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The Long-term Earnings Impact of Post-secondary Education Following Job Loss

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Symbols

The following standard symbols are used in Statistics Canada publications:

.	not available for any reference period
..	not available for a specific reference period
…	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the Statistics Act
^{E}	use with caution
F	too unreliable to be published

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Abstract

In this study, the long-term impact on earnings of attending post-secondary education institutions following job loss is estimated using a large longitudinal administrative database of Canadian workers. A difference-in-difference model is used for this purpose. The results suggest that, over the period spanning five years preceding and nine years following job loss, workers who attended post-secondary education shortly after displacement saw their earnings increase by almost $7,000 more than displaced workers who did not. Significant benefits are found by sex, age, marital status, and union coverage, with the exception of men aged 35 to 44 years. Despite the benefits of education, job displacement is found to be associated with only a modest increase in post-secondary education attendance for all groups examined.

Executive summary

Between October 2008 and October 2009, the Canadian workforce lost roughly 500,000 paid jobs. As a result, interest in the outcomes of displaced workers has been renewed. While there are several conclusive studies on the earnings consequences of job loss, less is known about the factors which help mediate earnings losses. The current study is devoted to investigating one of these potential factors: training in a post-secondary institution.

The literature on the impact of training on earnings following job loss has generally concluded that training does not raise earnings. There are at least two possible reasons for this conclusion. First, the studies usually assess earnings over a short follow-up period, and may fail to observe longer-term benefits of training. Second, the studies focus on short-term training provided by the US government (outside the formal school setting), which are usually targeted at "disadvantaged" adults, particularly those with low skills and in long spells of unemployment. However, studies that use a different approach (Jacobson, LaLonde, and Sullivan 2005*a* and 2005*b*) estimate substantial returns to one year of college, and show that it takes time for the benefits of training to be realized.

This paper provides the first large-scale, long-term evidence on the utilization and effectiveness of retraining for displaced workers in Canada. The study uses the Longitudinal Worker File (LWF)—an administrative database representing 10% of Canadian workers that allows displaced workers and attendance in post-secondary education to be identified. The LWF allows workers to be followed longitudinally from five years preceding to nine years following job displacement, thereby permitting the analysis of the earnings consequences of training following displacement, as well as the relationship between job displacement and post-secondary training.

The study results indicate that, over the period spanning five years preceding and nine years following job loss, workers who attended post-secondary education shortly following displacement (in the next calendar year) saw their earnings increase by almost $7,000 more than displaced workers who did not. Significant benefits are found by sex, marital status, union coverage, and age, with the exception of men aged 35 to 44 years. However, despite the apparent benefits of education, job displacement is found to be associated with only a modest increase in post-secondary education attendance for all groups examined (about a 1 percentage point increase on a base of roughly 10%).

Overall, the study points to potentially substantial benefits to education for displaced workers. The key issue is whether one can interpret the reported earnings differences as the causal impact of education, or whether the different earnings paths of the treatment and control groups result from non-random selection into post-secondary education. Further analysis should allow for worker-specific trends in earnings, because workers who choose training after displacement may have a different pre-displacement pattern of earnings growth.

1 Introduction

The economic downturn of 2008–2009 resulted in large scale job losses across most of the industrialized world. In Canada, a net loss of almost 500,000 paid jobs was registered between October 2008 and October 2009 according to the Labour Force Survey (LFS)[1]. This represented about 3% of the paid workforce. The downturn has renewed interest in the outcomes of displaced workers. There is a rich research literature documenting the negative outcomes experienced by workers displaced by layoffs or plant closures (e.g., Jacobson, LaLonde, and Sullivan 1993; Morissette, Zhang, and Frenette 2007; Hijzen, Upward, and Wright, 2010).

Faced with job loss, individuals have several options available to them. First, they can search for new employment. Little is known, however, about the effectiveness of job search on re-employment, although de Raaf, Dowie and Vincent (2009) are implementing a social experiment to study this question. Second, displaced workers may create their own job by becoming self-employed. The literature generally finds that some workers are 'pushed' into self-employment (Moore and Mueller 2002). Third, households experiencing a job displacement may respond by adjusting their labour supply. Morissette and Ostrovsky (2008) find that among couples in which husbands were displaced by layoff or plant closure, subsequent earnings gains of wives were 22% as large as the earnings losses of displaced husbands five years after job loss. Fourth, displaced workers—particularly those in older age groups—can withdraw from the labour force (Schirle 2009). And fifth, displaced workers can re-invest in their human capital. This last response is the focus of this study.

