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# The Causal Effects of Education on Adaptability to Employment Shocks: Evidence from the Canadian Labour Market

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February 2009

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# The Causal Effects of Education on Adaptability to Employment Shocks: Evidence from the Canadian Labour Market*

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**Abstract**

This study investigates the causal effects of education on individuals' adaptability to employment shocks. Specifically, we assess the extent to which education influences re-employment success for unemployed workers. We also examine the impact of education on job search intensity, one potential mechanism through which education may increase the probability of re-employment following unemployment. Given that the positive correlation between education and adaptability is likely to be confounded by the endogeneity of education, we make use of data on compulsory schooling laws to create instrumental variables to assess the causal effects of education on adaptability. Based on data from the Canadian Census and the Labour Force Survey, we find that education both significantly improves re-employment opportunities and exerts significant positive impacts on job search intensity for the unemployed.

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*Keywords:* *Education, Human Capital, Adaptability, Displaced Workers, Unemployment, Job Search, Causal Effects, Compulsory Schooling Laws*

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## Executive Summary

The labour market in Canada has been characterized by dramatic structural changes in recent decades, partly due to technological change, globalization, and the increasingly competitive world economic environment. Whether displaced or unemployed workers are able to adapt efficiently to adverse employment shocks is critical to not only their own welfare, but also the maintenance of healthy communities and efficient allocation of labour resources. As a consequence, building an adaptable workforce has acquired heightened status on the nation's policy agenda.

Relying on data from the Canadian Census and the Labour Force Survey (LFS), this study assesses the causal effects of education on individuals' adaptability to employment shocks in two dimensions: re-employment success after being unemployed and job search intensity. A key methodological challenge to our research is that the positive correlations between education and adaptability that we expect to observe are likely to be confounded by the endogeneity of education, and thus do not necessarily reflect the true causal effects of education on adaptability. In particular, positive associations between education and adaptability could arise because of unobserved factors that are correlated with both measures. For example, those with more innate ability may acquire more education and more readily adapt to changing circumstances. Similarly, individuals from advantaged backgrounds with well-connected social networks are likely to enjoy better and more employment/re-employment opportunities and also likely to acquire more schooling. In these circumstances standard regression methods, such as ordinary least squares (OLS) estimation, yield biased estimates of the true causal link between education and adaptability.

Given that the positive correlation between education and adaptability is likely to be confounded by the endogeneity of education, we use data on compulsory schooling laws to create instrumental variables for assessing the causal effects of education on adaptability. Our findings suggest that education significantly increases re-employment success for unemployed workers, and that highly-educated individuals tend to adopt more job search strategies than those with less education.

Specifically, based on the 1981, 1986, 1991, 1996, and 2001 Canadian Census data, we find that graduating from high school increases the probability of re-employment conditional on being unemployed in the previous year by 24 to 27 percentage points. An additional year of schooling increases this probability by 2 to 3 percentage points. These estimated causal impacts are larger – in some cases substantially larger – than the corresponding OLS estimates of the effects of additional education. Similarly, results based on LFS data show that graduating from high school increases the probability of re-employment conditional on being unemployed five months earlier by 16 percentage points. This probability increases by 1.5 percentage points with each additional year of

schooling. The LFS data also indicate that graduating from high school increases the probability of full-time re-employment conditional on being unemployed five months earlier by 14 percentage points, and this probability increases by 1.4 percentage points with each additional year of schooling.

Job search intensity is not only a good indicator of individuals' adaptability to employment shocks, but also a potential mechanism through which education may increase the probability of re-employment following unemployment. Using the LFS data, we find positive and significant causal effects of education on job search intensity for five of the six months during which an individual remains in the survey, conditional on being unemployed in a given month. Depending on the instruments used, for instance, graduating from high school increases the number of job search methods used in the second month of survey by 0.6 or 1.3, and an additional year of schooling increases this number by 0.06 or 0.12. The results based on the pooled cross-sectional samples of unemployed individuals indicate that graduating from high school increases the number of job search methods used in a given month conditional on being unemployed in that month by 0.7, and an additional year of schooling increases this number by 0.06.

Findings from this study not only shed light on the causal relationships between education and individuals' adaptability, but also contribute to the growing literature on the private and social benefits of education. Further, this study bears several implications for public policy. First, it provides empirical evidence that supports education as an effective means to enhance adaptability, a valuable characteristic in a changing labour market. Second, to the extent that education improves adaptability, the private and social benefits of education may be understated by standard outcome measures (e.g., earnings). Third, it lends support to the case for education as a "preventative" alternative to government-sponsored adjustment assistance policies, which are often based on a "repair shop" model that deals with problems ex post.

## 1 Introduction

The labour market in Canada has been characterized by dramatic structural changes in recent decades, partly due to technological change, globalization, and the increasingly competitive world economic environment. Workers' adaptability to the changing environment has become increasingly important for both individuals' labour market success and the efficiency of the overall labour market. Whether displaced or unemployed workers are able to adjust efficiently to adverse employment shocks is critical to not only their own welfare, but also the maintenance of healthy communities and efficient allocation of labour resources. As a consequence, building a workforce that can effectively adjust to changing circumstances has acquired heightened status on the policy agenda. A recent federal government report, for instance, states that "Countries that succeed in the 21st century will be those with citizens who are creative, adaptable and skilled" (Human Resources Development Canada, 2002, p.5). Individuals' adaptability was thus chosen as the target of investigation for this study. In particular, we seek to explore the causal effects of education on individuals' adaptability to employment shocks.

A large body of previous research has shown that education exerts substantial impacts on a variety of labour market outcomes, such as earnings and employment opportunities, as well as non-market outcomes, such as health, longevity, civic participation, and involvement in criminal activity (Grossman, 2005; Riddell, 2007). Some scholars have speculated that education may also enhance adaptability. Blinder (2006), for example, suggests that "…more schooling probably makes workers more flexible and more adaptable to change…." Empirical studies on the relationship between education and adaptability, however, have been rather limited.[1] Earlier studies are also largely qualitative in nature and often based on indirect measures of adaptability. Moreover, to our knowledge there has been no prior research that has established a causal link between education and adaptability.

Several previous studies have noted that education may influence adaptability. Drawing upon sociological and psychological literatures, Fullan and Loubser (1972) identify various dimensions of adaptive skills, and analyze qualitatively the relationship

[1] See Schultz (1975) for a survey of early studies.

between education and each dimension of adaptive capacity.[2] They conclude that education may have differential effects on different dimensions of adaptive skills and that its overall impact is ambiguous. Globerman (1986) focuses on individuals' adaptability to technological change, and concludes that formal education enables individuals to learn efficiently on the job and therefore enhances workers' adaptability to technological change. The evidence reviewed by Globerman, however, is mostly indirect and qualitative.

The lack of empirical research on the relationship between education and adaptability is partly attributable to the fact that adaptability is not directly observable and can only be inferred indirectly from observed behaviour. Lacking measures of adaptive skills, most studies on this topic rely on indirect evidence to test the hypothesis that individuals with higher levels of education possess stronger adaptive skills (Bartel & Litchenberg, 1987; Khaldi, 1975; Nelson & Phelps, 1966; Shultz, 1964, 1975; Welch, 1970, 1973). Bartel and Litchenberg (1987), for instance, find that the relative demand for educated workers declines as capital stock (and presumably the technology embodied therein) ages, which provides indirect evidence that highly-educated workers have a comparative advantage with respect to adjustment to and implementation of new technology.

Given that the construct of adaptability is multi-dimensional, in this study we construct two alternative measures of adaptability based on the adjustment process of unemployed individuals. Specifically, we assess the extent to which education influences both re-employment success and job search intensity for unemployed workers. As a major adverse employment shock, unemployment is a costly and damaging event for most people (Farber, 2005). How efficiently unemployed workers adapt to the changing environment directly determines re-employment success. Therefore, obtaining re-employment conditional on previously being unemployed is a suitable measure of an individual's adaptability.

[2] Fullan and Loubser (1972) conceptualize the two major dimensions of adaptive capacity as the capacity for variation (i.e., the ability to generate new ideas and alternative solutions to problems) and the capacity for selective retention (i.e., the ability to evaluate and consequently select and apply new ideas to the solution of problems). The capacity for variation has three further dimensions: ability to retrieve information from memory, flexibility, and openness to new experiences.

Another adaptability measure that we use is job search intensity. An individual's job search intensity during unemployment, such as the number of job search strategies used, reflects the individual's capacity for variation, i.e., the ability to generate new ideas and alternative solutions to problems, which is conceptualized as one of the two major dimensions of adaptive capacity by Fullan and Loubser (1972). Therefore, we examine the causal effects of education on job search intensity as an alternative measure of adaptability. Moreover, a number of studies on re-employment have demonstrated the crucial role of job search behaviour for re-employment (Claussen, 1994; Eden & Aviram, 1993; Schaufeli & Van Yperen, 1993). Our investigation of the effects of education on job search intensity thus may help illuminate the mechanism through which education enhances the probability of re-employment.

