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RETURNS TO APPRENTICESHIP: ANALYSIS BASED ON THE 2006 CENSUS

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Abstract

We utilize the 2006 Census -- the first large-scale, representative Canadian data set to include information on apprenticeship certification -- to compare the returns from apprenticeships with those from other educational pathways (high school graduation, non-apprenticeship trades and community college). An apprenticeship premium prevails for males but a deficit is evident for females, with this pattern prevailing across the quantiles of the pay distribution, albeit with the premium being larger for males at the lower quantiles. Reasons for these patterns are discussed as are the relative importance of differences in the endowments of wage determining characteristics and differences in pay for the same wage determining characteristics.

JEL Classifications: I21 and J24

Keywords: Apprenticeship, Earnings, Canada, Decomposition and Census

Executive Summary

We utilize the 2006 Census -- the first Canadian data set to include information on having an apprenticeship certification to compare with the returns from other educational pathways.

Our results indicate that, when compared to other alternative education pathways for apprentices, male apprentices earn substantially more (24%) than those whose highest level of education is high school graduation, considerably more (15%) than those with other trades, and even slightly more (2%) than college graduates. Overall, as the level of education of the comparison group increases from high-school graduate, to other trade certificate to community college, the relative importance of differences in pay received for the same endowments of wage determining characteristics decreases (respectively from 54% to 37% to 3%). This likely reflects a combination of the lower credential value of the training and of the unobservables possessed by apprentices relative to the more qualified comparison groups.

Since the returns from an apprenticeship for males are considerably higher than those from other non-apprentice trades, then combining them (as had to be done in studies prior to the 2006 Census) clearly underestimated the returns from apprenticeships.

For females, a vastly different picture emerges. Acquiring an apprenticeship yields lower returns then simply completing high school and substantially lower returns than completing community college, likely reflecting the fact that female apprenticeships tend to be in low-wage jobs in industries like food and service.

The patterns are fairly similar whether apprentices have or do not have a high school diploma. The patterns also tended to prevail across all quantiles of the pay distribution. However, for males the apprenticeship pay premium was generally higher at the lower quantiles with apprenticeships being a better pathway for higher earnings compared to high school or college, especially for those who otherwise would be at the lower ends of the wage distribution. For females, the overall pay deficit for apprentices relative to the other alternative pathways generally did not change much over the wage distribution- apprenticeships do not appear to be beneficial for females at any percentile in the overall pay distribution.

Overall, our results are robust across the various econometric approaches used in this paper. They show a return to apprenticeship accreditation for males that is basically equivalent to community college graduation, and significantly higher than the returns estimated for males in other trades and high school graduates. In contrast, female apprentices earn slightly less than women whose highest degrees are high school diplomas or other trades certificates, and significantly less than community college graduates.

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Although apprenticeships[1] tend to be associated with the European education system, they are an important component of the post-secondary system in Canada, constituting 13% of post-secondary enrolment compared to 28% in community colleges and 59% in universities (Sharpe and Gibson 2005, p. 13, 43). Furthermore, several provinces have initiated programs which promote apprenticeships to students, often touting its viability as a career option. Yet we know remarkably little about the economic returns to apprenticeships compared to the substantial knowledge we have of the returns to education in general. In the *education* area, the evidence suggests that the causal returns to education are substantial, likely in the neighbourhood of 10 percent, ranging from 6 percent to 15 percent, being slightly higher for females than males.[2] There are substantial credential effects associated with completing key phases like high school or university, and the high returns tend to be sustained or even increasing over time in spite of the large increases in the supply of educated persons, highlighting that the demands for education associated with the knowledge economy and skill-biased technological change are outstripping the supply responses. It would be important from both a policy and research perspective to know about the returns to apprenticeship in the context of an economy which places a premium on

[1] Ryan (1998, p. 289) defines apprenticeship as "employer-sponsored programs which integrate part-time schooling with part-time training and work experience on employers' premises …. within an externally defined curriculum which contains mandatory part-time schooling, leads to a nationally recognized vocational qualification and takes at least two years to complete."

[2] Recent reviews of that extensive literature include Card (1999, 2001), Carnoy (1997), Gunderson and Krashinsky (2004), Gunderson and Oreopoulus (2010), Psacharopoulos and Patrinos (2004), Riddell (2002), and Trostel, Walker and Woolley (2002).

knowledge-based skills, but up until this point, no comparable information existed in the apprenticeship area.

In addition to this, there are other important aspects of the education literature that are of particular relevance to the analysis of certified apprentices in the economy. In particular, students who do not complete their high school degrees are well-studied in the education literature. A great deal of work has examined this group because of the large monetary penalty they incur from not completing their degrees, which has been highlighted by the strong increase in earnings resulting from exogenous increases in education from compulsory school laws. Indeed, more stringent laws to curb dropping out may be a solution to providing economic assistance to this group,[3] but it may also be the case that practical, vocationally-oriented training of apprentices is an alternative and equally viable option for those who otherwise may drop-out of more academically-oriented education.