The Longitudinal Worker File (LWF), a large administrative database representing 10% of Canadian workers, is used to study the long-term impact of post-displacement training on earnings. Post-displacement training is defined as attendance at a post-secondary educational institution shortly after job displacement. The data follow workers for up to nine years following job displacement and, for comparison purposes, over the five years prior to displacement. The estimation strategy exploits the longitudinal nature of the data by implementing a simple difference-in-difference approach.

As well, the impact of job displacement on post-secondary education attendance is estimated using a two pronged approach. First, a difference-in-difference model is estimated, as in the case of earnings. However, because of data limitations, the time frame for this analysis is somewhat shorter than that for earnings. Specifically, workers are followed from four years before to four years after potential displacement. The possible selectivity of workers who are let go by firms is addressed by focusing on those displaced by mass layoffs and firm closures—events that are likely precipitated by a decline in market product demand rather than individual worker productivity.

The results suggest that, over the period spanning five years preceding and nine years following job loss, workers who took education and training following job loss saw their earnings increase by almost $7,000 more than displaced workers who did not take education or training. Significant benefits are found by sex, marital status, union coverage, and age group, with the exception of men aged 35 to 44 years. Despite the benefits of training, job displacement was found to be associated with only a modest increase in post-secondary education attendance for all groups examined.

In the following section, a review of the literature on the impact of training on earnings is provided. In Section 3, the data are described; in Section 4, the econometric approach used in the study is outlined. Results are presented in Section 5, and Section 6 concludes.

1. Statistics Canada, CANSIM table 282-0011.

2 Literature review

The literature is rich in studies showing that displaced workers experience large earnings losses following job loss. Since the publication of Jacobson *et al.* (1993), a number of research papers from several different countries have used large administrative data bases to track displaced and non-displaced workers over relatively long periods of time. For example, Huttunen, Moen, and Salvanes (2006), Eliason and Storrie (2006), Ichino, Schwerdt, Winter-Ebmer, and Zweimüller (2007), Morissette *et al.* (2007), and Hijzen *et al.* (2010) produce estimates for Finland, Sweden, Austria, Canada, and the UK respectively. These studies strive to match displaced workers with comparable non-displaced workers on the basis of their observable characteristics, and to control for any unobservable differences by using difference-in-difference methods.

A number of stylized facts have emerged from this literature. Most importantly, income losses are large and long-lasting. Older workers and workers with longer tenure of employment experience particularly large losses. However, the source of the income loss varies across countries. In the United States, significant income losses persist even for those workers who return to employment, because displaced workers accept lower wages in their new jobs. In Europe, income losses are primarily the result of spells of non-employment; wages for those displaced workers who return to work are only slightly lower, on average, than pre-displacement wages.

The literature is thinner on studies that explore the factors that help workers respond to job displacement and the potential for training programs to reduce earnings losses. In a detailed survey of US government employment and training programs, Heckman, LaLonde, and Smith (1999, p.1868) conclude that: “For most groups of participants, the benefits are modest, and at worst participation in government programs is harmful.” However, as Heckman, LaLonde, and Smith also note, these training programs are usually targeted at “disadvantaged” adults, particularly those with low skills and long spells of unemployment. The literature shows that displaced workers have characteristics quite different from those of unemployed or disadvantaged workers more generally (Jacobson, LaLonde, and Sullivan, 2005*a*). Displaced workers tend to be older and to have considerable work experience, although their skills may be firm- or industry-specific. They may also lack job search skills, particularly if they had been employed for an extended period prior to displacement.

What is known about the effectiveness of training programs for displaced workers? Almost all the evidence comes from the United States. A number of American studies conducted in the 1980s and 1990s suggest that displaced workers benefit from job search assistance, but that the additional benefits from training are negligible. For example, Leigh (1994) summarizes evidence on four government-sponsored programs targeted at displaced workers in the United States and finds no evidence that classroom training in vocational skills yielded any additional benefit. Decker and Corson (1995) conduct an evaluation of the Trade Adjustment Assistance program and find no evidence that training has a positive impact on trainees’ earnings, at least in the first three years after their initial unemployment insurance claim.

