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Returns to University Level Education: Variations Within Disciplines, Occupations and Employment Sectors

REPORT

Jorgen Hansen

Prepared under contract for

Learning Policy Directorate

Strategic Policy

September 2006

Human Resources and Social Development Canada
Ressources humaines et Développement social Canada

Canada

SP-662-09-06E

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SP-662-09-06E
(également disponible en français)

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This paper is available in French under the title *Rendement des études universitaires : Variation selon la discipline, la profession et le secteur d'emploi.*

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Paper
ISBN: 0-662- 43921-X
Cat. No.: HS28-57/2006E

PDF
ISBN: 0-662- 43922-8
Cat. No.: HS28-57/2006E-PDF

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Table of Contents

List of Tables

Abstract

Using data from three waves (1990, 1995, and 2000) of the National Graduates Survey (NGS), this paper provides a detailed analysis of earnings differences between colleges or trade schools graduates and university graduates. The results indicate significant returns to a university degree, and the earnings difference is larger for women (about 27%) than for men (about 15%). However, the estimated differences between university graduates and graduates from colleges or trade schools decreased for both men and women between 1992 and 2002. For men, the differences dropped from 24.2% in 1992 to 16.7% in 2002, while it dropped from 31.3% to 24% for women. The results also show that there are large differences in the return to a university education across disciplines, industry, and occupations.

As a complement to the NGS data, which only include graduates from post-secondary education, the paper also utilizes data from the three most recent Canadian Censuses (1991, 1996, and 2001) to investigate differences in earnings for high school and university graduates. These earnings differences are represented by the internal rates of return between high school and university graduates, and when aggregated across disciplines and regions, the results suggest a modest increase between 1991 and 2001, from 9% to 11%. Thus, while the earnings differences between trade schools and college graduates and university graduates decreased during the 1990s, the earnings differences between high school graduates and university graduates increased.

1. Introduction

It is well recognized that investments in human capital are essential for innovations and economic growth. While human capital encompasses many aspects, formal education is probably the one that has received most attention (other forms of human capital include job training, learning, health etc.). Investigating the individual determinants of higher education and the returns associated with such education is important for many reasons. For example, spending on higher education constitutes a large portion of overall government spending. While there are social returns to education that justify subsidies to higher education, there are also private returns that somewhat offset government subsidies. Moreover, the structure of the labor market is constantly changing and has over the last decade become more oriented towards skilled workers. As a consequence, the educational system needs to adapt in order to respond to the changing demands from employers.

Over the last three decades, there has been much work on establishing the economic returns to education (see Card (1999) for a recent survey of results and Heckman et al (2005) for a critical assessment of the existing literature on the returns to education). It has been reported that the average marginal return is somewhere between 5% and 10%, depending on country and methodology. The average marginal return describes the average effect on wages when increasing educational attainments with one unit (typically a year). While estimates of the average marginal return provide some insight into the link between productivity and education, it ignores some potentially important aspects of how education and productivity are related. First, it is likely that the economic returns vary with accumulated education (see for instance Belzil and Hansen (2002)). Most educational systems are structured around a finite number of degrees, such as high school and university degrees. It is thus unlikely that the marginal return associated with the 10^{th} year (occurring while in high school) is the same as that associated with completing the 12^{th} year (normal high school graduation). Secondly, the marginal returns are likely to be different for different individuals, partly driven by differences in labor market abilities and differences in field of study. With a few exceptions, these issues have generally been ignored in the returns to education literature (Belzil and Hansen (2005) provide a framework for analyzing heterogeneity in the return to education).[1]

There are also other aspects of the returns to education that should be considered. For instance, most existing work has focused on the effect of schooling on hourly wages and paid less attention to the effect of schooling on employment rates. One important aspect of education may indeed be that it reduces the likelihood of experiencing unemployment and therefore increasing life-time incomes, even if the effect on hourly wages is relatively small. The basic human capital model predicts that education will be acquired if the expected life-time earnings (discounted to present value) from this exceed

[1] As argued by Heckman et al (2005), the coefficient associated with education in a standard Mincer regression equation should be generally thought of as a person-specific growth rate of log earnings with schooling and not a rate of return. Further, the vast instrumental variable (IV) literature estimate coefficients that are often interpreted as average returns to education for individuals induced to go to school by changes in the values of the instrument used, consistent with the Local Average Treatment Effect (LATE) literature. However, as shown by Heckman et al (2005), different instruments define different average returns, and these returns may not always reflect responses to meaningful economic policies.

those of not acquiring additional education. Thus, in order to assess the returns to education researchers should not limit their attention to wages only, but also consider effects on employment patterns. Aside from economic returns to education, there are non-pecuniary returns as well. Examples of this include better work environment, more comprehensive benefit packages, possibility to influence work schedules etc. The effect of education on non-economic aspects of employment has generally been ignored in the previous literature, in part because such aspects are often difficult to quantify.

The comparison of expected life-time earnings under two different education levels, for example high school versus college or university, defines the internal rate of return to education. In general, the reported estimates of the return to schooling in the literature (both based on Ordinary Least Squares (OLS) and instrumental variable (IV)) do not coincide with the internal rate of return. The internal rate of return accounts for both direct (e.g. tuition fees) and indirect costs (opportunity cost) of schooling, income taxes and the length of working life that may depend on schooling levels. As mentioned in Heckman et al (2005), while there are many Mincer-returns to schooling reported in the literature, there are only few estimates of the internal rate of return to education (Vaillancourt (1995) provides estimates of these returns for Canada using data from the 1986 Census).

The primary objective with this paper is to provide a descriptive analysis of returns to university education in Canada. The empirical analysis will rely on OLS regression analysis thereby ignoring many of the methodological difficulties associated with estimating returns to education. Thus, the results provided in this paper should not be taken as estimates of causal effects of university education but instead as descriptions of how university education is correlated with different labor market outcomes, such as earnings and unemployment. In order to estimate the reward to a university education, data drawn from three waves of the National Graduates Survey (NGS). The surveys were conducted in 1992, 1997, and 2002, and targeted individuals who graduated from Canadian post-secondary institutions in 1990, 1995, and 2000, respectively. The objectives with the surveys are to obtain information on early labor market experiences with a focus on employment, occupations, and the relationship between jobs and education. It should be noted that the returns to university education that can be estimated using the NGS data are mainly differences in entry wages between respondents with a university education and respondents with a post-secondary schooling certificate below a university degree. It is possible that the wage growth differ across educational attainments and in this case, the returns obtained using the NGS data may be lower than similarly defined returns obtained from data that include earnings data over the life-cycle and not only entry earnings. Since the NGS data is limited to individuals who completed some form of post-secondary education, all individuals whose highest level of education is high school or less are excluded from the data. However, a commonly reported wage return to university education is based on comparison between wages or earnings between university and high school graduates. In order to obtain such returns, the analysis in this paper will also rely on data collected from three waves (1991, 1996, and 2001) of the Canadian Census. The census data was supplemented with data on tuition fees in Canada obtained from Statistics Canada's survey on "Tuition and living accommodation costs at Canadian degree-granting universities and colleges". Using life-cycle wage profiles estimated from the census data and the tuition fee

data, internal rates of return to university education are calculated. These internal rates of returns are allowed to differ across time, major field of study, and geographical regions.

Overall, the NGS results indicate that there are significant earnings differences between respondents with a university degree and those with a college or trade school diploma. These earnings differences, obtained using OLS, are similar in magnitude across a number of different specifications of the regression function. The earnings difference is larger for females (about 27%) than for males (about 15%). The results also indicate that there are large differences in the earnings return to a university education across disciplines. The highest returns are generally found in "Engineering", "Business and Commerce", "Health" and "Sciences". The lowest return, found in all years, was found in "Fine and applied arts".

Regarding earnings differences between university graduates and college or trade school graduates within industries, the results suggest that the university return for males is highest in "Manufacturing" in both 1992 and 2002, and lowest in "Agricultural and related fields" and "Education services" in 2002. For females, the industry-specific returns to university education vary significantly across industries and over time. In 2002, the highest return was found in "Agricultural and related fields" and the lowest was found in "Construction" and "Transportation". It should however be noted that few women are found in these industries (around 2% are found in these three industries).

When the returns are allowed to differ across occupations, the results indicate significant occupational differences. High return occupations for both men and women are: "Management", "Business and related", "Sciences", "Health", and "Sales". These occupations are closely related to the high return disciplines discussed above. The occupation with the lowest return is "Art and culture".

The NGS results on university returns over time suggest that the return has decreased between 1992 and 2002 for both men and women. For men, the return estimated using a specification that controls for discipline, occupation, and industry, was 24.2% in 1992 and 16.7% in 2002, a drop of 30%. For females, a similar development was observed. The return was 31.3% in 1992 and 24% in 2002, a drop of 23%.

This paper also considers alternative labor market outcomes, such as incidence of unemployment, full-time employment and permanent employment. For unemployment incidence, the results suggest no significant effect of university education. For full-time employment, the effect is insignificant for males (in 2002) while positive and significant for females (also in 2002). The results also indicate a higher degree of job satisfaction for male university graduates. For females, the effect is insignificant.

The final set of results concerns the internal rates of return to a university education. These internal rate of returns, aggregated across disciplines and regions, suggest a modest increase between 1991 and 2001, from 9% to 11%. These rates of returns are the same for both men and women. Substantial variations across disciplines and regions were found, and consistent with the results based on the NGS data, the highest returns are found in "Business", Engineering", "Health", and "Sciences", and the lowest is found in "Fine and applied arts".

The remainder of this paper is organized as follows. In the next section, the data source is described. Apart from a description of the samples, the section also includes a description of variable definitions and the distribution of post-secondary education in Canada. In Section 3 the methodology is presented. The following section presents the estimation results. Section 5 contains a comparison of the results in this paper with those in the literature. Finally, Section 6 concludes the paper and provides policy implications of the main results.

2. Data

2.1 Sample description and variable definitions

As mentioned above, the main data sources are the last three cycles of the National Graduates Survey (NGS). The NGS contains detailed information on post-secondary education activities, such as field of study and program length, as well as on subsequent labor market outcomes (wages, employment, occupation, industry etc.). In addition, the data spans a 10-year period (from 1992 to 2002) during which there were changes both in the financing of higher education and in enrolment rates. However, the data is limited to individuals who attended some form of post-secondary education. Thus, individuals whose highest degree is a high school diploma and high school drop-outs are excluded. Traditionally, the economic returns to university level education have been identified by comparing wages of university educated workers with workers who have high school or less. Such an analysis is not possible to conduct using the NGS since this survey only includes individuals with education beyond high school. Thus, the economic returns to university education that can be identified in the NGS are differences in wages among university educated respondents as well as differences in wages between university educated respondents and respondents with less than university education (trade-vocational diploma or college diploma).

For the 1990 and 1995 surveys, public use files of NGS were used, while the master file was used for NGS 2000. While there are a number of restrictions imposed on the public use files, they still provide detailed information on graduates from post-secondary educational institutions. Perhaps the most important limitation in the public use files is the reporting of annual earnings, which is reported as a discrete variable (ranging from 1 (less than $10,000) to 6 (over $50,000)). In the analysis, the discrete variable was used to construct an estimate of annual earnings using mid-points. While the aggregation of earnings into discrete classes appears restrictive, estimates from the NGS 2000 (based on the master files which include actual earnings as well as the discrete classes) indicate that the reported results are not sensitive towards this definition of the dependent variable. Another limitation of the public use files is the fact that province of residence is suppressed and aggregated into four regions (Atlantic provinces (Newfoundland and Labrador, Nova Scotia, Prince Edward Island, and New Brunswick), Quebec, Ontario, and Western provinces (Manitoba, Saskatchewan, Alberta, and British Columbia)).[2]

The public use files also restrict the classifications of major field of study, industry, and occupation. For example, major field of study is aggregated into 10 categories: (i) educational, recreational and counseling services; (ii) fine and applied arts; (iii) humanities and related fields; (iv) social sciences and related fields; (v) commerce, management and business administration; (vi) agricultural and biological sciences/technologies; (vii) engineering and applied sciences; (viii) health professions, sciences and technologies;

[2] The location variable reflects the main region of residence of the graduate during the 12 months before enrolling in the program he/she graduated from.