Information on the economic returns to apprenticeship training may help in decisions to acquire apprenticeship training or to pursue a particular field of study in the education system or to leave school and acquire labour market experience. Training and life-long learning, of which apprenticeships can be a part, are regarded as increasingly important to adjust to the constantly changing market. They are consistent with the increased emphasis being placed on positive labour market adjustment strategies that equip people to respond to basic market forces by migrating out of declining sectors and regions towards expanding ones, in contrast to the more passive income maintenance programs that can deter such adjustment. For students making the transition from school-to-work, an apprenticeship can be a viable option by combining education

[3] Evidence of credential or sheepskin effects for Canada are documented in Ferrer and Riddell (2002) and for the U.S. in Jaeger and Page (1996), Kane and Rouse (1995) and Park (1999) and references cited therein.

through an institutional component with hands-on practical training acquired through on-the-job training. By bridging the gap between school and work, an apprenticeship program can reduce the likelihood of an initial experience in the labour market of a prolonged bout of unemployment; this can have a permanent legacy or scarring effect through the negative signal it conveys to employers as well as the negative effect on the confidence of youths and their attitudes toward labour market work.[4]

1. LACK OF DATA ON APPRENTICESHIPS

In spite of this potential importance of apprenticeships we have remarkably little information on the economic returns to apprenticeships. In part this reflects a lack of data. Until the 2006 Census that is used in this study, conventional data sets that have been used to estimate the returns to education did not distinguish apprenticeships from other forms of vocational education. This is the case with Survey of Consumer Finances (SCF), the Survey of Labour and Income Dynamics (SLID), the Labour Force Survey (LFS), the Workplace and Employee Survey (WES), the National Longitudinal Survey of Children and Youth (NLSCY), the Youth in Transition Survey (YITS) the National Apprenticed Trade Survey (NATS) of 1994, and the National Graduates Surveys (NGS). The 2007 National Apprenticeship Survey (NAS) has information only on apprentices so there is no comparison group. As such, it cannot, by itself, identify the returns to apprenticeship certification.

The census is the most common data source for estimating returns to education in Canada; however, until the 2006 Census, the education category of "trade certificate" was the

[4] Canadian evidence of the scarring effect from initial negative labour market experiences is given, for example, in Beaudry and Green (2000) and McDonald and Worswick (1999) as well as in some of the chapters in Picot, Saunders and Sweetman (2007).

closest approximation to completing an apprenticeship. It is an imperfect measure, however, since it includes trade certificates that are not apprenticeships – and our evidence indicates that this is not a homogenous group. Due to this limitation, a number of Canadian studies that have used earlier census data did not separate out the specific apprenticeship designation. They generally concluded that the returns to completing a vocationally oriented trade certificate or diploma, which included apprenticeships, were generally lower than the returns from completing more academic as opposed to vocational programs. This is the case, for example, in Ferrer and Riddell (2002) based on the 1996 Census, Boothby and Drewes (2004) based on the 1981, 1991 and 2001 Census, and Gunderson and Krashinsky (2005) based on the 2001 Census. The higher returns to academic streams compared to technical/vocational streams is generally consistent with the international evidence as well.[5]

With the advent of the 2006 Census, however, it is now possible to separate apprentices from non-apprentice trade certificates and diplomas and hence to estimate separate returns for apprenticeships and to compare those returns to ones from other potential pathways such as high school, non-apprentice trade certificates or diplomas and community college degrees. That is the purpose of this analysis.

2. METHODOLOGY AND DATA

Our methodology involves estimating conventional human capital earnings equations augmented to estimate the credential effects associated with completing key phases – in our case,

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[5] International evidence is reviewed in OECD (1998), Psacharopoulos and Patrinos (2004), Ryan (2001) and Trostel, Walker and Woolley (2002).

an apprenticeship. We use the Master Files of the 2006 Census which is the first Canadian data set to separate out apprentices from other forms of education.[6]

Our dependent variable is the natural logarithm of weekly earnings constructed as annual earnings in the year 2005 divided by weeks worked in the year 2005. An hourly wage measure could not be readily calculated since the measure of hours worked per week refers to the survey week in 2006, while the annual earnings and weeks worked measures correspond to the previous year, 2005.

