the factors "skills acquisition," "knowledge acquisition," and "income" in the choice of field of study and, finally, the province of residence 12 months prior to the beginning of the university program. Parents' education and recourse to student loans reflect the family's wealth, while the time spent in studies is an indicator of individual ability. Of the retained variables, only marital status is liable to change over time, especially between the time of the choice of program of studies and the time of the observation. We retain this variable's value after the diploma is granted as a proxy for women's attachment to the labour force.

Furthermore, we retained seven fields of study to facilitate empirical estimation: (1) "Education," (2) "Fine arts and humanities," (3) "Social sciences," (4) "Commerce and business," (5) "Agricultural and biological sciences," (6) "Health," and (7) "Sciences."

We also limited our sample to graduates having obtained a bachelor's degree or a first professional degree. Adding further levels of education would require modelling the vertical choice of education level in addition to the horizontal choice of field of study within each level. While this exercise is theoretically

[4] The model is also called *mixed* because it includes two types of coefficients, one of which is invariant to the choice of field of study. The model is some times called conditional multinomial logit.

possible, empirical estimation of the resulting model would be of particular technical difficulty. We also eliminated graduates having received another Master's or Ph. D. prior to starting the bachelor's degree.

In the model we estimate, the job-field of study relationship and the initial annual earnings pertain to the job held two years after graduation (first NGS wave). Information on the job-field of study relationship is not provided during the second wave (five years after graduation). To counter this limitation in the data, we are compelled to assume that the initially observed job-field of study relationship (two years after graduation) is maintained (five years after graduation). Consequently, the growth rate of annual income may be approximated by a (constant) mean annual rate between the two observations.

Finally, it is worth noting that the parameters of the selectivity equations are assumed constant across cohorts. As a result, the cohort effect is captured in the variables $\ln\left(R_{j0}^{k}\right)$ and g_{j}^{k} for initial income and the income growth rate, respectively, in situations *k* and *n*.

IV. Empirical results

Model (9) is estimated using data from a sample of 12,046 graduates having obtained a bachelor's degree, 6,787 of whom are from the 1990 cohort and 5,259 from the 1995 cohort. Women represent 55% of both subsamples. Furthermore, a sample of 6,662 graduates from the class of 1986 was used to estimate the coefficients of equations (10), (11) and (12), which in turn served to generate predictions of the probability of finding a job corresponding to the field of study and of the initial income and its annual growth rate, for the 1990 cohort. The same method was used to obtain predictions for the class of 1995 from 1990 data. In this paper we will not examine the results of the estimation of equations (10) to (12).[5] We are particularly interested in the expected income variable (computed from these estimates), and its impact on the choice of field of study.

In Table 4, we present the estimated coefficients on expected lifetime earnings components (Equations 9), which are field invariant. The remaining conditional logit coefficients (field-specific) are

[5] These estimates are available from the authors on request.

cumbersome to interpret.[6] The estimated coefficients of the log of the expected initial income and of its expected growth rate are positive and very significant for both men and women. These results suggest that a positive pecuniary yield is a key factor in students' decisions, and that students are liable to select fields of study that offer high returns, *ceteris paribus*. At the same time, they support the economic assumption that lifetime income has an impact on decisions to invest in education. Furthermore, the significant influence of the rate of growth of the salary bolsters the argument that students are influenced by lifetime income and not only by the initial income. This point is strongly defended by Berger (1988).

Furthermore, the gap between men and women is not statistically significant with regards to the coefficient of the rate of expected annual growth of the income, but it is for the coefficient of the log of the expected initial income. Men are thus marginally more sensitive than women to pecuniary considerations in their choice. Studies by Montmarquette et al. (2002) and Boudarbat (2004) have reached the same conclusion. Finally, the pseudo-R^2 of 0.060 for women and 0.0914 for men reveal that the retained explanatory variables fall far short of explaining the full picture of the choice of field of study—these decisions are complex. Finally, the model using the same explanatory variables explains the behaviour of women less adequately than that of men, strengthening the case for accounting for different socio-economic realities confronting men and women.