(ix) mathematics and physical sciences; and (x) other. This classification of major field of study corresponds to the one used in the Census surveys. For industry groups, the standard industrial classification based on last week's job was used. This leaves 17 categories: (i) agricultural and related; (ii) fishing and trapping; (iii) logging and forestry; (iv) mining, quarrying and oil well; (v) manufacturing; (vi) construction; (vii) transportation and storage; (viii) communication and other utility; (ix) wholesale and retail trade; (x) finance and insurance; (xi) real estate operator and insurance agent; (xii) business services; (xiii) government services; (xiv) education services; (xv) health and social services; (xvi) accommodation, food and beverage services; and (xvii) other. While the coding of industries are the same for the 1990 and 1995 waves of the NGS, there are slight differences between these two surveys and the 2000 survey. Three industries that appear in 1990 and 1995 (finance, real estate, and business) do not appear in 2000 while one appears in 2000 (professional) that does not appear in the two previous surveys. Finally, for occupation, the standard occupational classification based on last week's job was used. This leaves 11 categories: (i) management occupations; (ii) business, finance and administrative occupations; (iii) natural and applied sciences and related occupations; (iv) health occupations; (v) occupations in social science, education, government service and religion; (vi) occupations in art, culture, recreation and sport; (vii) sales and service occupations; (viii) trades, transport and equipment operators and related occupations; (ix) occupations unique to primary industry; (x) occupations unique to processing, manufacturing and utilities; and (xi) other.

2.2 Distribution of post-secondary education

In Tables 1a and 1b, I present the distribution of post-secondary education by region and time, separately for males and females.[3] Table 1a shows that between 36.7% (Quebec) and 50.3% (Western) of post-secondary education graduates have trade vocational or college diploma as the highest degree in 1992. Similar proportions have obtained a university diploma while 5%-10% have obtained a Master's or Doctorate degree. Comparing these proportions with those in 2002 (from NGS 2000) show that the fractions of graduates that have trade or college diploma have increased in all regions except the Western provinces (and exceed 50% in the Atlantic provinces and in Quebec in 2002). While the fractions with trade/college diploma increased in most regions between 1992 and 2002, the fractions with university diploma were reduced. The largest drop is shown for Quebec, where the fraction dropped from 52.8% in 1992 to 34.5% in 2002. Finally, the fractions with Master's or Doctorate degrees increased in all provinces except Quebec where it dropped from 10.6% in 1992 to 9.7% in 2002. In 2002, the highest fraction with Master's or Doctorate degrees is found in Ontario (10.2%) and the lowest is found in the Atlantic provinces (7.8%). For the Western provinces, the fraction is 8.9%.

[3] Descriptive statistics for selected variables in NGS 1990, 1995, and 2000, are shown in Table A1.

Table 1a Distribution of post-secondary education for males, by region and time				
Highest degree completed:	**Atlantic**	**Quebec**	**Ontario**	**Western**
			NGS 1990	
Trade vocational or college diploma	49.6	36.7	39.7	50.3
University diploma	45.0	52.8	50.2	43.8
Master's or Doctorate	5.5	10.6	10.1	5.9
			NGS 1995	
Trade vocational or college diploma	52.6	55.0	41.9	47.9
University diploma	42.4	37.7	48.1	45.0
Master's or Doctorate	5.0	7.3	10.0	7.1
			NGS 2000	
Trade vocational or college diploma	52.0	55.8	46.3	43.3
University diploma	40.2	34.5	43.5	47.8
Master's or Doctorate	7.8	9.7	10.2	8.9
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.				

Table 1b Distribution of post-secondary education for females, by region and time				
Highest degree completed:	**Atlantic**	**Quebec**	**Ontario**	**Western**
			NGS 1990	
Trade vocational or college diploma	42.4	40.2	38.9	52.4
University diploma	52.9	51.4	54.8	43.5
Master's or Doctorate	4.7	8.3	6.3	4.1
			NGS 1995	
Trade vocational or college diploma	39.5	42.0	38.1	45.9
University diploma	53.7	50.9	54.0	48.0
Master's or Doctorate	6.7	7.1	8.0	6.1
			NGS 2000	
Trade vocational or college diploma	38.2	46.3	43.4	38.1
University diploma	53.4	44.9	49.0	53.8
Master's or Doctorate	8.4	8.8	7.6	8.0
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.				

The same proportions for female graduates are presented in Table 1b. For 1992, the proportions are very similar to those presented in Table 1a (for the same year). However, by 2002, the proportion of female graduates that have a university diploma ranges from 44.9% (Quebec) to 53.8% (Western), which for all regions are substantially higher than the corresponding figures for male graduates. There were also relatively large increases in the fractions with Master's or Doctorate degrees between 1992 and 2002 (the fraction almost doubled in the Western provinces). The male-female differences in proportions with post-graduate diplomas decreased between 1992 and 2002, and there are small differences between males and females in 2002.

To summarize, there are both regional and gender differences in the distribution of post-secondary education in Canada. For males, trade/college and post-graduate studies appear to have become more popular over time. For females, the data indicate that trade/college is less popular in 2002 compared to a decade earlier and more females are acquiring higher education (university and beyond).

3. Methodology

Using the NGS data, a set of linear regressions are estimated. Initially, to document earnings (or employment) difference between university graduates and those with less than a university degree, the following regression is estimated:

$$y_{i,t,g,r} = \alpha_{t,g,r} + \boldsymbol{\gamma}_{t,g,r} UNIV_{i,t,g,r} + \varepsilon_{i,t,g,r}$$

where $y_{i,t,g,r}$ represents log earnings (or employment) for individual *i*, at time *t* (t=1992, 1997, 2002), for gender *g*, in region *r*, and $UNIV_{i,t,g,r}$ is an indicator for university level education. The vector $\boldsymbol{\gamma}_{\mathbf{t,g,r}}$ contains time, gender, and region-specific returns representing the wage or employment differences between those with trade-vocational or college diploma and those with a university level education. The specification above can easily be generalized to control for individual specific characteristics which may affect earnings or employment rates.

In order to estimate the return to university level education by fields of study, the above regression specification is modified as follows:

$$y_{i,t,g,r} = \alpha_{t,g,r} + \boldsymbol{\theta}_{t,g,r} * \mathbf{z}_{i,t,g,r} + \boldsymbol{\gamma}_{t,g,r} UNIV_{i,t,g,r} + \boldsymbol{\gamma}^{z}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{z}_{i,t,g,r} + \varepsilon_{i,t,g,r}$$

where *y* and *UNIV* are as defined above and $\mathbf{z}_{i,t,g,r}$ is a vector of indicator variables for major field of study. The vector $\boldsymbol{\gamma}^{z}_{t,g,r}$ now shows the field-specific university returns. Again, as before, the specification above can easily be generalized to control for individual specific characteristics which may affect earnings or employment rates.

Finally, to estimate the university return by occupation and industry, respectively, the above regression specification is modified as follows:

$$y_{i,t,g,r} = \alpha_{t,g,r} + \boldsymbol{\theta}^{occ}_{t,g,r} * \mathbf{occ}_{i,t,g,r} + \boldsymbol{\gamma}_{t,g,r} UNIV_{i,t,g,r} + \boldsymbol{\gamma}^{occ}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{occ}_{i,t,g,r} + \varepsilon_{i,t,g,r}$$

for occupation-specific returns and

$$y_{i,t,g,r} = \alpha_{t,g,r} + \boldsymbol{\theta}^{ind}_{t,g,r} * \mathbf{ind}_{i,t,g,r} + \boldsymbol{\gamma}_{t,g,r} UNIV_{i,t,g,r} + \boldsymbol{\gamma}^{ind}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{ind}_{i,t,g,r} + \varepsilon_{i,t,g,r}$$

where *y* and *UNIV* are as defined above and **occ (ind)** is a vector of indicator variables for occupation (industry). Thus, $\boldsymbol{\gamma}^{occ}_{t,g,r}$ ($\boldsymbol{\gamma}^{ind}_{t,g,r}$) represents the occupation-specific (industry-specific) returns to university.

In the most general specification, the indicator for university graduation *UNIV* is interacted with the variables describing major field of study, occupation and industry. That is,

$$\begin{aligned} y_{i,t,g,r} &= \alpha_{t,g,r} + \boldsymbol{\theta}^{ind}_{t,g,r} * \mathbf{ind}_{i,t,g,r} + \boldsymbol{\gamma}_{t,g,r} UNIV_{i,t,g,r} + \boldsymbol{\gamma}^{ind}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{ind}_{i,t,g,r} \\ &+ \boldsymbol{\theta}^{occ}_{t,g,r} * \mathbf{occ}_{i,t,g,r} + \boldsymbol{\gamma}^{occ}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{occ}_{i,t,g,r} + \boldsymbol{\theta}^{z}_{t,g,r} * \mathbf{z}_{i,t,g,r} + \boldsymbol{\gamma}^{z}_{t,g,r} UNIV_{i,t,g,r} * \mathbf{z}_{i,t,g,r} + \varepsilon_{i,t,g,r} \end{aligned}$$

The above regression functions are designed to capture differences in labor market outcomes between university educated respondents and respondents with less than university education, but who has graduated from some post-secondary institution. As supplements to these estimates, internal rate of returns of university education will also be estimated. These internal rates will illustrate the life-cycle earnings differences between high-school and university graduates, accounting for wage growth differences and both direct and indirect costs of university education. Specifically, the estimate of the internal rate of return to university education is the interest rate, r, which solves:

$$\sum_{j=0}^{T} \frac{V_j^{univ}(g,t,m) - V_j^{hs}(g,t)}{(1+r_{g,t,m})^j} = 0 \qquad (1)$$

where

$$V_j^{univ}(g,t,m) = -C(g,t,m) \quad j = 0,1,2,3$$
$$V_j^{univ}(g,t,m) = \exp\left(\hat{\beta}_{0,g,t,m} + \hat{\beta}_{1,g,t,m} * (j-3) + \hat{\beta}_{2,g,t,m} * (j-3)^2\right) \quad j = 4,5,,,,T$$

and

$$V_j^{hs}(g,t) = \exp\left(\hat{\alpha}_{0,g,t} + \hat{\alpha}_{1,g,t} * j + \hat{\alpha}_{2,g,t} * j^2\right) \quad j = 0,1,,,,T$$

where *–C(g,t,m)* is a measure of cost of attending university (tuition and other fees) in region *g*, at time *t*, in field of study *m*. The estimated parameters $\hat{\beta}_{i,g,t,m}$ (i=0,1,2) are obtained from OLS regressions of log earnings on experience and its square for university graduates using census data. Note that these estimates define earnings profiles that differ across regions (g), time (t), and major field of study (m). Similarly, the estimated parameters $\hat{\alpha}_{i,g,t}$ (i=0,1,2) are obtained from OLS regressions of log earnings on experience and its square for high school graduates using census data. Finally, the internal rate of returns for university education are defined by $r_{g,t,m}$, which is also allowed to differ across regions, time, and major field of study.

At this point it is important to stress some of the limitations of the analysis conducted in this paper. First, it should be noted that the specifications used in this paper ignore any possible endogeneity of educational attainments (completion of a university degree). As a result, one should be careful to give a causal interpretation to the reported estimates. Instead, the estimates should be interpreted as describing observed earnings differences between university graduates and graduates from colleges or trade schools. It is beyond the scope of this paper to attempt to control for endogeneity in our measure of educational attainment.

Another limitation with this study is related to the nature of the data being used (the National Graduates Surveys (NGS)). First, these surveys only sample graduates from post-secondary educational institutions and therefore include no individuals with schooling levels below post-secondary education. Thus, the samples used consist of non-randomly selected individuals from the population and implies that the reported earnings gains associated with

completion of a university education cannot generally be compared to the many "returns" to a university degree that exists in the literature. For this reason, the reported earnings gains may be lower than those reported in the literature. Secondly, the earnings information was obtained two years after graduation which means that the earnings differences mainly reflect differences in early career earnings. It is possible that the earnings profile over the life-cycle differ between university graduates and graduates from colleges or trade schools, and if this is the case, the reported earnings differences would also be lower than what would be found in data that uses information obtained for all working graduates. Thirdly, this paper uses data from the public use versions of the NGS data. This restricts some of the information available. In particular, earnings are reported in six discrete classes in the public use version, while actual earnings are available in the master files. Moreover, the number of categories regarding major field of study, occupation, and industry, is lower in the public use files.

