The “Sheepskin Effects” of Canadian Credentials[§]

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Abstract

This paper re-examines the “sheepskin” effects of educational credentials in Canada using data from the 1996 Census. I examined the impact of relaxing the specification of experience profile in the standard Mincer model on the estimates of sheepskin effects. I also relaxed the linear functional form assumption in the standard model by utilizing alternative comparison groups. I found that the estimated credential effects are sensitive to specifications. Regression analysis in the standard model is not adequate to control for the workers’ productivity difference unrelated to the credentials. Misspecification of the earnings equation and pooling sample mayt introduce biases into the estimates of credential effects. With carefully constructed comparison groups, the estimated sheepskin effects of a Bachelor’s degree are smaller than that reported in Ferrer and Riddell (2002).

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1 Introduction

The “sheepskin effects”, or the credential effects of education, refer to the increases in wages and earnings associated with awards of degrees or certificates, conditional on the amount of education received. It is often cited as evidence in favour of the perspective of education as signalling device instead of as human capital investment. Existing empirical research of sheepskin effects usually extend the Mincer’s earnings equation by including dummy variables of graduation. Ferrer and Riddell (2002) used the 1996 Canadian Census data and found large credential effects of bachelor’s degrees on earnings. In existing literature, the sheepskin effect estimates are usually sensitive to specifications (Flores-Lagunes and Light, 2004), although the estimates of Ferrer and Riddell are rather robust in several specifications they examined. Using an analytical framework of evaluation, estimation of sheepskin effects is by comparing graduates to a similar comparison group of dropouts. The difference in comparison groups in different specifications may be one of the reasons of sensitive estimates. This paper examines the robustness of estimated sheepskin effects of Canadian credentials by using more flexible specifications than the extended Mincer’s earnings equation used in Ferrer and Riddell. . I examined the impact of relaxing the specification of experience profile in the standard Mincer model on the estimates of sheepskin effects. I also relaxed the linear functional form assumption in the standard model by utilizing alternative comparison groups.

Until recently, most survey data do not contain information on the amount of education and the credentials received at the same time. Therefore, previous research attempt to show sheepskin effects as the spikes in the earnings at the graduation year of high school or college. This method is not applicable to Canada since the education structures are not uniform across provinces. Recent Canadian survey data contain information of years of schooling and credentials received of respondents. Ferrer and Riddell (2002) made use of this special feature of the 1996 Census data and found large sheepskin effects. However, the standard Mincer earnings equation may not suit the estimation of sheepskin effect due to its own insufficiency. Heckman, Lochner and Todd (2003) have shown that earnings do not grow at the same rate of different educational attainments. Estimates of sheepskin effects may contain the growth difference not related to the credentials in the standard model. Card (1999) summarized the possible biases and issues raised in estimating returns to education due to unobserved characteristics of workers. The estimates of the signalling effects of credentials may suffer from similar problems in estimation.

Various methods in the evaluation literature can be applied to reduce or cancel out bias from self-selection or heterogeneity in unobserved ability in estimates of returns to education. However, some of these methods may not be applicable in identifying the signalling effects of credentials. Employers may be able to observe and reward directly on some characteristics that are unobservable by researchers. There are also some other characteristics unobservable by both researchers and employers, in which credentials may signal the presence of these characteristics. It is difficult to find proper instruments in order to reduce the bias from the former unobservables but not the latter. Evaluation strategies based on the selection on unobservables would be inappropriate for in estimating sheepskin effects. Researchers have to find comparison groups that appear to be similar, both to employers and to researchers, to those workers with credentials.

The main objective of this paper is to follow up on the research by Ferrer and Riddell (2002) and investigate whether the usage of standard model is "comparing the comparable". Instead of assuming workers with different levels of educational attainment have the same work experience earnings profile, I estimate models allowing work experience earnings profile to be different. This analysis indicates how misspecification of earnings profile affects the credential effects estimates. I also examine the effect on the estimates of using various sub-samples of similar respondents. In the standard approach, it assumes that the specification and the variables used are sufficient to control for any systematic difference in a pooled sample of many different respondents. It implicitly assumes that the functional form of regression and can handle any selection based on the observable characteristics. This is a strong assumption and a possible source of sensitivity of estimates. Using only carefully selected sub-samples in estimation is an exercise of constructing alternative comparison group that rely less on the linear form assumption. It also relaxes the assumption of selection on observables in the standard approach. The sheepskin effects are also heterogeneous by different cohorts. I found that the estimated credentials effects are sensitive to the specifications. I also found that the sheepskin effects of bachelor's degrees are smaller than those reported in Ferrer and Riddell (2002). The changes of estimates in different models suggest that the comparison group constructed by the standard model may not be adequate to handle selection by observables.

The next section contains a brief review on the existing literature and a discussion of the important issues related to estimating sheepskin effects. I present the empirical models used in Section 3. A description on the data set used follows in Section 4. I discuss the main findings in Section 5. Some concluding remarks based on my findings would follow in Section 6.

2 Previous Literature

2.1 Basic models

Within the human capital framework, the standard earnings equation by Mincer (1962) relates log earnings (ln$Y$) linearly with years of schooling (S), experience (E) and experience squared, as in

$$\ln Y = \beta_0 + \beta_S S + \beta_E E + \beta_{E^2} E^2 + \varepsilon, \tag{1}$$

where β_s is the earnings premium associated with a year of formal education. Many empirical studies have demonstrated that this functional specification on schooling captures the essential features of education-earnings relationship. A positive β_s is consistent with both the human capital theory and the screening hypothesis of education (Layard and Psacharopoulos, 1974). Under the screening hypothesis or credentialist theory, wage or earnings differentials associated with education do not mainly reflect improvements in individual productive capacity caused by education. The wage or earnings differentials come from the employers' use of educational attainment as a proxy for pre-existing differences in talents. The social value of education is to match the right person to the right job. Therefore, graduation from a course should provide more evidence of ability and staying power than attendance for a number of years. A commonly used model is

$$\ln Y = \beta_0 + \beta_S S + \beta_E E + \beta_{E^2} E^2 + \beta_C C + \varepsilon, \tag{2}$$

where C denotes the completion of a particular educational program, such as high school, college or university. β_C would capture the change in earnings due to the credential, the so called sheepskin effect.

In general, existing survey data sets provide information on educational attainment either in the form of program completion for particular programs or in the form of years of schooling completed but not both. Since the average amount of education received by dropouts is less than that of the graduates, estimates of β_C obtained in data sets containing information only on program completion would capture the effect of differences in the amount of education between graduates and dropouts, as well as any credential effects. Several studies using this type of data are surveyed in Layard and Psacharopoulos (1974). Surprisingly these studies suggest higher earnings for dropouts then graduates.[1] For the data with only years of schooling, C normally denotes the year of completion of programs. Thus β_C capture the spike of earning difference at the graduation years. Since the dropouts completed the graduation year are also included in C, the estimates of β_C do not reflect pure sheepskin effects. American studies using dummies to capture spikes include Hungerford and Solon (1987) and Belman and Heywood (1991). Both studies used U.S. Current Population Survey (CPS) data to estimate (2). Their results showed 3.5% - 6.5% sheepskin effects on wages of high school graduation for men and 9% - 20% of university degrees.

Using U.S. Current Population Survey of 1965-1991, Frazis (2002) found that there is a spike in returns to the 16th year of schooling, presumably the graduate year of bachelor degrees, and unusually very low or negative return to the 15th year of schooling. Hungerford and Solon (1987) have similar results using the 1978 U.S. CPS. Frazis (2002) showed that this observation can be explained by two-ability human capital model and signalling theory with uncertain abilities.

2.2 Some recent North American studies

Making use of the methodological change in the collection of data on educational attainment in the 1992 U.S. Current Population Survey, Jaeger and Page (1996) matched CPS data before and after the change, making both years of schooling and diploma received available to study the sheepskin effects. They found that a high school diploma has an 11.9% to 12.5% effect on men's earnings and 6.2% to 10.5% on women's. They also found that associate degrees raise men's earnings by 8% to 19% and -10% to 30% for women. Bachelor degrees have a 22% to 39% on women's earnings and 25% to 31% on men's earnings.

While Jaeger and Page did not control for other covariates in their earning equations, Kane and Rouse (1995) used data from the U.S. National Longitudinal Survey of the High School Class of 1972 combined with transcript information. They controlled for the community size, parents'

[1]Notice that the various studies varied in the data used and in the inclusion of other covariates. See

income, the percentile of high school ranking, the total ability score, parents' education, parents' occupations and the missing school record in their earnings equation estimation. They found that an associate degree has a significant sheepskin effect of 12% on women's earnings. For bachelor's degrees, they found a significant 18% increase in earnings for men. Other estimated sheepskin effects on earnings are insignificant in their study. Estimations using wages instead of earnings show similar results.

Ferrer and Riddell (2002) used the 1996 Census data from Canada to estimate Canadian sheepskin effects of 4% to 5% effects for high school diplomas, 3% to 6% for community college diplomas and 21% for bachelor's degrees. The credential effects are even larger for workers with more than 16 years of education. The largest diploma effects are those for bachelor's degrees and professional degrees in medicine and related fields. In their study, they found that the marginal effect of a college or trade diploma is higher on workers without high school diplomas. They also found that both marginal and accumulated bachelor degree effects on earnings are lower for workers with college or trade diplomas. To study for robustness of the results, they estimated models with non-parametric years of schooling as well as the number of years of education by institutions. They did not find their results to be very sensitive to these changes in specification.

2.3 Issues in estimations

The sheepskin effects estimated in these studies could be subject to various estimation problems. Kane, Rouse and Staiger (1999) found that the measurement error in self-reported years of schooling exceeds that of the self-reported degree receipt in their matched sample of transcripts and self-reported educational attainment. As a result, the usual estimated earnings premium associated with one year of schooling could be biased downwards, and the estimates of sheepskin effects might be biased upwards. This is difficult to detect in most survey samples because of the lack of transcript data.

Flores-Lagunes and Light (2004) studied the effect of measurement error in years of schooling and work experience on the estimated sheepskin effects by using the standard model. Using the 1979 U.S National Longitudinal Survey of Youth, they found that models ignoring in-school work experience and age at school exit would over-state the sheepskin effects by 7

Table 2 of Layard and Psacharopoulos (1974) percentage points for a bachelor's degree. Measurement errors of the years of schooling biased the estimated returns to schooling downwards, thus the estimated credential effects are biased upwards. If the credential dummies are allowed to interact with the years of schooling, the bias due to the measurement errors would be even larger. However, the changes of estimates when the interaction terms are introduced do not follow what the classical theory suggests. Their empirical results show that the estimates of credential effects are smaller if the credential effects are allowed to be different at different years of schooling.

The existing literature assumes that the earnings differences due to the observable characteristics by employers are sufficiently controlled using variables in the data. However, if these variables or the specification are not sufficient, the estimated sheepskin effects are biased. We can borrow and extend a model used in the evaluation literature to discuss the problem on hand,

$$Y = HC + U + e, \tag{3}$$

where U is the earnings due to the observable (by employers) heterogeneity, e is the unobservable heterogeneity, C is the program completion indicator, and H is the difference in earnings due to the human capital difference from completing particular educational program. In the standard model, the sheepskin effect is estimated by the difference in earnings between graduates and dropouts, conditional on some observable characteristics. The estimator of the sheepskin effect is

$$\begin{aligned} \hat{\beta}_C &= (Y \mid C=1) - (Y \mid C=0) \\ &= (H \mid C=1) + [(U \mid C=1) - (U \mid C=0)] + [(e \mid C=1) - (e \mid C=0)] \end{aligned} \tag{4}$$

The key difference of this model and the model usually used in program evaluation literature is in the residual (U+e). In the evaluation literature this is not separated and the parameter of interest is H.

$$E(\hat{\beta}_C) = E(H \mid C=1) + [E(U \mid C=1) - E(U \mid C=0)] + [E(e \mid C=1) - E(e \mid C=0)]. \tag{5}$$

Usually in evaluation, $[E(U|C=1)-E(U|C=0)]$ or $[E(e|C=1)-E(e|C=0)]$ is not zero. That is, there is a systematic heterogeneity between the treatment groups. If there is a vector of observable characteristics, X, that can controlled for and eliminate $[E(U|X,C=1)-E(U|X,C=0)]$ and $[E(e|X,C=1)-E(e|X,C=0)]$, the parameter of interest, H, can be identified. However, the parameter of interest in sheepskin effect estimation is the systematic difference in unobserved heterogeneity, $[E(e|C=1)-E(e|C=0)]$. Therefore, assume that $E(H|X,C=1)=0$ and $[E(e|X,C=1)-E(e|X,C=0)]=[E(e|C=1)-E(e|C=0)]$, we have

$$E(\hat{\beta}_C \mid X) = [E(U \mid X, C=1) - E(U \mid X, C=0)] + [E(e \mid X, C=1) - E(e \mid X, C=0)]. \qquad (6)$$

The main focus is whether the available information, X, and the model specification can successfully eliminate $[E(U|X,C=1)-E(U|X,C=0)]$. In other words, after controlling for the some characteristics observed by researchers, there is no systematic difference in the expected earnings due to the observed heterogeneity besides the credential. It is known as the conditional independence assumption in the evaluation literature. Since employers normally observe more than researchers can observe, researchers should at least use observably similar observations in the comparison group. If parametric specification is used in synthesize a comparison group, then it is important to know whether the comparison group selected is comparable.