The natural logarithm of earnings is regressed on years of education[7] as well as dummy variables to capture the credential or sheepskin effect associated with key phases of education including: completing high school, obtaining a trade certificate or diploma, completing an apprenticeship (our key variable), completing community college, some university, university grad, some post-grad, Masters degree, PhD, and a medical degree. The returns associated with completing these phases of education would be the returns associated with each year of education they have accumulated plus the credential effect associated with completing their particular certificate or degree.[8] The conventional control variables used in our analysis are experience, experience squared, marital status, visible minority status, region and industry. Variables like occupation and city size are not controlled for because they are mechanisms

[6] Since the Master Files of the Census are confidential data sets the analysis had to be done at a Statistics Canada Research Data Centre.

[7] To construct our continuous measure of years of education we follow the procedure first used in Ferrer and Riddell (2002) and followed in Gunderson and Krashinsky (2005). Essentially a continuous measure is constructed based upon detailed information in the 2006 Census on the highest degree obtained and on the amount of time spent completing various degrees. These are summed to create a measure representing the total number of years of education.

[8] In log earnings equations, the true proportional change is $\exp(\beta) - 1$ where β is the estimated coefficient. For low values of β the approximation is very close, underestimating the true value by less than 0.01 for values of $\beta < 0.15$ which is the case for our main variables of interest, hence we report the β coefficients.

through which higher education can affect earnings. Unionization is not included because such a measure is not available in the census data. The regressions were run separately for males and females.

As is conventional in estimating returns to education (e.g., Ferrer and Riddell 2002, Gunderson and Krashinsky 2005) we restrict our analysis to groups whose earnings are likely to be affected in a normal fashion by education and exclude certain groups whose earnings may be affected by unusual circumstances that could otherwise “contaminate” the estimates. Specifically, we exclude: (1) immigrants on the grounds that their earnings reflect the returns to education outside of Canada as well as other factors such as credential recognition; (2) persons whose primary source of income is not from a wage and salary job, but can reflect such factors as income from self-employment or transfer payments or other non-wage sources; (3) persons over the age of 65 on the grounds that work patterns after 65 can reflect unusual events and are not likely to be strictly related to their education acquired 40 or more years earlier; (4) persons still in school or in apprenticeships since their education is obviously not completed; (5) persons whose weekly earnings is less than $110 (updating the restriction of $90 used in Ferrer and Riddell 2002), since weekly earnings below those amounts are likely to reflect measurement error or very unusual circumstances since they would imply an hourly wage of less than $3.00 per hour for full-time workers; and (6) part-time workers as defined in the Census as working fewer than 30 hours per week on the grounds of their limited attachment to the labour market.

Our empirical estimates involve three procedures. The first, presented in Table 1, involves estimates of a baseline earnings regression with years of education, various control variables and various dummy variables for obtaining the credential associated with phases of education including an apprenticeship, to compare with the returns for other phases such as high school graduation, non-apprenticeship trade certificate, community college, and university.

The second procedure, presented in Table 2, involves decompositions based on estimating separate earnings equations for apprentices and various other comparison groups that represent viable alternative pathways for apprentices. These are high school, a non-apprenticeship certificate or diploma, and community college. The estimation of separate equations allows the returns to the wage determining characteristics to differ between apprentices and the various comparison groups. The average earnings differential between apprentices and each of these comparison groups is then decomposed into two component parts using a conventional Blinder-Oaxaca decomposition. One part is attributed to differences in the average endowments of wage determining characteristics (the explanatory variables) between apprentices and each of the comparison groups – termed the explained or endowment components. The other component is attributed to differences in the pay or returns that apprentices and each comparison group get for the same wage determining characteristics – termed the unexplained or coefficient component. In this context, this unexplained component could reflect the returns to the apprenticeship training as well as the effect of unobserved factors associated with acquiring the credential such as an apprenticeship. Specifically, the decomposition is:

$$(\bar{Y}_a - \bar{Y}_n) = (\bar{X}_a - \bar{X}_n)\beta_n + (\beta_a - \beta_n)\bar{X}_a$$

where $\bar{Y}$ is the mean log of earnings, $\bar{X}$ is the mean values of a vector of human capital and other wage determining characteristics, β is a vector of estimated regression coefficients showing the return to each of the characteristics, the subscript "a" denotes apprentices, and "n" denotes the non-apprentice comparison group. The decomposition above evaluates the differences in endowments according to the non-apprenticeship pay structure β_n. The results are not sensitive to using alternative pay structures such as the apprenticeship pay structure. The decomposition analysis is presented in Table 2 when comparisons are made between apprentices and education pathways that could be considered as viable alternatives for apprentices. Since there is current policy interest in whether a high-school diploma should be required for an apprenticeship, the decomposition analysis is also done separately for those with and without such a diploma.