4. Results

4.1 Earnings differences between university and trade/college graduates

While the previous tables showed the distribution of post-secondary education in Canada, the entries in Table 2 show earnings and employment differences between university and trade/college graduates across gender and time. The top panel shows the estimated coefficient from a linear regression of log annual earnings on a dummy for university graduate. Thus, the entries can be thought of as an approximation of the percentage earnings difference between those with trade/college and university diplomas.[4] Note that graduates with education beyond university diploma have been excluded from the analysis.[5] For males, the entry for 1992 suggest that the wage difference is around 20% and statistically significant at conventional levels. The university returns are estimated to be lower in 1997 and 2002 (around 15%). For females, the earnings differences are estimated to be higher: 28% in 1992, 33% in 1997, and 27% in 2002.

Table 2
Earnings and employment differences between university graduates and trade/college graduates, by gender, and time

	NGS 1990	NGS 1995	NGS 2000
	Annual wage/salary		
Males	0.199*	0.145*	0.144*
	(15.58)	(12.93)	(14.32)
Females	0.281*	0.332*	0.273*
	(23.15)	(25.38)	(28.14)
	Employment rate		
Males	0.023*	-0.017*	-0.030*
	(3.11)	(-3.03)	(-4.85)
Females	0.003	0.010	-0.030*
	(0.50)	(1.68)	(-5.65)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show coefficients from a regression of log annual earnings (dummy for employed) on a dummy variable for university graduate. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

[4] The exact percentage difference can be calculated as [exp(estimated coefficient)-1]*100. The difference between this and the approximated value is small for numerically small values of estimated coefficients.

[5] These were excluded as the focus in this paper is on the return to a university education. It could be argued that there is an option value of university education in terms of providing the option of continuing to post-graduate studies, and that the estimated returns reported in this paper therefore underestimates the returns as they ignore this option. However, given the structure of the data which provides wage/earnings data only two years after graduation, it would be difficult to obtain accurate wage/earnings data for the highly educated workers (some may remain in school and work on a part-time, non-permanent basis).

The lower panel of Table 2 shows the effect of having a university diploma on the probability of being employed. Thus, the dependent variable is a dummy variable for employment and the estimated coefficients can be interpreted as percentage points changes in employment rate proportions across the two groups. For males, the entries show higher employment rates for university graduates in 1992 (2.3 percentage points) while the employment rates are significantly lower for university graduates in both 1997 and 2002.[6] For females, the entries show positive but not significant estimates for 1992 and 1997, while the estimate for 2002 is negative and significantly different from zero. While negative estimates suggest that university educated respondents are less likely to work than those with trade/college diplomas, it should be noted that not being employed may imply unemployment or non-employment because of studies or other reasons. Thus, the higher fractions of non-employment among university graduates in 2002 may indicate a higher incidence of continued studies in this group. This may especially be the case with these data since they are collected relatively soon after graduation.

Table 3
Earnings differences between university graduates and trade/college graduates, by gender, region and time

	Atlantic	Quebec	Ontario	Western
			NGS 1990	
Males	0.187*	0.213*	0.160*	0.113*
	(6.87)	(7.54)	(7.49)	(5.72)
Females	0.349*	0.261*	0.156*	0.274*
	(12.63)	(9.94)	(11.31)	(14.35)
			NGS 1995	
Males	0.134*	0.253*	0.065*	0.123*
	(6.23)	(9.83)	(2.58)	(8.62)
Females	0.337*	0.524*	0.230*	0.243*
	(13.91)	(18.71)	(7.89)	(15.73)
			NGS 2000	
Males	0.159*	0.279*	0.084*	0.069*
	(6.45)	(16.58)	(3.33)	(4.04)
Females	0.362*	0.433*	0.192*	0.161*
	(16.04)	(25.51)	(7.32)	(9.97)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show coefficients from a regression of log annual earnings (dummy for employed) on a dummy variable for university graduate. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

[6] It should be noted that not being employed may imply unemployment or non-employment because of studies or other reasons.

In Table 3, earnings differences between trade/college and university graduates broken down by gender, region and time are presented. The top panel shows results for NGS 1990, the middle panel for NGS 1995 and the lower panel for NGS 2000. In 1992, there were large regional differences in university returns. For males, the highest return is reported for Quebec (0.213) and the lowest is found in Western (0.113). For females, the highest return is found in the Atlantic provinces (0.349) while the lowest is found in Ontario (0.156). Looking at the bottom panel, we can see that the returns to university have decreased for males in all provinces except Quebec. The decrease was largest in Ontario (a drop with 7.6 percentage points from 0.160 to 0.084) and in the Western provinces (a drop with 4.4 percentage points from 0.113 to 0.069). The increase in Quebec is relatively large (an increase with 6.6 percentage points from 0.213 in 1992 to 0.279 in 2002) and significant at conventional levels. For females, the returns increased in all regions except in the Western provinces. The increases were largest in Quebec (from 0.261 to 0.433), followed by Ontario (from 0.156 to 0.192) and the Atlantic provinces (from 0.349 to 0.362). In the Western provinces, the female return dropped from 0.274 in 1992 to 0.161 in 2002.

Overall, the entries in Tables 2 and 3 suggest that university education is more profitable for females than males, and that the returns (for both males and females) are highest in Quebec and lowest in the Western provinces. Moreover, the returns are generally lower in 2002 than in 1992 for males while the opposite is true for females.

4.2 Employment differences between university and trade/college graduates

The employment differences between trade/college and university graduates broken down by gender, region and time are presented in Table 4. The top panel shows results for NGS 1990, the middle panel for NGS 1995 and the lower panel for NGS 2000. In 1992, there were large regional differences in university returns. For both males and females, the highest return in terms of employment is reported for the Atlantic provinces (0.098 for males and 0.061 for females). For the other regions, there are no significant relationships between employment rates and university completion. Looking at the bottom panel, we can see that the employment probabilities are generally significantly lower for university graduates in 2002. There are some regional differences for males, with the large, negative effect found for Ontario (-0.052) and a small and insignificant effect for the Atlantic provinces (0.011). For females, there are no significant regional differences in the employment effects of a university degree.

Table 4
Employment differences between university graduates and trade/college graduates, by gender, region and time

	Atlantic	Quebec	Ontario	Western
			NGS 1990	
Males	0.098*	0.008	0.014	0.022
	(5.59)	(0.40)	(1.02)	(1.91)
Females	0.061*	-0.001	-0.007	0.006
	(4.05)	(-0.05)	(-0.53)	(0.56)
			NGS 1995	
Males	0.015	-0.007	-0.029*	-0.032*
	(1.10)	(-0.43)	(-2.10)	(-4.15)
Females	0.004	0.075*	-0.023	-0.025*
	(0.30)	(4.71)	(-1.47)	(-3.10)
			NGS 2000	
Males	0.011	-0.032*	-0.052*	-0.013
	(0.69)	(-2.79)	(-3.40)	(-1.28)
Females	-0.019	-0.035*	-0.035*	-0.020*
	(-1.41)	(-3.40)	(-2.61)	(-2.19)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show coefficients from a regression of log annual earnings (dummy for employed) on a dummy variable for university graduate. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

4.3 Earnings differences across major field of study

The earnings and employment patterns shown in Tables 2 to 4 did not consider differences in returns across major fields of studies. It is however likely that the returns are quite different across different fields of study. Tables 5a and 5b present the distribution of university education by time and major field of study for males and females, respectively. For males (Table 5a), in 1992, the most common field of study was "Social sciences and related fields" (proportion equals 0.227), followed by "Business and commerce" (0.161) and "Engineering" (0.155). The fields with the lowest fractions of students are: "Fine and applied arts" (0.022), "Other" (0.037), and "Health" (0.045). There were some changes in these fields of specialization over the 1990s, and in 2002, the most popular fields are: "Engineering" (0.209), "Business and commerce" (0.206) and "Social sciences and related fields" (0.175). The least popular choices were: "Other" (0.004), "Agricultural, biological, nutritional, and food sciences" (0.036), and "Fine and applied arts" (0.043). The fields that have seen the largest increases are "Engineering", "Business and commerce", and "Health", while the largest decrease is observed in "Social sciences and related fields".

Table 5a
Distribution of university education for males, by time and major field of study

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and Counselling Services	0.110	0.136	0.098
Fine and Applied Arts	0.022	0.020	0.043
Humanities and Related Fields	0.090	0.090	0.091
Social Sciences and Related Fields	0.227	0.219	0.175
Commerce, Management and Business administration	0.161	0.177	0.206
Agricultural and Biological Sciences/Technologies	0.059	0.057	0.036
Engineering and Applied Sciences	0.155	0.151	0.209
Health Professions, Sciences and Technologies	0.045	0.043	0.078
Mathematics and Physical Sciences	0.093	0.090	0.060
Other	0.037	0.018	0.004

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show fractions of university graduates by reported major field of study.

Table 5b
Distribution of university education for females, by time and major field of study

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and Counselling Services	0.207	0.195	0.158
Fine and Applied Arts	0.036	0.031	0.044
Humanities and Related Fields	0.124	0.133	0.103
Social Sciences and Related Fields	0.255	0.264	0.256
Commerce, Management and Business administration	0.129	0.138	0.167
Agricultural and Biological Sciences/Technologies	0.064	0.058	0.020
Engineering and Applied Sciences	0.020	0.024	0.092
Health Professions, Sciences and Technologies	0.095	0.100	0.137
Mathematics and Physical Sciences	0.033	0.026	0.019
Other	0.038	0.031	0.005

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show fractions of university graduates by reported major field of study.

For females (whose entries are shown in Table 5b) in 1992, the most common field of study was "Social sciences and related fields" (proportion equals 0.255), followed by "Educational, recreational and counselling services" (0.207) and "Business and commerce" (0.129). The fields with the lowest fractions of students are: "Engineering" (0.020), "Mathematics, computer and physical sciences" (0.033), and "Fine and applied arts" (0.036). There were some changes in these fields of specialization over the 1990s, and in 2002, the most popular fields are: "Social sciences and related fields" (0.256), "Business and commerce" (0.167) and "Educational, recreational and counselling services" (0.158). The least popular choices were: "Other" (0.005), "Mathematics, computer and physical sciences" (0.019), and "Agricultural, biological, nutritional, and food sciences" (0.020). Similar to the entries in Table 5a for males, the fields that have seen the largest increases are "Engineering", "Business and commerce", and "Health". The largest decrease is observed in "Educational, recreational and counselling services".

Table 6a
Earnings differences for males between university graduates and trade/college graduates, by time and major field of study

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and	0.120	0.277*	0.220*
Counselling Services	(1.71)	(5.09)	(2.64)
Fine and Applied Arts	-0.073	0.102	-0.137*
	(-0.92)	(1.61)	(-2.81)
Humanities and Related Fields	-0.021	0.123	0.084
	(-0.30)	(1.83)	(1.24)
Social Sciences and Related Fields	0.048	-0.010	0.125*
	(1.20)	(-0.34)	(2.89)
Commerce, Management and	0.232*	0.383*	0.352*
Business administration	(7.09)	(16.61)	(15.12)
Agricultural and Biological	0.035	0.201*	0.125*
Sciences/Technologies	(0.72)	(4.93)	(2.63)
Engineering and Applied	0.329*	0.288*	0.166*
Sciences	(15.24)	(14.98)	(9.17)
Health Professions, Sciences and	0.219*	0.468*	0.237*
Technologies	(4.40)	(9.58)	(5.91)
Mathematics and Physical	0.163*	0.066	0.315*
Sciences	(4.36)	(0.95)	(8.94)
Other	0.604*	0.254*	0.332*
	(5.00)	(2.51)	(2.74)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

Table 6b
Earnings differences for females between university graduates and trade/college graduates, by time and major field of study

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and	0.427*	0.368*	0.397*
Counselling Services	(13.64)	(12.56)	(13.61)
Fine and Applied Arts	0.154*	0.298*	-0.062
	(2.75)	(5.59)	(-1.43)
Humanities and Related Fields	0.130	0.105	0.353*
	(1.91)	(1.49)	(5.86)
Social Sciences and Related Fields	0.103*	0.213*	0.142*
	(3.37)	(7.90)	(4.53)
Commerce, Management and	0.407*	0.539*	0.416*
Business administration	(15.87)	(23.88)	(20.85)
Agricultural and Biological	0.212*	0.284*	0.386*
Sciences/Technologies	(4.47)	(5.94)	(6.08)
Engineering and Applied	0.365*	0.458*	0.072*
Sciences	(5.83)	(8.34)	(2.08)
Health Professions, Sciences and	0.321*	0.581*	0.369*
Technologies	(11.11)	(21.65)	(16.39)
Mathematics and Physical	0.358*	0.309*	0.393*
Sciences	(7.69)	(2.00)	(7.05)
Other	0.503*	0.552*	0.257*
	(5.49)	(6.54)	(2.80)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

The entries in Table 6a show the earnings difference between trade/college and university graduates. Thus, the figures in the table show the earnings difference between the two educational levels *within* a given field of specialization. This means that the entries cannot be used to infer earnings differences across fields of specializations (such as arts and commerce). For males in 1992 (first column in Table 6a), we find that the highest returns to a university degree are in "Engineering" (33%), "Business and commerce" (23%), and "Health" (22%), while the lowest return is in "Fine and applied arts" (-7% but not significantly different from zero).[7] In 2002, the highest returns are found in "Business and commerce" (35%), "Mathematics, computer and physical sciences" (32%), and "Health" (24%). The lowest return is still found in "Fine and applied arts" (-14%). Between 1992 and 2002, the returns in "Business and commerce" and "Mathematics, computer and physical sciences" increased significantly while the return in 2002 in "Engineering" was about half of what it was in 1992.