One methodological challenge to our research is that the positive correlations between education and adaptability that we expect to observe are likely to be confounded by the endogeneity of education, and thus do not necessarily reflect the true causal effects of education on adaptability. In particular, positive associations between education and adaptability could arise because of unobserved factors that are correlated with both measures. For example, those with more innate ability may acquire more education and more readily adapt to changing circumstances. Similarly, individuals from advantaged backgrounds with well-connected social networks are likely to enjoy better and more employment/re-employment opportunities and also likely to acquire more schooling. Therefore, positive (partial) correlations between the probability of re-employment and education based on ordinary least squares (OLS) estimates may overestimate the effects of education on re-employment and fail to reveal the true causal link between the two.[3]

To overcome the endogeneity of education problem, we make use of historical changes in compulsory school laws as instrumental variables for education. Based on data from the Canadian Census and the Labour Force Survey (LFS), we find that education both significantly improves re-employment opportunities and exerts significant positive impacts on job search intensity for the unemployed. Given the general consistency in findings across different data sets and alternative measures of adaptability

[3] Surveys by Card (2001) and Griliches (1977) discuss the endogeneity of education and the potential biases of OLS estimates in the context of estimating the return to schooling.

to employment shocks, our results provide empirical support for the hypothesis that there exists a causal link between education and adaptability to employment shocks.

Findings from this study not only shed light on the causal relationships between education and individuals' adaptability, but also contribute to the growing literature on the private and social benefits of education. Further, this study bears several implications for public policy. First, it provides empirical evidence that supports education as an effective means to enhance adaptability, a valuable characteristic in a changing labour market. Second, to the extent that education improves adaptability, the private and social benefits of education may be understated by standard outcome measures (e.g., earnings). Third, it lends support to the case for education as a "preventative" alternative to government-sponsored adjustment assistance policies, which are often based on a "repair shop" model that deals with problems ex post. As is believed to be the case with health care, preventative strategies may be more efficient than "repair shop" strategies in addressing labour market challenges.

The remainder of the paper is organized as follows. In Section 2, we review two areas of research related to our study, i.e., education's effects on re-employment and its effects on job search intensity. In Sections 3 and 4, we report and discuss empirical results on the effects of education on the two alternative measures of adaptability: probability of re-employment conditional on being unemployed in the previous period and job search intensity. We conclude the paper in Section 5.

## 2 Prior Research on the Effects of Education on Re-employment and Job Search Intensity

The relationship between education and the probability of re-employment or leaving unemployment can be readily analyzed using a job search model. According to the theory of unemployment duration, the probability of leaving unemployment in any period equals the product of the probability of receiving an offer and the probability of this offer exceeding the reservation wage. Lancaster and Nickell (1980) classify the variables affecting the probability of an individual leaving unemployment into four main categories, i.e., personal characteristics, local labour demand, family composition, and income variables. Personal characteristics (e.g., education) and local labour demand are

believed to influence the probability of receiving a job offer in any period given a particular distribution of possible wages. Family composition may also affect the job offer probability because being married, for example, may be seen as a signal of reliability. Meanwhile, family composition may also affect the supply side since family needs may influence the period during which the head of a household can afford to remain jobless. Finally, income variables are potentially important determinants of whether a job offer will be accepted or not.

Using UK data, Nickell (1979) analyses the relationship between education and unemployment incidence and the relationship between education and unemployment duration. He finds that each year of schooling up to 12 years reduces the expected duration of unemployment by over 4%. The acquisition of some qualifications at Ordinary levels or above reduces the expected unemployment duration by 12%. Focusing on the post-displacement adjustment process, Farber (2005) finds that job losers with higher levels of education have higher post-displacement employment rates and are more likely to be re-employed full-time. Mincer (1991) similarly demonstrates shorter duration of unemployment for more educated workers.

In a job search model, more educated workers have an incentive to spend more resources in order to shorten the period of unemployment, which is more costly in terms of foregone earnings to them than to less educated workers. Evidence on greater job search intensity of more educated workers is available in Barron and Mellow (1979), Yoon (1981), and Zuckerman (1982), studies based on Bureau of Labor Statistics surveys of unemployed workers. Using data from the National Longitudinal Survey, Holzer (1988) finds that more educated young unemployed workers use a greater variety of job search methods than their less educated counterparts, and that the diversity of job search methods is negatively related to the duration of unemployment. Mincer (1991) provides evidence that more educated workers are more efficient in acquiring and processing job search information, and that firms and workers search more intensively to fill vacancies for more skilled workers.

However, the positive correlations between education and efficient post-displacement or post-unemployment adjustment found in the above studies are likely to be confounded by the endogeneity of education, and thus do not necessarily represent

true causal effects of education. In particular, the positive associations between education and adaptability could arise because of unobserved factors that are correlated with both variables. Our study advances this line of research through the use of instrumental variables derived from data on compulsory schooling laws in order to examine the causal link between education and re-employment as well as that between education and job search intensity.

## 3 The Effects of Education on Re-employment

This section presents empirical evidence on the causal effects of education on the probability of re-employment based on data from both the Canadian Census and the Labour Force Survey. Given that our aim is to determine whether education has any causal role in the post-unemployment adjustment process rather than to determine the magnitude of its effect relative to the effects of other factors, we restrict our analytic model to a simple, reduced form specification without developing a structural model of the re-employment process.

### 3.1 Results from the Canadian Census

#### Data and Measures

One data source for this study is the Canadian Census Public Use Microdata Files, in particular, the 1981, 1986, 1991, 1996, and 2001 Census data.[4] We pooled together the five Census years as a cross-sectional data set for empirical analysis. The Census provides information about each respondent's current labour market status as of the reference week, as well as information about labour market activities in the previous year. Because it provides both retrospective (previous year) and contemporaneous (survey week) information for the same individual, the census has a longitudinal dimension that we exploit in this paper. We define an individual as having experienced unemployment in the previous year if he/she did not work for the full previous calendar year but has recent work experience, as indicated by having worked during the previous calendar year.[5] Having recent labour market attachment is a strong indication that those

[4] There was no measure of unemployment status available in 1971 or 1976 census.

[5] There is strong evidence that -- contrary to survey instructions -- a considerable number of full-year workers excluded their paid vacation or sick leave when reporting their weeks worked in the previous year.

who did not work during part of the previous year were searching for jobs. Based on the census data, we create a measure of adaptability to employment shocks as the probability of being re-employed at the time of the survey conditional on being unemployed in the previous year.[6] This conditional probability is the dependent variable in our empirical analyses.

Following Ferrer and Riddell (2002), we measure years of completed education based on three factors: (i) highest grade of elementary or secondary school ever attended (maximum 13); (ii) years of education completed at university; and (iii) years of schooling ever completed at an institution other than a university, high school, or elementary school.[7] The total number of years of schooling is the sum of these three components.[8]

We restrict the sample to those aged 20-64 and born in Canada. Because our empirical analyses focus on transitions from unemployment to employment, we further restrict the sample to those who were unemployed in the previous year. The resulting sample size is 458,641. As shown by the sample descriptive statistics in Table 1, 75% of those unemployed in the previous year became re-employed as of the census reference week. The average number of years of schooling completed by respondents in our sample is 12.8 and 70% of our sample had graduated from high school.

**Ordinary Least Squares Estimates**

We begin by reporting ordinary least squares (OLS) estimates of the impact of education on the probability of re-employment conditional on being unemployed in the previous year. Since the distribution of years of schooling is concentrated around 12 to 13 years, with a small percentage of individuals having eight years of schooling or less, we used

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Therefore, we follow the advice of Statistics Canada and classify an individual as a full-year worker if the number of reported weeks worked was 49 or more.

[6] Starting from the 1991 Census, one cannot distinguish between paid and unpaid workers based on the class of worker variable. Therefore, in our analyses, re-employed individuals refer to all employed workers.

[7] Years of education completed at university is capped at six or more in the public use file, while years of schooling ever completed at an institution other than a university, high school, or elementary school is capped at four or more. Thus the maximum number of years of completed schooling is 23, and for those who did not attend a non-university post-secondary institution, the maximum number of years of education is 19.

[8] The census public use file reports highest grade of elementary or secondary school ever attended in two categories for those with less than nine years of schooling: (i) less than five years and (ii) five to eight years. For each category, we took the mid-point (2.5 and 6.5 years respectively) in our analyses. For individuals who reported less than one year of university or non-university post-secondary education, we assigned 0.5 year of schooling.

eight years of schooling or less as the base category and regressed the probability of re-employment on the complete set of years of schooling dummies.[9] The regression also controls for survey year, province/territory, census metropolitan area (CMA) (i.e., Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, census family size, and language.