The third procedure, presented in Table 3, involves decompositions based on the Recentered Influence Function (RIF) modification of conventional quantile regressions developed by Firpo, Fortin and Lemieux (2009) (hereafter FFL) to enable portraying how the decomposition results vary across the wage distribution. Briefly, the RIF procedure makes it possible to interpret coefficients estimated from a quantile regression in a manner similar to an OLS regression -- that is, the unconditional marginal effect of an independent variable on the unconditional distribution of the dependent variable. The RIF procedure also allows for an approach within a quantile regression setting that is analogous to the Oaxaca-Blinder decomposition technique: FFL use the *unconditional* quantile regressions estimated using the RIF procedure in order to determine the percentage of the *unconditional* wage difference at a given percentile that can be attributed to differences in observable characteristics, and the percentage that can be attributed to differences in the returns to these characteristics.

This effect of observable characteristics on the unconditional distribution of a dependent variable (such as wages) within a quantile regression context is a new innovation within the decomposition literature. Specifically, OLS regressions allow inferences about the impact of given independent variable on the unconditional mean of a dependent variable, and this application is especially important for exercises such as Oaxaca-Blinder decompositions, which further explore the percentage of the unconditional distribution that can be attributed to observable factors. However, these types of inferences about the unconditional distribution of a dependent variable had not been possible for particular quantiles within the wage distribution, because prior to FFL, quantile regressions were *conditional* on their independent variables. This aspect has two drawbacks: first, it is not consistent with a Blinder-Oaxaca decomposition, since that approach focuses on the effects upon an unconditional wage distribution, and second, results from conditional quantile regressions are not amenable to a "policy interpretation". For example, a median regression of earnings on education does not allow the econometrician to determine the impact of a one-year increase in education for the overall population on median earnings.

However, the FFL innovation does allow for such an interpretation. Theoretically, let the outcome variable, Y, be a function of observables (X) and unobservables (e) as follows:

$$Y = h(X, \varepsilon)$$

The "policy interpretation" -- which is represented by the function α below -- sought after by an econometrician is the impact of a small change in X on some unconditional statistic related to Y. In the past, this statistic has often been the mean of Y, but in this case, we are interested in the effect of a change in X on the t^{th} quantile of the unconditional distribution of Y. This effect is represented by $\alpha(t)$, and is defined as:

$$\alpha(\tau) = lim_{t \to 0} \frac{Q_\tau[h(X + t, \varepsilon)] - Q_\tau[h(X, \varepsilon)]}{t}$$

where $Q_t[Y]$ is the unconditional distribution of Y at the t^{th} quantile. FFL define α (t) as the "unconditional quantile partial effect" (UQPE), and demonstrate that this effect is analogous to the average effect of a change of X on Y, which is:

$$E\left[\frac{\partial E(Y|X)}{\partial x}\right]$$

The key problem is to operationalize the estimation of $\alpha(t)$, and FFL do so by creating a "Recentered Influence Function" (RIF). FFL begin by noting that an "influence function" (IF) is simply the impact of one observation on a particular quantile $Q_t[Y]$ of the unconditional distribution of Y:

$$IF(Y, Q_\tau[Y]) = \frac{(\tau - I\{Y \leq Q_\tau[Y]\})}{f_Y(Q_\tau[Y])}$$

In this case, $I\{Y \leq Q_\tau[Y]\}$ is an indicator variable and $f_Y(Q_\tau[Y])$ is the density of the marginal distribution of Y.

The Recentered Influence Function is simply this statistic added to the value of the particular quantile of interest:

$$RIF(Y, Q_\tau[Y]) = Q_\tau[Y] + IF(Y, Q_\tau[Y])$$

FFL demonstrate that a "RIF-regression model" -- the regression of this statistic on independent variables -- will generate an *unconditional* quantile regression. That is, the RIF-regression will estimate the effect of a change in an independent variable on the unconditional distribution of Y, which is the "policy effect" that is desired. In turn, these estimates will permit exercises such as decompositions for particular quantiles of Y.

3. RESULTS

3.1 Baseline Regression with Dummy for Apprenticeships and Other Credentials

Table 1 provides the estimates of the log earnings equations, separate for males and for females. As indicated by the means in column 1, about 6 percent of Canadian males have completed an apprenticeship, slightly fewer than the 8.8 percent who have a general trade certificate, about one-third of the 19 percent who have community college and almost half of the

14.6 percent who have a university B.A. For females, however, only 1.8 percent have completed an apprenticeship (column 4).

As indicated by the coefficients of column 2 for males, higher earnings are generally associated with each higher credential that is acquired. These are credential effects over-and-above the general return to an additional year of education of 4.4% and after controlling for the effect of other pay determining characteristics such as experience, marital status, visible minority status, province and industry.