[7] Because of the small sample sizes in the cells for the category "Other", especially in 2002, the results for this category are somewhat unreliable.

We observe a similar pattern regarding earnings returns to university for males and females. However, the return in the category "Educational, recreational and counseling services" is significantly higher for females than for males (around 40% for females as opposed to 22% for males). Consistent with earlier results, the returns within fields of specialization are generally higher for females than for males (the only exception in 2002 is the return to university in engineering which is 17% for males and 7% for females). The entries in Tables 6a and 6b also show how the field-specific returns have evolved over time. For both males and females, we find that the returns in "Engineering" have decreased significantly. Moreover, the returns in "Business and commerce" increased significantly for males, but remained basically the same for females. Other fields that saw increased returns for both males and females are: "Mathematics, computer and physical sciences", "Health", and "Agricultural, biological, nutritional, and food sciences".

4.4 Earnings differences across industries

Tables 7a and 7b show the distribution of university educated workers, by time and industrial category for males and females, respectively. As mentioned above, the industry classification in the data was identical between the 1990 and 1995 NGS waves, but was slightly different in the 2000 wave. However, the industry groups are still comparable. The entries in both Tables 7a and 7b are conditional on working last week at the interview date and the sample sizes are therefore smaller then the ones used to obtain Tables 5a and 5b. Starting with males, Table 7a shows that the most common industry in 1992 was "Business services" (16.6% of those working worked in this industry) followed by "Education services" (16.4%) and "Manufacturing" (12.5%). The industries with the lowest fraction of workers were: "Agricultural and related" (1.1%), "Fishing and trapping" (0.1%), and "Mining, quarrying and oil well" (1.2%). In 2002, the most common industry is "Professional" (21.1%) which is a category that does not exist in 1990 or in 1995 NGS, but appears to be a merger of the following categories in 1990: Finance, Real estate, and business. The "Education" industry employed 18.9% of the working graduates in 2002, a slight increase from 1992. In 2002, 10.6% worked in the "Manufacturing" sector, down from 12.5% in 1992. Similar to 1992, the agricultural and fishing industries attracted the fewest number of graduates. The industry that showed the largest increase over the 10 years between 1992 and 2002 was "Accommodation, food and beverage services", which increased from 2.8% in 1992 to 8.2% in 2002. It is possible that one reason for this significant increase is an increase in temporary job holdings by university graduates in 2002 compared to 1992, and that it is not reflecting a change in job preferences among university graduates. The fraction of workers in the "Communication and other utility" also increased substantially from 4.4% in 1992 to 8.9% in 2002.

Table 7a Distribution of university educated respondents for males, by time and industry			
Industry:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Agriculture & Related	0.011	0.005	0.008
Fishing & Trapping	0.001	0.001	0.019
Logging, Forestry, Mining, Quarrying & oil well	0.012	0.017	n.a.
Manufacturing	0.125	0.139	0.106
Construction	0.024	0.018	0.022
Transportation & Storage	0.013	0.014	0.015
Communication & Other Utilities	0.044	0.027	0.089
Wholesale & Retail Trade	0.082	0.084	0.070
Finance & Insurance	0.062	0.078	n.a.
Real Estate Operator & Insurance Agent	0.009	0.008	n.a.
Business Services	0.166	0.212	n.a.
Professional Services	n.a.	n.a.	0.211
Government Services	0.107	0.059	0.087
Education Services	0.164	0.140	0.189
Health & Social Service	0.082	0.065	0.079
Accommodation, Food & Beverage Service	0.028	0.020	0.082
Other Service	0.071	0.114	0.023
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Entries show fractions of university graduates by reported industry.			

Table 7b Distribution of university educated respondents for females, by time and industry			
Industry:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Agriculture & Related	0.005	0.006	0.003
Fishing & Trapping	0	0.0001	0.006
Logging, Forestry, Mining, Quarrying & oil well	0.003	0.004	n.a.
Manufacturing	0.040	0.053	0.050
Construction	0.003	0.001	0.008
Transportation & Storage	0.005	0.011	0.010
Communication & Other Utilities	0.018	0.018	0.073
Wholesale & Retail Trade	0.072	0.097	0.071
Finance & Insurance	0.059	0.061	n.a.
Real Estate Operator & Insurance Agent	0.008	0.006	n.a.
Business Services	0.083	0.140	n.a.
Professional Services	n.a.	n.a.	0.127
Government Services	0.081	0.044	0.074
Education Services	0.318	0.258	0.267
Health & Social Service	0.218	0.177	0.201
Accommodation, Food & Beverage Service	0.023	0.031	0.084
Other Service	0.064	0.093	0.027
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Entries show fractions of university graduates by reported industry.			

Table 7b shows the industry distribution for female university graduates in 1992, 1997, and 2002. As expected given the field of specialization, the most common industries in 1992 were "Education services" (31.8%) and "Health and social services" (21.8%). Agricultural, fishing, mining, and manufacturing attracted the lowest proportions of female graduates. The industry distribution in 2002 was similar to the one in 1992. Again, education and health industries were attracting almost half of all working female graduates. There were also some significant increases in the fraction working in the "Accommodation, food and beverage services" (which increased from 2.3% in 1992 to 8.4% in 2002) and in "Communication and other utility" (which increased from 1.8% in 1992 to 7.3% in 2002).

Table 8a
Earnings differences for males between university graduates and trade/college graduates, by time and industry

Industry:	NGS 1990	NGS 1995	NGS 2000
Agriculture & Related	0.082	0.529*	-0.140
	(0.73)	(4.38)	(-1.51)
Fishing & Trapping	0.023	-0.179	0.197*
	(0.07)	(-0.53)	(3.06)
Logging, Forestry, Mining,	0.264*	0.132	n.a.
Quarrying & oil well	(2.66)	(1.90)	
Manufacturing	0.225*	0.202*	0.281*
	(6.59)	(8.28)	(11.24)
Construction	0.176*	-0.023	0.062*
	(2.61)	(-0.39)	(2.21)
Transportation & Storage	0.102	0.105	0.069
	(1.14)	(1.52)	(1.10)
Communication & Other	0.163*	0.384*	0.213*
Utilities	(2.81)	(6.10)	(5.19)
Wholesale & Retail Trade	0.174*	0.130*	0.281*
	(4.50)	(4.31)	(8.69)
Finance & Insurance	0.072	0.097	n.a.
	(0.98)	(1.71)	
Real Estate Operator &	0.098	0.330*	n.a.
Insurance Agent	(0.71)	(3.07)	
Business Services	0.220*	0.203*	n.a.
	(5.35)	(7.32)	
Professional Services	n.a.	n.a.	0.267*
			(11.71)
Government Services	0.088*	0.065	0.059
	(2.11)	(1.53)	(1.75)
Education Services	0.098	-0.061	-0.011
	(1.44)	(-1.08)	(-0.27)

Table 8a (continued)
Earnings differences for males between university graduates and trade/college graduates, by time and industry

Industry:	NGS 1990	NGS 1995	NGS 2000
Health & Social Service	0.137*	0.154*	0.197*
	(3.04)	(3.20)	(5.42)
Accommodation, Food &	0.233*	0.049	0.128*
Beverage Service	(3.31)	(0.79)	(4.07)
Other Service	-0.101	0.110*	0.041
	(-1.60)	(3.33)	(0.77)

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

Table 8b
Earnings differences for females between university graduates and trade/college graduates, by time and industry

Industry:	NGS 1990	NGS 1995	NGS 2000
Agriculture & Related	-0.011	0.448*	0.466*
	(-0.07)	(3.22)	(3.27)
Fishing & Trapping	n.a.	n.a.	0.306*
			(2.68)
Logging, Forestry, Mining,	0.296	0.385*	n.a.
Quarrying & oil well	(1.52)	(2.03)	
Manufacturing	0.291*	0.380*	0.318*
	(5.13)	(8.48)	(8.47)
Construction	0.506*	0.266	-0.014
	(2.95)	(0.95)	(-0.14)
Transportation & Storage	0.484*	0.212*	0.037
	(3.00)	(2.02)	(0.41)
Communication & Other	0.457*	0.258*	0.347*
Utilities	(5.00)	(2.54)	(9.29)
Wholesale & Retail Trade	0.302*	0.286*	0.311*
	(6.83)	(8.29)	(10.04)
Finance & Insurance	0.281*	0.351*	n.a.
	(4.98)	(6.58)	
Real Estate Operator &	0.499*	0.372*	n.a.
Insurance Agent	(3.61)	(3.16)	
Business Services	0.250*	0.274*	n.a.
	(5.69)	(7.50)	
Professional Services	n.a.	n.a.	0.303*
			(11.91)

Table 8b (continued) **Earnings differences for females between university graduates and trade/college graduates, by time and industry**			
Industry:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Government Services	0.206*	0.141*	0.103*
	(4.57)	(2.36)	(2.83)
Education Services	0.316*	0.207*	0.183*
	(7.44)	(4.42)	(5.84)
Health & Social Service	0.253*	0.323*	0.286*
	(11.06)	(12.65)	(15.52)
Accommodation, Food &	0.285*	0.192*	0.063*
Beverage Service	(3.79)	(3.40)	(2.18)
Other Service	0.164*	0.241*	0.475*
	(2.83)	(6.71)	(9.71)
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.			

In Tables 8a and 8b, the earnings difference between trade/college and university graduates are shown, by industrial category. Similar to the estimated earnings differences *within* a given field of specialization, the figures in the tables show the earnings difference between the two educational levels *within* a given industry. For males in 1992 (first column in Table 8a), we find that the highest returns to a university degree are in "Accommodation, food and beverage services" (23.3%), "Manufacturing" (22.5%), and "Business services" (22%), while the lowest returns are in "Fishing and trapping" (2.3%) and "Other" (-10.1%). In 2002, the highest returns are found in "Manufacturing" (28.1%) and "Wholesale and Retail Trade" (28.1%). The lowest return are found in "Agricultural and related" (-14%) and "Education services" (-1.1%). Between 1992 and 2002, the returns in "Manufacturing", "Communication and other utility", "Wholesale and Retail Trade", and "Health and social services" increased significantly while the return in 2002 in "Accommodation, food and beverage services" was about half of what it was in 1992.

The industry-specific returns to university education for females are similar to those for males. In 1992, the highest returns are found in "Real estate operator and insurance agent" (49.9%), "Communication and other utility" (45.7%), "Wholesale and Retail Trade" (30.2%), and "Manufacturing" (29.1%). The lowest return is found in "Agricultural and related" (-1.1%). As for males, there were some changes in the returns between 1992 and 2002. The return in "Agricultural and related" increased the most, from -1.1% in 1992 to 46.6% in 2002. In the following industries, the returns decreased significantly: "Transportation and storage" (from 4.4% in 1992 to 3.7% in 2002), "Communication and other utility" (from 45.7% in 1992 to 34.7% in 2002), "Government services" (from 20.6% in 1992 to 10.3% in 2002), and "Accommodation, food and beverage services" (from 28.5% in 1992 to 6.3% in 2002). It should be noted that some industry classes contain few individuals and this implies that the estimated returns may not necessarily reflect population returns in the specific industry.