Dar and Gill (1998) summarize studies of eleven different retraining programs designed to assist displaced workers (US, Sweden, Australia, Canada, Denmark, and France). They conclude that retraining is generally far more expensive than job search assistance, but does not necessarily yield better results. However, the studies summarized by Dar and Gill could not provide estimates of longer-term effects since none of them were longitudinal. Dar and Gill conclude that there is a lack of rigorous evidence on the costs and effectiveness of retraining programs for displaced workers.

In a recent American study, Heinrich, Mueser, and Troske (2008) evaluate the Adult and Dislocated Worker Programs using data from 12 states and nearly 160,000 participants. The

authors find that recipients of training services who were not displaced have lower initial earnings than non-participants, but that their earnings catch up within 10 quarters, ultimately registering large total gains. Nonetheless, displaced workers experience significantly smaller returns to training than do non-displaced workers who trained.

There are several possible reasons why these studies find that government-sponsored programs generate little or no increase in earnings. First, the studies are usually short-term, often assessing outcomes within six months of program completion. If training improves workers' ability to progress in their careers (as opposed to simply raising their initial wage in the first job held following displacement), then a longer time horizon would be required to observe the benefits achieved. Second, the nature of the training is often very job-specific or, at the other extreme, of a general nature (e.g., basic life skills), as opposed to the more balanced training normally acquired in formal education. A third reason is that often individuals are selected for government-sponsored training programs on the basis of their specific characteristics. Aside from the usual identification challenges this may create, there may be a stigma effect associated with program participation. Finally, some of the earlier studies listed here are demonstration projects and hence are based on small sample sizes. Jacobson, LaLonde, and Sullivan (2005*a*) note that it is often difficult to measure the effect of the programs precisely with such data.

In their studies, Jacobson, LaLonde, and Sullivan (2005*a*; 2005*b*) link administrative earnings records with community college transcripts for workers displaced from their jobs in the early 1990s in Washington State and the city of Pittsburgh. They estimate returns to one year of college to be around 9% for men and around 13% for women. These estimates are much closer to the usual rate of return associated with one year of schooling found in more general studies of returns to education, and suggests that more rigorous college-level publicly-provided training may be effective. Jacobson, LaLonde, and Sullivan also show that it takes time for the benefits of training to be realized: earnings may actually be lower in the treatment group shortly after the completion of college-level training, but increase in subsequent years.

This paper provides the first large-scale, long-term evidence on the utilization and effectiveness of retraining for displaced workers in Canada.[2] An administrative database representing 10% of Canadian workers is used. The database allows workers to be followed from five years before to nine years after job displacement, and allows post-secondary education to be identified. The earnings consequences of training following displacement are examined over a period of nine years. The findings from this study also contribute to the literature by estimating the extent to which job displacement is associated with post-secondary training.[3] In this case, a shorter time frame is used (from four years prior to potential displacement to four years after) because of data limitations.

2. Zhang and Palameta (2006) examine the link between adult training in general and earnings using the Canadian Survey of Labour and Income Dynamics (SLID). Using a difference-in-difference (fixed effects) model, they find a strong association between adult training and earnings. However, given the much smaller sample size of the SLID, they were not able to estimate results for displaced workers.
3. Chapman, Crossley, and Kim (2003) look at the impact of credit constraints on training decisions of recent job losers, finding strong evidence of credit constraints. In particular, they find that the possession of liquid assets is strongly associated with self-financed training. Since the data used by Chapman, Crossley, and Kim (the Canadian Out of Employment Panel, or COEP) had no information on the pre-displacement period or on non-displaced workers, they could not investigate the role of displacement on training as is done here.

3 Data description

The LWF is used in this study.[4] The LWF, created by Statistics Canada, is a 10% random sample of all Canadian paid workers, constructed from four linked administrative data sources: the Record of Employment (ROE) files of Human Resources and Skills Development Canada; the T1 (T1 General - Income Tax and Benefit Return) and the T4 (T4 slip, Statement of Remuneration Paid) files of the Canada Revenue Agency; and the Longitudinal Employment Analysis Program (LEAP) of Statistics Canada. The data are longitudinal and span the period 1983 to 2007.