Based on the coefficient estimates on the complete set of schooling dummies, Figure 1 displays how education affects the probability of re-employment at each schooling level.[10] It shows a steady increase in the probability of re-employment as schooling increases from 9 to 19 years. There is a particularly large jump in the re-employment rate between 11 and 12 years of schooling, consistent with high-school completion having an additional effect on the probability of re-employment. The partial relationship is otherwise approximately linear up to 19 years of schooling.

We conducted the same analysis for each census in addition to analyzing the pooled census data. The effects of education on re-employment are consistent across different census years. For censuses taken in 1986 and later, we further controlled for minority status and aboriginal status, variables that were not available in the 1981 Census. The results are very similar to those from analyses without these two control variables.

In addition to the above analyses where schooling was represented as a set of dummy variables, we also conducted analyses where the main independent variable is a dummy for high-school graduation or the number of years of schooling. OLS results from these additional analyses are presented in Tables 2 and 3 respectively. As shown in Table 2, graduating from high school is associated with a 7.6% increase in the probability of re-employment conditional on being unemployed in the previous year. Table 3 reveals that an additional year of schooling is associated with a 1.3% increase in the probability of re-employment. The estimation results not reported in the tables further indicate that males,

[9] To create dummy variables for each level of schooling, a half year of schooling was counted as one year. Because the percentage of the population reporting more than 18 years of schooling was only 3.7%, we used the dummy variable for 19 years of schooling to cover all of those having more than 18 years of schooling.

[10] The estimates shown are for the base category (see notes to Figure 1). Alternative choices of the base characteristics shift the intercept up or down but do not alter the slope.

married people, people aged 35 to 49, CMA residents, and people with a smaller family size are more likely to locate a new job after unemployment than are others.

### 3.1.3 Instrumental Variable Estimates

The OLS estimates just presented are consistent with the hypothesis that education increases the probability of re-employment after being unemployed. These estimates, however, may reflect the effects of unobserved individual characteristics that influence both the probability of re-employment and schooling choices. Therefore, the positive correlations between the probability of re-employment and education as shown by the OLS estimates may overestimate the effects of education on re-employment and fail to reveal the true causal link between the two. It is also possible that the OLS estimates could underestimate the effect of education on re-employment, for instance, due to the existence of measurement error in educational attainment.

To address the endogeneity of education problem, we use changes in compulsory schooling laws over time and across jurisdictions to instrument for schooling. Changes in these laws have been shown to have significant effects on educational attainment, and have been a commonly-used instrument for education (see, for example, Acemoglu & Angrist, 2000; Lochner & Moretti, 2004; Milligan, Moretti & Oreopoulos, 2004; and Oreopoulos, 2003, 2006a).

Using the compulsory schooling laws data compiled by Oreopoulos (2003, 2006a), we first create five indicator variables to indicate whether the youngest school leaving age is 12, 13, 14, 15, or 16, and then another three indicator variables to indicate whether the oldest school entry age is 6, 7, or 8. The linkage between the census data and data on compulsory schooling laws is established based on the birthplace of each individual and the year when the individual turned 14 for matching school leaving age or the year the individual turned 6 for matching school entry age.[11] Schmidt (1996) finds that the effects of compulsory schooling laws in the U.S. were largest when matched to individuals at age 14. Acemoglu and Angrist (2000), Lleras-Muney (2002), Schmidt (1996), and Goldin and Katz (2003) adopt the same procedure in their studies based on

[11] Individuals having moved across provinces before age 6 were mismatched for both the school leaving age and school entry age while individuals having moved across provinces between age 6 and age 14 were mismatched for the school leaving age. Because changes in compulsory schooling laws were unlikely to cause people to move across provinces, this should not cause significant bias in our estimates for the whole sample.

the U.S. data, while Oreopoulos (2003, 2006a) adopts the same procedure when analyzing Canadian data.

We also construct a variable for the difference between the youngest school leaving age and the oldest school entry age, which corresponds to the number of years spent in school for an individual who waited to enter school until reaching the required school entry age and who left school immediately after reaching the school leaving age. Acemoglu and Angrist (2000), Lleras-Muney (2002), and Oreopoulos (2003, 2006a) use a similar instrumental variable based on the number of mandatory school years in their research.

Relying on the instrumental variables thus created, we estimate the causal effects of high-school graduation and years of schooling on individuals' adaptability to employment shocks, measured as the probability of re-employment conditional on being unemployed in the previous year. Identification of the causal effects of education is based on changes over time in the youngest school leaving age and oldest school entry age in a given province as well as variations in compulsory schooling laws across provinces. The identifying assumption is that conditional on birthplace, cohort of birth, and survey year, the timing of the changes in compulsory schooling laws within each province is orthogonal to unobserved characteristics that affect schooling choices, such as ability and family background.

Ideally, we would like to estimate a general model where the effect of education on the probability of re-employment varies across years of schooling. This is not empirically feasible, however, because the instruments we use are limited in both the range of schooling years affected and the amount of actual variation. In fact, it is not possible to use two-stage least squares (2SLS) to estimate a model of the probability of re-employment that is linear in years of schooling with a separate "sheepskin" effect of high-school graduation. Therefore, for the instrumental variable analysis we use years of schooling or a dummy for high-school graduation as the main independent variable.

Tables 2 and 3 present the 2SLS estimates of the impact of education on the probability of re-employment using specifications identical to those used to obtain the OLS estimates. Column (1) in the upper panels of Tables 2 and 3 reports the coefficient estimates for the effects of different school leaving ages and school entry ages on

educational attainment. The base categories are those with school leaving age of 12 or 13 and those with school entry age of 8. In column (2) in Tables 2 and 3 we also report results using the number of mandatory school years variable as the sole instrument for schooling.

The first-stage results indicate that, in general, the more stringent the compulsory schooling legislation, the higher the probability of high-school graduation and the more years of schooling completed. Table 2 shows, for example, that individuals who lived in provinces requiring the youngest school leaving age to be 15 when they were 14 years of age were 11.4 percentage points more likely to have completed high school by the time of the survey compared with individuals living in provinces requiring the youngest school leaving age to be 13 or less when they were age 14 (the excluded category). Individuals who lived in provinces requiring the oldest school entry age to be six when they were six years of age were 3.3 percentage points more likely to have completed high school by the time of the survey compared with individuals who lived in provinces requiring the oldest school entry age to be eight when they were age six (the excluded category).

In addition, Table 3 indicates that the average years of schooling completed was 0.55 years higher with a youngest school leaving age of 14 compared with 13 or less. Raising the youngest school leaving age from 14 to 15 generated an increase in years of schooling by almost an additional year.[12] Moreover, the first-stage results listed in Column (2) in Tables 2 and 3 show that a one-year increase in the number of mandatory school years would increase the probability of high-school graduation by 1.6 percentage points and increase educational attainment by 0.13 years. These results are similar to those obtained in Oreopoulos (2006a).

To assess the adequacy of the instrumental variables, we performed F-tests for exclusion of instruments in the first-stage regression.[13] As shown in Column (1) in the upper panels of Tables 2 and 3, when the five indicator variables for school leaving age and school entry age were used as the instruments for schooling, the F-statistic was 27.2 with high-school graduation as the endogenous variable and 56.8 with years of schooling

[12] One thing to note is that raising the school leaving age from 15 to 16 may lower educational attainment. Oreopoulos (2006a) provides detailed explanations for such an anomaly.

[13] The existing econometric literature defines weak instruments based on the strength of the first-stage equation (Bekker, 1994; Staiger & Stock, 1997; Stock & Yogo, 2003).

as the endogenous variable, which suggests strong correlations between the instruments and schooling. Both test statistics are well above the critical values for weak instruments recommended by Stock and Yogo (2003). When the number of mandatory school years variable was used as the instrument for schooling, the F-statistic was 78.8 with high-school graduation as the endogenous variable and 44.7 with years of schooling as the endogenous variable. Therefore, our instruments should be reasonably strong.

The bottom panels of Tables 2 and 3 report instrumental variable estimates of the effects of high-school graduation and years of schooling, respectively, on the probability of re-employment conditional on being unemployed in the previous year. Results in Column (1) are based on analyses using the five indicator variables for school leaving age and school entry age; results in Column (2) are based on analyses using the number of mandatory school years variable as the sole instrument for schooling. Irrespective of the instruments used, the IV estimates are consistently higher than the OLS estimates, although the differences between the two sets of estimates are not always statistically significant. We discuss the implications of the differences between the OLS and IV estimates later in the paper.