Of relevance to this study, males who acquire an apprenticeship credential earn 9.2% more those who do not complete high school. This is over-and-above the 4.4% additional return they may have for each year of additional education they may acquire. The premium of 9.2% for an apprenticeship is substantially larger than that for a non-apprenticeship trade certificate or diploma of 5% and it is almost as large as the premium of 11.4% for graduating from a community college. It is also less than the premiums associated with higher levels of education. The fact that the premium for an apprenticeship is substantially larger than that of a non-apprenticeship trade certificate or diploma highlights the importance of separating apprentices from other trade certificates as is done in the 2006 Census but not earlier censuses. The coefficients on the other control variables are generally in line with those common in the literature.

As indicated in column 5, for females a very different pattern emerges. Specifically, having a trade certificate or diploma is associated with 4% *lower* earnings compared to those who did not graduate from high school and, of particular relevance to this study, having an apprenticeship certification is associated with 11.7% *lower* earnings after controlling for the other determinants of earnings including years of education and experience. Higher returns are associated with the credentials associated with successive higher levels of education and the returns to a year of education without the credential effects is 7.2%, substantially higher than the returns of 4.4% for males, a result that is commonly found in the literature. The effect of being married for females is inconsequential (less than 1%) in contrast to the substantial positive effect of 13.5% for males. Clearly, marriage is not an equal opportunity "employer." The regional and industrial rankings for females were fairly similar to those for males.

3.2 Decomposition Analysis for Apprenticeships and Other Comparison Groups

Table 2 gives the decomposition results comparing the relative importance of different endowments of pay determining characteristics and different returns for the same characteristics when estimating separate earnings equations for apprentices and various other comparison groups that represent viable alternative education pathways for apprentices (high-school graduates, trade certificates and community college graduates). Furthermore, we exploit the information within the Census that documents the way in which various degrees are earned. Since it is possible to ascertain whether or not an apprenticeship, trades certificate or community college degree was obtained with or without a high school diploma, we bifurcate the analysis to consider groups both with and without high school degrees. Specifically, the top panel is based on all apprentices (both with and without high school degrees) and the designated control groups (both with and without a high school degree, except the first row, which specifies high school graduates). The middle panel limits the analysis to apprentices with a high-school diploma, and compares them to the three control groups, who obtained their educational accreditations after acquiring a high school degree. Lastly, the bottom panel analyzes apprentices without a high-school diploma, and three relevant control groups who obtained their highest educational accreditations without completing a high school degree. Within each panel, separate results are presented for males and females.[9]

3.2.1 Male Apprentices

As indicated in the first column of the top panel, the relative earnings premium for male apprentices declines as comparisons are made with groups of higher qualifications; nevertheless, their higher earnings prevail even when comparisons are made with community college graduates. Specifically, male apprentices earn substantially more (24%) than those whose highest level of education is high school graduation, considerably more (15%) than those with other non-apprenticed trades and even slightly more (2%) than community college graduates.

As indicated in columns (2) and (3), of Table 2, the substantial pay premium that male apprentices have over male high-school graduates is almost equally due to their greater endowments of pay determining characteristics (46%) and the greater returns they receive for the same characteristics (54%). In essence, apprentices are more qualified than high-school graduates both in terms of their endowments of other wage determining characteristics and in terms of their apprenticeship qualification being associated with higher returns.

As the qualifications of the comparison group increase from high-school graduate (row 1), to other trade certificate (row 2) and then to community college graduates (row 3), not only does the overall higher earnings for male apprentices decline (column 1), but the relative importance of the higher endowments of wage determining characteristics possessed by apprentices increases (respectively from 46% to 63% to 97% in column 2) while the relative importance of differences in pay received for the same endowments of wage determining

[9] Full regressions upon which the decompositions are based are available from the authors on request.

characteristics decreases (respectively from 54% to 37% to 3% in column 3). This declining magnitude of the pure apprenticeship pay premium for the same endowments of wage determining characteristics as the qualification of the comparison group increases likely reflects a combination of the lower credential value of the training and of the unobservables possessed by apprentices relative to the more qualified comparison groups.[10]

These results also highlight the importance of separating apprenticeship trades from non-apprenticeship trades (as is feasible in the 2006 Census) as opposed to their being combined (which was not possible in previous Census). The returns from an apprenticeship are considerably higher than those from other non-apprentice trades so that combining them clearly downplays the returns from apprenticeships. This suggests that the findings of low returns to the more vocational forms of education, found in earlier studies based on census data where apprentices could not be separated, masked the higher returns to apprenticeships. This was the case, for example, in Ferrer and Riddell (2002) based on the 1996 Census, Boothby and Drewes (2004) based on the 1981, 1991 and 2001 Census and Gunderson and Krashinsky (2005) based on the 2001 Census.