Canada's Employment Insurance Act and *Employment Insurance Regulations* require every employer to issue an ROE when an employee working in insurable employment has an interruption in earnings.[5] The information contained on the ROE is used to determine whether a person qualifies for Employment Insurance (EI) benefits, the benefit rate, and the duration of the claim. The ROE must be issued at the point of job separation regardless of the intent of the employee to file a claim for EI benefits. More important, the ROE indicates the reason for the work interruption or separation.[6] The ROE can thus be used to identify workers who are laid off, workers who quit and workers who separate from their employer for other reasons. For the purposes of this study, a displaced worker is a worker who was laid off in the 1998 calendar year.

It is possible to distinguish between workers who are temporarily or permanently laid off. Permanently laid off workers are those who do not return to the same firm during the 12 months following lay-off. The definition of job displacement used in this analysis encompasses all permanently displaced workers. However, for analyzing the impact of displacement on the decision to train, it is important to compare displaced workers whose characteristics are similar to those of a control group of non-displaced workers. For this reason, a sample of displaced workers who were displaced as a result of firm closures or mass layoffs—events which are arguably exogenous with respect to the characteristics of individual workers—is used.

Identification of firm closure is made possible by the fact that the LWF includes LEAP, a longitudinal file that tracks all Canadian companies. Since LEAP identifies firms' births and deaths, the linkage between LEAP and LWF makes it possible to identify layoffs that occur as a result of firm closures.[7] However, the LWF contains no information on establishment closures. Because many large firms consist of multiple establishments, plant closures may occur and cause mass layoffs without inducing firm closures. Thus, firm closures will not capture these job losses. To take these into account, a broader definition of displacement, one that includes not only workers who lose their jobs through firm closures, but also those who lose their jobs through mass layoffs, is used. This approach follows Morissette *et al.* (2007), with a mass layoff in year t identified as a situation in which 30% or more of a firm's workforce is laid off between years $t-4$ and $t+1$. A firm closure in year t is defined as a situation in which a firm went from positive employment in year t to no employment in year $t+1$.

4. The description of the LWF in this section is taken largely from Morissette *et al.* (2007).
5. Virtually all forms of paid employment are insurable in Canada. The few exceptions to this rule are listed in the *Employment Insurance Act*.
6. A penalty under the *Employment Insurance Act* for non-compliance may apply to employers who fail to issue a ROE. Moreover, employers who enter a false or misleading reason for a separation may be subject to penalty or prosecution.
7. The universe of LEAP includes businesses, incorporated or not, that issue a T4 to at least one employee tax purposes. Businesses comprised solely of individuals or partnerships that do not draw a salary are excluded from LEAP. Considerable methodological verification takes place to ensure that the longitudinal linkage of companies is reliable. In particular, "false" deaths are identified using a "labour tracking" methodology aimed at distinguishing mergers and acquisitions from real firm closures. In essence, this approach identifies firms over time through the consistency of its core of workers. See Baldwin, Dupuy and Penner (1992) for more details.

LEAP also contains information related to the industry in which the firm operates. Specifically, the 2002 version of the North American Industry Classification System is used.

The Canadian Revenue Agency requires employers to issue a T4 slip to any employee with paid earnings of more than $500 over the course of the year. This information is used as a measure of paid earnings over the course of the calendar year.[8] Firm size can be approximated by dividing the total payroll for a firm by average wages within province and industry cells.[9]

Finally, the LWF includes information from the *T1 General – Income Tax and Benefit Return*. The T1 file contains information on several personal characteristics used as control variables in the study, including sex, age, province of residence, marital status, and union dues paid (to identify union membership).

The LWF does not contain information on the *stock* of education at a point in time. Nevertheless, participation in post-secondary schooling, which is central to this study, can be identified. Specifically, the T1 file includes information on tuition credits and education deductions claimed for courses taken at a post-secondary education institution in Canada. And while a student may transfer these credits or deductions to a parent for tax purposes, it is possible for the years 1999 onwards to identify both the student and the claimant (if they are different). In short, training information is available from 1999 onwards.