The IV coefficient for high-school graduation is 0.27 when the five indicator variables for school leaving and entry ages are used as the instruments and 0.24 when the number of mandatory school years variable is used as the instrument. The IV coefficient for years of schooling is 0.02 when the five indicator variables for school leaving and entry ages are used as the instruments and 0.03 when the number of mandatory school years variable is used. All of these IV estimates are significant at the .01 level. They imply that graduating from high school increases the probability of re-employment conditional on being unemployed in the previous year by around 24 to 27 percentage points. An additional year of schooling increases this probability by around 2 to 3 percentage points.

To check for the robustness of the findings, we conduct the same analyses with a more restrictive measure of unemployment based on the receipt of Employment Insurance (EI) (known as Unemployment Insurance until 1996) benefits. We define an individual as having experienced unemployment in the previous year if he/she did not work for the full year and received EI benefits in the previous year. Compared with the

measure of unemployment based on work activity in the previous year, the measure of unemployment based on EI benefits receipt is arguably narrower as not all unemployed workers receive EI benefits. Moreover, EI receipt tends to be under-reported in survey data. The results based on this more restrictive measure of unemployment, however, are very similar to those based on the measure of unemployment described earlier in the paper.[14]

### 3.2 Results from the Labour Force Survey

#### 3.2.1 Data and Measures

Another data set used in this study is the Labour Force Survey (LFS) covering the period 1976-1996, which provides rich information on labour market activities each month over two decades. In the LFS, each respondent remains in the sample for six consecutive months. In each month, approximately one sixth of the sample exits from the survey and is replaced by an incoming rotation group. The rotation group feature of the LFS makes it possible to link individuals longitudinally across the six months that respondents remain in the survey.

For this study, we make use of an augmented LFS data file that contains the public use data on each respondent in each month as well as the respondent's labour force status (i.e., employment, unemployment, or out-of-the labour force) in all subsequent months that the respondent remains in the survey. We pooled together the monthly surveys over the period 1976-1996 as a cross-sectional data set for empirical analysis. For each respondent who was unemployed in the first month of the survey, we measure adaptability in terms of the probability of re-employment, either full-time or part-time, in each of the remaining five months before the respondent exits the survey. In addition, we examine the probability of full-time re-employment in each of the remaining months in the survey.

In January 1990, the LFS revised the questions used to measure educational attainment. In both the original and the revised questionnaires, the questions about education were asked in two parts: number of years of primary and secondary schooling and post-secondary education. Starting in January 1990, however, the question on the

[14] Due to space limitation, we do not report the results from analyses where unemployment is measured based on EI benefits receipt. These results, however, are available upon request from the authors.

number of years of primary and secondary schooling completed was replaced by a question on the highest grade completed and the response categories were reduced from six to three. A new question was added on whether or not the respondent graduated from high school. Moreover, the response categories for post-secondary education were increased from three to six.

For this study, we constructed three measures of educational attainment: a set of dummy variables for five educational levels according to the LFS coding; high-school graduation; and number of years of schooling. The five education levels represented by the set of dummy variables are as follows: 0 to 8 years; some secondary or high-school graduate; some post-secondary; post-secondary certificate or diploma; and university degree. Because no information is available on whether the respondent had graduated from high school in surveys administered before 1990, we defined "high-school graduation" as equivalent to "number of years of schooling equals or exceeds 12."

The LFS reports number of years of or highest grade of elementary and secondary school ever completed or attended in three categories for those with 13 years of schooling or less: (i) less than 9 years, (ii) 9 to 10 years, and (iii) 11 to 13 years. For each category, we take the mid-point (4, 9.5, and 12 years respectively) in our analysis. For individuals who report some post-secondary education, we assign 14 years of schooling. For individuals holding a post-secondary certificate or diploma, we assign 15 years of schooling. For individuals holding a university degree, we assign 16 years of schooling. For individuals with a graduate degree (available in post-1990 data), the years of schooling is set to be 18.

We restrict the sample to those aged 20-64. Since each "birth cohort" (i.e. individuals who are in their first month in the LFS) is a representative sample of the Canadian labour force, we further restrict the sample to those in their first month of rotation at the time of the survey. Moreover, because our empirical analysis focuses on transitions from unemployment to employment, we restrict the sample to those who are unemployed job searchers in their first month of participation in the survey. Among unemployed workers, those who are temporarily laid-off and those who are waiting for

the start of a new job probably exhibit different behaviour from unemployed searchers.[15] Therefore, we drop those individuals from our sample.

The resulting sample size is 249,330, of whom 24% became re-employed and 19% became re-employed full-time by the sixth month of their stay in the survey (see Table 4 for sample descriptive statistics). In the first month of rotation, the average duration of unemployment for our sample is 20.9 weeks, the average number of years of completed schooling is 11.3, and 64% of our sample has a high-school degree.

### 3.2.2 Ordinary Least Squares Estimates

We begin by using OLS to assess the impact of education on the probability of re-employment in each of the remaining five months of rotation conditional on being unemployed in the first month of rotation. Since a very small percentage of individuals had eight years of schooling or less, we use eight years of schooling or less as the base category and regress the probability of re-employment on a set of educational attainment dummies. The regression also controls for survey year, survey month, province of residence, CMA (Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, duration of unemployment, and economic family size.

OLS results based on LFS data are similar to those obtained earlier with census data. The estimated effects of education on the probability of re-employment and full-time re-employment are consistent across the second to the sixth month of rotation. Due to space limitations, we only report the results for the effects of education on the probability of re-employment and full-time re-employment in the sixth month of rotation conditional on being unemployed in the first month of rotation.[16] As shown in Figure 2, there is a steady increase in the probability of re-employment with an increase in schooling level as represented by the set of educational attainment dummies. For the probability of full-time re-employment, there is a pronounced jump when educational attainment increases from some post-secondary to post-secondary certificate or diploma.

[15] Those on temporary layoff and with a job to start in the near future are not required to be searching for work in order to be classified as unemployed. These two groups also have much higher transition rates into employment than unemployed job searchers (Jones & Riddell, 1999, 2006).

[16] The results on the effects of education on the probability of re-employment and full-time re-employment in other months are available from the authors by request.

The first columns in Tables 5 and 6 present the OLS estimates of the effects of high-school graduation and years of schooling respectively on the probability of re-employment and full-time re-employment. The estimates in Table 5 suggest that graduating from high-school is associated with a 4.7 percentage point increase in the probability of re-employment and a 2.9 percentage point increase in the probability of full-time re-employment conditional on being unemployed five months earlier. Table 6 reveals that an additional year of schooling is associated with a 0.7 percentage point increase in the probability of re-employment and a 0.4 percentage point increase in the probability of full-time re-employment conditional on being unemployed five months earlier. The results also indicate that males, married people, people with a larger family size, and those with a shorter duration of unemployment have a higher probability of obtaining a new job after unemployment.

### 3.2.3 Instrumental Variable Estimates

In order to estimate the causal effects of high-school graduation and years of schooling on the probability of re-employment with the LFS data, we use the same set of instrumental variables for schooling based on compulsory schooling laws as explained in Section 3.1.3. Because the LFS does not report the birthplace of the respondents or the province of residence when the respondents turned 6 or 14, we need to rely on the respondents' current province of residence at the time of the survey in linking LFS data with data on the compulsory schooling laws. Although this might introduce some measurement error into our instrumental variables, previous studies suggest that such measurement error is not likely to seriously affect the instrumental variable estimates (Milligan, Moretti & Oreopoulos, 2004).

Another difficulty in linking LFS data with data on compulsory schooling laws is that LFS public use data only reports the five-year age group instead of the exact age of each respondent. We therefore use the mid-point of the age group that a respondent belonged to as the age of the respondent at the time of the survey. For example, if a respondent belonged to the 25 to 29 age group, we would assume that her age was 27. We also tried using the lower bound of an age group as the age of each respondent and obtained similar results.

The upper panels of Tables 5 and 6 present the coefficient estimates for the effects of different school leaving ages and school entry ages as well as the number of mandatory school years on educational attainment. Similar to the results based on Census data, the more stringent the compulsory schooling legislation, the higher the probability of high-school graduation and the more years of schooling completed. When the five indicator variables for school leaving and entry ages were used as the instruments, the F-statistic for exclusion of instruments in the first-stage regression was 36.4 with high-school graduation as the endogenous variable and 52.9 with years of schooling as the endogenous variable, which suggests a strong correlation between the instruments and schooling. When the number of mandatory school years variable was used as the instrument, the F-statistic for exclusion of instruments in the first-stage regression was 25.0 with high-school graduation as the endogenous variable and 34.5 with years of schooling as the endogenous variable. Therefore, our instruments should be reasonably strong.