In the studies of sheepskin effects, the parameter of interest is the selection on unobservables, $[E(e|X,C=1)-E(e|X,C=0)]$, while the "treatment effect" $E(H|X,C=1)$ is assumed to be zero or known and controlled for. Unless there is a good measurement of H, otherwise it is impossible to separate $E(H|X,C=1)$ from the actual sheepskin effects.

In estimating sheepskin effects using specification (2), most previous studies assume that the relationship between earnings and work experience is the same regardless of the level of educational attainment. The sheepskin effect in most studies is assumed to be a fixed effect, so that a credential only shifts up the experience profile of a worker but does not affect its shape over time. In other words, they assume that the experience profiles are parallel to each other in different levels of educational attainment. However, if the relationship between earnings and work experience is not the same in different levels of educational attainment, the estimated earnings premium associated educational attainment is biased. A simple extension of (2) includes the interaction terms of schooling and work experience,

$$\ln Y = \beta_0 + \beta_S S + \beta_E E + \beta_{E^2} E^2 + \beta_C C + \beta_{SE} SE + \beta_{SE^2} SE^2 + \varepsilon. \qquad (7)$$

If the interaction terms are omitted, E and S are not independent from the residuals. A misspecification by omitting the interaction terms of schooling and work would bias the estimates of β_s and β_e, as well as the estimate of the sheepskin effect β_C. Heckman, Lochner and Todd (2003) showed that the earnings profiles of workers are indeed nonparallel in different levels of educational attainment. They found that earnings are growing faster for more educated workers. They also found that using a specification of higher order polynomial of work experience does not capture the experience profile as well as allowing diverging earnings profiles. The effect of misspecification in the standard model on the estimated sheepskin effects have not been well demonstrated in the literature.

Signalling theory does not assume that the signalling effect is homogenous. Thus, the heterogeneous sheepskin effects may result into the sensitive estimates under different specification and different sub-samples.

One related issue is the change of credential effect over a worker's tenure. Layard and Psacharopoulos (1974) suggested the signalling effects of credentials decline over time. The idea behind this hypothesis is that employers learn about the true productivity of their employees over time, and credentials become less relevant in wage determination. Riley (1979) argued that the sheepskin effects are not diminishing over time because the signals of productivity by credentials have to be correct in average. Belman and Heywood (1997) argued that the credential effects are decreasing over time because credential holders have better job match quality and they have less room for improvement in job match quality. However, when the quality of job match is revealed slowly over time, Habermalz (2003) showed that the returns to educational signals are increasing over time. Empirically it is difficult to determine which hypothesis is more valid. Most data do not provide information about the quality of job match. Researchers usually do not have access to the information revealed to employers over time.

Besides the misspecification problem, pooling observations from different respondents can also bias the estimation. For example, the specification in (2) assumes that the independent variables are sufficient to control for the observable productivity difference between graduates and dropouts. In other words, using this specification, we can construct a counterfactual wage of a university graduate as if she has 12 years of schooling without a high school diploma, and we assume that this counterfactual wage would match that of a real high school dropout with 12 years of schooling. Employers could not distinguish our "synthetic" dropout from the actual dropout. The regressions of a pooled sample implicitly assume that we can extrapolate more educated graduates to less educated graduates to form a comparison group to the less educated dropouts. It also implicitly assume that we can extrapolate less educated dropouts to more educated dropouts to form a comparison group to the more educated graduates. The extrapolations rely solely on the linear functional form of the earning equation. This is a strong assumption. If there is any deviation from the functional form in any group of respondents could possibly bias the estimates of sheepskin effects. Also, employers can observe a lot of attributes that researchers cannot, and employers may treat workers with different observed characteristics differently, the linear functional form used in the standard model does not allow such difference. It is possible that comparison groups constructed by such extrapolations in the regressions are not comparable. In other words, $E(U|X,C=1) \neq E(U|X,C=0)$. A carefully constructed comparison group using sub-sample of similar individuals may reduce the bias introduced by observations pooling. Unfortunately, previous studies seldom apply such a method because of the small sample sizes of data sets.

Even with precise estimates from the above specification, the positive earnings premium associated with completing particular educational programs might not be due to the signalling aspect of credentials. Ferrer and Riddell (2002) raise the issue that if the courses in an educational program are complimentary to each other, the increase in productivity of finishing all courses in an educational program is greater than the sum of the increases in productivity resulting from finishing each course separately. Thus, $E(H|X,C=1)>0$. The estimates using specification like (2) cannot separate the signalling effect from any such increase in productivity.

3 Empirical Models

Recent social surveys by Statistics Canada include questions about the years of schooling in each institution, highest level of educational attainment and all certificates, diplomas and degrees obtained. There are 10 possible responses to the question about the highest credential obtained in recent Canadian surveys. Because of the popularity of non-university post-secondary education in Canada, a significant portion of Canadians hold both degrees and certificates from university and non-university institutions.

Following Ferrer and Riddell (2002), there are 15 categories of educational attainments as presented in Appendix 1. 13 indicators of completing particular educational programs can be constructed. There are also variables of the years of schooling in elementary schools and high schools, non-university post-secondary institutions and universities.

Ideally the most flexible form of an empirical model is to conditional on each possible combination of years of schooling, S, and educational program completion status, C. That is

$$\ln Y = g_{SC}(E) + \varepsilon. \tag{8}$$

The sheepskin effect is estimated as the difference of log earnings between program graduates and dropouts, conditional on the years of schooling. Kernel regression or other non-parametric methods can be used to estimate the work experience profiles, $g_{SC}(E)$, without functional specification. Such estimation requires large sample size to have reliable results. Usually, the number of respondents who do not complete particular educational programs is small even in census data and the most popular educational program. The dimension problem is usually tackled by assuming that work experience profile is independent from credentials and by applying parametric specification to the work experience profiles.

The empirical form of (2) is usually controlled for some demographic characteristics.

$$\ln Y = \beta_0 + \beta_S S + \beta_E E + \beta_{E^2} E^2 + \beta_C C + \beta_X X + \varepsilon, \tag{9}$$

where X denotes demographic characteristics including province, census metropolitan area, minority status, aboriginal status, language and marital status. This standard model in the literature assumes a quadratic form in work experience and an independent educational attainment - credentials - work experience relationship in the regression. In other words, it assumes that schooling and credentials shift the earnings profile up (or down) in parallel.

To investigate the effects of the parallel profiles assumption on the estimates of credential effects, I extend specification (9) by incorporating interaction terms between level of education and experience:

$$\ln Y = \beta_0 + \beta_S S + \beta_E E + \beta_{E^2} E^2 + \beta_C C + \beta_X X + \beta_{DE} DE + \beta_{DE^2} DE^2 + \varepsilon, \tag{10}$$

where D is a vector of dummy variables representing each level of education attained

However, using the 15 categories as D in the interaction terms may run into the dimension problem even if census data is used. Instead, I only consider six broader categories:-

1. High school certificate or below,
2. College/Trade educated without any university education,
3. College/Trade educated with some university education but no degree,
4. College/Trade educated with Bachelor degree,
5. Bachelor’s degree or undergraduate education with no College/Trade education, as well as
6. Postgraduate Degree.

As a comparison to Ferrer and Riddell (2002)'s work, various specifications are estimated: a model using a continuous total years of schooling variable, a model using a series of dummy variables to represent the total years of schooling, a model using the years of schooling by institution, as well as using a higher order functional form in potential experience[2] . Statistical tests are performed to determine whether earnings profiles are parallel and whether parallel profiles affects the earnings equation estimation systematically.

In the specification (9), the comparison group of particular credential holders is the set of observations without the credential extrapolated to the sample observed characteristics as that of the credential holders. Canadians' educational attainment is increasing in the last 50 years. The standard model extrapolates the earnings of older cohort, who are less likely to have credentials, to form the comparison group to be compared with credentials holders, who are more likely to be younger. If potential experience does not control all the difference between older workers and younger workers, estimates on schooling/education premium could be biased. I estimate the same model by three different cohorts: 15 to 35, 36 to 45 and 46-65 years old to examine the robustness of the estimates.

As discussed in the last section, pooling all individuals into one sample can bias the estimation of sheepskin effects if the variables used are insufficient to control for the productivity difference observable by employers. Pooled sample implicitly assumes that employers cannot distinguish a well trained medical doctor from a high school dropout before reading their curriculum vitae in daily contact. A better comparison group in sheepskin effects estimation is to restrict the sample to similar observations as to those who completed a particular educational program. Given that educational attainment is observable by employers and researchers, a sample restriction strategy is to focus on observations with similar educational attainment. It may not be sufficient to eliminate all the bias introduced by pooling samples, but if there is any bias in the pooled sample a comparison of estimates would provide the needed evidence.

To estimate the high school certificate's credential effects, I use a sub-sample of observations without any postsecondary education, a sub-sample of observations with some non-university postsecondary education but no university education, and a sub-sample of

[2]Actual work experience is a better measurement of the human capital accumulated on the job than the potential experience. However, the Canadian Census does not collect information about the actual work experience.

observations with non-university credentials but no university education. To study non-university diplomas and certificates' effects, I estimate using a sub-sample of observations with no high school certificate, a sub-sample of high school graduates with no university education and a sub-sample of high school graduates with some university education. Similarly, I estimate the bachelor's degree's sheepskin effects using a sub-sample of high school graduates with no other post-secondary education, a sub-sample with some non-university education but no certificates, as well as a sub-sample with college/trade certificates.

The variable of years of schooling is top-coded in the Census data. Therefore, both potential experience and the years of schooling variables are affected. The estimated credential effects in the standard model may contain part of the returns to education due to a faster growth of earnings.[3]

4 Data

Following Ferrer and Riddell (2002), the sample contains only full time full year workers aged 15 to 65 who are non-immigrants with at least \$90 in weekly earnings and report that wages and salaries as their main source of income. In this paper, I only consider the sample for men to avoid complications from the intermittent labour force participation in the women sample.

The data used in this study is from the 1996 Canadian Census of Population microdata (1/36 sample). Table 1 contains the summary statistics for variables used in the estimation from the data set. The Census data set contains 87,247 observations. Table 2 presents the cross-tabulations of years of education and educational attainment from the Census data.

The distribution of levels of education is presented in Table 3. The average weekly earnings by level of education are shown in Table 4. Notice the lower earnings of degree holders with College/Trade certificates than their counterparts without any College/Trade training.

[3] Indeed, estimates of sheepskin effect using the Survey of Labour and Income Dynamics, which does not top-code years of schooling, are lower than that using the Census data. The results are provided upon request.

5 Results

Results from kernel regressions[4] of (8) using the Census data are presented as earnings profile in Figure 1 to Figure 3. Since the number of observations of dropouts from educational programs is usually small, the kernel regressions of postgraduate degrees are not robust. Other demographic variables like province, census metro area, marital status, etc. are not included in estimations for simplicity. For high school certificates I estimated earnings profiles of 11, 12 and 13 years of schooling and no postsecondary education. For non-university postsecondary certificates and diplomas I estimated the earnings profiles of 13, 14 and 15 years of total schooling with no university education. For bachelor's degrees I estimated the earnings profiles of 15, 16 and 17 years of total schooling with no non-university education. The results from kernel regression show roughly how credential effects change over time without functional form restrictions. The estimates are subject to sampling variation and should not be used for statistical inference.

Conditional on the total years of schooling, the credential effects of high school certificates on the earnings profile are generally small. From Figure 1(a) to 1(c), the sheepskin effect does not decline or increase over time. Figure 2(a) to 2(c) present the earnings profile of workers with non-university postsecondary education. Again, there is no apparent pattern of credential effect over time. College/trade school dropouts with 14 years of schooling would catch up with those graduates in 30 years. However, the sheepskin effects diverge over time for those with 15 years of schooling.

Bachelor's degree holders enjoy a big credential effect as shown in Figure 3(a) to 3(c). Again, the pattern of the sheepskin effect over time is not clear. For those with 15 years of schooling, the sheepskin effect is more or less constant over time. It appears that the sheepskin effect increases in the first 10 years and decreases after the first 20 years for those with 16 years of schooling. The largest sheepskin effect is shown in the Figure 3(c) for those with 17 years of schooling. Notice that the number of observations for the university program dropouts decreases with the total years of schooling. There are only 95 data points to estimate the earning profile of the dropouts in Figure 3(c). It is possible the pattern exhibits in Figure 3(c) is due to the sampling error.