Measuring the intensity, or quantity, of post-displacement training is not straightforward. Similarly, training may begin prior to layoff (perhaps in anticipation of such an event), or it may continue for several years following job loss. The incidence of training following displacement, which is the focus of this study, is simpler to define conceptually and far easier to measure in practice. Also for reasons of policy relevance and measurability, the scope of the study is limited to the estimation of the effect of post-secondary training attendance on post-displacement earnings.

4 Methods

4.1 The impact of training on earnings

The first part of the analysis consists of estimating the impact of post-displacement education (i.e., attendance at a post-secondary education institution) on paid earnings, among a sample of displaced workers. Specifically, workers who were displaced in 1998 following five consecutive years of positive paid earnings are considered. The workers were between 25 and 44 years old in 1997 (and thus no older than 54 years old in 2007) and therefore less likely than older individuals to consider retiring after displacement. The measure of post-displacement training is a simple binary indicator of post-secondary education attendance in 1999, the calendar year following job displacement.[10] Figure 1 summarizes the sample construction.

8. Information on hours of work is not available; consequently it is not possible to calculate hourly wage rates.
9. This is done because we the total number of employees in each firm in each year is observed, not the number of days that each worker was employed.
10. The exact date of enrolment in an education institution is not known, only the calendar year in which enrolment occurs is known. Enrolment in the year of displacement might therefore include enrolment which occurred before displacement.

Figure 1
Data representation and timeline (earnings)

Representation	Timeline
Worker criteria	
Positive earnings	1993 to 1997
Aged 25 to 44	1997
Displacement criteria	
Record of Employment received	1998
Does not return to firm	1999
Treatment	
Tuition credits received or education deductions claimed	1999
Outcome	
Earnings	1993 to 2007

The annual ordinary least squares (OLS) estimates of Equation (1) for workers who were displaced in 1998 are calculated separately by year and by sex.

$$yi,t = \alpha^0 t + \alpha^S t\, Si + \alpha^{\mathbf{x}} t\, \mathbf{x}i + \varepsilon i,t \quad t = 1993, \ldots, 2007. \tag{1}$$

Earnings of individual *i* in year *t* (*yit*) are regressed on a dummy variable *Si* indicating post-secondary participation in the year following displacement and on a vector **x***i* containing several earnings determinants (measured in 1997, the year prior to displacement), including age, age squared, a vector of province of residence dummies, a vector of industry dummies, and a vector of firm size dummies.

Selection into training is a concern in this specification, leading to a correlation between $\varepsilon i,t$ and *S*. Displaced workers may selectively choose training on the basis of unobserved characteristics. For example, highly productive workers may be more likely than less productive workers to train given differences in expected returns. Alternatively, workers with the lowest opportunity costs (i.e., those who are least likely to find employment) may be most likely to train. The former case would generate a positive bias of the effects of training on earnings, while the latter would generate a negative bias.[11]

If the unobserved characteristics which cause selection into training do not vary over time for each individual, these fixed influences can be removed by estimating first-differences, comparing the change in earnings for those who attend post-displacement education with the change in earnings for those who do not. This is a simple difference-in-difference estimator.[12]

$$yi,2007 - yi,1993 = \alpha^0 + \alpha^S Si + \alpha^{\mathbf{x}} \mathbf{x}i + \varepsilon i \tag{2}$$

Selection may also be based on time-varying unobserved characteristics, in which case estimates from Equation (2) will still be biased and inconsistent. For example, displaced workers may choose to train if they know that their skills (unobserved to the researcher) have been deteriorating in the years leading up to displacement. As there is five years of pre-displacement information, one can

11. If one were to relax the assumption of homogeneous returns to training (equal α across workers), selection might also arise because workers with high returns to training are more likely to select into training.
12. Note that this is also equivalent to a first-differenced regression where Si is interacted with a time dummy for the year 2007.

examine whether the treatment and control groups have similar pre-displacement trends in earnings.