In Table 5, we present the marginal effects from the mixed multinomial logit model. These results are given to facilitate a comparison between men and women. They should be interpreted as the effect of a unit change in a covariate on the probability of choosing a given field of study, *ceteris paribus*. For a dichotomous variable, this marginal effect measures the discrete change in the probability of choosing a specific field of study when the value assumed by this variable switches from 0 to 1, all other things being constant. All marginal effects were estimated at the means of the covariates.

Our results give rise to a fundamental conclusion. Substantial increases in lifetime income, while all other factors remain constant, would be necessary to draw students into majors they are not inclined to choose initially. For example, this would be the case if we were to attempt to attract students of a given

[6] These results are available upon request from the author.

gender into majors in which their gender is underrepresented. Thus, it would be more effective to seek to influence individual decisions through market variables rather than to seek to coerce changes in their decisions. Assume, for example, that we which to increase the number of men in the field of health. We could limit the number of female students in this field by a quota. This would certainly curb the number of women in the program. However, to recruit the required number of students, it may become necessary to accept applicants with poorer academic records. In the long run this could result in a deterioration of the quality of the "health" program. Borghans and Groot (1999) assert that affirmative action programs that force employers to hire women in positions usually occupied by men are ineffectual, since they do not account for the fact that the educational segregation of manpower cannot be reversed overnight. Effective reverse discrimination programs are those that seek to rectify this segregation. However, this approach presupposes that the root of the segregation is not discrimination, but rather a consequence of the theory of human capital.

Aside from issues of educational segregation, our model's results suggest that an unfettered market is capable of aligning the supply with the demand for skilled labour. In simple terms, an increase in demand in a profession should be associated with rising salaries, since supply cannot adjust immediately. These higher salaries are, in turn, liable to boost the proportion of students opting for the field of study corresponding to the profession in demand. Similarly, if the supply of labour overshoots demand, salaries will be driven down, which will reduce the supply. However, as Thomas and Montmarquette (2005) point out, some public policies, such as a funding system for public education that is disconnected from labour market signals, can have the effect of impeding that interplay of market forces and prolonging any disequilibrium, whether perceived or real, between the demand for, and supply of, skilled labour. Also, any labour market rigidity, such as that associated with union contracts, could keep the market from sending signals that reflect the true state of the market.

Other factors influence students' choices. Among them, the impact of parents' having a university education on their children's choice of discipline may be of particular interest, given the ongoing rise in university enrolment in Canada. As we see in Table 5, it is of some interest here to distinguish between the

mother's and the father's level of education. In fact, the influence of the mother's and the father's education often work in opposite directions—in addition to depending on the sex of the child.

A mother having a university education is liable to be associated with her daughter(s) taking up "Fine arts and humanities," "Social sciences," or "Health," to the detriment of other fields. This same mother, however, is likely to impart a tendency amongst her son(s) to study "Commerce and business" or "Agricultural and biological sciences." Mothers with a university education thus appear to perpetuate educational segregation. On the other hand, a father having acquired a university education is liable to increase the likelihood that his daughter(s) will pursue the fields "Education," "Fine arts and humanities," "Agricultural and biological sciences," or "Sciences." This same father is likely to increase the probability that his son(s) will choose "Fine arts and humanities," "Social sciences," "Health," or "Sciences." Other comments suggest themselves. For example, the probability of choosing "Education" diminishes among women whose mothers have a university degree and among men whose fathers have one. In addition, a man is less likely to choose "Fine arts and humanities" if his mother went to university but more likely to do so if his father did. Furthermore, a woman whose mother attended university will tend to opt for "Social sciences," but will tend to avoid this field if her father has a university education. These effects are reversed for men. Moreover, the probability that a child will choose to study "Health" increases if his or her parent of the same sex has a university education. Finally, it is of interest to note that the likelihood of students (male or female) choosing to study "Sciences" declines if their mothers have a university education and increases if their fathers do. In summary, our results reveal that the relationship between students' choices and their parents' education depends on the sex of both the child and the parent.