The bottom panels of Tables 5 and 6 present the instrumental variable estimates of the effects of high-school graduation and years of schooling respectively on the probability of re-employment and the probability of full-time re-employment in the sixth month of rotation conditional on being unemployed in the first month of rotation. When examining the probability of re-employment using the five dummy variables for the school leaving and entry ages, the IV coefficients are 0.156 for high-school graduation and 0.015 for years of schooling. Both estimates are higher than the corresponding OLS estimates and significant at the .01 level. These estimates imply that graduating from high school increases the probability of re-employment in the sixth month of rotation conditional on being unemployed in the first month by about 16 percentage points. An additional year of schooling tends to increase such probability by 1.5 percentage points. When the number of mandatory school years variable is used as the sole instrument for schooling, however, the IV coefficients are much smaller and not significant.

The 2SLS estimates of the effects of schooling on the probability of full-time re-employment are very similar to those of the effects of schooling on the probability of re-employment. Specifically, graduating from high school increases the probability of full-time re-employment in the sixth month of rotation conditional on being unemployed in

the first month by about 14 percentage points. An additional year of schooling increases this probability by 1.4 percentage points.

## 4 The Effects of Education on Job Search Intensity

Job search intensity is not only a good indicator of individuals' adaptability to employment shocks, but also a potential mechanism through which education may increase the probability of re-employment following unemployment. In this section, we present our estimates of the causal effects of education on job search intensity.

### 4.1 Data and Measures

Our analysis of job search intensity employs LFS data over the period 1976 to 1996. We first assess the causal links between education and job search intensity in each of the six months of rotation respectively. The analytic sample is thus restricted to those in their first month of rotation in the sample and is identical to that used for analyzing the effects of education on re-employment with the LFS data as described in subsection 3.2.1. The LFS provides rich information on the methods that the respondents used in job search following unemployment, such as checking with public employment agency, checking with employers directly, contacting relatives, looking at advertisements, placing or answering advertisements, or other methods. Based on the LFS data, we create a variable for the total number of job search methods used for each of the six rotation months conditional on being unemployed in that month.[17] One thing to note is that the sample size changes across months because some of those who were unemployed in their first survey month subsequently become employed or exit the labour force. We also pool together all unemployed individuals in the LFS regardless of their month of rotation to assess the effects of education on job search intensity, which results in a sample size of 1,221,063.

### 4.2 Ordinary Least Squares Estimates

The OLS results using three alternative measures of educational attainment (i.e., a set of dummy variables for schooling levels, a dummy for high-school graduation, and the number of years of schooling) show consistently positive and significant impacts of

[17] Eriksson, Lilja, and Torp (2002) measure job search intensity by both the total number of job search methods used and the time spent on job search, the latter of which is not available in LFS.

education on job search intensity, based on the sample of unemployed individuals in their first month of rotation. As shown in Figure 3, there is a steady increase in job search intensity with an increase in schooling level as represented by the set of educational attainment dummies. The OLS estimates of the effects of high-school graduation and years of schooling on job search intensity, presented in the first columns in Tables 7 and 8 respectively, also indicate that education exerts consistently significant effects on job search intensity for each of the six months of rotation. The estimates reported in Table 7, for example, suggest that graduating from high-school is associated with an increase in the number of job search methods used in the first month of rotation conditional on being unemployed in that month by 0.2. Table 8 reveals that an additional year of schooling increases the number of job search methods used in the first month of rotation by 0.03. The OLS results also indicate that males, people with a smaller family size, and those with a longer duration of unemployment tend to search for jobs more intensively than do other unemployed searchers.

The OLS results based on the sample of all unemployed individuals regardless of their month of rotation are very similar to the above results based on the restricted sample. As presented in the first columns in Tables 9 and 10, graduating from high-school is associated with an increase in the number of job search methods used in a month conditional on being unemployed in that month by 0.2. An additional year of schooling increases the number of job search methods used in a given month by 0.03.

**4.3 Instrumental Variable Estimates**

The instrumental variables used for estimating the causal effects of education on job search intensity with the LFS data are the same as those used previously for assessing education's effects on re-employment with these data. We also use the same specifications as those for estimating education's effects on the probability of re-employment. Therefore, when using the sample restricted to respondents in their first month of rotation, the first-stage results in 2SLS for analyzing job search intensity in the first month of rotation are identical to the results for re-employment provided in Tables 5 and 6. Due to changes in the sample across different months of rotation, the first-stage results for other months' estimations are slightly different from those for the first month's estimation. To save space, we only report the second-stage results on the effects of

education on job search intensity by month of rotation in Tables 7 and 8 without reporting the first-stage results.

As shown in Tables 7 and 8, regardless of the instruments used, the instrumental variable estimates of the effects of high-school graduation and years of schooling respectively on the number of job search methods used in a month conditional on being unemployed in that month are higher than the corresponding OLS estimates and are significant at the .01 level for all months of rotation except the first month. We find that graduating from high school increases the number of job search methods used in the second month of rotation by 0.6 when the five indicator variables for school leaving and entry ages are used as the instruments and 1.3 when the number of mandatory school years variable is used as the instrument. An additional year of schooling increases the number of job search methods by 0.06 when the five indicator variables for school leaving and entry ages are used as the instruments and 0.12 when the number of mandatory school years variable is used as the instrument. The estimated causal effects of education on job search intensity from the third to the sixth month of rotation are similar to those for the second month of rotation. For the first month of rotation, however, the instrumental variable estimates of the effect of education on job search intensity are not significant when the five indicator variables for school leaving and entry ages are used as the instruments, but are significant at the .05 level and larger than the corresponding OLS estimates when the number of mandatory school years variable is used as the instrument.

The results based on the sample of all unemployed individuals regardless of their month of rotation are listed in Tables 9 and 10. The first-stage results shown in the upper panels of Tables 9 and 10 indicate that our instruments should be reasonably strong. When the five indicator variables for school leaving and entry ages are used as the instruments, the F-statistic for exclusion of instruments in the first-stage regression is 42.3 with high-school graduation as the endogenous variable and 59.4 with years of schooling as the endogenous variable. When the number of mandatory school years variable is used as the instrument, the F-statistic for exclusion of instrument in the first-stage regression is 25.9 with high-school graduation as the endogenous variable and 35.1 with years of schooling as the endogenous variable.

The bottom panels of Tables 9 and 10 present the instrumental variable estimates of the effects of high-school graduation and years of schooling respectively on the number of job search methods used in a month conditional on being unemployed in that month. When examining the job search intensity using the number of mandatory school years variable as the sole instrument for schooling, the IV coefficients are 0.7 for high-school graduation and 0.06 for years of schooling. Both estimates are higher than the corresponding OLS estimates and significant at the .01 level. Based on the point estimates, graduating from high school increases the number of job search methods used in a month conditional on being unemployed in that month by about 0.7. An additional year of schooling tends to increase such value by about 0.06. When the five dummy variables for the school leaving and entry ages are used as the instruments, however, the IV coefficients are much smaller and not significant.

The strong positive effects of education on both job search intensity and re-employment success found in our study are consistent with findings from prior research that suggest that job search behaviour plays an important role in re-employment success (Claussen, 1994; Eden & Aviram, 1993; Schaufeli & Van Yperen, 1993). Based on regression results not reported here, we find that job search intensity in a given month exerts significant and positive impacts on the re-employment success in the following month for all months of rotation except for the first month. We also find that controlling for job search intensity in a given month in the regressions tends to diminish the effects of schooling on re-employment success in subsequent months. One useful direction for future research is to investigate to what extent education's effect on re-employment success is mediated through its impact on job search intensity.

## 5 Why Are IV Estimates Higher than OLS Estimates?

The empirical results in this study based on both the Census data and LFS data indicate that the IV estimates are consistently higher than the corresponding OLS estimates, although the difference between the two estimates is not always statistically significant. Thus our results indicate that the causal effect of education on adaptability is at least as large as – and perhaps larger than – would be suggested by standard OLS estimation. Many recent studies of the causal impact of education on earnings have obtained a similar

result (Card, 2001). There are several potential explanations for this result. One is the existence of measurement error in educational attainment, which results in downward bias in the OLS estimates (Griliches, 1977; Card, 2001).[18]

An alternative explanation is that the OLS and IV estimates measure different things in the presence of heterogeneity across individuals in the impacts of additional education. OLS applied to a sample representative of the overall population yields an estimate of the average treatment effect (ATE), which shows the expected benefits of education experienced by an individual chosen at random from the population. IV methods, on the other hand, generally estimate the local average treatment effect (LATE) for the subset of the population who are actually affected by the instruments (Imbens & Angrist, 1994).

In IV estimation using changes in compulsory attendance laws as the instrument, for example, the IV estimates indicate the impact of education on re-employment success for the subset of the population who acquired more schooling than they otherwise would have chosen to acquire as a consequence of the changes in the laws. For this subset of the population, the payoff to incremental investments in education may exceed the average return in the population, as represented by the OLS estimates. This could happen, for example, if the individuals who remained in school longer because of these laws are a subset of the population that faces above-average potential returns from additional schooling.[19] If individuals base their educational choices on the anticipated costs and benefits, this situation could arise because these youths faced above-average costs of additional schooling, perhaps because of an inability to borrow to finance their education, of a need to work to contribute to family income, or because of a greater dislike of school.