[4]The Nadaraya-Watson nonparametric regression with Gaussian kernel is used in estimation. Optimal bandwidth from the Stata procedure is used. Estimates are not sensitive to bandwidth of 1.5 years, 3 years or 5 years.

Assuming that people start working right after graduation and retired at the age of 60, we can calculate the present value of the lifetime returns to educational credentials from the kernel regression estimations. The results are presented in Table 5. The largest sheepskin effect of a high school certificate is 4.65%. Except for the group with 12 years of schooling, high school certificates' effects are small or even negative. The results for the 12 years of schooling are comparable to those in Ferrer and Riddell (2002). However, the variation of the sheepskin effects estimated is quite large.

The college/trade credential has the largest effect, at 8.3% (using 7.5% as the discount rate), on earnings of people with 14 years of schooling. It is smaller for people with more or less years in school. The variation may be originated from the large variation in the content and nature of college/trade education programs in Canada. The results are not sensitive even if the estimations are conditional on the years of college education and the years of high school/elementary school completed.

Although the sheepskin effects of a bachelor's degree estimated by kernel regressions are larger than that of the high school certificate or college/trade credentials, they are around 14% to 19%. The largest effects are in the group with 17 years of schooling, in which results should be interpreted carefully because of the smaller sample size. Notice that the sample used in the estimation of the sheepskin effects of a bachelor's degree excludes respondents who have any kind of college/trade education. In Ferrer and Riddell (2002), they reported that the sheepskin effect of a bachelor's degree without college/trade degrees is around 20%.

Table 6 presents the returns to an additional year of schooling by using the discounted lifetime earnings (up to aged 60). Most estimates are small or negative, with the exception of the 12th year of a high school graduate, the 14th year of a college/trade graduate and the 17th year of a bachelor's degree holder. If the smaller sample size is not critical to estimation, the returns to the 17th year of schooling of the university graduates are larger than that of the university dropouts. This is consistent with the observation that less people are dropping out the longer they stay in a program. The dropouts are possibly people whose human capital does not increase with more education. Therefore, the large estimated credential effect of bachelor's degree to people with 17 years of schooling is probably due to problem of comparing the non-comparable. The comparison group used might have lower human capital than the graduates.

Figure 4 shows the earnings profiles of a typical high school graduate, college graduate and bachelor's degree graduate. These three earnings profiles are not parallel. Contrast to Heckman, Lochner and Todd (2003) who found that earnings profiles are diverging in the U.S., the earnings profiles of Canadians are not diverging or converging. The college/trade graduates have slower growth of earnings than both high school graduates and university graduates. As discussed in Hui (2003) the role of college/trade education in Canada is very different from that of in the U.S. The results also show that it is not suitable to treat observations with college/trade education as if they are similar to others.

5.1 Parallel Work Experience Profile?

The first three columns of Table 7 present the Census estimates assuming that the effect of potential work experience grows at the same rate for different education groups. The first column is a standard Mincer earnings equation includes quadratic terms in potential work experience and total years of schooling. The second column uses credential dummies instead of years of schooling. The third column estimates the model (9). These three models replicate those in Ferrer and Riddell (2002). Notice the large incremental credential effect of a bachelor's degree for workers without any non-university post-secondary certificates at 27.2% compared to the much smaller effect at 13.8% for those with non-university post-secondary certificates.

The rightmost three columns present estimates of extended models that include interaction terms between dummies of six levels of education and potential experience and its squared. Most coefficients on the interaction terms are statistically significant. The joint test rejects the null hypothesis of parallel potential work experience profiles for different educational attainments. The coefficients of the interaction terms suggest that workers with university education or bachelor's degree have a faster growing profile, while the profile for the college/trade educated grows more slowly. A plot of the earnings profiles using the estimates from the rightmost column is in Figure 5.

The estimated coefficients of the credential dummies can be interpreted as the sheepskin effects since they do not involve any interaction with the six categories of education. The only exception is the case of the bachelor's degree with college/trade credentials. Relaxing the parallel profile assumption does not change significantly the initial earnings premium associated with high school graduation certificates. However, it significantly increases the earnings premium of a college/trade certificates. It also makes the earnings premium of a bachelor's degree drop from

27.2% to 20.2% for workers without college/trade certificates. The earnings premium of a bachelor's degree is 11.9% (using a discount rate of 7.5%) for workers with college/trade certificates. Most postgraduate degrees' effects on initial earnings increased when parallel earnings profile is not assumed. Durbin-Wu-Hausman tests[5] reject the hypothesis that assuming parallel experience profiles have no effect on the estimates of other variables' coefficients.

The results for the non-parametric version of the total years of schooling appear in Table 8. The effects of relaxing the parallel profile assumption on the estimates of credential effects are very similar to those presented in Table 7. The joint test rejects the null hypothesis of parallel work experience profiles for different educational attainments. Durbin-Wu-Hausman tests reject the hypothesis that non-parallel earnings profiles have no effect on the estimates of other variables' coefficients.

Estimates from using years of schooling by institutions are presented in Table 9. Relaxing the parallel experience profile assumption has a similar impact on the estimated coefficients of the credential dummies as in Table 7 and Table 8. From the first and the fourth column of Table 9, the estimated marginal effect of a year in elementary/high school is much higher when the parallel experience profile assumption is relaxed. The estimated marginal effect of a year in university, however, is much smaller when parallel experience profiles are not assumed.

Compared to the estimated credentials effects in the model using total years of schooling in Table 7 and Table 8, the specification of years of schooling may not be as important as the specification in the work experience profile. Indeed, the work experience profiles are not parallel even when higher order of the potential experience is included in the estimation, as shown in the last column of Table 8.

The results from the kernel regressions of sub-samples and regressions with potential experience - educational attainment interactions show that estimated credential effects are sensitive to the specifications. The estimated credential effect of a bachelor's degree in the standard model is overstated because of the misspecification. It is also possible the comparison group constructed implicitly by regression's extrapolation is not comparable to graduates. The introduction of

[5]The model with flexible experience profile is assumed to be consistent. The Durbin-Wu-Hausman test falsified the null hypothesis that the parallel profile model is also consistent. If the parallel profile model is consistent, the estimates of variables other than the potential experience and it's

potential experience – educational attainment interaction terms provide a better comparison group to the graduates.

The third column of Table 9 studies the values of the high school graduation certificates to people with and without further education. The estimated high school certificate effect is nearly doubled for those pursuing further education. Ferrer and Riddell (2002) interpreted this result as the option value of a high school certificate "opening the door" for further education. A high school certificate is usually required for further education in Canada and U.S. Heckman, Lochner and Todd (2003) show that it is usually inadequate academic performance that prevents students pursuing higher education. However, the standard model is not dynamic in nature as in Heckman, Lochner and Todd (2003) and the results from Table 9 should not be interpreted as such. Indeed, when the parallel experience profile assumption is relaxed, the difference in the effect of the high school certificates shrinks. It is more likely that the further classification of the high school certificate captures the systematic difference between the two groups of observations.

The effects of college/trade certificates on the credentials effects of further education are presented in Table 10. Ferrer and Riddell (2002) found that the cumulative credential effect of a bachelor's degree with a college/trade credential is significantly lower than the credential effect of a bachelor's degree without any college/trade credential. If we relax the parallel work profile assumption, there is not enough evidence to support that the two accumulated credential effects of bachelor's degrees are different.

The estimated sheepskin effects are shown to be sensitive to the parallel experience profile assumption. In many specifications, allowing interaction between potential experience and educational attainment would decrease the estimated sheepskin effects of bachelor's degrees. Flores-Lagunes and Light (2004) show that in theory if the educational attainment is measured with error, the upward bias of an estimated credential effect is larger when interactions between the credentials and the educational attainment are introduced into the model. However, both their empirical results and my results do not support this theoretical prediction. The sensitivity of estimates is not likely to be due to the measurement error of the years of schooling variable.

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squared should not exihibit systematic difference. The DWH test statistics could be negative in practice and it sould be interpreted as insignificance.

5.2 Estimates by Age Groups

The above estimations show that the comparison group selection is important to have better estimates of credential effects. Regressions of the standard model impose some strong conditions to the comparison group. For example, a bachelor's degree holder and a high school graduate have the same experience profiles. The comparison group of the bachelor's degree holders composed of those university dropouts as well as high school graduates who are projected to have similar number of years in school and work experience. If wage and earnings are growing faster for the more educated, the returns to education of the more educated are understated in the standard model and the estimated sheepskin effects are upward biased. Another problem mentioned above is that sheepskin effects may be heterogeneous to different people. Older workers are possibly in different market than that of the younger workers and sheepskin effects can be larger or smaller.

Regressions of the standard model assume that older cohorts are similar to the younger cohorts. However, Bar-Or, Burbidge, Magee and Robb (1995) show that there is an increasing returns to education in Canada. Therefore, the returns to education to the older cohorts are probably different from that of the younger cohorts. Given that the educational attainment is increasing during the last several decades in Canada, the comparison groups of graduates probably include people who are older and who has lower returns to education. The credential effects are possibly overestimated.

Table 11 presents the estimates by three age groups:15 to 35 years old, 36 to 45 years old and 46 to 65 years old. The first three columns represent models using total years of schooling to measure the amount of education received, while the rightmost three columns use years of schooling by institutions. All six models do not assume parallel experience profile.

The high school certificate has the larger credential effect for the oldest group and youngest group and smallest for people of 36 to 45 years of age. Postsecondary credentials' effects are smaller for the oldest group.

Many estimates' standard errors become large enough that they are no longer statistically significant when estimations are divided by age groups. In general, the youngest group have the largest credential effects and these estimates are more likely to be significant. It is tempting to interpret it as evidence that credentials "open the door" to the younger workers. However, it is also possible that the comparison group is not comparable. The full-time full-year workers below 24 years old have 27% have no high school diplomas, compared to 15% of those in the age of 24 to 35 years old. The comparison group consists of young people who are still in transition to the labour market and the lower earnings may due to other factors than credentials.[6]

5.3 Estimates using similar sub-samples

Using a pooled sample has the benefit of efficiency, but it comes with the trade-off of linking different observations through the functional specification. When we pooled together people with postgraduate degrees and high school dropouts to estimate the signalling effect of high school graduation certificate, we are assuming the labour market do not observe directly any difference between those high school dropouts if they are given postgraduate degrees and the MBAs who lost their high school graduate certificates. We also assume either credential effect is homogenous, or even if credential effect is heterogeneous, it is not related to some characteristics observable by employers but not the researchers.

Ideally, we can match each graduate of a particular educational program to people observably identical but they do not have the credential. However, we can also run into the "curse of dimensionality" very soon: the combinations of the years of schooling by institutions and the credentials are large that a lot of these combinations have only a few observations in the data sets. The kernel regressions I showed are common situations where observations are still available for the comparison groups. To further study the effects of combining several credentials, or the effect of one credentials conditional on the other one, the requirement of matching is too much even for census data. Rosenbaum and Rubin (1983) showed that if you can match on the observed characteristics, that is, if (6) satisfies the conditional independence assumption, then you can also match on the propensity score of completing a particular program, based on the observed characteristics. This helps solve the problem because a propensity score is a scalar - just a real number between zero and one, rather than a vector of characteristics. In the context of sheepskin effects, however, it is difficult to find factors that determine the propensity of completing a program conditional on the years of schooling completed. We can expect that the decision of

[6]. Indeed, when the observations of the aged 15 to 23 are dropped, the estimated credential effects are all smaller. However, the impact to the full sample is very small. I keep these observations in the sample such that the estimates can be compared to Ferrer and Riddell (2002).

quitting an educational program is related to some life events during the study. The existing Canadian data sets do not have such information available for workers with more work experience.

To study the effects of credentials conditional on some other credential, like the case of bachelor's degree with college/trade credential, I attempted to use regression models on several sub-samples of similarly observations. This method should suffer less the problem of using full sample as shown above and still feasible enough to use existing data. For the high school certificates, I used three different sub-samples: respondents with no postsecondary education, respondents with some postsecondary (including college/trade and university) but no credentials, and respondents with only college/trade credential but no university credentials. For the college/trade credentials, I used another set of sub-samples: high school graduates with college/trade education but no university education, high school graduates with college/trade, and university education (but no degree) and college/trade educated respondents with no high school certificate. For the bachelor's degrees, I have: high school graduates with university education and no college/trade education, high school graduates with university education and some college/trade education but no credentials, and high school graduates with university education and college/trade credentials. The experience profile and returns to a year of schooling are assumed to be the same for both graduates and dropouts within each sub-sample. Employers are assumed to know the education history of the workers. It is reasonable to expect that employers offer similarly to people with similar education history. Respondents in each sub-sample should be more directly comparable to each others.