From another perspective, students who are supported by the student loan program, another indicator of family wealth, are less prone to choose studies in Commerce and business." They are, however, slightly more inclined toward "Agricultural and biological sciences." It is also of some interest to note that the probability of choosing to study "Health" does not significantly depend upon obtaining the student loan. By sex, the probability of choosing studies in "Social sciences" increases for women who obtain the student loan versus no significant difference for men.

The time allocated to school proves to be a determinant factor in the choice of field of study. The major most likely to attract students unable to commit themselves to full-time studies is "Social sciences," followed by "Commerce and business," then "Fine arts and humanities." At the other end of the spectrum, those inclined to study full time are liable to opt for studies in "Sciences" or "Health," or "Education" in the case of women. These effects are much more pronounced in the case of men. Students who pursue their studies part time probably do so in order to be able to continue working simultaneously and draw an income, but the forgone earnings associated with studies in "Sciences" and "Health" are compensated by higher pay after receiving a degree.

The goals that students seek to attain through their education stand out as being among the most influential factors in their choices. Thus, "Education," "Commerce and business," "Health," and "Sciences" are the fields of choice for students seeking to acquire skills. Conversely, this group is much less likely to opt for studies in "Fine arts and humanities" or "Social sciences." In this way, students appear to identify fields of study with more or less specific vocations. The fields "Education," "Commerce and business," "Health," and "Sciences" lead to very precise occupations (e.g., teacher, commercial agent, physician, engineer) while, in the opinion of students, "Fine arts and humanities" and "Social sciences" have a broader vocation.

The fields "Education" and "Health" are also disciplines of choice for both male and female students seeking to acquire knowledge, but the genders differ on the other fields of study. Thus, for example, women seeking to acquire knowledge will tend to gravitate toward studies in "Social sciences," avoiding the field of "Commerce and business," but men in the same situation are more inclined to take the opposite approach, shunning "Social sciences" and opting for "Commerce and business."

Furthermore, it is of interest to note that students who assign a great deal of weight to income are more likely to choose studies in "Commerce and business" and much less liable to opt for "Fine arts and humanities." This latter field of study is the least lucrative (Table 2), while "Commerce and business" appears to continue to have a reputation associating it with high, even very high, incomes—especially for those who successfully strike out on their own.

Finally, we observe that women who are not (or are not likely to remain) single will tend to opt for studies in "Education" and "Health." These two majors appear to be particularly suited to reconciling family and work. A similar pattern obtains for men who, in addition, are probably less inclined to study "Sciences." Conversely, women and men who are (and are likely to remain) single will tend to opt for studies in "Fine arts and humanities" or "Social sciences."

V. Conclusion

University education has experienced a sharp expansion in Canada in recent decades. In 2001, nearly one in four Canadians between the ages of 25 and 64 had attended university. Furthermore, the percentage of individuals with a bachelor's degree nearly doubled during that same period, from 6.7% in 1981 to 12.8% in 2001. Thus, it appears essential for Canadian education policy to understand individual decisions at the level of university studies, especially in terms of their link to labour market conditions. This understanding is key to improving the efficiency of the educational system and/or confronting eventual problems of labour-market disequilibrium.

In this study we examine the determinants of the choice of field of study made by students enrolling in university programs at the level of the bachelor's. More specifically, we seek to measure the impact of labour-market variables, represented here by expected lifetime income after graduation. We contribute to the literature on the subject by developing a model of choice of discipline that accounts for the link between the field of study and the job held after graduation. Empirical data indicates a substantial wage gap between employment that is connected to studies and employment that is not. The model is estimated using data from the Canadian National Graduate Survey for the classes of 1986, 1990, and 1995.