4.2 The impact of displacement on educational participation

In the second part of the paper, the impact of job displacement on post-secondary education attendance is estimated. Since the dependent variable in this case is post-secondary attendance, information for each year pre- and post-displacement is required. Consequently, the analysis is limited to the 1999 to 2007 period (when post-secondary attendance is reliably available on the LWF). The cohort of workers who were *potentially* displaced in 2003 is selected, yielding pre- and post-displacement periods of four years each. Other sample criteria are similar to those used in the earnings analysis. Specifically, workers who had positive earnings in each of the pre-displacement years and were between the ages of 25 and 44 in the year prior to displacement are selected. The sample design in this case is shown in Figure 2.

Figure 2
Data representation and timeline (post-secondary education attendance)

Representation	Timeline
Worker criteria	
Positive earnings	1999 to 2002
Aged 25 to 44	2002
Treatment	
Record of Employment issued	2003
Does not return to firm	2004
Outcome	
Tuition credits received or education deductions claimed	1999 to 2007

Equation (3) summarizes the regressions that are estimated. Separate OLS models are estimated by year and by sex, as before. As before, Si,t is a dummy variable indicating attendance at a post-secondary institution in year t, Di is a dummy variable indicating displacement in the year 2003, and $\mathbf{x}i$ is a vector of characteristics (measured in 2002, the year prior to potential displacement), which includes age, age squared, paid earnings, a vector of province of residence dummies, a vector of seven industry dummies, and a vector of four firm size dummies.

$$Si,t = \beta^0 t + \beta^D t Di + \beta^{\mathbf{x}} t \mathbf{x}i + \mu i,t \quad t = 1999, \ldots, 2007. \tag{3}$$

As in the previous section, it is assumed that there are unobservable characteristics which may be correlated with the decision to enter post-secondary education and with the probability of being displaced. This is dealt with in two ways. First, if the unobservable characteristics are not time-varying, fixed-effects methods can be used. This compares the change in training participation between the treatment and control groups between 1999 and 2004.

$$Si,2004 - Si,1999 = \beta^0 + \beta^D Di + \beta^{\mathbf{x}} \mathbf{x}i + \mu i \tag{4}$$

There may also be time-varying unobserved characteristics which affect both S and D. For example, some workers may have been laid off because their employer saw their motivation levels deteriorate over time. The solution to this second identification issue is to focus on workers who were displaced for reasons not likely related to their individual productivity. Specifically, all workers who were displaced for reasons other than a firm closure or a mass layoff are dropped. Mass layoffs and firm closures are more likely to be associated with declining market demand for the

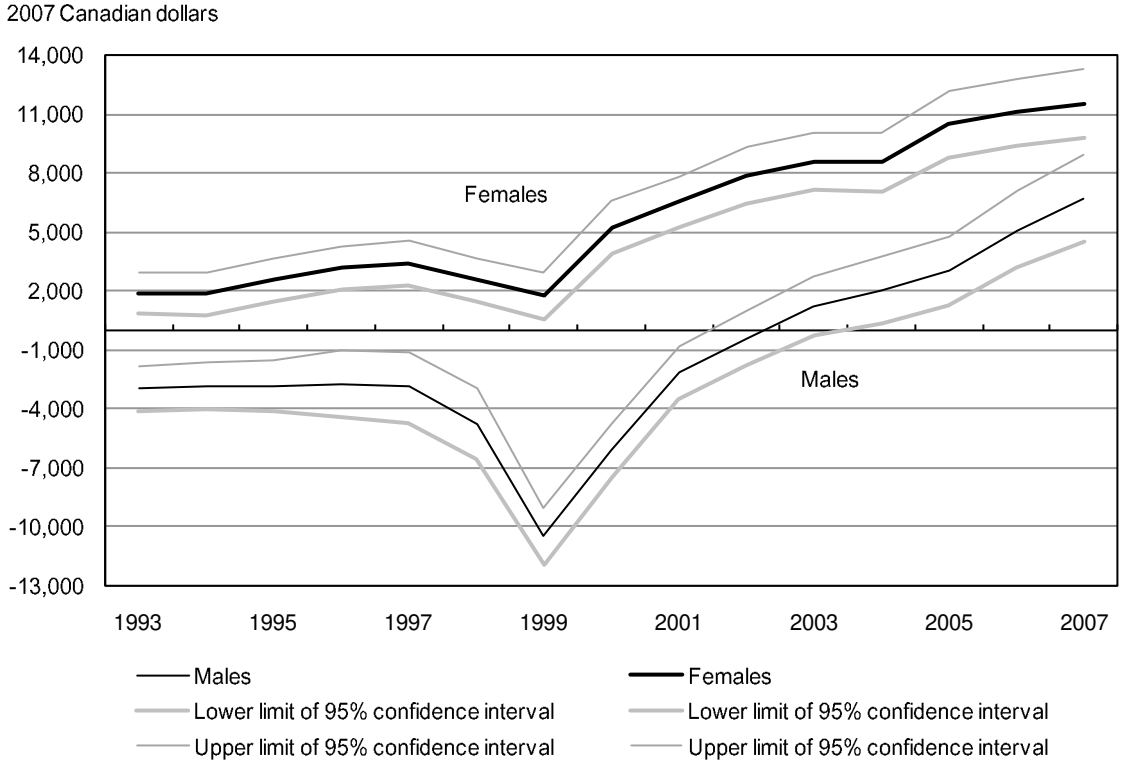
firm's output rather than an individual's productivity. Equation (3) is thus re-estimated, where *Di* is redefined to mean displacement in 2003 due to a mass layoff or firm closure (excluding workers displaced for other reasons).