5.3.1 High school Certificates

Table 12 presents the estimates of credential effects of high school certificates using the Census data. The first column uses 30,513 observations of people who have high school or below education. Thus the comparison group of the high school graduates are those who do not graduate and do not study in college or trade. The estimated high school certificate effect is around 5.5%. The second column shows the estimates for the sub-sample of people with at least some college or trade training. The estimated certificate effect 8.1%, significantly different from the less educated group. Notice that this sub-sample compares high school graduates who dropout from the college/trade education to those with no credential but college/trade educated. So the graduates and dropouts could be in two different educational structures or labour market. The third column shows

3.3% increase in earnings by the high school certificate on the group of people who have college or trade certificates. Similar pattern of results can be obtained from sixth to eighth column when years of schooling by institution are included in the estimation.

The fourth column is the estimates by using all observation with less than bachelor's degree education. The figure, 0.485, is significantly larger than the estimate, 0.324, from the pooled sample. The ninth column confirm similar pattern when years of education by institutions are used instead of the total years of schooling. The fifth and tenth columns extend the fourth column and ninth column model by allowing non-parallel experience profile. The estimates of the high school certificate effects are not sensitive to the parallel profile assumption.

The results from using sub-samples show that the larger credential effect of the high school certificates to individuals pursuing further education in Ferrer and Riddell (2002) does not represent the option value. Indeed, the credential effect of a high school certificate to a college/trade graduate is smaller than to a high school student with no postsecondary education. Part of the large value in the estimates comes from the larger sheepskin effect to the group with some college/trade education but no credential.

5.3.2 College/Trade Credentials

Table 13 presents the estimated effects of college/trade credentials using the Census data. The college/trade credentials provide the least increment in earnings, only 4.3%, to high school graduates who also received some university education. Pure high school graduates can be benefited by the college/trade at around 6%.

For respondents with no high school certificates, the college/trade certificates provide the highest average impact on earnings at around 8.8%. The comparison group are people with some college/trade education but no credential from any institution, which is the same group used in the sub-sample that produce the largest high school certificate effect. These estimates are similar to that in Ferrer and Riddell (2002).

5.3.3 Bachelor's Degrees

The estimates of sheepskin effects of a bachelor's degree using sub-samples are much lower than that from the estimations of the full sample. The results using the Census data are presented in Table 14. Using total years of schooling in estimation, a bachelor's degree raises weekly earnings by around 16% to 17%. The difference of the effects between high school graduates with no college/trade education and college/trade graduates is small and insignificant. The estimates using years of schooling by institutions further lower the estimates to 14%. The results from the full sample show that a bachelor's degree is much more valuable to high school graduates than to college/trade graduates. The results using the sub-samples do not show the same pattern. The full sample contains large number of individuals with some college education but no university education. As shown in Caponi and Plesca (2000) and Hui (2003) and the kernel estimation above, this group is not similar to individuals that went to the universities. They face different experience profile and they are less productive even when education received is controlled for. Estimations using the full sample assume that they are as productive as anyone else once educational attainment is controlled for. Therefore, part of the sheepskin effect of bachelor's degree capture the productivity difference not related to the credential in the full sample. It is reasonable to expect that employers compare a bachelor's degree holder to someone with similar background. The sub-samples I use are closer to this practice that each sub-sample contains observations with similar educational background.

6 Conclusions

The availability of information about years of schooling and certificate awarded in various data sets in the last decade allow researchers to have better measurements of the sheepskin effects of educational credentials. Making use of this information, the estimated degree effects conditional on schooling in various studies (Ferrer and Riddell, 2002, Jaeger and Page 1996, Park 1999) are generally larger and more sensitive than that reported in previous studies. Kane, Rouse and Staiger (1999) and Flores-Lagunes and Light (2004) attempt to explain the sensitivity is the consequence of measurement error in years of schooling. This paper attempts another direction that the larger and sensitive estimates of credential effects are possibly due to poor comparison group selections. The changes of estimates are consistent with findings in previous research.

Although we could possibly confident to conclude that there are sheepskin effects in the labour market, it might be difficult to identify how large these sheepskin effects are because estimates are sensitive to empirical specifications. Kernel regression of the experience profiles show that earnings profiles are not parallel for graduates from universities, colleges or trade schools and high schools. I have shown that the estimated sheepskin effects vary by allowing flexible experience profiles for workers with different educational attainments. The estimated sheepskin effects probably pick up the difference in earnings growth by educational attainment. Bachelor's degree holders experience faster growth in earnings than college or trade certificate holders. In other words, by assuming the same work experience earnings profile, the estimates of the sheepskin effects may contain difference in earnings from factors we fail to control for and should not be attributed as sheepskin effects.

The variation of estimates by age groups is also large. Given that potential experience used in estimation is highly correlated with age, the large variations of estimated sheepskin effects by age groups are not surprising. However, a parallel experience profile is not assumed in the estimations by age groups, and yet there is a large variation of estimates. It is also possible that the credential effects are heterogeneous to different cohorts. Estimations using the full sample assume that the synthetic cohorts using observations of the older workers are good comparison groups to the younger cohorts. The variations of estimates by cohorts show that it may be an invalid assumption.

I also showed that by using observations that are similar in educational attainment, the estimated credential effects are significantly different from the estimates using the full sample. Ferrer and Riddell (2002) used a pooled sample from the 1996 Census data and found that a bachelor's degree's incremental value is significantly higher to people without college/trade credential than people who have. I found that if we limit to sub-sample with similar educational attainment, the estimated bachelor's degree's incremental value is roughly the same regardless of college/trade education. The pooled sample estimated sheepskin effects probably contain the systematic productivity difference between university students and college students as documented in Hui (2003). This systematic difference in productivity is probably observable by employers without referring to any educational credential.

The benefit of using a framework from the evaluation literature can be fruitful. As long as we have good measurement on the education received, the identification of credential effects only requires enough information to satisfy the conditional independence assumption of matching in comparison group construction. Indeed, if we have information of the determining factors of dropping out, we can also apply other matching techniques in comparison group construction. The crucial factor is whether comparable observations are used to match that of the graduates.

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Appendix

Appendix 1

In Ferrer and Riddell (2002), they regroup the educational attainment into 15 categories, derived from the three census questions about the years of schooling, the degrees received and the highest degree received:

1. No degree,
2. High school graduation certificate or equivalent (HS),
3. Some community college, trade school, CEGEP , technical institute, university education with no post-secondary certificate,
4. Trade, non-university certificate or diploma or university certificate below bachelor’s degree (College/Trade or C/T) without high school certificate,
5. Trade, non-university certificate or diploma, or university certificate below bachelor’s degree with high school certificate,
6. Bachelor’s degree (BA) without College/Trade certificate,
7. Bachelor’s degree with College/Trade certificate,
8. University certificate or diploma above bachelor level (BA+) without College/Trade certificate,
9. University certificate or diploma above bachelor level with College/Trade certificate,
10. Degree in medicine, dentistry, veterinary medicine or optometry (MD) without College/Trade certificate,
11. Degree in medicine, dentistry, veterinary medicine or optometry with College/Trade certificate,
12. Master’s degree (MS) without College/Trade certificate,
13. Master’s degree with College/Trade certificate,
14. Doctorate degree (PhD) without College/Trade certificate,
15. Doctorate degree with College/Trade certificate.

The education system in Quebec consists of 11 years of elementary and high school education and a 2-year college (CEGEP) education that is either vocational terminal program or academic preparation for the universities.

Figure 1(a): Log Earnings of Men with 11 Years of Schooling.