Our estimates demonstrate that expected lifetime income has a significant influence on students when they are choosing their field of study. Students prefer fields that will give them a job. Furthermore, as in the case of other studies, we observe an impact of expected lifetime income that is differentiated by sex. Women are marginally less sensitive to differences in expected lifetime income than men. We also conclude

that substantial variations in expected income are necessary to attract students into disciplines they would normally shun, *ceteris paribus*. This result is important for any effort to mitigate educational segregation.

Other factors play a role in students' choices. Notably, parents' education levels, marital status, and the vocation identified with each field of study (the acquisition of skills or knowledge). The impact of parents' education is a function of the parent's and the child's sex. Several conflicting effects are observed, such as a mother's bias in favour of, or a father's bias against, a given field of study, or one effect on a daughter and its opposite on a son.

The disciplines "Education" and "Health" appear to facilitate reconciling family and work, since they are likely chosen by students who are not (or not liable to remain) single. Conversely, women and men who are (and are likely to remain) single will tend to opt for studies in "Fine arts and humanities" or "Social sciences."

Finally, we point out that the explanatory power of the estimated model is weaker for women, which reflects the complexity of factors that come into play in their decisions.

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Table 1
Some Descriptive Statistics

		Education	Fine Arts, Humanities	Social Sciences	Commerce Business	Agricultural Biological Sciences	Health	Sciences	Total
Improving their chances for a high income was important, or very important, to their choice of field of study	1990	0,92	0,78	0,92	0,96	0,87	0,86	0,93	0,90
	1995	0,93	0,81	0,89	0,96	0,92	0,95	0,92	0,90
Deem the job- field of study relationship important or very important (*)	1990	0,95	0,76	0,85	0,94	0,87	0,96	0,94	0,88
Would opt for the same field of study if they had to make the choice again	1990	0,80	0,68	0,64	0,70	0,62	0,82	0,77	0,71
	1995	0,77	0,67	0,59	0,70	0,59	0,76	0,74	0,68
Obtained student loans to finance their studies (**)	1990	0,55	0,49	0,51	0,45	0,58	0,58	0,52	0,52
	1995	0,47	0,36	0,42	0,36	0,42	0,46	0,44	0,42
Mother and/or father is a university graduate	1990	0,38	0,46	0,37	0,36	0,47	0,44	0,43	0,40
	1995	0,42	0,47	0,40	0,40	0,50	0,45	0,42	0,43
Were working prior to university (***)	1990	0,37	0,24	0,27	0,20	0,13	0,23	0,14	0,24
	1995	0,22	0,21	0,22	0,17	0,08	0,28	0,14	0,19
Their employment is closely related to their field of study (two years after graduation) (****)	1990	0,48	0,28	0,29	0,38	0,33	0,74	0,37	0,38
	1995	0,70	0,29	0,33	0,57	0,32	0,77	0,59	0,49

(*) This question was not asked of the class of 1995.

(**) The 1990 data captures any borrowing within the student loan program, while in 1995 it was only included if it was one of the two principal sources of funding for the studies. This difference explains the substantial drop in the percentages between 1990 and 1995.

(***) These are graduates for whom work constituted the principal activity.

(****) This information was provided in the data file and not derived by the authors.

Table 2
Mean Annual Earnings Two Years after Graduation, by Fields of Study and Relationship Job-Major, Full-Time Workers (in 2000$)