3.2.2 Female Apprentices

For female apprentices, a vastly different picture emerges. Female apprentices earn *less* than all other comparison groups: 6.6% less than female high school graduates (due mainly to their lower endowment of wage determining characteristics); 1% less than females in other non-apprenticeship trades (because their greater endowments of wage determining characteristics is slightly dominated by the lower returns they receive for those endowments); and 25% less than

[10] The signal value of the credential or certification of the apprenticeship is emphasized throughout the comprehensive review of apprenticeships by Wolter and Ryan (2010, p. 527, 528, 535).

female graduates from community colleges (due mainly to the lower returns they receive for their wage determining characteristics).

When female apprentices are compared to female college graduates, the majority (83%) of the substantial pay deficit of 25% is accounted for by the lower returns that female apprentices receive for the same endowments of wage determining characteristics (column 3). This is in contrast to the situation for males where the pure earnings premiums (column 3) were similar for apprentices and college graduates.

Since the returns to more general education are higher for females than for males (discussed previously) this suggests that entering apprenticeship trades is particularly disadvantageous for females – a fact that is documented in the general literature (Gunderson 2009). This highlights the importance of obtaining information on the barriers that inhibit females from entering higher paying apprenticeships.[11] Since apprenticeships are subject to occupational certification and licensing by self-governing bodies, the potential for barriers and discrimination are obvious possibilities and this merits more research.

3.2.3 Apprentices With and Without A High-School Diploma:

The middle and bottom panels of Table 2 provide separate estimates for apprentices with and without a high school diploma respectively. The discussion will focus on the *differences* between the middle and bottom panels since that is the focus of interest.[12]

[11] The literature on barriers to women in apprenticeships is reviewed and summarized in Gunderson (2009).
[12] The sample sizes in the middle plus the last panel add up to the numbers in the top panel except for the first rows when apprentices are compared to high school graduates. In this case, the sample sizes do not add up because the top panel and bottom two panels compare different groups. The top panel compares all apprentices (both with and without a high school degree) to non-apprentices who graduated high school. The middle panel compares apprentices with a high school degree to non-apprentices without a high school degree, and the bottom panel compares apprentices without a high school degree to non-apprentices without a high school degree. Because non-

In general, the patterns are fairly similar and the differences are small. The main difference occurs where the overall earnings premium for male apprentices compared to male college graduates is larger (10.3%) for apprentices with no high school diploma compared to those with a high school diploma (3.1%). Most of the larger apprenticeship premium for those without a diploma is due to the greater returns that apprenticeships yield for those without a high school diploma (column 3). This is consistent with the apprenticeship having a greater certification value for those without the certification of a high school diploma.

3.3 RIF Quantile Decompositions

Table 3 provides the decomposition results based on the Recentered Influence Function (RIF) procedure developed by Firpo, Fortin and Lemieux (2009) to enable portraying how the decomposition results vary across the wage distribution.

Since Table 2 indicated that the results tended to be similar for apprentices with and without a high school diploma, we present only the results for all apprentices and not separate ones for those with and without a high school diploma.

As indicated in the top panel for males, the overall pay premium for apprentices prevailed across all parts of the wage distribution for all comparison groups. As was the case for the average apprenticeship premium presented in Table 2 (and repeated in the last column of Table 3) the pay premium for apprentices declined as comparisons are made with groups of higher qualifications, the premium being highest when apprentices are compared with high school graduates, then with other non-apprentice trades, and lowest when compared to college graduates. This pattern also prevailed across each of the five quantiles. Of note, however, is the

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apprentices without a high school degree are excluded from the top panel in the first row, the sample sizes do not add up for the first row of the top, middle and bottom panels.

fact that the apprenticeship pay premium generally declined for the higher quantiles. For example, the pay premium for apprentices compared to high school graduates is 30.7% at the bottom 10th percentile but only 16.5% at the top 90th percentile of the pay distribution. When comparisons are made with college graduates, the pay premium for apprentices is approximately 4% at the bottom 10th percentile but slightly less than 1% at the top 90th percentile of the pay distribution. Reasons for this do not have to do with changes in the relative importance of endowments or returns since those proportions do not change much over the pay distribution. Only when apprentices are compared with other non-apprentice trades is the apprentice pay premium roughly similar (in fact slightly increasing) over the pay distribution. In essence, apprenticeships appear to be a better pathway for higher earnings compared to high school or college, especially for those who otherwise would be at the lower ends of the wage distribution.

For females, the overall pay deficit for apprentices that existed at the mean of the pay distribution (last column) also tended to prevail across most parts of the wage distribution for all comparison groups. Unlike for males, however, where the apprenticeship premium declined as comparisons were made with groups of higher qualifications, the pay deficit for female apprentices did not change much over the wage distribution. With few exceptions, apprenticeships do not appear to be "kind to females" anywhere in the pay distribution.