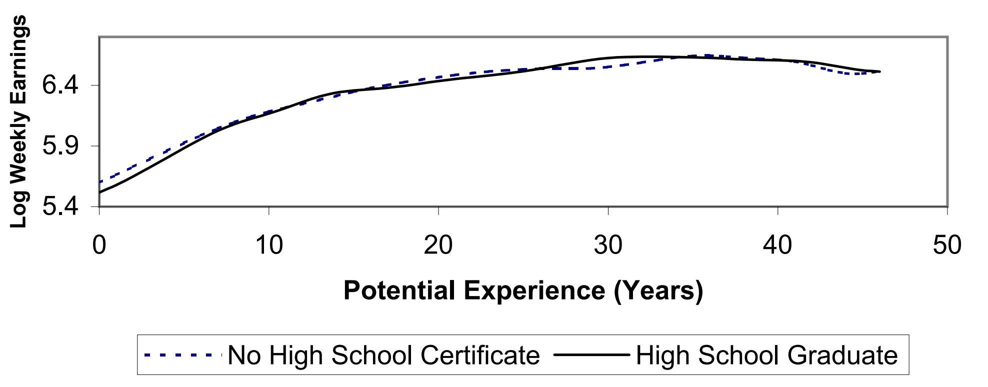


Figure 1(b): Log Earnings of Men with 12 Years of Schooling

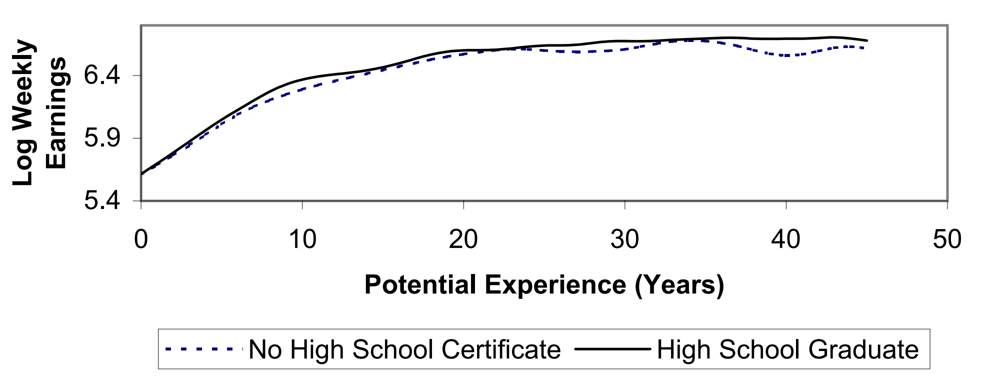


Figure 1(c): Log Earnings of Men with 13 Years of Schooling

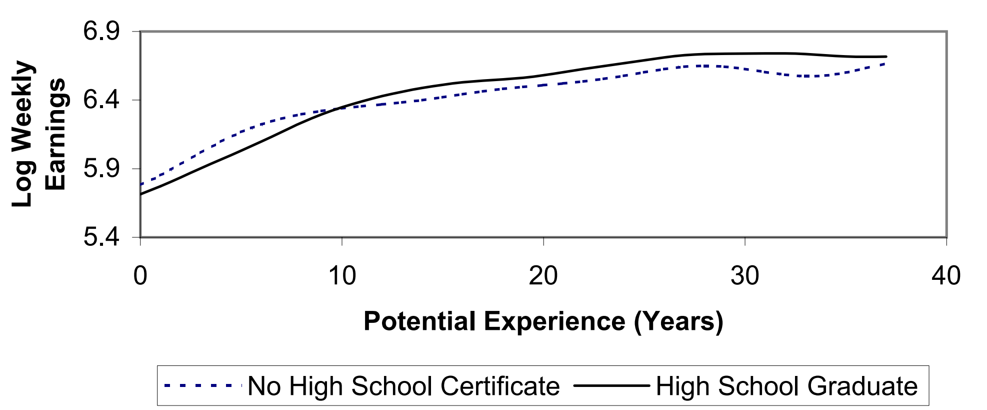


Figure 2(a): Log Earnings of Men with 13 Years of Schooling

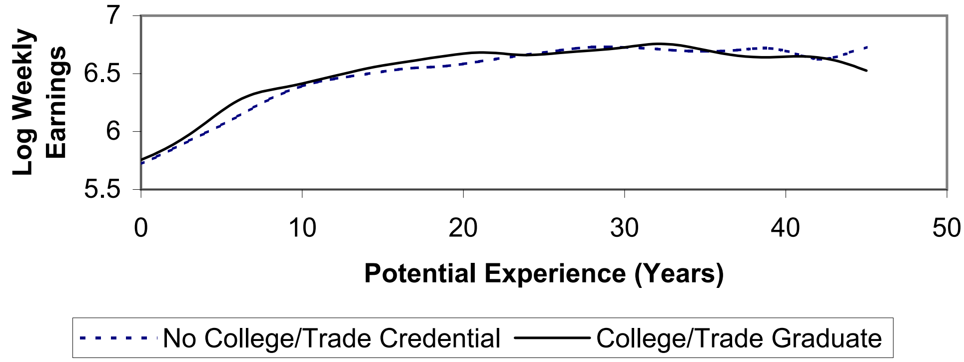


Figure 2(b): Log Earnings of Men with 14 Years of Schooling

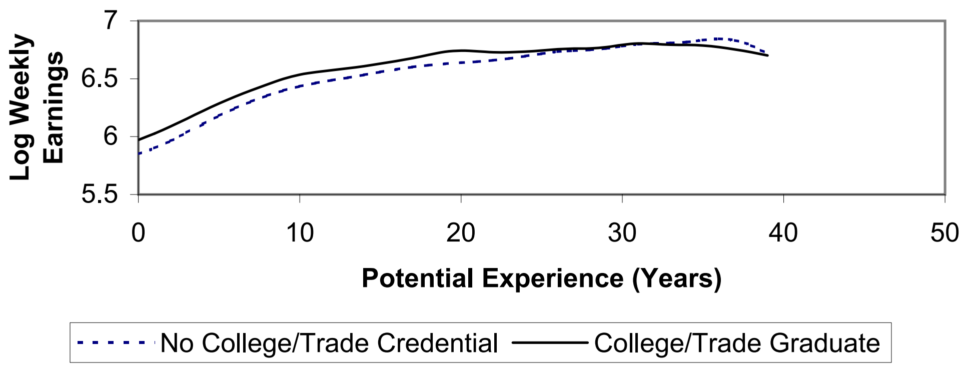


Figure 2(c): Log Earnings of Men with 15 Years of Schooling

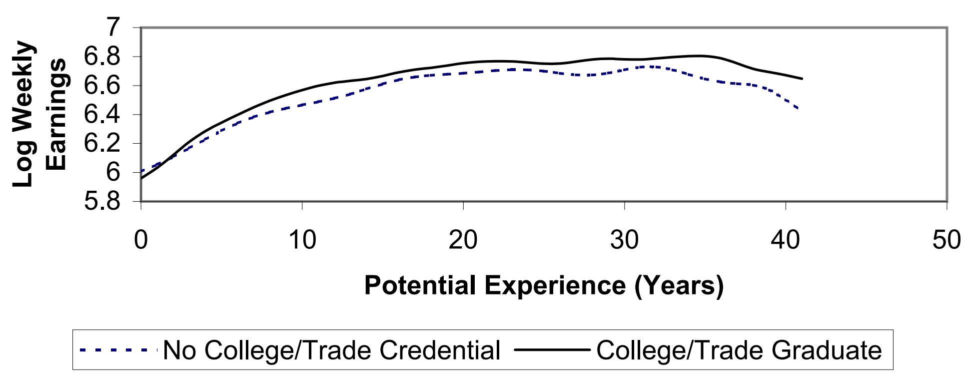


Figure 3(a): Log Earnings of Men with 15 Years of Schooling

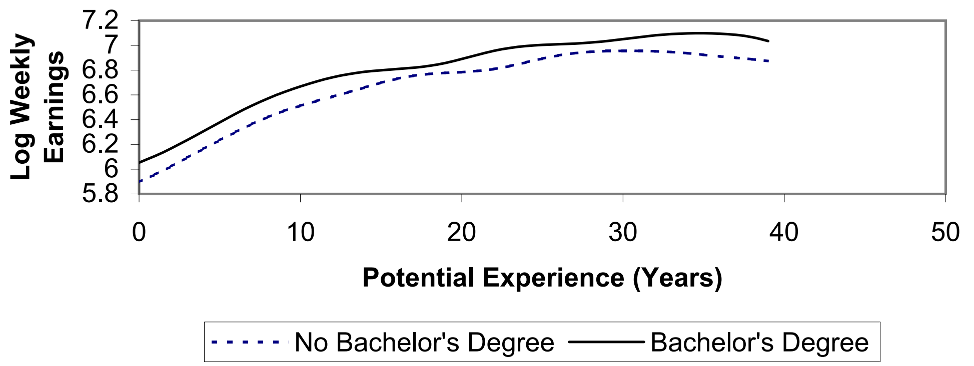


Figure 3(b): Log Earnings of Men With 16 Years of Schooling

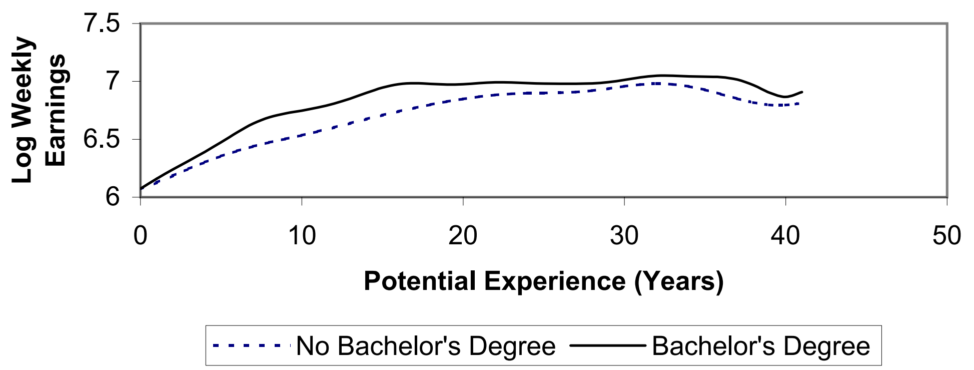
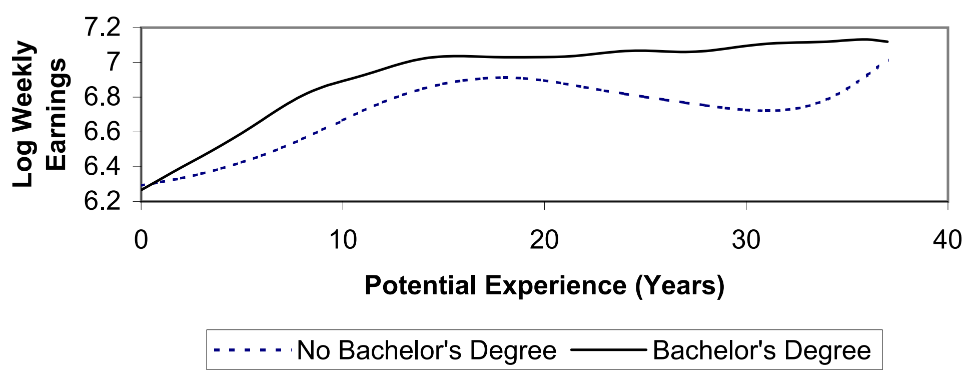


Figure 3(c): Log Earnings of Men With 17 Years of Schooling



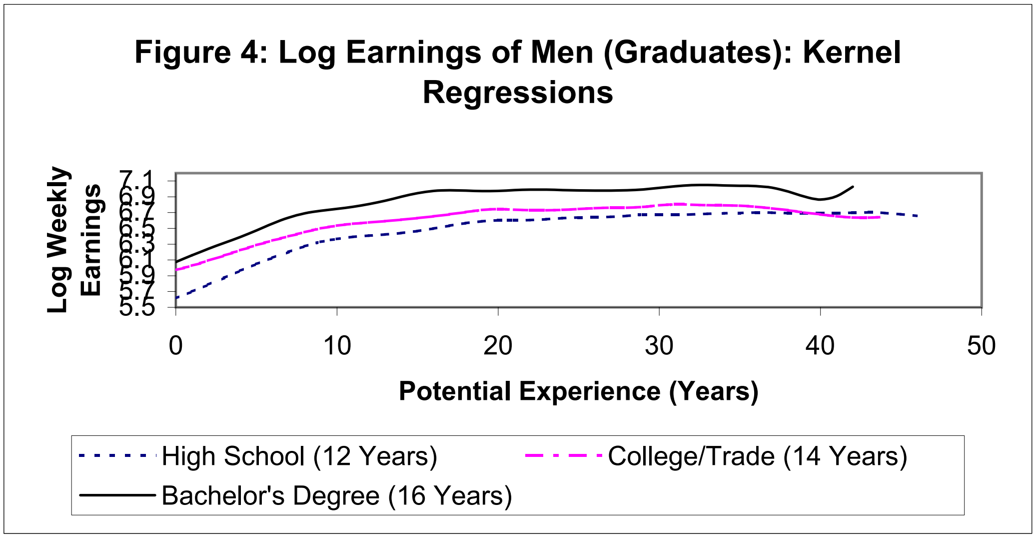


Figure 4: Log Earnings of Men (Graduates): Kernel Regressions
Log Weekly Earnings
7.1
6.9
6.7
6.5
6.3
6.1
5.9
5.7
5.5
0
10
20
30
40
50
Potential Experience (Years)
High School (12 Years)
College/Trade (14 Years)
Bachelor's Degree (16 Years)

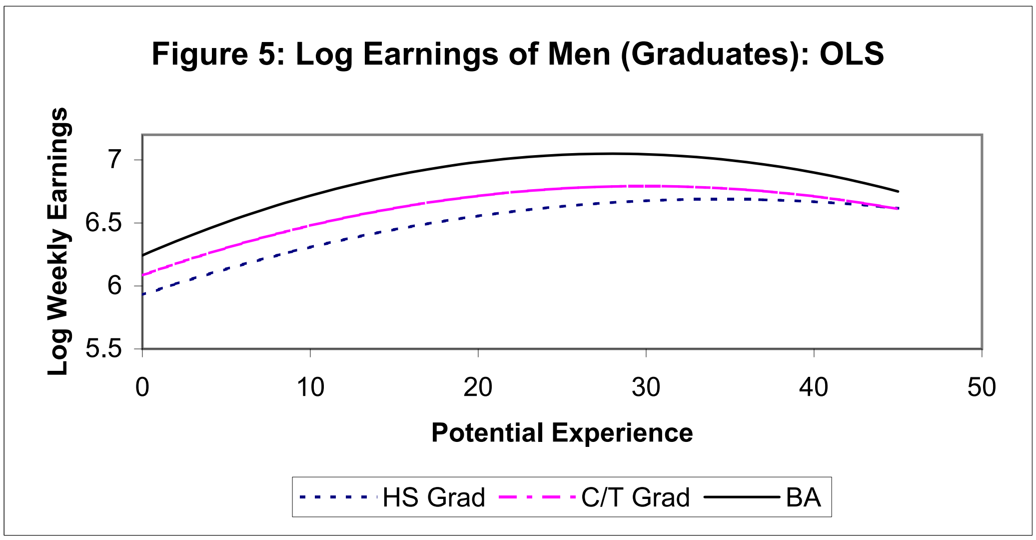


Figure 5: Log Earnings of Men (Graduates): OLS
Log Weekly Earnings
7
6.5
6
5.5
0
10
20
30
40
50
Potential Experience
HS Grad
C/T Grad
BA

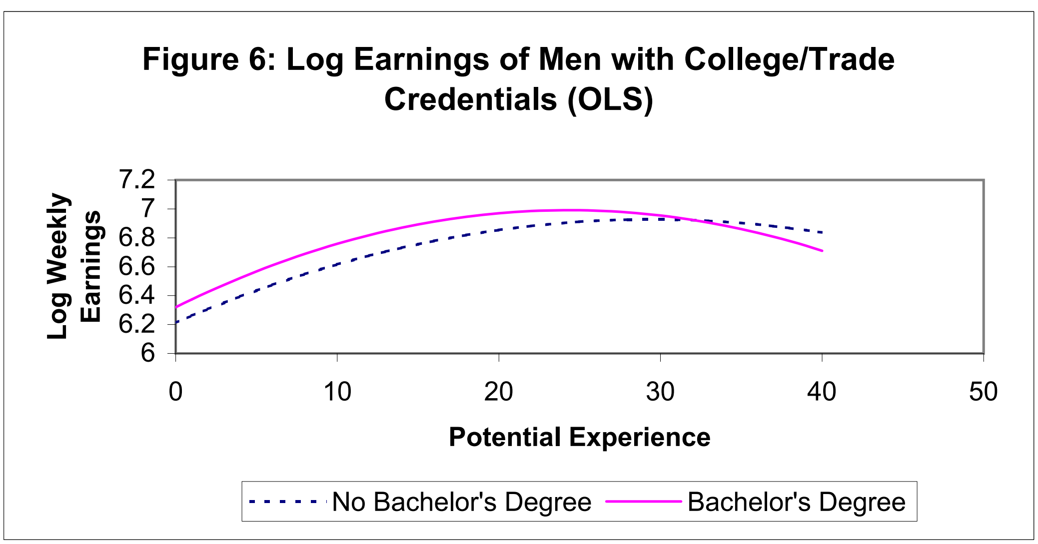


Figure 6: Log Earnings of Men with College/Trade Credentials (OLS)
Log Weekly Earnings
7.2
7
6.8
6.6
6.4
6.2
6
0
10
20
30
40
50
Potential Experience
No Bachelor's Degree
Bachelor's Degree