	1986		1990		1995	
	Partly or not related	Directly related	Partly or not related	Directly related	Partly or not related	Lien direct
Education	32 532	35 743	37 327	40 019	28 516	34 800
	(16 098)	*(19 968)*	*(13 455)*	*(38 360)*	*(12 321)*	*(8 221)*
Fine Arts, Humanities	29 324	31 101	28 637	33 152	28 234	31 985
	(17 414)	*(13 081)*	*(13 913)*	*(13 304)*	*(11 934)*	*(13 017)*
Social sciences	30 412	39 820	37 147	42 914	28 450	35 726
	(13 154)	*(56 063)*	*(62 620)*	*(46 781)*	*(11 580)*	*(12 771)*
Commerce, Business	35 539	37 313	35 166	36 692	33 198	36 184
	(31 616)	*(11 936)*	*(28 205)*	*(22 107)*	*(10 391)*	*(14 252)*
Agricultural and Biological Sciences	26 503	32 091	27 208	34 795	27 605	30 720
	(14 730)	*(10 888)*	*(11 310)*	*(16 795)*	*(10 369)*	*(11 369)*
Health	40 334	40 831	42 117	43 646	42 196	43 446
	(41 331)	*(25 954)*	*(12 098)*	*(14 210)*	*(13 805)*	*(10 320)*
Sciences	36 672	38 931	39 437	41 216	38 618	40 843
	(14 953)	*(8 810)*	*(11 323)*	*(17 331)*	*(13 994)*	*(9 610)*
Total	31 948	37 204	35 518	39 956	30 645	36 842
	(19 580)	*(24 712)*	*(37 567)*	*(30 617)*	*(12 554)*	*(11 794)*

Note: Figures in parentheses are standard-deviations. Data are weighted.

Table 3
Distribution of Graduates over Fields of Study (%)

	Males			Females			Both Genders		
	1986	1990	1995	1986	1990	1995	1986	1990	1995
Education	10,16	12,13	12,79	20,43	21,27	20,52	15,82	17,35	17,48
Fine Arts, Humanities	13,35	12,53	11,97	20,47	17,98	18,79	17,28	15,64	16,11
Social Sciences	20,89	25,09	24,16	27,48	27,88	29,91	24,53	26,69	27,65
Commerce, Business	16,36	15,81	16,18	10,64	11,29	10,38	13,20	13,23	12,66
Agricultural and Biological Sciences	7,02	5,98	6,75	6,05	6,99	6,63	6,49	6,56	6,68
Health	2,37	4,69	3,81	8,19	9,46	8,51	5,58	7,41	6,66
Sciences	29,86	23,76	24,33	6,74	5,13	5,27	17,11	13,13	12,77
Total	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Table 4
Estimated coefficients on expected log lifetime earnings (Equations 9)

	Males		Females	
	Coef.	Std. Err.	Coef.	Std. Err.
log initial (annual) earnings	0,8747(*)	0,0395	0,7562(*)	0,0364
Earnings' rate of growth	0,0305(*)	0,0015	0,0273(*)	0,0014

(*) Significant at the level 1%.

Table 5

Marginal Effects of Covariates on the Probability of Choosing Each Field of Study