[18] If, as is likely, the measurement error in educational attainment is non-classical in nature the OLS estimates and IV estimates may both be biased estimates of the returns to schooling (Kane, Rouse & Staiger, 1999).

[19] Recent studies by Carneiro, Heckman, and Vytlacil (2003) and Oreopoulos (2006b) question the ATE vs. LATE interpretation of the difference between OLS and IV estimates. In the compulsory schooling laws context, Oreopoulos (2006b) investigates whether IV estimates of the returns to schooling often exceed OLS estimates because gains are high only for small and peculiar groups among the more general population. He finds instead that the gains from compulsory schooling are very large no matter whether these laws impact a majority or minority of those exposed to the laws.

Another potential source of heterogeneity in the impacts of education is non-linearity in the relationship between schooling and adaptability. The non-parametric estimates shown in Figure 1 – which allow the relationship between re-employment success and years of schooling to take any shape – suggest that the relationship is concave, so that the impact of an additional year of school is larger at low than at high levels of educational attainment. In these circumstances a linear specification of the relationship – as is assumed in our estimates based on years of schooling – will understate the ATE at low levels of schooling and overstate the ATE at high levels. To examine this possibility we report in Table 11 OLS estimates based on two subsets of the full sample: (i) those with 16 years of schooling or less and (ii) those with 14 years of schooling or less. The OLS estimates based on these restricted samples are larger than those based on the full sample, and the largest OLS estimate is that associated with the most restricted sample. These results are consistent with the presence of diminishing returns to additional years of schooling, and appear to contribute to the gap between the OLS and IV estimates. Indeed, the OLS estimate based on the sub-sample consisting of those with 16 years of schooling or less equals the IV estimate reported in Table 3.

## 6 Conclusions

In a labour market characterized by constant structural changes, adaptability to employment shocks is important for individuals' labour market success as well as the efficiency of the overall market. Studies on whether and how education enhances adaptability have become especially relevant and timely. Previous studies have provided theoretical analyses or indirect evidence on the positive effects of education on individuals' adaptability. Our study contributes to this line of research by empirically assessing the causal effects of education on individuals' adaptability to employment shocks in two dimensions: re-employment success after being unemployed; and job search intensity.

Based on data from the Canadian Census and the LFS, we find that education significantly increases re-employment success for unemployed workers, and that highly-educated individuals tend to adopt more job search strategies than those with less education. Our instrumental variables estimates provide clear evidence that the positive

association between educational attainment and individuals' adaptability to employment shocks cannot be easily explained away by unobserved factors that are correlated with both variables.[20] Several recent studies – such as Lochner and Moretti (2004), Milligan, Moretti, and Oreopoulos (2004) and Oreopoulos (2003, 2006a) find that the increased educational attainment brought about by past changes to compulsory schooling laws had large beneficial effects on the lives of those who would otherwise have dropped out of secondary school at an earlier age. Our results provide further evidence of such benefits from additional high-school education. Our findings of positive causal effects of education on adaptability to employment shocks also lend support to the case for education as a "preventative" type of adjustment assistance policy, in contrast to traditional adjustment assistance programs that deal with problems ex post. As is believed to be the case with health care, preventative strategies may be more efficient than "repair shop" strategies in addressing labour market challenges.

[20] We conducted the same analyses with U.S. data in another project and obtained very similar results on the effects of education on the probability of re-employment following unemployment.

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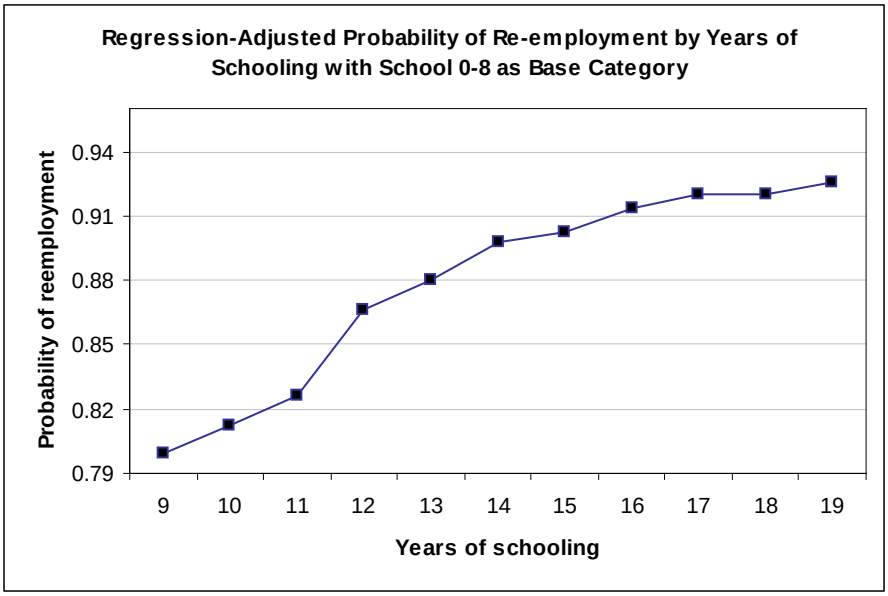
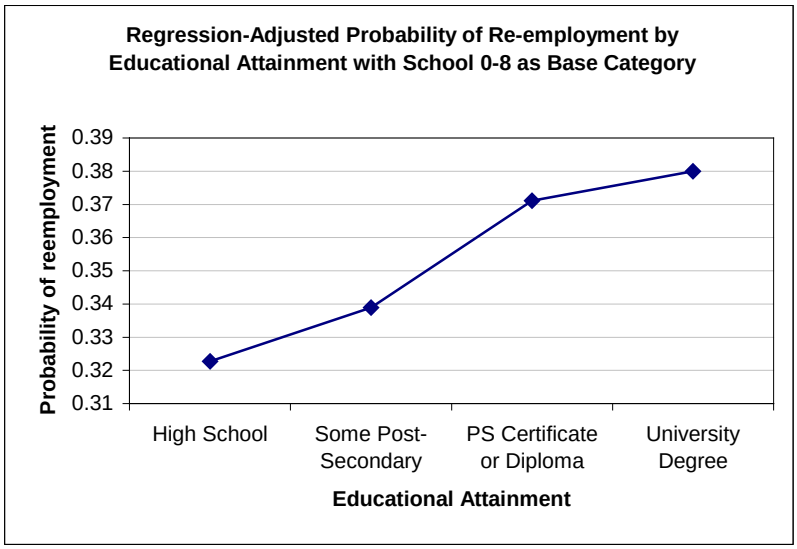
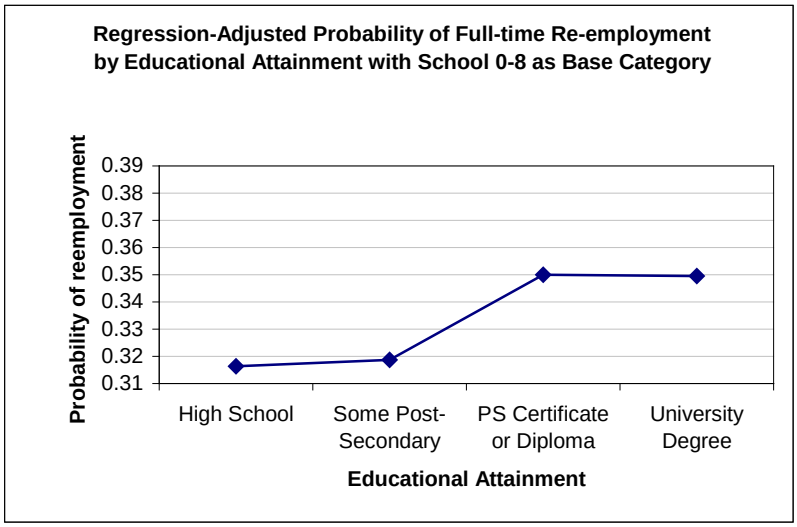
**Figure 1**
**Regression-Adjusted Probability of Re-employment Conditional on Being Unemployed in the Previous Year**
Data source: Canadian Census (1981-2001)
Number of observations: 458,641




Note: Regression-adjusted probabilities of re-employment were obtained by conditioning on survey year, province/territory, CMA (Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, census family size, and language. The graphs display the coefficient estimates on the complete set of schooling dummies. The intercept applies to the base category -- males surveyed in 1981 who were 35 to 39 years of age, had eight years of schooling or less, were married, lived in a CMA other than Toronto, Montreal, or Vancouver, lived in Ontario, and only spoke English at the time of the survey.