4. SUMMARY AND CONCLUDING OBSERVATIONS

We utilize the 2006 Census -- the first Canadian data set to include information on having an apprenticeship certification to compare with the returns from other educational pathways. Our results indicate that, when compared to other alternative education pathways for apprentices, male apprentices earn substantially more (24%) than those whose highest level of education is high school graduation, considerably more (15%) than those with other trades, and even slightly more (2%) than college graduates. Overall, as the level of education of the comparison group increases from high-school graduate, to other trade certificate to community college, the relative importance of differences in pay received for the same endowments of wage determining characteristics decreases (respectively from 54% to 37% to 3%). This likely reflects a combination of the lower credential value of the training and of the unobservables possessed by apprentices relative to the more qualified comparison groups.

Since the returns from an apprenticeship for males are considerably higher than those from other non-apprentice trades, then combining them (as had to be done in studies prior to the 2006 Census) clearly underestimated the returns from apprenticeships.

For females, a vastly different picture emerges. Acquiring an apprenticeship yields lower returns than simply completing high school and substantially lower returns than completing community college, likely reflecting the fact that female apprenticeships tend to be in low-wage jobs in industries like food and service.

The patterns are fairly similar whether apprentices have or do not have a high school diploma. The patterns also tended to prevail across all quantiles of the pay distribution. However, for males the apprenticeship pay premium was generally higher at the lower quantiles with apprenticeships being a better pathway for higher earnings compared to high school or college, especially for those who otherwise would be at the lower ends of the wage distribution. For females, the overall pay deficit for apprentices relative to the other alternative pathways generally did not change much over the wage distribution- apprenticeships do not appear to be beneficial for females at any percentile in the overall pay distribution.

Overall, our results are robust across the various econometric approaches used in this paper. They show a return to apprenticeship accreditation for males that is basically equivalent to community college graduation, and significantly higher than the returns estimated for males in other trades and high school graduates. In contrast, female apprentices earn slightly less than women whose highest degrees are high school diplomas or other trades certificates, and significantly less than community college graduates.

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Table 1 – Log Earnings Equations by Gender, Full-time Workers, 2006 Census (Mean Weekly Earnings =$675 for women and $886 for men)

	Males			Females		
Variable	**Mean**	**Coef.**	**t-stat**	**Mean**	**Coef.**	**t-stat**
	(1)	(2)	(3)	(4)	(5)	(6)
(Less than high school)						
High school grad	0.243	.030	11.22	0.256	.032	10.84
Trade certificate	0.088	.050	15.50	0.066	-.039	-9.95
Apprenticeship	0.061	.092	21.83	0.018	-.117	-19.48
Community college	0.191	.114	27.20	0.249	.089	20.41
Some university	0.043	.172	34.31	0.057	.203	39.69
University grad	0.146	.291	49.20	0.174	.259	40.42
Some post grad	0.022	.294	36.46	0.029	.270	33.65
Masters degree	0.047	.320	39.53	0.044	.281	32.34
PhD	0.012	.412	37.09	0.006	.303	22.84
Medical degree	0.008	.965	77.48	0.006	.716	49.03
Education (years)	13.296	.044	49.19	13.546	.072	72.90
Experience (years)	22.407	.045	231.51	21.352	.037	193.48
Experience squared	650.152	-0.00075	-176.10	598.028	-.00059	136.08
(Not married)						
Married	0.550	.135	99.35	0.496	.004	2.84
(Not visible minority)						
Visible minority	0.188	-.276	-159.24	0.179	-.162	-96.09
(Atlantic provinces)						
Quebec	0.239	.070	28.10	0.239	.077	32.84
Ontario	0.383	.205	84.72	0.391	.226	99.96
Manitoba	0.039	.060	16.10	0.035	.120	33.83
Saskatchewan	0.030	.057	13.74	0.029	.103	26.87
Alberta	0.113	.261	89.10	0.108	.207	74.72
British Columbia	0.120	.185	64.62	0.120	.188	69.17
Yukon	0.002	.185	11.67	0.001	.305	21.85
North West Territories	0.005	.467	39.25	0.002	.522	45.69
Nunavut	0.004	.463	42.91	0.001	.589	53.30
(Primary industries)						
Mining	0.022	.764	125.73	0.007	.656	64.52
Manufacturing	0.201	.384	86.49	0.095	.292	46.36
Trade	0.151	.216	47.42	0.141	.135	21.76
Transport/Utilities	0.076	.366	77.02	0.032	.387	56.79
Real Estate/Finance/Info	0.078	.409	82.36	0.112	.399	63.61
Service	0.297	.164	36.82	0.510	.198	32.53
Public administration	0.081	.446	97.34	0.076	.469	74.71
Constant		5.071	489.37		4.595	383.22
R-squared		.278			0.277	
Sample size		1,240,751			1,063,689	