Table 1: Summary Statistics

Variables	1996 Census Mean	Std. Dev	Std. Err.
Weekly Earnings	841.78	467.23	1.582
Log Weekly Earnings	6.60	0.54	0.002
Potential Experience (years)	20.10	10.89	0.037
Potential Experience squared/100	5.23	5.04	0.017
Potential Experience cube/1000	15.77	21.80	0.074
Potential Experience^4/10000	52.69	95.74	0.324
Years of Schooling	13.49	3.10	0.010
Years of Elementary/High School	11.58	1.59	0.005
Years of C/T	0.87	1.25	0.004
Years of C/T (no university)	0.74	1.20	0.004
Years of C/T (with university)	0.13	0.54	0.002
Years of University	1.04	1.88	0.006
Years of Schooling<5	0.00	0.07	0.000
5-8 Years of Schooling	0.04	0.19	0.001
9 Years of Schooling	0.03	0.18	0.001
10 Years of Schooling	0.06	0.24	0.001
11 Years of Schooling	0.07	0.26	0.001
12 Years of Schooling	0.19	0.39	0.001
13 Years of Schooling	0.13	0.34	0.001
14 Years of Schooling	0.10	0.30	0.001
15 Years of Schooling	0.08	0.28	0.001
16 Years of Schooling	0.10	0.30	0.001
17 Years of Schooling	0.08	0.27	0.001
18 Years of Schooling	0.05	0.23	0.001
19 Years of Schooling	0.04	0.19	0.001
20 Years of Schooling	0.01	0.10	0.000
21 Years of Schooling	0.00	0.07	0.000
22 Years of Schooling	0.00	0.03	0.000
Years of Schooling>=23	0.00	0.02	0.000
High School Certificate	0.67	0.47	0.002
Only High School Certificate	0.16	0.37	0.001
High School Certificate or More	0.51	0.50	0.002
C/T Cert without High School Cert	0.11	0.31	0.001
C/T Cert with High School Cert	0.29	0.45	0.002
Bachelor Degree without C/T Cert	0.15	0.36	0.001
Bachelor+ Cert without C/T Cert	0.02	0.12	0.000
Master Degree without C/T Cert	0.03	0.17	0.001
Medical Degree without C/T Cert	0.00	0.06	0.000
Doctoral Degree without C/T Cert	0.01	0.08	0.000
Bachelor Degree with C/T Cert	0.04	0.20	0.001
Bachelor+ Cert with C/T Cert	0.00	0.06	0.000
Master Degree with C/T Cert	0.01	0.08	0.000
Medical Degree with C/T Cert	0.00	0.02	0.000
Doctoral Degree with C/T Cert	0.00	0.03	0.000

Note: C/T = College or Trade School

Table 1: Summary Statistics (continued)

Variables	Mean	Census Std. Dev	Std. Err.
Newfoundland	0.02	0.12	0.000
P.E.I.	0.00	0.06	0.000
Nova Scotia	0.03	0.18	0.001
New Brunswick	0.03	0.16	0.001
Quebec	0.26	0.44	0.001
Ontario	0.36	0.48	0.002
Manitoba	0.04	0.20	0.001
Saskatchewan	0.03	0.18	0.001
Alberta	0.10	0.31	0.001
British Columbia	0.11	0.32	0.001
Yukon and Northwest Territories	0.00	0.06	0.000
Toronto	0.11	0.31	0.001
Montreal	0.12	0.32	0.001
Vancouver	0.05	0.23	0.001
Other CMA	0.32	0.47	0.002
Married/Common Law	0.75	0.43	0.001
Aboriginal	0.02	0.12	0.000
Visible Minority	0.03	0.16	0.001
Speaks English / Anglophone	0.66	0.47	0.002
Speaks French / Francophone	0.11	0.32	0.001
Speaks both English and French	0.23	0.42	0.001
Level of Education (15 categories)	4.00	2.65	0.009
Level of Education (6 categories)	2.41	1.57	0.005
Hourly Wage	NA		
Log Hourly Wage	NA		
Sample Size	**87247**		

Note: C/T = College or Trade School

Source: author's calculations from the 1996 Census of Population, PUMF on Individuals. Ottawa: Statistics Canada. All statistics are weighted.

Table 2: Cross Tabulation of Years of Schooling and Highest Degree Obtained

1996 Census Data

	Highest Degree Obtained																
Years of Schooling	**No Degree**	**High-school**	**Some Post-secon-dary**	**C/T with-out HS**	**C/T with HS**	**BA with-out C/T**	**BA with C/T**	**BA+ with-out C/T**	**BA+ with C/T**	**MD with-out C/T**	**MD with C/T**	**MS with-out C/T**	**MS with C/T**	**PhD with-out C/T**	**PhD with C/T**	**All**	**%**
0-4 years	359	0	9	37	6	0	0	0	0	0	0	0	0	0	0	*411*	*0.47*
5-8 years	2960	0	50	347	12	0	0	0	0	0	0	0	0	0	0	*3369*	*3.86*
9 years	2238	226	18	319	42	0	0	0	0	0	0	0	0	0	0	*2843*	*3.26*
10 years	4095	488	92	752	99	0	0	0	0	0	0	0	0	0	0	*5526*	*6.33*
11 years	3234	1509	281	1091	348	0	0	0	0	0	0	0	0	0	0	*6463*	*7.41*
12 years	3876	8682	586	1469	1846	0	1	0	0	0	0	0	1	0	0	*16461*	*18.87*
13 years	571	2460	2890	1670	3776	12	1	3	0	0	0	4	0	0	0	*11387*	*13.05*
14 years	0	203	2233	1551	4664	64	18	12	4	0	0	6	3	1	0	*8759*	*10.04*
15 years	0	186	1035	1226	4199	447	60	36	14	1	0	26	5	2	0	*7237*	*8.29*
16 years	0	145	451	1042	3974	2519	347	143	24	5	1	62	12	5	0	*8730*	*10.01*
17 years	0	85	142	212	1613	3099	668	415	51	27	2	308	35	36	4	*6697*	*7.68*
18 years	0	43	19	0	524	1558	752	409	91	133	9	938	94	210	8	*4788*	*5.49*
19 years	0	19	0	0	196	671	475	224	75	88	15	917	169	243	24	*3116*	*3.57*
20 years	0	1	0	0	62	159	242	49	40	14	11	137	160	16	20	*911*	*1.04*
21 years	0	1	0	0	26	57	95	17	11	11	5	61	96	11	26	*417*	*0.48*
22 years	0	0	0	0	3	5	28	2	6	1	4	21	26	5	2	*103*	*0.12*
23 years	0	0	0	0	0	3	4	0	2	2	0	9	6	2	1	*29*	*0.03*
All	*17333*	*14048*	*7806*	*9716*	*21390*	*8594*	*2691*	*1310*	*318*	*282*	*47*	*2489*	*607*	*531*	*85*	*87247*	*100*
Percentage	*19.87*	*15.11*	*9.94*	*11.14*	*24.52*	*9.85*	*3.08*	*1.50*	*0.36*	*0.32*	*0.05*	*2.85*	*0.70*	*0.61*	*0.10*	*100*	

Source: author's calculations from the 1996 Census of Population,
PUMF on Individuals and the 1996 Survey of Labour and Income

Table 3: Level of Education

	1996 Census	
Level of Education (6 categories)	**Number of Observations**	**Percentage**
High school or below	30513	34.97
C/T without university education	31069	35.61
C/T with some university education	6149	7.05
C/T with Bachelor's Degree	4358	5.00
University up to Bachelor's without C/T	9489	10.88
Postgraduate degrees	5669	6.50
Overall	*87247*	*100*

Source: author's calculations from the 1996 Census of Population, PUMF on Individuals. Ottawa: Statistics Canada. The percentages are unweighted.

Table 4: Average Weekly Earnings by Level of Education

Level of Education	1996 Census Weekly Earnings ($)
No Degree	685.76 [2.76]
HS	733.42 [3.23]
Some U or C/T	781.30 [5.00]
C/T w/o HS	799.37 [3.88]
C/T with HS	854.59 [2.83]
BA w/o C/T	1079.72 [6.30]
BA with C/T	997.04 [9.90]
BA+ w/o C/T	1156.07 [16.23]
BA+ with C/T	1071.35 [26.61]
MD w/o C/T	1712.55 [56.69]
MD with C/T	1443.20 [127.91]
MS w/o C/T	1276.03 [12.86]
MS with C/T	1143.94 [22.35]
PhD w/o C/T	1365.20 [24.66]
PhD with C/T	1214.53 [50.14]

Source: author's calculations from the 1996 Census of Population, PUMF on Individuals. Ottawa: Statistics Canada. Standard errors are in brackets. All statistics are weighted.

Table 5: Sheepskin Effects by Kernel Regressions using 1996 Census Data

	High School Certificate		
Discount Rate	11 Years	12 Years	13 Years
2.50%	-0.67%	4.65%	3.95%
5.00%	-1.27%	4.39%	2.28%
7.50%	-1.89%	4.21%	0.54%
10.00%	-2.47%	4.08%	-1.10%
12.50%	-3.00%	3.96%	-2.54%
No. of observations (No credential)	3234	3876	571
No. of observations (Graduates)	1499	8653	2316

	College/Trade Credential		
Discount Rate	13 Years	14 Years	15 Years
2.50%	3.38%	5.86%	7.51%
5.00%	4.23%	7.20%	6.90%
7.50%	4.92%	8.34%	6.33%
10.00%	5.44%	9.26%	5.80%
12.50%	5.79%	9.96%	5.29%
No. of observations (No credential)	5021	1401	538
No. of observations (Graduates)	5090	5582	4342

	Bachelor's Degree		
Discount Rate	15 Years	16 Years	17 Years
2.50%	13.73%	14.44%	22.27%
5.00%	13.86%	14.82%	20.51%
7.50%	14.10%	14.91%	18.91%
10.00%	14.39%	14.71%	17.49%
12.50%	14.68%	14.28%	16.23%
No. of observations (No credential)	497	242	95
No. of observations (Graduates)	426	2396	2704

Source: author's calculations from the 1996 Census of Population, PUMF on Individuals. Ottawa: Statistics Canada. All statistics are weighted. Individuals are assumed to retire at the age 60 in the calculation of lifetime earnings.

Table 6: Returns to Education by Kernel Regressions using 1996 Census Data

No Credential

	In High School		In College/Trade		In University	
Discount Rate	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year
2.50%	2.81%	-1.28%	2.31%	-3.21%	-0.52%	-1.06%
5.00%	1.61%	-1.79%	0.91%	-2.77%	-1.06%	-0.31%
7.50%	-0.07%	-2.30%	-0.58%	-2.83%	-1.79%	-0.10%
10.00%	-2.07%	-2.89%	-2.13%	-3.34%	-2.70%	-0.45%
12.50%	-4.24%	-3.60%	-3.70%	-4.19%	-3.74%	-1.26%

Graduates

	In High School		In College/Trade		In University	
Discount Rate	12th Year	13th Year	14th Year	15th Year	16th Year	17th Year
2.50%	8.31%	-1.94%	4.76%	-1.70%	0.10%	5.71%
5.00%	7.44%	-3.77%	3.79%	-3.04%	-0.22%	4.63%
7.50%	6.14%	-5.74%	2.66%	-4.64%	-1.09%	3.37%
10.00%	4.50%	-7.71%	1.41%	-6.40%	-2.42%	1.95%
12.50%	2.62%	-9.63%	0.09%	-8.26%	-4.08%	0.43%

Source: author's calculations from the 1996 Census of Population, PUMF on Individuals. Ottawa: Statistics Canada. All statistics are weighted. Individuals are assumed to retire at the age 60 in calculation of lifetime earnings.