		Education				**Fine Arts, Humanities**				**Social Sciences**			
		Females		Males		Females		Males		Females		Males	
		Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.
Age (when starting the program)		0,0362	0,0015	0,0208	0,0015	-0,0323	0,0012	-0,0024 ns	0,0015	-0,0285	0,0016	-0,0011 ns	0,0024
Age squared		-0,0005	0,0000	-0,0002	0,0000	0,0006	0,0000	0,0001	0,0000	0,0005	0,0000	0,0001*	0,0000
log initial annual earnings in	Education	0,1272	0,0062	0,0844	0,0040	-0,0278	0,0014	-0,0112	0,0005	-0,0501	0,0025	-0,0244	0,0012
	Fine arts, Humanities	-0,0278	0,0014	-0,0112	0,0005	0,1076	0,0052	0,0909	0,0042	-0,0402	0,0020	-0,0266	0,0013
	Social sciences	-0,0501	0,0025	-0,0244	0,0012	-0,0402	0,0020	-0,0266	0,0013	0,1616	0,0078	0,1672	0,0076
	Commerce, Business	-0,0171	0,0008	-0,0171	0,0008	-0,0137	0,0007	-0,0186	0,0009	-0,0247	0,0012	-0,0406	0,0019
	Agr.-Biolog. sciences	-0,0094	0,0005	-0,0049	0,0003	-0,0076	0,0004	-0,0054	0,0003	-0,0136	0,0007	-0,0117	0,0006
	Health	-0,0150	0,0008	-0,0025	0,0001	-0,0120	0,0006	-0,0027	0,0002	-0,0216	0,0011	-0,0059	0,0003
	Sciences	-0,0078	0,0004	-0,0244	0,0012	-0,0063	0,0003	-0,0266	0,0013	-0,0113	0,0006	-0,0581	0,0027
Earnings' rate of growth in	Education	0,0046	0,0002	0,0029	0,0002	-0,0010	0,0001	-0,0004	0,0000	-0,0018	0,0001	-0,0009	0,0000
	Fine arts, Humanities	-0,0010	0,0001	-0,0004	0,0000	0,0039	0,0002	0,0032	0,0002	-0,0015	0,0001	-0,0009	0,0001
	Social sciences	-0,0018	0,0001	-0,0009	0,0000	-0,0015	0,0001	-0,0009	0,0001	0,0058	0,0003	0,0058	0,0003
	Commerce, Business	-0,0006	0,0000	-0,0006	0,0000	-0,0005	0,0000	-0,0006	0,0000	-0,0009	0,0001	-0,0014	0,0001
	Agr.-Biolog. sciences	-0,0003	0,0000	-0,0002	0,0000	-0,0003	0,0000	-0,0002	0,0000	-0,0005	0,0000	-0,0004	0,0000
	Health	-0,0005	0,0000	-0,0001	0,0000	-0,0004	0,0000	-0,0001	0,0000	-0,0008	0,0000	-0,0002	0,0000
	Sciences	-0,0003	0,0000	-0,0009	0,0000	-0,0002	0,0000	-0,0009	0,0001	-0,0004	0,0000	-0,0020	0,0001
Single		-0,0862	0,0030	-0,0250	0,0027	0,0454	0,0028	0,0443	0,0028	0,0398	0,0034	0,0214	0,0041
Mother's education	Secondary/college	-0,0012 ns	0,0037	-0,0108	0,0032	-0,0134	0,0036	0,0087*	0,0036	0,0141	0,0043	0,0013 ns	0,0050
	University	-0,0485	0,0042	-0,0023 ns	0,0039	0,0211	0,0045	-0,0157	0,0041	0,0461	0,0055	-0,0206	0,0059
Father's education	Secondary/college	-0,0027 ns	0,0037	-0,0317	0,0030	0,0147	0,0037	-0,0225	0,0036	-0,0309	0,0042	0,0216	0,0052
	University	0,0101*	0,0041	-0,0399	0,0032	0,0394	0,0041	0,0259	0,0040	-0,0558	0,0045	0,0117*	0,0055
Obtained student loans		0,0036 ns	0,0028	0,0155	0,0025	-0,0100	0,0026	-0,0013 ns	0,0027	0,0351	0,0032	-0,0023 ns	0,0037
Duration of studies		-0,0012	0,0001	-0,0027	0,0001	0,0007	0,0000	0,0006	0,0001	0,0005	0,0001	-0,0011	0,0001
Enrolled full-time		0,0466	0,0038	0,0064 ns	0,0035	-0,0142	0,0036	-0,0231	0,0038	-0,0582	0,0046	-0,1306	0,0057
Put a great weight on	Acquiring skills	0,1564	0,0034	0,0727	0,0030	-0,1509	0,0051	-0,1921	0,0063	-0,1375	0,0057	-0,0805	0,0064
	Acquiring knowledge	0,0064 ns	0,0075	0,0400	0,0046	-0,0077 ns	0,0054	0,0171	0,0041	0,0343	0,0069	-0,1386	0,0083
	High income	0,0201	0,0050	-0,0126	0,0047	-0,0757	0,0050	-0,1475	0,0060	0,0308	0,0054	0,0043 ns	0,0063
Estimated probability of choosing this major		0,2140		0,1083		0,1719		0,1179		0,3094		0,2575	

(Continued)

Table 5 (Continued)