Table 2 – Decomposition Results, Full-Time Workers, by Gender and Comparison Groups

Gender and Alternative Comparison Groups	Overall Gap (Ya – Yn) (1)	"Explained" by Endowments (Xa –Xn)ßn (2)	"Unexplained" or Coefficients (ßa – ßn)Xa (3)	Sample Size (4)
All Apprentices				
Males				
Apprentice – High School Grads	.2405 (100%)	.1100 (46%)	.1305 (54%)	377,044
Apprentice – Other Trades	.1549 (100%)	.0982 (63%)	.0567 (37%)	185,005
Apprentice – College Grads	.0232 (100%)	.0226 (97%)	.0006 (3%)	312,599
Females				
Apprentice – High School Grads	-.0656 (100%)	-.0527 (80%)	-.0129 (20%)	290,000
Apprentice – Other Trades	-.0112 (100%)	.0429 (383%)	-.0541 (-483%)	89,151
Apprentice – College Grads	-.2470 (100%)	-.0424 (17%)	-.2046 (83%)	283,752
Apprentices with High School Diploma				
Males				
Apprentice – High School Grads	.2527 (100%)	.1066 (42%)	.1461 (58%)	433,129
Apprentice – Other Trades (with HS Degree)	.1590 (100%)	.1042 (66%)	.0548 (34%)	196,686
Apprentice – College Grads (with HS Degree)	.0313 (100%)	.0570 (182%)	-.0257 (-82%)	337,952
Females				
Apprentice – High School Grads	.0531 (100%)	.0546 (103%)	-.0015 (-3%)	403,982
Apprentice – Other Trades (with HS Degree)	.0108 (100%)	.0025 (23%)	.0082 (77%)	116,260
Apprentice – College Grads (with HS Degree)	-.2394 (100%)	-.0292 (12%)	-.2101 (88%)	366,788
Apprentices with No High School Diploma				
Males				
Apprentice – No High School Degree	.2912 (100%)	.1141 (39%)	.1771 (61%)	433,129
Apprentice – Other Trades (without HS Degree)	.1310 (100%)	.0709 (55%)	.0601 (45%)	196,686
Apprentice – College Grads (without HS Degree)	.1031 (100%)	.0413 (40%)	.0618 (60%)	337,952
Females				
Apprentice – No High School Degree	.0425 (100%)	-.0024 (-6%)	.0448 (106%)	403,982
Apprentice – Other Trades (without HS Degree)	-.0204 (100%)	.0021 (-10%)	-.0225 (110%)	116,260
Apprentice – College Grads (without HS Degree)	-.1927 (100%)	-.0349 (18%)	-.1578 (82%)	366,788

Table 3: RIF Quantile Decompositions by Gender and Various Comparison Groups

	10th Percentile	25th Percentile	50th Percentile	75th Percentile	90th Percentile	Mean
Males						
Apprentice vs. High School Grads	.3071	.3027	.2582	.2152	.1653	.2405
% Endowments	40.9%	42.2%	41.2%	43.0%	52.5%	45.7%
% Returns to Endowments	59.1%	57.8%	58.8%	57.0%	47.5%	54.3%
Apprentice vs. Other Trades	.1127	.1518	.1735	.1673	.1629	.1549
% Endowments	61.6%	57.8%	52.1%	48.8%	50.1%	63.4%
% Returns to Endowments	38.4%	42.2%	47.9%	51.2%	49.9%	36.6%
Apprentice vs. College Grads	.0396	.0401	.0324	.0138	.0066	.0313
% Endowments	146.5%	157.9%	196.9%	492.0%	1,224.2%	182.1%
% Returns to Endowments	-46.5%	-57.9%	-96.9%	-392.0%	-1,124.0%	-82.1%
Females						
Apprentice vs. High School Grads	-.0562	-.0533	-.0676	-.0806	-.0705	-.0656
% Endowments	73.6%	91.2%	77.4%	76.1%	84.7%	80.3%
% Returns to Endowments	26.4%	8.8%	22.6%	23.9%	15.3%	19.7%
Apprentice vs. Other Trades	-.0571	-.0475	-.0179	.0103	.0363	-.0112
% Endowments	27.3%	19.8%	6.1%	34.0%	17.4%	-383.0%
% Returns to Endowments	72.7%	80.2%	93.9%	66.0%	82.6%	483.0%
Apprentice vs. College Grads	-.2784	-.3013	-.2407	-.2351	.2435	-.2470
% Endowments	8.8%	9.8%	13.3%	14.5%	12.9%	17.2%
% Returns to Endowments	91.2%	90.2%	86.7%	85.5%	87.1%	82.8%