4.5 Earnings differences across occupations

Tables 9a and 9b show the distribution of university educated workers, by time and occupation classification. For males, shown in Table 9a, the most common occupations in 1992 are in "social science, education, government service and religion" (24.3%) and "natural and applied sciences and related occupations" (19.9%), while the least common occupations are in "trades, transport and equipment operators" (3.6%), "occupations unique to primary industry" (1.6%), and "occupations unique to processing, manufacturing and utilities" (1.5%). As opposed to the distribution of university educated males across major fields of study and industry classification, there were no large changes in the occupational distribution between 1992 and 2002. In fact, none of the changes are large enough to be significant at conventional significance levels. The occupational distribution for females is similar to that of males for all years. One exception is the lower proportion of females in "natural and applied sciences and related occupations" and higher proportion in "health occupations". Also similar to the entries for males, there were no significant changes in occupational distribution between 1992 and 2002.

Table 9a
Distribution of university educated respondents for males, by time and occupation

Occupation:	NGS 1990	NGS 1995	NGS 2000
Management	0.095	0.098	0.078
Business, Finance and Administrative	0.171	0.181	0.170
Natural and Applied Sciences	0.199	0.225	0.235
Health	0.055	0.041	0.059
Social science, Education, Government Service and Religion	0.243	0.181	0.231
Art, Culture, Recreation and Sport	0.038	0.031	0.046
Sales and Service	0.114	0.134	0.115
Trades, Transport and Equipment Operators	0.036	0.032	0.027
Primary Industry	0.016	0.010	0.021
Processing, Manufacturing and Utilities	0.015	0.027	0.017
Other	0.017	0.039	0

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Entries show fractions of university graduates by reported occupation.

Table 9b Distribution of university educated respondents for females, by time and occupation			
Occupation:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Management	0.076	0.104	0.048
Business, Finance and Administrative	0.174	0.202	0.210
Natural and Applied Sciences	0.055	0.062	0.070
Health	0.132	0.102	0.127
Social science, Education, Government Service and Religion	0.393	0.297	0.368
Art, Culture, Recreation and Sport	0.043	0.043	0.055
Sales and Service	0.109	0.155	0.107
Trades, Transport and Equipment Operators	0.002	0.001	0.005
Primary Industry	0.001	0.001	0.003
Processing, Manufacturing and Utilities	0.001	0.002	0.006
Other	0.014	0.030	0
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Entries show fractions of university graduates by reported occupation.			

The earnings differences between university graduates and those with less than university education, by occupational category, are shown in Table 10a for males and Table 10b for females. For males, the highest returns, in all years, are found in "management", "business, finance and administrative", "natural and applied sciences and related occupations", and health occupations. The returns for these occupations range from 20% to 32% in 1992, and from 21% to 27% in 2002. The lowest return, again for all years, is found in "art, culture, recreation and sport" occupations (while small and positive in 1992 it is negative, -14.5%, and significant in 2002). The occupation-specific returns for females are similarly distributed (see Table 10b).

Table 10a Earnings differences for males between university graduates and trade/college graduates, by occupation			
Occupation:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Management	0.181*	0.186*	0.210*
	(4.08)	(5.05)	(5.00)
Business, Finance and Administrative	0.293*	0.193*	0.266*
	(8.53)	(6.32)	(10.00)
Natural and Applied Sciences	0.319*	0.213*	0.213*
	(12.19)	(9.50)	(10.78)
Health	0.217*	0.467*	0.219*
	(4.61)	(8.06)	(4.79)

Table 10a (continued)
Earnings differences for males between university graduates and trade/college graduates, by occupation

Occupation:	NGS 1990	NGS 1995	NGS 2000
Social science, Education, Government Service and Religion	0.158*	0.052	0.036
	(2.93)	(0.92)	(1.01)
Art, Culture, Recreation and Sport	0.011	-0.035	-0.145*
	(0.16)	(-0.59)	(-3.12)
Sales and Service	0.167*	0.159*	0.206*
	(5.37)	(6.56)	(8.04)
Trades, Transport and Equipment Operators	0.145*	-0.036	-0.008
	(3.21)	(-0.85)	(-0.19)
Primary Industry	0.149	0.073	-0.106
	(1.76)	(0.92)	(-1.79)
Processing, Manufacturing and Utilities	0.092	0.072	0.157*
	(1.29)	(1.47)	(2.77)
Other	0.145	0.133*	n.a.
	(1.68)	(2.70)	

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.

Table 10b
Earnings differences for females between university graduates and trade/college graduates, by occupation

Occupation:	NGS 1990	NGS 1995	NGS 2000
Management	0.473*	0.225*	0.248*
	(9.91)	(5.31)	(5.35)
Business, Finance and Administrative	0.372*	0.249*	0.225*
	(16.24)	(11.10)	(11.98)
Natural and Applied Sciences	0.200*	0.227*	0.223*
	(3.85)	(4.26)	(6.57)
Health	0.329*	0.454*	0.313*
	(13.38)	(15.36)	(13.43)
Social science, Education, Government Service and Religion	0.178*	0.220*	0.239*
	(5.35)	(5.75)	(11.21)
Art, Culture, Recreation and Sport	0.194*	0.002	-0.069
	(3.11)	(0.03)	(-1.70)

Table 10b (continued) **Earnings differences for females between university graduates and trade/college graduates, by occupation**			
Occupation:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Sales and Service	0.343*	0.177*	0.238*
	(11.56)	(7.71)	(10.11)
Trades, Transport and Equipment Operators	0.353	0.144	0.096
	(1.80)	(0.71)	(0.96)
Primary Industry	-0.040	-0.001	0.368*
	(-0.13)	(-0.01)	(2.99)
Processing, Manufacturing and Utilities	0.111	0.044	0.202*
	(0.44)	(0.27)	(2.25)
Other	0.368*	0.274*	n.a.
	(4.17)	(4.53)	
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level.			

4.6 Earnings differences across different model specifications

The earnings return described above are obtained by estimating linear regression models allowing different earnings for university and non-university graduates across different dimensions (major field of study, industry, and occupations). However, these regressions do not control for observable characteristics that may to some extent explain differences in earnings across educational levels. The entries in Tables 11a and 11b show the university returns from different regression specifications over time for males and females, respectively. Specifically, in the entries in the first column in Table 11a shows the earnings difference between university graduates and trade/college graduates obtained from a regression which includes no other observable characteristics of the individuals. These figures are the same as those presented in Table 2. In column two, controls for individual and job specific characteristics (parents' education, language, marital status, presence of children, and indicators for the nature of the job (permanent vs. temporary, full-time versus part-time)) were added. Adding these characteristics slightly increases the university returns for all years. For NGS 1990, the return increase from 0.199 to 0.207, and for NGS 2000, the return increase from 0.144 to 0.168. However, none of these increases are significant. In column three, controls for major field of study were also added to the regression specification. This implies a further increase in the university returns for all years. Adding controls for occupation - in addition to controls for individual and job specific characteristics, and major field of study – slightly increase the return in 1992 and reduce the return in 1997 and 2002. Finally, in column five, industry controls are added, and for all years, the returns are reduced. The estimated returns from the most complete regression specification are: 0.242 (in 1992), 0.172 (in 1997), and

0.167 (in 2002). These returns suggest that there has been a decrease in the economic return to university education between 1992 and 2002 of about 7.5 percentage points, corresponding to a reduction of about 30%.

Table 11a
Earnings differences for males between university graduates and trade/college graduates. Using alternative model specifications

Survey	(1)	(2)	(3)	(4)	(5)
NGS 1990	0.199*	0.207*	0.241*	0.249*	0.242*
	(15.58)	(16.83)	(17.27)	(16.81)	(16.02)
NGS 1995	0.145*	0.185*	0.233*	0.200*	0.172*
	(12.93)	(19.60)	(21.62)	(17.61)	(15.65)
NGS 2000	0.144*	0.168*	0.202*	0.179*	0.167*
	(14.32)	(19.54)	(20.92)	(19.19)	(17.16)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, if the employment was permanent, and finally, if the employment was full-time.

Table 11b
Earnings differences for females between university graduates and trade/college graduates. Using alternative model specifications

Survey	(1)	(2)	(3)	(4)	(5)
NGS 1990	0.281*	0.293*	0.323*	0.322*	0.313*
	(23.15)	(24.98)	(26.04)	(24.54)	(23.11)
NGS 1995	0.332*	0.338*	0.365*	0.284*	0.261*
	(25.38)	(31.92)	(31.89)	(24.55)	(22.63)
NGS 2000	0.273*	0.260*	0.287*	0.256*	0.240*
	(28.14)	(31.50)	(32.35)	(29.60)	(27.80)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, if the employment was permanent, and finally, if the employment was full-time.

The corresponding figures for females are presented in Table 11b. Adding controls for observable characteristics, major field of study, occupation, and industry, show that the economic return to a university education decreased between 1992 and 2002 for females as well. In 1992, the estimated return is 0.313 while in 2002, it equals 0.240. Both coefficients are precisely estimated with high t-values. The decrease of 7.3 percentage points corresponds to a reduction of about 23%. While both males and females experienced a reduction in the return, the return for females remains higher than the one for males.

4.7 Earnings differences across major field of study, industries and occupations

The results presented in Tables 6a, 6b, 8a, 8b, 10a, and 10b show earnings differences between university graduates and graduates from trade school or college across major field of study, industries and occupations, respectively. However, the regression specification that forms the basis for the results in Tables 6a and 6b for instance assumes that there are no earnings differences across industries or occupations, apart from those occurring due to differences in major field of study. Likewise, the results in Tables 8a and 8b assume that there are no earnings differences across major field of study or occupations, apart from those occurring due to differences across industries. While

highlighting the earnings differences across certain dimensions, these results are obviously imposing potentially binding restrictions on earnings differences between college/trade school graduates and university graduates. The results presented in Tables 12a and 12b are based on very flexible regression specifications that do not impose any such restrictions. Overall, it appears as if major field of study significantly determines differences in earnings differences between university graduates and college or trade school graduates. Once major field of study is allowed to influence the university return, there are generally no significant differences in the university return across industries or occupations. This is largely due to the high correlations that exist between field of study, industry, and occupation.

Table 12a
Returns to university education for males, by time, major field of study, industry, and occupation

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and	0.165	0.290*	0.244*
Counselling Services	(1.55)	(4.06)	(3.05)
Fine and Applied Arts	0.287*	0.152	0.170*
	(2.14)	(1.79)	(2.95)
Humanities and Related Fields	0.276*	0.069	0.158*
	(2.95)	(0.84)	(2.36)
Social Sciences and Related Fields	0.211*	0.093	0.204*
	(3.09)	(1.82)	(3.89)
Commerce, Management and	0.215*	0.244*	0.207*
Business administration	(3.71)	(5.66)	(5.50)
Agricultural and Biological	0.313*	0.004	0.085
Sciences/Technologies	(3.76)	(0.06)	(1.50)
Engineering and Applied	0.413*	0.231*	0.153*
Sciences	(6.64)	(4.77)	(3.54)
Health Professions, Sciences and	0.290*	0.438*	0.314*
Technologies	(2.47)	(3.93)	(5.48)
Mathematics and Physical	0.295*	0.165*	0.293*
Sciences	(4.61)	(1.96)	(6.05)
Other	0.502*	0.235*	0.294*
	(3.36)	(2.15)	(2.88)

Table 12a (continued)
Returns to university education for males, by time, major field of study, industry, and occupation