Table 7: Models with Continous Total Years of Schooling using 1996 Census

	Parallel Experience Profile			Flexible Experience Profile		
	[1]	[2]	[3]	[4]	[5]	[6]
Experience	0.0442 [0.0005]***	0.0452 [0.0005]***	0.0448 [0.0005]***	0.039 [0.0006]***	0.042 [0.0006]***	0.0441 [0.0006]***
Experience * C/T only				0.0078 [0.0005]***	0.0063 [0.0007]***	0.0033 [0.0007]***
Experience * C/T and University				0.008 [0.0011]***	0.0117 [0.0012]***	0.0044 [0.0012]***
Experience * C/T and Bachelor				0.0252 [0.0016]***	0.0171 [0.0021]***	0.0112 [0.0021]***
Experience * Undergraduate Only				0.0243 [0.0011]***	0.0159 [0.0013]***	0.0136 [0.0013]***
Experience * Postgraduate				0.0263 [0.0014]***	0.0032 [0.0029]	0.0011 [0.0029]
Experience^2 / 100	-0.0654 [0.0012]***	-0.0746 [0.0012]***	-0.0692 [0.0012]***	-0.0544 [0.0013]***	-0.065 [0.0014]***	-0.0641 [0.0014]***
Experience^2 * C/T only				-0.0219 [0.0017]***	-0.021 [0.0019]***	-0.0152 [0.0019]***
Experience^2 * C/T and University				-0.0235 [0.0042]***	-0.0322 [0.0043]***	-0.0182 [0.0043]***
Experience^2 * C/T and Bachelor				-0.0815 [0.0068]***	-0.0601 [0.0077]***	-0.0497 [0.0077]***
Experience^2 * Undergrad Only				-0.0635 [0.0037]***	-0.0396 [0.0042]***	-0.0391 [0.0041]***
Experience^2 * Postgrad				-0.0646 [0.0049]***	-0.013 [0.0075]*	-0.0121 [0.0076]
Years of Schooling	0.0607 [0.0006]***		0.0324 [0.0010]***	0.0448 [0.0009]***		0.0322 [0.0010]***
High-school Cert		0.1176 [0.0049]***	0.052 [0.0052]***		0.1074 [0.0051]***	0.0542 [0.0053]***
C/T without HS		0.1633 [0.0059]***	0.0849 [0.0063]***		0.1615 [0.0082]***	0.1111 [0.0083]***
C/T with HS		0.1328 [0.0045]***	0.0758 [0.0048]***		0.1191 [0.0063]***	0.0895 [0.0064]***
BA without C/T		0.3737 [0.0060]***	0.2403 [0.0073]***		0.2888 [0.0097]***	0.1842 [0.0102]***
BA+ without C/T		0.0095 [0.0135]	-0.0161 [0.0136]		0.1186 [0.0292]***	0.0857 [0.0293]***
MS without C/T		0.0962 [0.0105]***	0.0474 [0.0107]***		0.2052 [0.0276]***	0.1485 [0.0277]***
MD without C/T		0.3985 [0.0335]***	0.3479 [0.0332]***		0.5063 [0.0411]***	0.4476 [0.0408]***
PhD without C/T		0.1461 [0.0184]***	0.0888 [0.0184]***		0.2593 [0.0326]***	0.1966 [0.0326]***
BA with C/T		0.2321 [0.0089]***	0.1296 [0.0096]***		0.19 [0.0155]***	0.1064 [0.0158]***
BA+ with C/T		0.0021 [0.0258]	-0.0117 [0.0262]		0.0783 [0.0366]**	0.0371 [0.0369]
MS with C/T		0.0935 [0.0202]***	0.0453 [0.0204]**		0.168 [0.0324]***	0.0912 [0.0325]***
MD with C/T		0.3245 [0.0840]***	0.2814 [0.0832]***		0.3961 [0.0864]***	0.3222 [0.0855]***
PhD with C/T		0.1683 [0.0346]***	0.1047 [0.0350]***		0.2451 [0.0438]***	0.1531 [0.0442]***
Observations	87247	87247	87247	87247	87247	87247
R-squared	0.27	0.27	0.28	0.28	0.28	0.29
Test for Parallel Profile (p-value)				0.0000	0.0000	0.0000
Hausman Test (p-value)				0.0000	0.0000	N/A

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term.Robust standard errors are in brackets.

Table 8: Models with Non-parametric Total Years of Schooling using 1996 Census

	Parallel Experience Profile			Flexible Experience Profile		
	[1]	[2]	[3]	[4]	[5]	[6]
Experience	0.0469 [0.0006]***	0.0456 [0.0006]***	0.084 [0.0029]***	0.0418 [0.0007]***	0.0457 [0.0007]***	0.0741 [0.0033]***
Experience^2 / 100	-0.0729 [0.0013]***	-0.071 [0.0013]***	-0.3363 [0.0230]***	-0.0607 [0.0015]***	-0.0674 [0.0015]***	-0.2356 [0.0263]***
Experience^3 / 1000			0.0656 [0.0069]***			0.0364 [0.0080]***
Experience^4 / 10000			-0.0052 [0.0007]***			-0.0025 [0.0008]***
0-4 Years of Schooling	-0.2007 [0.0253]***	-0.1676 [0.0254]***	-0.2072 [0.0255]***	-0.2291 [0.0252]***	-0.1984 [0.0254]***	-0.2259 [0.0255]***
5-8 Years of Schooling	-0.1793 [0.0103]***	-0.1443 [0.0110]***	-0.1725 [0.0111]***	-0.2012 [0.0106]***	-0.1731 [0.0112]***	-0.1889 [0.0112]***
9 Years of Schooling	-0.1583 [0.0098]***	-0.129 [0.0103]***	-0.1362 [0.0103]***	-0.1636 [0.0099]***	-0.1427 [0.0104]***	-0.1475 [0.0104]***
10 Years of Schooling	-0.1197 [0.0073]***	-0.0933 [0.0079]***	-0.0941 [0.0079]***	-0.1203 [0.0074]***	-0.1013 [0.0079]***	-0.103 [0.0080]***
11 Years of Schooling	-0.0761 [0.0067]***	-0.0622 [0.0069]***	-0.0618 [0.0069]***	-0.0776 [0.0067]***	-0.0649 [0.0069]***	-0.0661 [0.0069]***
13 Years of Schooling	0.0513 [0.0055]***	0.0296 [0.0057]***	0.0288 [0.0056]***	0.0269 [0.0061]***	0.0266 [0.0061]***	0.024 [0.0062]***
14 Years of Schooling	0.1288 [0.0060]***	0.0894 [0.0065]***	0.0886 [0.0065]***	0.092 [0.0072]***	0.0806 [0.0072]***	0.0775 [0.0074]***
15 Years of Schooling	0.1803 [0.0065]***	0.1223 [0.0072]***	0.1224 [0.0072]***	0.1406 [0.0076]***	0.1119 [0.0077]***	0.1101 [0.0079]***
16 Years of Schooling	0.2803 [0.0062]***	0.1709 [0.0073]***	0.1708 [0.0073]***	0.2159 [0.0075]***	0.1577 [0.0079]***	0.1567 [0.0081]***
17 Years of Schooling	0.376 [0.0067]***	0.2041 [0.0088]***	0.2072 [0.0088]***	0.2809 [0.0088]***	0.1953 [0.0096]***	0.1973 [0.0098]***
18 Years of Schooling	0.4298 [0.0076]***	0.2021 [0.0105]***	0.2052 [0.0105]***	0.3067 [0.0103]***	0.1972 [0.0112]***	0.2008 [0.0115]***
19 Years of Schooling	0.4747 [0.0092]***	0.2215 [0.0121]***	0.225 [0.0121]***	0.3369 [0.0118]***	0.2157 [0.0128]***	0.2203 [0.0130]***
20 Years of Schooling	0.4303 [0.0167]***	0.1869 [0.0188]***	0.1948 [0.0189]***	0.3014 [0.0184]***	0.1855 [0.0193]***	0.1943 [0.0195]***
21 Years of Schooling	0.4585 [0.0255]***	0.1982 [0.0267]***	0.2096 [0.0266]***	0.325 [0.0263]***	0.1914 [0.0267]***	0.2032 [0.0268]***
22 Years of Schooling	0.4743 [0.0387]***	0.205 [0.0392]***	0.2132 [0.0409]***	0.3267 [0.0406]***	0.1948 [0.0396]***	0.205 [0.0414]***
23 or more Years of Schooling	0.4821 [0.1058]***	0.1879 [0.1037]*	0.1982 [0.1025]*	0.315 [0.1070]***	0.1831 [0.1026]*	0.1959 [0.1019]*

Table 8: Models with Non-parametricTotal Years of Schooling using 1996 Census (continued)

	Parallel Experience Profile			Flexible Experience Profile		
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
High-school Cert		0.0409	0.0437		0.0422	0.0421
		[0.0057]***	[0.0057]***		[0.0058]***	[0.0058]***
C/T without HS		0.0688	0.0691		0.1042	0.0922
		[0.0066]***	[0.0066]***		[0.0084]***	[0.0087]***
C/T with HS		0.0572	0.0535		0.0856	0.0749
		[0.0052]***	[0.0051]***		[0.0065]***	[0.0069]***
BA without C/T		0.2162	0.215		0.1782	0.1845
		[0.0084]***	[0.0083]***		[0.0111]***	[0.0127]***
BA+ without C/T		-0.0055	-0.0031		0.0996	0.1382
		[0.0137]	[0.0136]		[0.0294]***	[0.0534]***
MS without C/T		0.0748	0.0741		0.1776	0.2139
		[0.0113]***	[0.0113]***		[0.0282]***	[0.0534]***
MD without C/T		0.3778	0.3767		0.4777	0.5109
		[0.0338]***	[0.0336]***		[0.0414]***	[0.0619]***
PhD without C/T		0.1179	0.1173		0.2285	0.2618
		[0.0191]***	[0.0194]***		[0.0333]***	[0.0588]***
BA with C/T		0.1448	0.1404		0.1106	0.1301
		[0.0107]***	[0.0106]***		[0.0162]***	[0.0186]***
BA+ with C/T		-0.0028	-0.0017		0.0612	0.0929
		[0.0261]	[0.0260]		[0.0370]*	[0.0587]
MS with C/T		0.0886	0.0851		0.1472	0.1749
		[0.0209]***	[0.0208]***		[0.0333]***	[0.0568]***
MD with C/T		0.3233	0.3303		0.3747	0.4095
		[0.0841]***	[0.0838]***		[0.0864]***	[0.0953]***
PhD with C/T		0.1598	0.1509		0.2221	0.2463
		[0.0354]***	[0.0349]***		[0.0450]***	[0.0651]***
Observations	87247	87247	87247	87247	87247	87247
R-squared	0.27	0.29	0.29	0.28	0.29	0.29
Test for Parallel Profile (p-value)				0.0000	0.0000	0.0000
Hausman Test (p-value)				0.0000	0.0000	0.0000

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.

Table 9: Models with Continous Years of Schooling by Institutions using 1996 Census

	Parallel Experience Profile			Flexible Experience Profile		
	[1]	**[2]**	**[3]**	**[4]**	**[5]**	**[6]**
Experience	0.0449	0.0449	0.0449	0.044	0.0441	0.0451
	[0.0006]***	[0.0006]***	[0.0005]***	[0.0007]***	[0.0007]***	[0.0007]***
Experience^2 / 100	-0.0696	-0.0695	-0.0695	-0.0639	-0.064	-0.0658
	[0.0012]***	[0.0012]***	[0.0012]***	[0.0014]***	[0.0014]***	[0.0015]***
Years of Schooling			0.0314			0.032
			[0.0010]***			[0.0010]***
Years of Elem/High School	0.0309	0.0304		0.0326	0.0324	
	[0.0014]***	[0.0014]***		[0.0014]***	[0.0014]***	
Years of C/T	0.0321			0.0328		
	[0.0017]***			[0.0017]***		
Years of C/T (no University)		0.0378			0.0371	
		[0.0018]***			[0.0019]***	
Years of C/T (with University)		0.0032			0.0069	
		[0.0042]			[0.0047]	
Years of University	0.0375	0.0365		0.0289	0.0283	
	[0.0023]***	[0.0024]***		[0.0028]***	[0.0028]***	
High-school Cert	0.0533	0.0532		0.0538	0.0544	
	[0.0053]***	[0.0053]***		[0.0055]***	[0.0055]***	
High-school Cert only			0.0421			0.0506
			[0.0054]***			[0.0055]***
High-school Cert and More			0.0811			0.0777
			[0.0075]***			[0.0105]***
C/T without HS	0.0868	0.0787	0.0875	0.1105	0.1068	0.1239
	[0.0065]***	[0.0066]***	[0.0063]***	[0.0084]***	[0.0084]***	[0.0098]***
C/T with HS	0.0755	0.0667	0.0509	0.089	0.0838	0.0784
	[0.0052]***	[0.0053]***	[0.0067]***	[0.0065]***	[0.0065]***	[0.0075]***
BA without C/T	0.2206	0.2367	0.218	0.1946	0.2048	0.1791
	[0.0110]***	[0.0113]***	[0.0084]***	[0.0131]***	[0.0133]***	[0.0104]***
BA+ without C/T	-0.0184	-0.0158	-0.0156	0.0895	0.097	0.078
	[0.0136]	[0.0136]	[0.0136]	[0.0294]***	[0.0295]***	[0.0294]***
MS without C/T	0.0401	0.0403	0.0487	0.1555	0.1606	0.141
	[0.0111]***	[0.0111]***	[0.0107]***	[0.0282]***	[0.0283]***	[0.0279]***
MD without C/T	0.3404	0.3419	0.3493	0.4548	0.4608	0.4401
	[0.0334]***	[0.0335]***	[0.0332]***	[0.0413]***	[0.0414]***	[0.0409]***
PhD without C/T	0.0801	0.0773	0.0903	0.2047	0.2077	0.1891
	[0.0188]***	[0.0188]***	[0.0184]***	[0.0333]***	[0.0333]***	[0.0328]***
BA with C/T	0.1121	0.1791	0.1331	0.117	0.1446	0.1105
	[0.0122]***	[0.0153]***	[0.0096]***	[0.0179]***	[0.0187]***	[0.0158]***
BA+ with C/T	-0.0145	-0.0212	-0.0115	0.0395	0.0638	0.0314
	[0.0262]	[0.0261]	[0.0262]	[0.0369]	[0.0371]*	[0.0369]
MS with C/T	0.0371	0.0334	0.0467	0.097	0.1235	0.0858
	[0.0207]*	[0.0207]	[0.0204]**	[0.0329]***	[0.0331]***	[0.0326]***
MD with C/T	0.2735	0.2788	0.2829	0.3276	0.3616	0.3168
	[0.0830]***	[0.0828]***	[0.0832]***	[0.0858]***	[0.0857]***	[0.0855]***
PhD with C/T	0.094	0.0902	0.1065	0.1606	0.1872	0.1479
	[0.0352]***	[0.0345]***	[0.0350]***	[0.0447]***	[0.0443]***	[0.0442]***
Observations	87247	87247	87247	87247	87247	87247
R-squared	0.28	0.28	0.28	0.29	0.29	0.29
Test for Parallel Profile (p-value)				0.0000	0.0000	0.0000
Hausman Test (p-value)				0.0000	0.0000	0.0000

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.