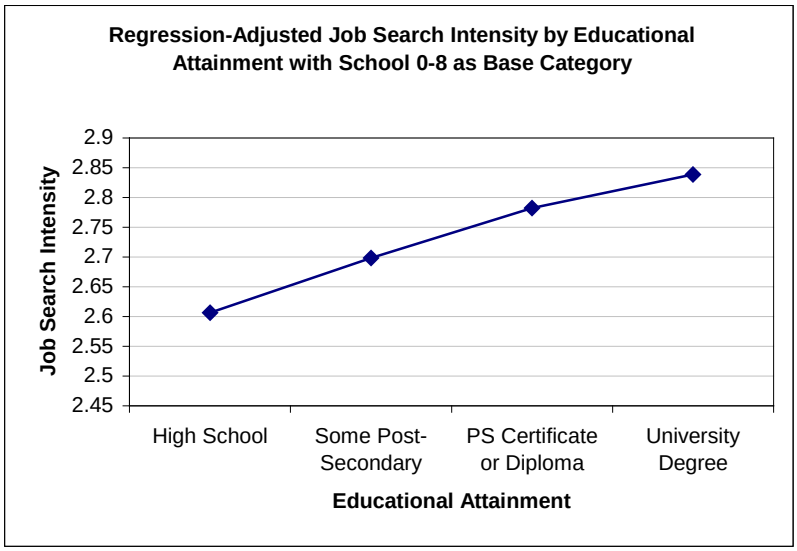
**Figure 2**
**Regression-Adjusted Probability of Re-employment in the Sixth Month of Rotation Conditional on Being Unemployed in the First Month of Rotation by Educational Attainment**
Data source: Labour Force Survey (1976-1996)
Number of observations: 249,330




Note: Regression-adjusted probabilities of re-employment were obtained by conditioning on survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The graphs display the coefficient estimates on the complete set of schooling dummies. The intercept applies to the base category -- males surveyed in January 1976 who were 35 to 39 years of age, had eight years of schooling or less, were married, and lived in Ontario at the time of the survey. All regressions were weighted by the final individual or family weights.

**Figure 3**
**Regression-Adjusted Job Search Intensity in the First Month of Rotation Conditional on Being Unemployed in that Month by Educational Attainment**
Data source: Labour Force Survey (1976-1996)
Number of observations: 249,330




Note: Regression-adjusted job search intensity was obtained by conditioning on survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The graphs display the coefficient estimates on the complete set of dummies for educational attainment. The intercept applies to the base category -- males surveyed in January 1976 who were 35 to 39 years of age, had eight years of schooling or less, were married, and lived in Ontario at the time of the survey. All regressions were weighted by the final individual or family weights.

**Table 1**
**Descriptive Statistics for Canadian Census (1981-2001)**
Number of observations: 458,641

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Re-employment | 0.750 | 0.433 | 0 | 1 |
| Years of schooling | 12.836 | 3.188 | 2.5 | 23 |
| High-school graduation | 0.701 | 0.458 | 0 | 1 |
| 1986 census | 0.170 | 0.375 | 0 | 1 |
| 1991 census | 0.237 | 0.425 | 0 | 1 |
| 1996 census | 0.231 | 0.422 | 0 | 1 |
| 2001 census | 0.224 | 0.417 | 0 | 1 |
| Census family size | 2.916 | 1.403 | 1 | 10 |
| English only | 0.621 | 0.485 | 0 | 1 |
| French only | 0.162 | 0.368 | 0 | 1 |
| English and French | 0.217 | 0.412 | 0 | 1 |
| Male | 0.489 | 0.500 | 0 | 1 |
| Married | 0.587 | 0.489 | 0 | 1 |
| School leaving age | 15.413 | 0.678 | 12 | 16 |
| School entry age | 6.439 | 0.615 | 6 | 8 |
| School leaving age = 12 | 0.002 | 0.045 | 0 | 1 |
| School leaving age = 13 | 1.3E-04 | 0.012 | 0 | 1 |
| School leaving age = 14 | 0.096 | 0.295 | 0 | 1 |
| School leaving age = 15 | 0.386 | 0.487 | 0 | 1 |
| School leaving age = 16 | 0.516 | 0.500 | 0 | 1 |
| School entry age = 6 | 0.627 | 0.484 | 0 | 1 |
| School entry age = 7 | 0.307 | 0.461 | 0 | 1 |
| School entry age = 8 | 0.066 | 0.248 | 0 | 1 |
| Number of mandatory school years | 9.260 | 1.120 | 5 | 10.5 |

**Table 2**
**Estimates of the Effect of High-school Graduation on Probability of Re-employment Conditional on Being Unemployed in the Previous Year**
Data source: Canadian Census (1981-2001)
Number of observations: 458,641

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is high-school graduation*** | | | |
| School leaving age = 14 | | 0.063** | |
| | | (0.015) | |
| School leaving age = 15 | | 0.114** | |
| | | (0.015) | |
| School leaving age = 16 | | 0.108** | |
| | | (0.015) | |
| School entry age = 6 | | 0.033** | |
| | | (0.007) | |
| School entry age = 7 | | 0.007 | |
| | | (0.008) | |
| Number of mandatory school years | | | 0.016** |
| | | | (0.002) |
| *F*-statistic for exclusion of instruments | | 27.17 | 78.82 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is an indicator variable for being re-employed conditional on being unemployed in the previous year*** | | | |
| High-school graduation | 0.076** | 0.268** | 0.238** |
| | (0.002) | (0.060) | (0.074) |

Note: All regressions controlled for survey year, province/territory, CMA (Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, census family size, and language. The robust standard errors corrected for province and year of birth clustering are in parentheses.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 3**
**Estimates of the Effect of Years of Schooling on Probability of Re-employment Conditional on Being Unemployed in the Previous Year**
Data source: Canadian Census (1981-2001)
Number of observations: 458,641

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is years of schooling*** | | | |
| School leaving age = 14 | | 0.549** | |
| | | (0.127) | |
| School leaving age = 15 | | 1.434** | |
| | | (0.118) | |
| School leaving age = 16 | | 1.296** | |
| | | (0.124) | |
| School entry age = 6 | | -0.028 | |
| | | (0.070) | |
| School entry age = 7 | | -0.235** | |
| | | (0.079) | |
| Number of mandatory school years | | | 0.130** |
| | | | (0.019) |
| *F*-statistic for exclusion of instruments | | 56.82 | 44.70 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is an indicator variable for being re-employed conditional on being unemployed in the previous year*** | | | |
| Years of schooling | 0.013** | 0.015** | 0.030** |
| | (0.000) | (0.004) | (0.010) |

Note: All regressions controlled for survey year, Province/Territory, CMA (Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, census family size, and language. The robust standard errors corrected for province and year of birth clustering are in parentheses.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 4**
**Descriptive Statistics for Labour Force Survey (1976-1996)**
Number of observations: 249,330

| Variable | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|
| Re-employ in second month | 0.160 | 0.366 | 0 | 1 |
| Re-employ full time in second month | 0.115 | 0.319 | 0 | 1 |
| Re-employ in third month | 0.217 | 0.412 | 0 | 1 |
| Re-employ full time in third month | 0.163 | 0.370 | 0 | 1 |
| Re-employ in forth month | 0.240 | 0.427 | 0 | 1 |
| Re-employ full time in forth month | 0.185 | 0.388 | 0 | 1 |
| Re-employ in fifth month | 0.246 | 0.431 | 0 | 1 |
| Re-employ full time in fifth month | 0.192 | 0.394 | 0 | 1 |
| Re-employ in sixth month | 0.240 | 0.427 | 0 | 1 |
| Re-employ full time in sixth month | 0.189 | 0.391 | 0 | 1 |
| Search methods in month 1 | 2.093 | 1.096 | 1 | 6 |
| Search methods in month 2 | 1.239 | 1.304 | 0 | 6 |
| Search methods in month 3 | 0.937 | 1.250 | 0 | 6 |
| Search methods in month 4 | 0.741 | 1.170 | 0 | 6 |
| Search methods in month 5 | 0.604 | 1.090 | 0 | 6 |
| Search methods in month 6 | 0.494 | 1.014 | 0 | 6 |
| Years of schooling | 11.320 | 3.574 | 4 | 18 |
| High-school graduation | 0.635 | 0.482 | 0 | 1 |
| Duration of unemployment | 20.899 | 24.121 | 1 | 99 |
| Economic family size | 3.032 | 1.345 | 1 | 5 |
| married | 0.568 | 0.495 | 0 | 1 |
| male | 0.552 | 0.497 | 0 | 1 |
| age | 32.769 | 10.411 | 22 | 62 |
| School leaving age | 15.410 | 0.674 | 12 | 16 |
| School entry age | 6.596 | 0.588 | 6 | 8 |
| School leaving age = 12 | 0.006 | 0.076 | 0 | 1 |
| School leaving age = 13 | 0.001 | 0.026 | 0 | 1 |
| School leaving age = 14 | 0.069 | 0.254 | 0 | 1 |
| School leaving age = 15 | 0.425 | 0.494 | 0 | 1 |
| School leaving age = 16 | 0.499 | 0.500 | 0 | 1 |
| School entry age = 6 | 0.457 | 0.498 | 0 | 1 |
| School entry age = 7 | 0.491 | 0.500 | 0 | 1 |
| School entry age = 8 | 0.053 | 0.223 | 0 | 1 |
| Number of mandatory school years | 8.986 | 1.070 | 5 | 10.5 |

Note: Duration of unemployment was measured in weeks.