Industry::	NGS 1990	NGS 1995	NGS 2000
Agriculture & Related	0.291*	0.131	0.041
	(2.45)	(1.03)	(0.36)
Fishing & Trapping	-0.381	-0.521	0.041
	(-1.19)	(-1.88)	(0.59)
Logging, Forestry, Mining, Quarrying & oil well	0.064	-0.162*	n.a.
	(0.70)	(-2.46)	
Manufacturing	0.091	-0.035	0.134*
	(1.82)	(-0.87)	(3.06)
Construction	0.054	-0.207*	0.008
	(0.74)	(-3.30)	(0.14)
Transportation & Storage	0.142	-0.012	0.070
	(1.56)	(-0.17)	(1.11)
Communication & Other Utilities	Ref. cat.	Ref. cat.	Ref. cat.
Wholesale & Retail Trade	0.074	-0.080	0.134*
	(1.39)	(-1.90)	(2.91)
Finance & Insurance	0.039	-0.097	n.a.
	(0.52)	(-1.65)	
Real Estate Operator & Insurance Agent	-0.109	0.122	n.a.
	(-0.89)	(1.33)	
Business Services	0.044	-0.079	n.a.
	(0.82)	(-1.93)	
Professional Services	n.a.	n.a.	0.108*
			(2.63)
Government Services	0.032	-0.195*	-0.064
	(0.58)	(-4.09)	(-1.43)
Education Services	0.051	-0.161*	-0.212*
	(0.71)	(-2.60)	(-3.87)
Health & Social Service	0.084	-0.305*	-0.062
	(1.28)	(-5.04)	(-1.12)
Accommodation, Food & Beverage Service	0.114	-0.179*	0.013
	(1.54)	(-2.81)	(0.29)
Other Service	-0.105	-0.244*	-0.051
	(-1.51)	(-4.50)	(-0.87)

Table 12a (continued)
Returns to university education for males, by time, major field of study, industry, and occupation

Occupation:	NGS 1990	NGS 1995	NGS 2000
Management	-0.089	0.021	-0.096*
	(-1.57)	(0.50)	(-2.22)
Business, Finance and Administrative	Ref. cat.	Ref. cat.	Ref. cat.
Natural and Applied Sciences	-0.166*	0.095*	-0.048
	(-3.30)	(2.51)	(-1.53)
Health	-0.118	0.305*	-0.087
	(-1.20)	(2.55)	(-1.37)
Social science, Education, Government Service and Religion	-0.096	0.078	-0.042
	(-1.42)	(1.12)	(-0.95)
Art, Culture, Recreation and Sport	-0.226*	-0.043	-0.257*
	(-2.62)	(-0.64)	(-4.97)
Sales and Service	-0.139*	0.144*	-0.029
	(-2.84)	(3.77)	(-0.88)
Trades, Transport and Equipment Operators	-0.186*	0.016	-0.188*
	(-3.04)	(0.31)	(-3.83)
Primary Industry	-0.140	0.008	-0.208*
	(-1.48)	(0.09)	(-2.84)
Processing, Manufacturing and Utilities	-0.159	-0.042	-0.085
	(-1.90)	(-0.80)	(-1.51)
Other	-0.005	-0.024	n.a.
	(-0.05)	(-0.35)	

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Regression specifications include controls for the following observable characteristics: information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, if the employment was permanent, and finally, if the employment was full-time.

Table 12b
Returns to university education for females, by time, major field of study, industry, and occupation

Major field of study:	NGS 1990	NGS 1995	NGS 2000
Educational, Recreational and	0.565*	0.156*	0.371*
Counselling Services	(8.21)	(3.04)	(9.05)
Fine and Applied Arts	0.377*	0.213*	0.040
	(4.23)	(2.73)	(0.86)
Humanities and Related Fields	0.374*	0.117	0.257*
	(3.94)	(1.60)	(4.54)
Social Sciences and Related Fields	0.355*	0.038	0.163*
	(5.25)	(0.77)	(4.19)
Commerce, Management and	0.478*	0.273*	0.324*
Business administration	(8.04)	(6.03)	(10.46)
Agricultural and Biological	0.478*	0.033	0.208*
Sciences/Technologies	(5.90)	(0.53)	(3.39)
Engineering and Applied	0.334*	0.201*	0.136*
Sciences	(3.68)	(3.05)	(3.13)
Health Professions, Sciences and	0.433*	0.344*	0.356*
Technologies	(5.69)	(5.67)	(8.85)
Mathematics and Physical	0.430*	0.220	0.343*
Sciences	(5.73)	(1.20)	(6.50)
Other	0.514*	0.437*	0.270*
	(4.43)	(5.08)	(3.13)
Industry:			
Agriculture & Related	-0.202	0.210	0.054
	(-1.19)	(1.66)	(0.34)
Fishing & Trapping	n.a.	n.a.	-0.009
			(-0.09)
Logging, Forestry, Mining, Quarrying & oil well	-0.069	0.213	n.a.
	(-0.41)	(1.43)	
Manufacturing	-0.071	0.160*	0.011
	(-0.98)	(2.90)	(0.24)
Construction	0.030	-0.055	-0.163
	(0.20)	(-0.21)	(-1.91)
Transportation & Storage	0.187	0.120	-0.210*
	(1.21)	(1.38)	(-2.72)
Communication & Other Utilities	Ref. cat.	Ref. cat.	Ref. cat.

Table 12b (continued) **Returns to university education for females, by time, major field of study, industry, and occupation**			
Industry:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Wholesale & Retail Trade	-0.130*	0.086	0.023
	(-1.97)	(1.75)	(0.56)
Finance & Insurance	-0.049	0.117*	n.a.
	(-0.65)	(2.03)	
Real Estate Operator & Insurance Agent	0.107	0.158	n.a.
	(0.80)	(1.55)	
Business Services	-0.078	0.123*	n.a.
	(-1.18)	(2.48)	
Professional Services	n.a.	n.a.	0.049
			(1.32)
Government Services	-0.182*	0.005	-0.122*
	(-2.70)	(0.07)	(-2.92)
Education Services	-0.086	-0.116*	-0.194*
	(-1.29)	(-2.06)	(-4.40)
Health & Social Service	-0.103	0.068	-0.082*
	(-1.73)	(1.40)	(-2.05)
Accommodation, Food & Beverage Service	-0.106	0.128*	-0.071
	(-1.24)	(2.12)	(-1.74)
Other Service	-0.178*	0.045	0.055
	(-2.40)	(0.81)	(1.08)
Occupation:			
Management	-0.001	-0.091*	-0.019
	(-0.02)	(-2.21)	(-0.46)
Business, Finance and Administrative	Ref. cat.	Ref. cat.	Ref. cat.
Natural and Applied Sciences	-0.032	-0.049	-0.002
	(-0.47)	(-0.88)	(-0.05)
Health	-0.049	0.045	0.016
	(-1.01)	(0.84)	(0.43)
Social science, Education, Government Service and Religion	-0.111*	0.065	0.048
	(-2.44)	(1.43)	(1.66)
Art, Culture, Recreation and Sport	-0.101	-0.162*	-0.147*
	(-1.27)	(-2.62)	(-3.62)
Sales and Service	0.007	-0.054	0.047
	(0.17)	(-1.64)	(1.66)

Table 12b (continued) Returns to university education for females, by time, major field of study, industry, and occupation			
Occupation:	**NGS 1990**	**NGS 1995**	**NGS 2000**
Trades, Transport and Equipment Operators	-0.011	0.087	-0.135
	(-0.05)	(0.48)	(-1.49)
Primary Industry	-0.417	-0.176	0.063
	(-1.24)	(-0.79)	(0.45)
Processing, Manufacturing and Utilities	0.162	0.025	0.077
	(0.61)	(0.14)	(0.97)
Other	-0.061	0.037	n.a.
	(-0.63)	(0.56)	
Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.			
Note: Dependent variable: log earnings. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Regression specifications include controls for the following observable characteristics: information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, if the employment was permanent, and finally, if the employment was full-time.			

The results presented in Tables 12a and 12b are consistent with those presented in Tables 6a and 6b (which were based on specifications that did not control for industry or occupation specific returns) and show that the following disciplines are high earnings fields: "Engineering", "Business and commerce", "Health" (22%), and "Mathematics, computer and physical sciences". Further, the magnitudes of the estimated coefficients are quite similar as those presented in Tables 6a and 6b.

4.8 Unemployment differences between university and college/trade school graduates

As mentioned in the introduction, the value of a university degree relative to a college or trade school diploma may not only be confined to wage differences. There are many other potential "returns" associated with higher education. In Tables 13a and 13b, I present regressions on unemployment rates on a dummy for university graduate using three alternative regression specifications. As can be seen from Table 13a, university graduates were less likely to be unemployed (at the time of the survey interview) than respondents with college or trade school diploma. In the 1990 survey, the estimate is -0.05 and significant at conventional levels. In the 1995 survey, the estimate is reduced to -0.029 but still significant. Finally, in the 2000 survey, the estimate is -0.006 and no longer significant at conventional levels. This suggests that the employment security value of a university degree for males was reduced during the 1990s, and that by 2002 (the 2000 NGS) there were no significant differences in unemployment incidence between trade school or college graduates and university graduates. However, the results do not allow us to infer whether this convergence in effect on unemployment is due to the

fact that university graduates are more likely to become unemployed in 2002 or if it is due to the fact that the unemployment incidence is lower for trade school or college graduates in 2002 compared to 1992. The results in column two of Table 13a add controls for observable characteristics to the regression specification and this has only small effects on the estimated coefficients. The effect in the 1990 survey is reduced from -0.05 to -0.044, while the effects remain virtually the same for the remaining two survey years. Finally, in column three, I also add controls for major field of study, and this again reduces the effect for the 1990 survey (to -0.027) but does not change the estimates for the other years significantly. Thus, the main conclusion regarding the effect of a university degree on the incidence of unemployment obtained from the results in column one remains even after controlling for a wide set of observable characteristics.

Table 13a
Unemployment differences for males between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)
NGS 1990	-0.050*	-0.044*	-0.027*
	(-7.58)	(-6.41)	(-3.35)
NGS 1995	-0.029*	-0.029*	-0.028*
	(-5.94)	(-5.90)	(-4.74)
NGS 2000	-0.006	-0.008	-0.010
	(-1.31)	(-1.65)	(-1.73)
Specification include controls for:			
Observable characteristics	No	Yes	Yes
(individual specific)			
Major field of study	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for being unemployed. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, and finally if the respondent had any children.

Table 13b
Unemployment differences for females between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)
NGS 1990	-0.009	-0.007	-0.007
	(-1.52)	(-1.13)	(-1.10)
NGS 1995	-0.033*	-0.028*	-0.027*
	(-6.88)	(-5.69)	(-5.03)
NGS 2000	0.009*	0.010*	0.005
	(2.19)	(2.48)	(1.06)
Specification include controls for:			
Observable characteristics	No	Yes	Yes
(individual specific)			
Major field of study	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for being unemployed. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, and finally if the respondent had any children.

The corresponding results for females are presented in Table 13b. In a regression specification with no other explanatory variables, apart from the dummy for university degree, (shown in column one) the effect of university graduation on the probability of being unemployed two years after graduation is mixed. There is a negative, but insignificant, effect for the 1990 survey, and a negative and significant effect for the 1995 survey (the estimate equals -0.033). For the 2000 survey, however, the effect is positive and significant (the estimate equals 0.009). This pattern resembles that found for males in the sense that the role of a university education as an insurance against unemployment is non-existent (or even reversed) in the last survey, while there results indicate that the incidence of unemployment was lower among university graduates in the 1990s, for both males and females. Adding controls to the regression specification, both individual and job specific observable variables, does not change the effects in any significant fashion. However, in the most general specification that also controls for major field of study, the estimate for the 2000 survey is insignificant.

To summarize, it appears that the value of a university degree in terms of reducing the incidence of becoming unemployed has been reduced over the last decade. While university graduates were less likely to be unemployed two years after graduation during the 1990s surveys, that was not the case in the 2000 survey. Further, the results are similar for both male and female respondents.

4.9 Full-time employment differences between university and college/trade school graduates

Another dimension of labor market attachment that may differ between those with a university degree and those with a college or trade school diploma is full-time employment. Some of the earnings differences observed above across the two groups may for instance be due to differences in hours of work, and not only reflect wage or skill price differences. By studying the proportion of graduates that are working full-time, as opposed to part-time, we may be able to infer the degree of labor market attachment associated with a university education. The entries in Tables 14a and 14b show estimates from a regression of a dummy for full-time employment on a dummy variable for university education. The sample is restricted to those who reported that they were working the week before the survey was conducted. Starting with the results for males (Table 14a), we see that university graduates were more likely to work full-time in 1992 (the 1990 survey) and less likely to work full-time in the two following surveys. These estimates were obtained from a reduced specification that fails to control for any person and job specific attributes. Looking instead at the entries in column five, which were obtained from a specification that controls for individual and job characteristics, major field of study, occupation, and industry, we see that university graduates were still more likely to work full-time in 1992 (the 1990 survey). However, for the remaining two survey years, the effect of a university degree is insignificant.