5 Results

5.1 The impact of post-secondary education attendance on earnings

In this section, the link between post-displacement training and earnings is examined. Chart 1 shows the estimates of $\alpha^S t$ from Equation (1). Equation (1) provides an estimate of the gap in earnings between those who attended post-secondary education in 1999 and those who did not. At this stage of the analysis, no covariates are included.

Chart 1
Estimates of the earnings gap between workers with and without post-secondary education after displacement, men and women



Notes: Estimates of the earnings gap (α^S_t) from Equation (1) without covariates, estimated separately for men and women. This is the raw difference in annual earnings between workers who enter post-secondary education after displacement and those who do not. 95% confidence intervals shown. The raw data which lies behind Chart 1 is presented in Text table 1 in the Appendix.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

In the years leading up to displacement, females who subsequently attended post-secondary schooling earned about $2,000 more than those who did not subsequently attend. This suggests positive selection into the treatment group. In contrast, the male treatment group earned about $3,000 less than the control group before displacement. The pre-treatment difference in earnings is highly significant but quite stable up to and including 1997. In 1998 (the year of displacement), one observes a fall in the earnings of the male treatment group compared to the male control group. There are a number of possible explanations for this. It might be that displaced workers in the

treatment group are displaced earlier in the calendar year. Perhaps more likely is the possibility that workers who found work soon after being displaced (possibly before the end of 1998) were then much less likely to enter training programs in 1999.

For males, participation in training is associated with a large temporary loss of earnings in 1999, the year in which training credits are received.[13] However, by 2002, the earnings of men in the treatment group and control group are equal, and from 2004 onwards the earnings of those in the treatment group are significantly higher despite having been significantly lower before displacement and training took place. By 2007, displaced men who attended post-secondary education institutions earned $6,719 more than non-trainees. This benefit alone (in a single year) is approximately equal to the loss in earnings experienced in 1999.

For females, participation in training is not associated with a large temporary fall in earnings relative to the control group, a result which suggests that women attended shorter courses or were more likely to be earning at the same time as participating in education. From 2000 onwards, their earnings relative to those of female non-trainees increases in a pattern similar to that observed among men. By 2007, displaced women who had trained earned $11,541 more than those who had not.

These raw estimates imply a large earnings premium to post-displacement training. A crude difference-in-difference calculation which takes into account pre-displacement differences suggests increases around $9,000 for both men and women.

To begin addressing the selectivity of training, observable characteristics by training status are examined; results are shown in Table 1. Individuals who attended a post-secondary education institution are younger, more likely to reside in British Columbia, and less likely to be married. There are also some differences in their pre-displacement firm characteristics: trainees are more likely to be employed in public services, less likely to be employed in manufacturing, and more likely to be employed in large firms.