		Commerce, Business				Agricultural, biological Sciences			
		Females		Males		Females		Males	
		Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.
Age (when starting the program)		0,0044	0,0015	-0,0065*	0,0026	-0,0017 ns	0,0012	-0,0111	0,0018
Age squared		-0,0002	0,0000	0,0000 ns	0,0001	0,0000 ns	0,0000	0,0001	0,0000
log initial annual earnings in	Education	-0,0171	0,0008	-0,0171	0,0008	-0,0094	0,0005	-0,0049	0,0003
	Fine arts, Humanities	-0,0137	0,0007	-0,0186	0,0009	-0,0076	0,0004	-0,0054	0,0003
	Social sciences	-0,0247	0,0012	-0,0406	0,0019	-0,0136	0,0007	-0,0117	0,0006
	Commerce, Business	0,0714	0,0035	0,1293	0,0059	-0,0047	0,0002	-0,0082	0,0004
	Agr.-Biolog. sciences	-0,0047	0,0002	-0,0082	0,0004	0,0415	0,0021	0,0432	0,0021
	Health	-0,0074	0,0004	-0,0041	0,0002	-0,0041	0,0002	-0,0012	0,0001
	Sciences	-0,0039	0,0002	-0,0407	0,0019	-0,0021	0,0001	-0,0117	0,0006
Earnings' rate of growth in	Education	-0,0006	0,0000	-0,0006	0,0000	-0,0003	0,0000	-0,0002	0,0000
	Fine arts, Humanities	-0,0005	0,0000	-0,0006	0,0000	-0,0003	0,0000	-0,0002	0,0000
	Social sciences	-0,0009	0,0001	-0,0014	0,0001	-0,0005	0,0000	-0,0004	0,0000
	Commerce, Business	0,0026	0,0001	0,0045	0,0002	-0,0002	0,0000	-0,0003	0,0000
	Agr.-Biolog. sciences	-0,0002	0,0000	-0,0003	0,0000	0,0015	0,0001	0,0015	0,0001
	Health	-0,0003	0,0000	-0,0001	0,0000	-0,0001	0,0000	0,0000	0,0000
	Sciences	-0,0001	0,0000	-0,0014	0,0001	-0,0001	0,0000	-0,0004	0,0000
Single		0,0113	0,0021	-0,0033 ns	0,0035	0,0196	0,0016	0,0054	0,0019
Mother's education	Secondary/college	-0,0064*	0,0026	-0,0005 ns	0,0043	0,0033 ns	0,0022	0,0224	0,0027
	University	-0,0264	0,0030	0,0450	0,0056	0,0002 ns	0,0026	0,0332	0,0040
Father's education	Secondary/college	0,0010 ns	0,0026	0,0341	0,0045	0,0091	0,0023	-0,0100	0,0024
	University	-0,0232	0,0027	-0,0352	0,0046	0,0165	0,0025	-0,0008 ns	0,0025
Obtained student loans		-0,0328	0,0020	-0,0560	0,0032	0,0114	0,0016	0,0214	0,0018
Duration of studies		-0,0002	0,0000	-0,0002	0,0001	0,0000 ns	0,0000	0,0000 ns	0,0001
Enrolled full-time		-0,0341	0,0032	-0,0639	0,0050	0,0067	0,0022	0,0116	0,0023
Put a great weight on	Acquiring skills	0,0657	0,0026	0,1039	0,0043	0,0032 ns	0,0024	-0,0157	0,0031
	Acquiring knowledge	-0,0782	0,0070	0,0313	0,0070	0,0095	0,0033	0,0183	0,0026
	High income	0,0447	0,0031	0,0972	0,0046	-0,0129	0,0031	-0,0210	0,0036
Estimated probability of choosing this major		0,1056		0,1804		0,0583		0,0521	

(Continued)

Table 5 (Continued)