Table 14a
Full-time employment differences for males between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)	(4)	(5)
NGS 1990	0.040*	0.049*	0.054*	0.052*	0.047*
	(3.43)	(4.41)	(4.21)	(3.85)	(3.42)
NGS 1995	-0.041*	-0.036*	-0.007	-0.010	-0.012
	(-7.87)	(-6.75)	(-1.08)	(-1.58)	(-1.83)
NGS 2000	-0.028*	-0.023*	0.004	0.006	0.006
	(-5.56)	(-4.44)	(0.64)	(0.93)	(0.93)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for full-time employment. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, and finally if the employment was permanent.

Table 14b
Full-time employment differences for females between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)	(4)	(5)
NGS 1990	0.015	0.028*	0.034*	0.040*	0.030*
	(1.35)	(2.57)	(2.82)	(3.19)	(2.32)
NGS 1995	0.018*	0.018*	0.053*	0.007	0.006
	(2.15)	(2.07)	(5.48)	(0.66)	(0.58)
NGS 2000	0.024*	0.024*	0.031*	0.025*	0.026*
	(3.78)	(3.65)	(4.40)	(3.53)	(3.67)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for full-time employment. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, and finally if the employment was permanent.

The female results are presented in Table 14b and suggest a different pattern. For females, the effect of a university degree is positive for most years and specifications. Focusing on the most general specification, which again controls for individual and job characteristics, major field of study, occupation, and industry, the estimates for the university dummy are positive and significant for the 1990 and 2000 surveys (estimates equal 0.03 in 1990 and 0.026 in 2000). For the 1995 survey, the estimate is still positive, but smaller in magnitude, and not statistically significant.

To summarize, there are no significant differences in full-time employment between university graduates and graduates from college or trade school in the later years for males. For females, however, we find positive effects for two of the three surveys. These results are as expected as the hours of work distribution tends to be fairly concentrated around full-time for males while it is more dispersed for females. Given that the opportunity cost of working is likely to be higher for females with a university degree, as expected the university educated women are more likely to work full-time than women who are less educated.

4.10 Permanent vs temporary employment differences between university and college/trade school graduates

Given the fact that the NGS surveys were conducted relatively shortly after graduation (two years although there was a follow-up to the 1990 NGS five years after graduation as well), another measure of the ease of school to work transition (apart from unemployment and full-time employment) is the time-dimension of the employment contract. Specifically, it may be that higher education increases the possibility of obtaining permanent employment and reduces the risk of working in jobs with time-limited contracts. The entries in Tables 15a and 15b show the effect of a university degree on the incidence of having a permanent employment two years after graduation for males and females, respectively. The results indicate that, regardless of gender, time, and regression specification, university graduates were more likely to be employed in jobs of a temporary nature.

Table 15a
Permanent employment differences for males between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)	(4)	(5)
NGS 1990	-0.044*	-0.056*	-0.033*	-0.032*	-0.030*
	(-4.01)	(-5.30)	(-2.69)	(-2.47)	(-2.23)
NGS 1995	-0.060*	-0.050*	-0.011	-0.008	-0.016
	(-7.09)	(-5.84)	(-1.13)	(-0.72)	(-1.58)
NGS 2000	-0.050*	-0.046*	-0.014	-0.011	-0.006
	(-6.67)	(-5.97)	(-1.65)	(1.17)	(0.65)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for full-time employment. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, and finally if the employment was permanent.

Table 15b
Permanent employment differences for females between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)	(4)	(5)
NGS 1990	-0.060*	-0.057*	-0.038*	-0.033*	-0.035*
	(-5.78)	(-5.56)	(-3.41)	(-2.81)	(-2.89)
NGS 1995	-0.125*	-0.126*	-0.090*	-0.064*	-0.058*
	(-13.77)	(-13.83)	(-8.86)	(-6.00)	(-5.53)
NGS 2000	-0.079*	-0.075*	-0.043*	-0.039*	-0.022*
	(-11.28)	(-10.66)	(-5.52)	(-5.00)	(2.80)
Specification include controls for:					
Observable characteristics (individual and job specific)	No	Yes	Yes	Yes	Yes
Major field of study	No	No	Yes	Yes	Yes
Occupation	No	No	No	Yes	Yes
Industry	No	No	No	No	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for full-time employment. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, and finally if the employment was permanent.

4.11 Job satisfaction differences between university and college/trade school graduates

A final dimension of non-pecuniary aspects of the return to university education is presented in Table 16, which shows estimated effects of being a university graduate on self-reported job satisfaction. Information on job satisfaction is only available in the 1990 and 2000 surveys. For the 1990 survey, the job satisfaction question was asked at the five-year follow-up interview. However, for the 2000 survey, the question was asked at the same time as other questions, namely during 2002. Thus, it is possible that differences in job satisfaction across the two surveys to some extent reflect this timing difference. In both surveys, respondents were asked to report their level of satisfaction with the job held during the survey reference week. The satisfaction level was aggregated into four classes: very satisfied, satisfied, dissatisfied, and very dissatisfied. In this paper, a respondent is satisfied with the job if he/she reported being very satisfied with the job.

Table 16
Job satisfaction differences for males between university graduates and trade/college graduates. Using alternative model specifications

	(1)	(2)	(3)	(4)	(5)
NGS 1990					
Males	0.033*	0.039*	0.042*	0.044*	0.044*
	(2.26)	(2.54)	(2.38)	(2.38)	(2.29)
Females	0.032*	0.033*	0.014	0.005	0.011
	(2.33)	(2.31)	(0.92)	(0.31)	(0.67)
NGS 2000					
Males	0.005	0.016	0.025*	0.010	0.0004
	(0.48)	(1.57)	(2.14)	(0.78)	(0.04)
Females	-0.027*	-0.029*	-0.030*	-0.059*	-0.071*
	(-3.06)	(-3.16)	(-3.02)	(-5.91)	(-7.00)
Specification include controls for:	No	Yes	Yes	Yes	Yes
Observable characteristics					
(individual and job specific)	No	No	Yes	Yes	Yes
Major field of study	No	No	No	Yes	Yes
Occupation	No	No	No	No	Yes
Industry	No	Yes	Yes	Yes	Yes

Source: Calculations based on baseline survey data from public use files of NGS 1990, NGS 1995, and NGS 2000.

Note: Dependent variable: indicator for satisfaction with the current job. T-statistics are reported in parenthesis. Respondents with education beyond a university degree (master's and PhD) are excluded. * indicate statistical significance at the 5%-level. Observable characteristics include information on father's and mother's educational attainments, if the interview was conducted in English, if the respondent was married, if the respondent had any children, if the employment was permanent, and finally if the employment was full-time.

As was done above, the entries in the table show the effect of a university education under different regression specifications. Starting with the entries in column one, which were obtained from simply regressing the job satisfaction dummy on the university dummy, university graduates appear to have higher degrees of job satisfaction than non-university educated respondents in 1995 but not in 2002. Looking at the entries in the last column, column five, we see that job satisfaction levels in 1995 are higher for male university graduates than male non-university graduates. For females, however, the estimate for the university dummy is not significant. For 2002, the results indicate no significant differences in job satisfaction for men and significantly less satisfaction levels for female university graduates.

4.12 Internal rate of returns, by time and major field of study

Using Census data from 1991, 1996, and 2001, internal rate of returns (IRR) for a university degree were calculated separately for the nine different major fields of study identified in the census data (which corresponds to the major field of study definition used in the NGS data) for females (Table 17) and males (Table 18).[8] The estimates assume that workers retire at age 65, irrespective of their educational attainments. To calculate each of the IRRs, log wage equation for each educational level (one for high school graduates and nine for university graduates, one for each major field of study), for each gender (females and males), and for each time period (1991, 1996, and 2001) was estimated. Thus, to calculate the IRRs reposted in Table 17 and Table 18, 60 log wage regressions were estimated. These log wage regressions were then used to predict life-cycle earnings. Information from data on tuition fees in Canada obtained from Statistics Canada's survey on "Tuition and living accommodation costs at Canadian degree-granting universities and colleges" were then used to estimate the direct costs of a university education, which may vary over time, major field of study, and geographical region. Finally, the IRR was obtained by solving equation (1) above, using the predicted life-cycle earnings along with the tuition fee data.

Table 17
Internal rate of returns to a university degree in Canada for females, by time, and major field of study

Major field of study:	1991	1996	2001	Δ 2001-1991
Educational, recreational, and counselling services	9	9	9	0
Fine and applied arts	5	4	4	-1
Humanities and related fields	7	8	9	2
Social sciences and related fields	9	9	10	1
Business and commerce	11	12	14	3
Agricultural, biological, nutritional, and food sciences	7	8	9	2
Engineering	13	12	13	0
Health	12	14	14	2
Mathematics, computer and physical sciences	12	13	14	2
Aggregate across all fields	9	10	11	2

Source: Calculations based on public use files from 1991, 1996, and 2001 Canadian Census.

[8] For all census years, individuals who were aged 20 to 65 were retained. Further, individuals who reported earnings less than $6,000 per year (in 1991 dollars) were excluded. In order to calculate IRR by year (3), gender (2), field (10) and region (4), 240 Mincer-type regressions were estimated. Further, in addition to the regression output, 108 tuition and other fees are needed (9 for each region (4) and year (3)).

Table 18 Internal rate of returns to a university degree in Canada for males, by time, and major field of study				
Major field of study:	**1991**	**1996**	**2001**	**Δ 2001-1991**
Educational, recreational, and counselling services	3	4	3	0
Fine and applied arts	1	-1	-7	-8
Humanities and related fields	3	2	4	1
Social sciences and related fields	9	9	10	1
Business and commerce	11	12	13	2
Agricultural, biological, nutritional, and food sciences	4	5	6	2
Engineering	13	14	16	3
Health	7	12	10	3
Mathematics, computer and physical sciences	11	12	13	2
Aggregate across all fields	9	10	11	2
Source: Calculations based on public use files from 1991, 1996, and 2001 Canadian Census.				

The entries in Table 17 indicate that the economic returns to a university education are around 10%. Looking first at the IRR that are aggregated across all fields of study, we see that the IRR equals 9% in 1991, 10% in 1996, and 11% in 2001. These figures are substantially lower than the earnings differences presented above using the NGS data. One reason for this substantial difference is that the earnings differences presented above using NGS data ignore the costs (both direct and indirect) of acquiring a university degree. These costs are explicitly embedded in the calculations of the IRRs. The entries in Table 17 also highlight differences in IRRs across major fields of study. Consistent with the findings above using NGS data, the highest returns are found in "Business and commerce" (14% in 2001), "Health" (14%), "Mathematics, computer and physical science" (14%), and "Engineering" (13%), while the lowest return is found in "Fine and applied arts" (4%). The final column of Table 17 shows the percentage point differences in IRRs between 1991 and 2001, and the entries indicate that the returns in "Business and commerce" increased the most (3 percentage points) and the returns in "Fine and applied arts" actually decreased by one percentage point.

The IRRs for males are presented in Table 18, and at the aggregated level across all major fields of study, the returns are identical to those found for females, 9% in 1991, 10% in 1996, and 11% in 2001. These returns are lower than those reported by Heckman et al (2005) for the U.S. (they report an IRR of 14% for a university education for white males in 1990). As for females, there is a considerable variation in the IRR across fields of study with the highest return (in 2001) in "Engineering" (16%) and the lowest return in "Fine and applied arts" (-7%).

4.13 Internal rate of returns, by time, region and major field of study

The results presented in Tables 17 and 18 assumed constant returns across Canada's provinces. While sample size restrictions prevent a provincial-specific analysis of the IRRs, the ten provinces were aggregated into four regions: Eastern Canada, Quebec, Ontario, and Western Canada. Tables 19-21 show the IRRs for females, by time, region, and major field of study. The IRRs aggregated across fields suggest the existence of regional variations in the economic returns to a university education. For 1991 (Table 19), the highest return is found for Eastern Canada (11%) and the lowest returns are found in Ontario and Western Canada (9%). In 2001 (Table 21), the highest return is found in Quebec (18%) and the lowest in Western Canada (13%). Thus, while all regions experienced an increase in the return between 1991 and 2001, the increase was largest in Quebec (eight percentage points) and lowest in Western Canada (four percentage points). The increase in return over time may be due to within-field increases or a change in the composition of major fields of study (or a combination of the two). As for the analysis presented in Table 17, the fields of study with the highest returns are "Business and commerce", "Health", "Mathematics, computer and physical science", and "Engineering", while the lowest return is found in "Fine and applied arts". This pattern holds for all regions and all time periods.