Table 10: Estimates of Cumulative Credential Effects and p-values for Tests using 1996 Census Data

	Parallel Experience Profile		Flexible Experience Profile	
Cumulative Credential Effect over High School	**Non-Parametric**	**Years by institution**	**Non-Parametric**	**Years by institution**
College/Trade w/o High School Cert	7.1	9.1	11.0	11.7
College/Trade with High School Cert	10.1	13.3	13.2	14.8
Bachelor Degree w/o College	28.3	30.2	23.8	27.0
Bachelor Degree with College	25.6	25.2	24.9	27.2
Univ. Diploma above Bachelor w/o College	27.8	28.3	34.3	36.4
Univ. Diploma above Bachelor with College	25.4	23.7	31.3	31.3
Medical Degree w/o College	74.2	70.7	85.1	84.6
Medical Degree with College	63.8	56.6	70.4	66.0
Master Degree w/o College	36.1	34.2	43.3	43.8
Master Degree with College	34.9	29.0	40.8	37.4
PhD w/o College	40.8	38.5	49.5	49.7
PhD with College	43.0	35.0	49.8	44.7

	Parallel Experience Profile		Flexible Experience Profile	
p-value for test of following hypothesis	**Non-Parametric**	**Years by institution**	**Non-Parametric**	**Years by institution**
Cumulative Value of Credentials				
C/T w/o HS = C/T with HS	0.000	0.000	0.000	0.000
Bachelor w/o C/T = Bachelor with C/T	0.162	0.001		
BA+ w/o C/T = BA+ with C/T	0.680	0.300	0.462	0.736
MD w/o C/T = MD with C/T	0.446	0.261	0.343	0.396
Master w/o C/T = Master with C/T	0.988	0.085	0.569	0.534
PhD w/o C/T = PhD with C/T	0.475	0.619	0.765	0.935
Marginal Value of Credentials				
C/T w/o HS = C/T with HS	0.132	0.128	0.019	0.003
Bachelor w/o C/T = Bachelor with C/T	0.000	0.000	0.000	0.000
BA+ w/o C/T = BA+ with C/T	0.927	0.895	0.206	0.280
MD w/o C/T = MD with C/T	0.547	0.454	0.255	0.269
Master w/o C/T = Master with C/T	0.554	0.897	0.222	0.132
PhD w/o C/T = PhD with C/T	0.293	0.723	0.875	0.610

Table 11: Models by Age Group using 1996 Census Data
(Dependent Variable: Log Weekly Earnings)

	Age			Age		
	15-35	36-45	46-65	15-35	36-45	46-65
Experience	0.0738 [0.0025]***	0.0255 [0.0076]***	0.0313 [0.0060]***	0.0743 [0.0026]***	0.013 [0.0079]*	0.0299 [0.0060]***
Experience^2 / 100	-0.1699 [0.0128]***	-0.0399 [0.0166]**	-0.0471 [0.0078]***	-0.173 [0.0132]***	-0.0085 [0.0175]	-0.045 [0.0079]***
Years of Schooling	0.0487 [0.0018]***	0.0301 [0.0021]***	0.018 [0.0020]***			
Years of Elem. / High school				0.0462 [0.0026]***	0.0411 [0.0030]***	0.0197 [0.0023]***
Years of C/T				0.0563 [0.0029]***	0.0207 [0.0032]***	0.0083 [0.0037]**
Years of University				0.0387 [0.0046]***	0.0126 [0.0053]**	0.0319 [0.0059]***
High-school Cert	0.0392 [0.0082]***	0.0468 [0.0092]***	0.0783 [0.0110]***	0.0426 [0.0084]***	0.0333 [0.0095]***	0.0744 [0.0114]***
C/T without HS	0.1037 [0.0129]***	0.0761 [0.0150]***	0.0811 [0.0181]***	0.1002 [0.0129]***	0.0741 [0.0150]***	0.0811 [0.0181]***
C/T with HS	0.0913 [0.0092]***	0.0587 [0.0122]***	0.0443 [0.0158]***	0.0846 [0.0093]***	0.0651 [0.0123]***	0.0473 [0.0159]***
BA without C/T	0.1968 [0.0185]***	0.1587 [0.0221]***	0.163 [0.0249]***	0.2271 [0.0211]***	0.1998 [0.0251]***	0.1257 [0.0290]***
BA+ without C/T	0.0446 [0.0624]	-0.0254 [0.2443]	-0.4978 [0.3466]	0.0585 [0.0630]	-0.0992 [0.2443]	-0.5358 [0.3477]
MS without C/T	0.1093 [0.0605]*	0.0121 [0.2424]	-0.4159 [0.3450]	0.1352 [0.0617]**	-0.0449 [0.2424]	-0.4661 [0.3464]
MD without C/T	0.3836 [0.0826]***	0.277 [0.2523]	-0.0593 [0.3455]	0.4097 [0.0835]***	0.2202 [0.2523]	-0.1114 [0.3470]
PhD without C/T	-0.0213 [0.0961]	0.0215 [0.2461]	-0.3124 [0.3458]	0.0079 [0.0970]	-0.0316 [0.2461]	-0.3689 [0.3476]
BA with C/T	0.1356 [0.0249]***	0.1073 [0.0340]***	0.087 [0.0444]*	0.1692 [0.0272]***	0.1415 [0.0360]***	0.0454 [0.0470]
BA+ with C/T	0.0339 [0.0720]	-0.1349 [0.2450]	-0.4844 [0.3422]	0.0383 [0.0723]	-0.1969 [0.2449]	-0.5079 [0.3430]
MS with C/T	0.0512 [0.0669]	-0.0365 [0.2437]	-0.4529 [0.3458]	0.0697 [0.0678]	-0.0816 [0.2436]	-0.4864 [0.3470]
MD with C/T	0.2689 [0.1284]**	0.303 [0.2672]	-0.4292 [0.4513]	0.2837 [0.1296]**	0.2627 [0.2681]	-0.4503 [0.4492]
PhD with C/T	0.0157 [0.1003]	0.0606 [0.2467]	-0.3815 [0.3535]	0.0404 [0.1015]	0.0238 [0.2467]	-0.4192 [0.3546]
Observations	32828	29085	25334	32828	29085	25334
R-squared	0.31	0.17	0.2	0.31	0.17	0.2

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.

Table 12: Estimated High School Certificate Effects using Sub-samples of 1996 Census Data

(Dependent Variable: Log Weekly Earnings)

	Parallel Experience Profile					Parallel Experience Profile				
	High School or Below	With Some C/T	With C/T Cert	All Below Bachelor Degree	Flexible Experience Profile	High School or Below	With Some C/T	With C/T Cert	All Below Bachelor Degree	Flexible Experience Profile
Experience	0.0483 [0.0009]***	0.0574 [0.0018]***	0.0418 [0.0010]***	0.0446 [0.0006]***	0.0446 [0.0007]***	0.0483 [0.0009]***	0.0572 [0.0018]***	0.0419 [0.0010]***	0.0449 [0.0006]***	0.0448 [0.0007]***
Experience^2 / 100	-0.0711 [0.0018]***	-0.0964 [0.0045]***	-0.0682 [0.0023]***	-0.0675 [0.0013]***	-0.0644 [0.0014]***	-0.0711 [0.0018]***	-0.0966 [0.0046]***	-0.0684 [0.0023]***	-0.0684 [0.0013]***	-0.0651 [0.0015]***
Years of Schooling	0.0327 [0.0019]***	0.0431 [0.0036]***	0.0323 [0.0015]***	0.0359 [0.0010]***	0.0347 [0.0011]***					
Years of Elem/High School						0.0327 [0.0019]***	0.0411 [0.0059]***	0.0309 [0.0027]***	0.0322 [0.0015]***	0.0332 [0.0015]***
Years of C/T						0 [0.0000]	0.0272 [0.0059]***	0.0343 [0.0020]***	0.0391 [0.0018]***	0.0381 [0.0019]***
Years of University						0 [0.0000]	0.0554 [0.0057]***	0.0292 [0.0036]***	0.0435 [0.0029]***	0.0324 [0.0040]***
High-school Cert	0.0534 [0.0062]***	0.0779 [0.0152]***	0.0324 [0.0059]***	0.0485 [0.0052]***	0.051 [0.0054]***	0.0534 [0.0062]***	0.0639 [0.0160]***	0.0344 [0.0060]***	0.0525 [0.0054]***	0.0534 [0.0055]***
C/T without HS				0.0782 [0.0064]***	0.1087 [0.0084]***				0.0772 [0.0066]***	0.1075 [0.0084]***
C/T with HS				0.0702 [0.0048]***	0.0884 [0.0064]***				0.0641 [0.0053]***	0.0853 [0.0066]***
Observations	30513	8674	31106	70293	70293	30513	8674	31106	70293	70293
R-squared	0.23	0.27	0.17	0.23	0.23	0.23	0.27	0.17	0.23	0.23

* significant at 10%; ** significant at 5%; *** significant at 1%

All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.

Table 13: Estimated College/Trade Certificate Effects using Sub-samples of 1996 Census Data
(Dependent Variable: Log Weekly Earnings)

	HS Grad w/o University Years	HS Cert with University Years	No HS Cert only	HS Grad w/o University Years	HS Cert with University Years	No HS Cert only
Experience	0.0479 [0.0014]***	0.0478 [0.0026]***	0.0431 [0.0018]***	0.0481 [0.0014]***	0.0478 [0.0026]***	0.0431 [0.0018]***
Experience^2 / 100	-0.0836 [0.0036]***	-0.0849 [0.0069]***	-0.0726 [0.0041]***	-0.0845 [0.0036]***	-0.0847 [0.0069]***	-0.0728 [0.0041]***
Years of Schooling	0.0404 [0.0027]***	0.0247 [0.0040]***	0.0352 [0.0028]***			
Years of Elem/High School				0.0284 [0.0052]***	0.0286 [0.0088]***	0.0342 [0.0037]***
Years of C/T				0.0453 [0.0032]***	0.025 [0.0067]***	0.0366 [0.0045]***
Years of University				0 [0.0000]	0.0225 [0.0064]***	0 [0.0000]
C/T Cert	0.0642 [0.0086]***	0.0423 [0.0182]**	0.0852 [0.0145]***	0.0598 [0.0087]***	0.0424 [0.0189]**	0.0842 [0.0147]***
Observations	17867	5162	8510	17867	5162	8510
R-squared	0.21	0.19	0.16	0.21	0.19	0.16

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.

Table 14: Estimated Bachelor's Degree Effects using Sub-samples of 1996 Census Data
(Dependent Variable: Log Weekly Earnings)

	HS Cert without C/T	HS Cert with some C/T	HS Cert and C/T Cert	HS Cert without C/T	HS Cert with some C/T	HS Cert and C/T Cert
Experience	0.0587	0.0533	0.0477	0.0587	0.0532	0.0478
	[0.0021]***	[0.0039]***	[0.0021]***	[0.0021]***	[0.0039]***	[0.0021]***
Experience^2 / 100	-0.105	-0.1002	-0.085	-0.1051	-0.0999	-0.0855
	[0.0055]***	[0.0113]***	[0.0058]***	[0.0055]***	[0.0113]***	[0.0058]***
Years of Schooling	0.0431	0.0262	0.0155			
	[0.0047]***	[0.0066]***	[0.0033]***			
Years of Elem/High School				0.0362	0.0229	0.0168
				[0.0104]***	[0.0131]*	[0.0070]**
Years of C/T				0	0.0166	0.0109
				[0.0000]	[0.0111]	[0.0046]**
Years of University				0.0449	0.0357	0.0196
				[0.0053]***	[0.0098]***	[0.0048]***
Bachelor Degree	0.1589	0.155	0.1485	0.1548	0.1325	0.1392
	[0.0172]***	[0.0291]***	[0.0128]***	[0.0182]***	[0.0342]***	[0.0155]***
Observations	9489	2535	7972	9489	2535	7972
R-squared	0.29	0.26	0.19	0.29	0.26	0.19

* significant at 10%; ** significant at 5%; *** significant at 1%
All regressions also include controls for Province/Territory, Census Metropolitan Area, Marital Status, Language, Aboriginal Status, Visible Minority Status and a constant term. The interaction terms of level of education and experience and experience squared are not shown. Robust standard errors are in brackets.