		Health				Sciences			
		Females		Males		Females		Males	
		Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.	Marg. Eff.	Std. Err.
Age (when starting the program)		0,0215	0,0010	0,0193	0,0011	0,0005 ns	0,0010	-0,0190	0,0028
Age squared		-0,0003	0,0000	-0,0003	0,0000	0,0000*	0,0000	0,0002	0,0001
log initial annual earnings in	Education	-0,0150	0,0008	-0,0025	0,0001	-0,0078	0,0004	-0,0244	0,0012
	Fine arts, Humanities	-0,0120	0,0006	-0,0027	0,0002	-0,0063	0,0003	-0,0266	0,0013
	Social sciences	-0,0216	0,0011	-0,0059	0,0003	-0,0113	0,0006	-0,0581	0,0027
	Commerce, Business	-0,0074	0,0004	-0,0041	0,0002	-0,0039	0,0002	-0,0407	0,0019
	Agr.-Biolog. sciences	-0,0041	0,0002	-0,0012	0,0001	-0,0021	0,0001	-0,0117	0,0006
	Health	0,0635	0,0031	0,0222	0,0012	-0,0034	0,0002	-0,0059	0,0003
	Sciences	-0,0034	0,0002	-0,0059	0,0003	0,0348	0,0018	0,1674	0,0077
Earnings' rate of growth in	Education	-0,0005	0,0000	-0,0001	0,0000	-0,0003	0,0000	-0,0009	0,0000
	Fine arts, Humanities	-0,0004	0,0000	-0,0001	0,0000	-0,0002	0,0000	-0,0009	0,0001
	Social sciences	-0,0008	0,0000	-0,0002	0,0000	-0,0004	0,0000	-0,0020	0,0001
	Commerce, Business	-0,0003	0,0000	-0,0001	0,0000	-0,0001	0,0000	-0,0014	0,0001
	Agr.-Biolog. sciences	-0,0001	0,0000	0,0000	0,0000	-0,0001	0,0000	-0,0004	0,0000
	Health	0,0023	0,0001	0,0008	0,0001	-0,0001	0,0000	-0,0002	0,0000
	Sciences	-0,0001	0,0000	-0,0002	0,0000	0,0013	0,0001	0,0058	0,0003
Single		-0,0322	0,0021	-0,0143	0,0013	0,0024 ns	0,0015	-0,0286	0,0041
Mother's education	Secondary/college	0,0104	0,0025	0,0001 ns	0,0014	-0,0068	0,0019	-0,0211	0,0049
	University	0,0175	0,0034	0,0026 ns	0,0017	-0,0101	0,0021	-0,0423	0,0057
Father's education	Secondary/college	-0,0045 ns	0,0025	-0,0017 ns	0,0015	0,0133	0,0021	0,0102*	0,0051
	University	-0,0040 ns	0,0027	0,0193	0,0019	0,0171	0,0024	0,0190	0,0055
Obtained student loans		0,0016 ns	0,0019	0,0064	0,0011	-0,0090	0,0014	0,0162	0,0037
Duration of studies		-0,0001	0,0000	0,0003	0,0000	0,0003	0,0000	0,0031	0,0001
Enrolled full-time		0,0178	0,0025	0,0342	0,0012	0,0354	0,0017	0,1653	0,0041
Put a great weight on	Acquiring skills	0,0545	0,0025	0,0267	0,0012	0,0087	0,0023	0,0850	0,0056
	Acquiring knowledge	0,0331	0,0041	0,0215	0,0016	0,0027 ns	0,0034	0,0104 ns	0,0080
	High income	-0,0083*	0,0036	-0,0087	0,0022	0,0012 ns	0,0027	0,0883	0,0058
Estimated probability of choosing this major		0,0925		0,0260		0,0484		0,2578	

Notes: (ns): non significant at the level 5%; (*) significant at the level 5%; the remaining coefficients are significant at the level 1% (Two-tailed test). Covariates also include the province of residence 12 months prior to starting university (coefficients not shown). Marginal effects are evaluated at the sample means for continuous variables, and the discrete change in the probability between 0 and 1 for dummy variables.