Table 19
Internal rate of returns to a university degree in Canada in 1991 for females, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	9	9	9	12
Fine and applied arts	5	7	2	n.a.
Humanities and related fields	5	7	6	8
Social sciences and related fields	8	9	8	9
Business and commerce	10	11	12	13
Agricultural, biological, nutritional, and food sciences	6	6	11	10
Engineering	15	11	13	19
Health	11	12	14	14
Mathematics, computer and physical sciences	12	11	14	12
Aggregate across all fields	9	9	10	11

Source: Calculations based on public use files from the 1991 Canadian Census.

Table 20
Internal rate of returns to a university degree in Canada in 1996 for females, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	9	10	9	10
Fine and applied arts	0	6	5	12
Humanities and related fields	6	9	8	8
Social sciences and related fields	7	10	10	8
Business and commerce	12	14	13	10
Agricultural, biological, nutritional, and food sciences	6	8	9	8
Engineering	12	12	n.a.	17
Health	13	14	18	18
Mathematics, computer and physical sciences	11	14	14	12
Aggregate across all fields	9	11	11	10

Source: Calculations based on public use files from the 1996 Canadian Census.

Table 21
Internal rate of returns to a university degree in Canada in 2001 for females, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	9	9	11	11
Fine and applied arts	4	5	3	n.a.
Humanities and related fields	8	9	10	7
Social sciences and related fields	9	10	11	11
Business and commerce	12	14	15	15
Agricultural, biological, nutritional, and food sciences	7	8	12	9
Engineering	12	13	16	16
Health	14	13	16	19
Mathematics, computer and physical sciences	13	14	18	14
Aggregate across all fields				

Source: Calculations based on public use files from the 2001 Canadian Census.

Finally, Tables 22-24 present IRRs for males by time, region, and major field of study. Similar to the findings for females, the IRRs aggregated across fields suggest the existence of regional variations in the economic returns to a university education. For 1991 (Table 22), the highest return is found for Eastern Canada (10%) and Quebec (10%), and the lowest return is found in Western Canada (8%). For 2001 (Table 24), we observe the same regional pattern. Because of sample size limitations, it was not possible to estimate the IRR for males in "Fine and applied arts" when disaggregated by regions. Regarding differences across major fields of study for males, the highest returns are found in "Engineering" and "Health" while the lowest are in "Humanities and related fields" and in "Educational, recreational, and counselling services".

Table 22
Internal rate of returns to a university degree in Canada in 1991 for males, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	-2	5	3	6
Fine and applied arts	n.a.	n.a.	n.a.	n.a.
Humanities and related fields	-5	5	2	5
Social sciences and related fields	8	8	8	10
Business and commerce	9	12	11	10
Agricultural, biological, nutritional, and food sciences	3	3	5	7
Engineering	13	12	14	16
Health	4	8	9	25
Mathematics, computer and physical sciences	9	11	12	10
Aggregate across all fields	8	9	10	10

Source: Calculations based on public use files from the 1991 Canadian Census.

Table 23
Internal rate of returns to a university degree in Canada in 1996 for males, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	1	5	5	6
Fine and applied arts	n.a.	n.a.	n.a.	n.a.
Humanities and related fields	<-20	3	3	n.a.
Social sciences and related fields	8	10	9	10
Business and commerce	10	15	11	11
Agricultural, biological, nutritional, and food sciences	2	5	6	7
Engineering	12	15	14	16
Health	8	15	14	16
Mathematics, computer and physical sciences	8	14	14	10
Aggregate across all fields	8	11	10	10

Source: Calculations based on public use files from the 1996 Canadian Census.

Table 24
Internal rate of returns to a university degree in Canada in 2001 for males, by region and major field of study

Major field of study:	Western Canada	Ontario	Quebec	Eastern Canada
Educational, recreational, and counselling services	4	4	6	5
Fine and applied arts	n.a.	n.a.	n.a.	n.a.
Humanities and related fields	2	5	3	4
Social sciences and related fields	9	11	11	9
Business and commerce	11	14	13	14
Agricultural, biological, nutritional, and food sciences	5	5	9	8
Engineering	13	16	18	16
Health	12	6	17	17
Mathematics, computer and physical sciences	12	14	15	15
Aggregate across all fields				

Source: Calculations based on public use files from the 2001 Canadian Census.

5. Comparison to Previous Literature

There exist a number of previous studies that examine the return to education in Canada. Finnie and Frenette (2003) examine the earnings differences across major fields of study using data extracted from three waves of the NGS data (NGS 1982, NGS 1986, and NGS 1990). While the fields of study are slightly different from the ones considered in this paper, their findings are similar to the ones found in this paper. For instance, the disciplines with the highest earnings are: "Health", "Engineering", "Science", and "Business/Commerce". These fields were also identified as high earnings fields in the NGS surveys used in this paper.

Burbidge et al (2003) report estimates of the earnings difference between university graduates and non-university graduates for Canada for the period 1981 to 2000. Their findings suggest that the earnings premium associated with a university education decreased for both males and females during the 1990s. They also report higher "returns" for females (ratio of earnings of university graduates to earnings of non-university graduates) than for males, the ratio in 2000 is around 150 for females and 135 for males. Again, these results, based on data extracted from the Survey of Consumer Finances (SCF), the Survey of Labour and Income Dynamics (SLID), and the Labour Force Surveys (LFS), compares favorably to the results presented in this paper based on the NGS data. The results in this paper showed higher returns for females than males and a decrease in the returns during the 1990s for both men and women.

Ferrer and Riddell (2002) use data from the 1996 Canadian Census to estimate the return to different educational degrees. Their specifications recognize the fact that there might be earnings increases associated with increases in years of schooling as well as earnings increases associated with obtaining a degree. Their results regarding the earnings difference between university graduates and graduates from college or trade schools show earnings differences of 23% for men and 32% for women (in a specification where credentials are the only source for earnings differences between the two types of graduates). These numbers are somewhat higher than those reported in this paper (17% for men and 26% for women), which is consistent with the fact that the figures in this paper are based on entry earnings (two years after graduation) and that the earnings difference increases with experience.

Finally, Vaillancourt (1995) presents estimates of return to different levels of education. These returns were obtained in a similar fashion as the internal rates of return presented in this paper, and were calculated using data from the 1986 Canadian Census. The estimated returns to a university education (Bachelor's degree) relative to completion of secondary education are 8.3% for men and 18.8% for women. While the estimate for men is similar to that found in this paper (9% in 1991), the estimate for women is substantially higher than the one reported in this paper (9% in 1991). Vaillancourt (1995) also presents internal rates of return by fields of study, and similar to the results here, he finds large variations across disciplines with high returns in "Commerce", "Science", "Engineering", and "Health". Overall, with some exceptions, the results in this paper are comparable to the ones obtained by Vaillancourt (1995).

6. Summary and Policy Implications

This paper has used data from three waves (1990, 1995, and 2000) of the National Graduates Survey (NGS) to investigate the earnings differences between university graduates and graduates from colleges or trade schools. The NGS data provide detailed information on graduates from post-secondary educational institutions in Canada such as major field of study and early labor market experiences. The drawback with the data is that interviews were conducted only a few years after graduation, meaning that much of the earnings differences that can be inferred from the data are representative for differences in early career wages earnings and not for life-cycle differences in earnings. Another drawback with the NGS data is that people with no post-secondary education are not included, making it impossible to estimate the value of a university education relative to a high school exam. Nevertheless, the data may be very useful for analyzing returns to university education as the richness of the data allow researchers to consider alternative measures of the return to university education, such as school to work transitions and job satisfaction. However, when interpreting the NGS results, one has to keep in mind that all university returns are relative to those who have completed some post-secondary education but not a university degree. To complement the NGS data, this paper also used data from the three most recent Canadian Censuses (1991, 1996, and 2001) to investigate differences in internal rates of return between high school and university graduates.

The results based on the NGS data suggest that there is a significant earnings difference between trade school and college graduates and university graduates. However, this earnings difference decreased during the 1990s. The data also show a relatively large drop in the fraction of post-secondary education graduates with a trade school certificate. It is possible that this drop is to a large extent due to an increase in the opportunity cost for trade/vocational school between 1990 and 2000. This would also be consistent with the observation of a reduction of the earnings difference between trade school and college graduates and university graduates during this period.

Considering how changes in returns between 1990 and 2000 vary across major fields of study, the NGS data indicate that the university earnings premium increased in most fields, except for engineering and fine arts. For females, the premium was more or less constant in most fields, increased only in two (humanities and biological sciences), and, similar to males, decreased in engineering and fine arts. The reduction in university premiums for fine arts and engineering for both gender groups coincide with an increase in university graduates from these two disciplines, suggesting that the university earnings premium obey basic laws of demand and supply. Thus, much of the overall reduction in the university premium during the 1990s appears to be due a change in field of specialization during this period.

During the period of study in this paper, tuition fees, in constant dollars, doubled in Canada. However, there are large provincial differences in the tuition fee increase during the 1990s, with large increases in Alberta and Ontario and modest increases in British Columbia and Quebec. Moreover, there are also large differences in fee increases across major fields of study, with large increases in dentistry and medicine and lower increases in fields such as arts, education and engineering. There has been some concern that the higher direct cost of attending university will discourage potential students and that this may have long lasting effects in an environment where more and more emphasis is put on a skilled workforce. It is therefore possible that the increase in the proportion of university graduates majoring in engineering and fine arts reflect the changes in the cost structure that occurred during the 1990s. However, we also observe an increase in the proportion of university graduates specializing in health, a discipline whose direct costs increased the most.

Thus, the changes in the university earnings premium and in the direct costs documented in this paper, suggest that students do consider the costs of attending university, and that relative changes in the cost structure, to some extent, influence the choice of discipline. These changes in enrolments across fields of specialization also appear to influence the economic benefits associated with university graduation. This sequence of events is consistent with Heckman at al (1998) who emphasize the need to consider general equilibrium effects of changes in costs of higher education.

One policy implication of these results is that the tuition fee policy is a powerful tool for the government and that students appear to respond to changes in the cost structure. Another indication that this is in fact true is the changes in full-time university enrolment in Canada during the 1990s. For males, enrolment decreased by 3.5% between 1994 and 1998, while for females, enrolment increased by 3.3%. These gender differences are consistent with the finding in this paper that women have higher returns to university graduation than men. Thus, while it is sensible to differentiate the tuition fees across fields of study to reflect both the cost of providing educational services and labor market opportunities of those who graduate, governments should also consider the effects that changes in relative costs may have on enrolment. However, it is important to stress that the results in this study are principally inferred from descriptive methods and in order to obtain a deeper understanding of the link between tuition fee policies and university enrolment (and completion), more sophisticated methodologies, such as those used by Heckman et al (1998) and Belzil and Hansen (2002), are needed.

Finally, the results based on the Census data, which showed the internal rates of return to a university degree relative to a high school diploma, indicated that there is a relatively high return to a university degree and that this return increased moderately between 1991 and 2001. The internal rates of return were found to vary across disciplines, consistent with the earnings differences found in the NGS data, with the highest returns in traditional high earnings fields. These internal rates of return to university education are conceptually very different from the earnings differences presented using the NGS data. Not only do they reflect economic return to a university degree relative to a high school diploma, they also explicitly account for direct costs of university attendance. Thus, internal rates of return tend to be lower than the commonly reported returns based on a

Mincer-type wage regression. The increase in the return to a university degree found in this section of the paper may therefore still be consistent with the NGS results of declining earnings differences of university graduates relative to *other post-secondary school graduates*. Further, the increase in the rate of return to completing university, although relatively modest, is also consistent with the changes in labor market demand during this period which tended to favor highly skilled workers. However, it is likely that the increase in the return to university completion during the 1990s would have been greater if tuition fees had not increased as much as they did during this period. Thus, while the cost increase during the 1990s reduced the economic benefit of a university education, earnings differences between university graduates and high school graduates increased sufficiently to fully compensate for the cost increase. This is true when aggregating across disciplines as well as when we consider discipline-specific returns.

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