**Table 5**
**Estimates of the Effect of High-school Graduation on Probability of Re-employment and Probability of Full-time Re-employment,**
Data source: Labour Force Survey (1976-1996)
Number of observations: 249,330

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is high-school graduation*** | | | |
| School leaving age = 14 | | 0.086** | |
| | | (0.017) | |
| School leaving age = 15 | | 0.197** | |
| | | (0.018) | |
| School leaving age = 16 | | 0.153** | |
| | | (0.016) | |
| School entry age = 6 | | 0.006 | |
| | | (0.011) | |
| School entry age = 7 | | 0.041* | |
| | | (0.018) | |
| Number of mandatory school years | | | 0.014** |
| | | | (0.003) |
| *F*-statistic for exclusion of instruments | | 36.41 | 24.99 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is an indicator variable for being re-employed in the sixth month of rotation conditional on being unemployed in the first month of rotation*** | | | |
| High-school graduation | 0.047** | 0.156** | 0.052 |
| | (0.003) | (0.046) | (0.119) |
| ***Second stage*: *dependent variable is an indicator variable for being full-time re-employed in the sixth month of rotation conditional on being unemployed in the first month of rotation*** | | | |
| High-school graduation | 0.029** | 0.142** | 0.066 |
| | (0.003) | (0.043) | (0.111) |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions were weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 6**
**Estimates of the Effect of Years of Schooling on Probability of Re-employment and Probability of Full-time Re-employment**
Data source: Labour Force Survey (1976-1996)
Number of observations: 249,330

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is years of schooling*** | | | |
| School leaving age = 14 | | 0.732** | |
| | | (0.151) | |
| School leaving age = 15 | | 1.924** | |
| | | (0.153) | |
| School leaving age = 16 | | 1.510** | |
| | | (0.145) | |
| School entry age = 6 | | 0.036 | |
| | | (0.088) | |
| School entry age = 7 | | 0.287* | |
| | | (0.131) | |
| Number of mandatory school years | | | 0.149** |
| | | | (0.025) |
| *F*-statistic for exclusion of instruments | | 52.86 | 34.51 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is an indicator variable for being re-employed in the sixth month of rotation conditional on being unemployed in the first month of rotation*** | | | |
| Years of schooling | 0.007** | 0.015** | 0.005 |
| | (0.001) | (0.004) | (0.011) |
| ***Second stage*: *dependent variable is an indicator variable for being full-time re-employed in the sixth month of rotation conditional on being unemployed in the first month of rotation*** | | | |
| Years of schooling | 0.004** | 0.014** | 0.006 |
| | (0.000) | (0.004) | (0.010) |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions were weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 7**
**Estimates of the Effect of High-school Graduation on Job Search Intensity by Month of Rotation**
Data source: Labour Force Survey (1976-1996)

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***Second stage*: *dependent variable is number of job search methods used in the first month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.218** | 0.075 | 0.691* |
| | (0.007) | (0.106) | (0.326) |
| Number of observations | 249,330 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the second month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.214** | 0.550** | 1.293** |
| | (0.008) | (0.140) | (0.467) |
| Number of observations | 209,544 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the third month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.219** | 0.801** | 2.080** |
| | (0.010) | (0.133) | (0.613) |
| Number of observations | 184,601 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the fourth month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.195** | 0.931** | 2.232** |
| | (0.010) | (0.156) | (0.717) |
| Number of observations | 167,468 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the fifth month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.159** | 0.845** | 2.524** |
| | (0.010) | (0.158) | (0.739) |
| Number of observations | 154,997 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the sixth month of rotation conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.143** | 0.668** | 1.860** |
| | (0.009) | (0.163) | (0.567) |
| Number of observations | 145,882 | | |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions are weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 8**
**Estimates of the Effect of Years of Schooling on Job Search Intensity by Month of Rotation**
Data source: Labour Force Survey (1976-1996)

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***Second stage*: *dependent variable is number of job search methods used in the first month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.034** | 0.008 | 0.064* |
| | (0.001) | (0.010) | (0.030) |
| Number of observations | 249,330 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the second month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.033** | 0.055** | 0.116** |
| | (0.001) | (0.014) | (0.040) |
| Number of observations | 209,544 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the third month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.033** | 0.078** | 0.194** |
| | (0.001) | (0.013) | (0.057) |
| Number of observations | 184,601 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the fourth month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.029** | 0.091** | 0.217** |
| | (0.001) | (0.016) | (0.070) |
| Number of observations | 167,468 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the fifth month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.023** | 0.083** | 0.249** |
| | (0.001) | (0.015) | (0.070) |
| Number of observations | 154,997 | | |
| ***Second stage*: *dependent variable is number of job search methods used in the sixth month of rotation conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.022** | 0.065** | 0.187** |
| | (0.001) | (0.016) | (0.056) |
| Number of observations | 145,882 | | |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions are weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 9**
**Estimates of the Effect of High-school Graduation on Job Search Intensity regardless of Month of Rotation**
Data source: Labour Force Survey (1976-1996)
Number of observations: 1,221,063

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is high-school graduation*** | | | |
| School leaving age = 14 | | 0.076** | |
| | | (0.016) | |
| School leaving age = 15 | | 0.194** | |
| | | (0.017) | |
| School leaving age = 16 | | 0.142** | |
| | | (0.015) | |
| School entry age = 6 | | 0.004 | |
| | | (0.010) | |
| School entry age = 7 | | 0.036* | |
| | | (0.017) | |
| Number of mandatory school years | | | 0.013** |
| | | | (0.003) |
| *F*-statistic for exclusion of instruments | | 42.29 | 25.86 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is number of job search methods used in a month conditional on being unemployed in that month*** | | | |
| High-school graduation | 0.171** | 0.013 | 0.693** |
| | (0.004) | (0.076) | (0.237) |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions are weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 10**
**Estimates of the Effect of Years of Schooling on Job Search Intensity regardless of Month of Rotation**
Data source: Labour Force Survey (1976-1996)
Number of observations: 1,221,063

| | OLS | IV | |
|---|---|---|---|
| | | (1) | (2) |
| ***First stage: dependent variable is years of schooling*** | | | |
| School leaving age = 14 | | 0.646** | |
| | | (0.141) | |
| School leaving age = 15 | | 1.918** | |
| | | (0.145) | |
| School leaving age = 16 | | 1.430** | |
| | | (0.132) | |
| School entry age = 6 | | 0.014 | |
| | | (0.091) | |
| School entry age = 7 | | 0.259 | |
| | | (0.133) | |
| Number of mandatory school years | | | 0.147** |
| | | | (0.025) |
| *F*-statistic for exclusion of instruments | | 59.39 | 35.06 |
| *p*-value | | 0.000 | 0.000 |
| ***Second stage*: *dependent variable is number of job search methods used in a month conditional on being unemployed in that month*** | | | |
| Years of schooling | 0.027** | 0.002 | 0.062** |
| | (0.001) | (0.007) | (0.022) |

Note: All regressions control for survey year, survey month, province of residence, nine age groups (age 20-24, 25-29, and so on), gender, marital status, economic family size, and duration of unemployment. The robust standard errors corrected for province of residence and year of birth clustering are in parentheses. All regressions are weighted by the final individual or family weights.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.

**Table 11**
**OLS Estimates of the Effect of Years of Schooling on Probability of Re-employment Conditional on Being Unemployed in the Previous Year**
Data source: Canadian Census (1981-2001)

| *Variable* | *Sample of individuals with 14 years of schooling or less* | *Sample of individuals with 16 years of schooling or less* | *Full Sample* |
|---|---|---|---|
| Years of schooling | 0.016** | 0.015** | 0.013** |
| | (0.001) | (0.001) | (0.000) |
| Number of observations | 321,969 | 396,764 | 458,641 |

Note: All regressions controlled for survey year, province/territory, CMA (Toronto, Montreal, Vancouver, or other CMA), nine age groups (age 20-24, 25-29, and so on), gender, marital status, census family size, and language. The robust standard errors corrected for province and year of birth clustering are in parentheses.
*Significant coefficient at the 5% level.
**Significant coefficient at the 1% level.