To the extent that these characteristics are associated with the earnings trajectory of displaced workers, the results should take differences in these factors into account. Chart 2 provides estimates of $\alpha^S t$ estimated from Equation (1) with a full set of control variables $\mathbf{x}i$ included (for the year 1997). The chart shows that the pre-displacement difference in earnings between trainees and non-trainees is almost entirely explained by differences in observable characteristics. Estimates of $\alpha^S t$ for males are insignificantly different from zero for 1993–1997, although there is still a noticeable decline in male trainees' earnings relative to those of male non-trainees in the year of displacement (1998). For females, the inclusion of covariates reduces the positive pre-treatment gap in wages only slightly. For both males and females, the inclusion of covariates reduces the implied impact of training on earnings to about $6,500.

In Table 2, estimates of the fixed-effects model from Equation (2) are reported. Estimates of the size of the training effect in 2007 are very similar to the informal difference-in-difference calculations from Chart 2. By 2007, the treatment effect is $6,551 for males and $6,672 for females.

The size of the sample permits the estimation of Equation (2) separately by various characteristics. There are significant effects by age, marital status, and union membership for both men and women, with the exception of 35-to-44-year-old men. There are also statistically significant differences in the effects by each of the characteristics for men only. Specifically, men who were

13. Readers are reminded that this is in comparison with a control group of individuals who are *also* displaced. Losses compared to those of a control group which included non-displaced workers would be far larger.

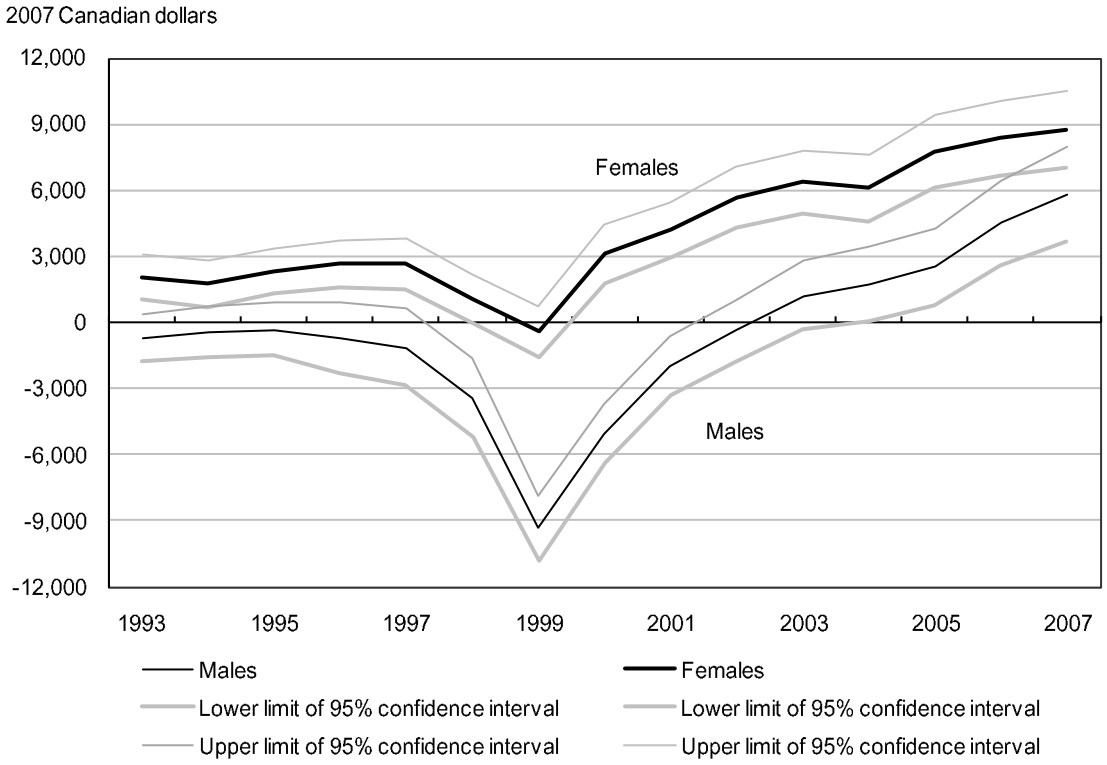
older, married, or part of a union prior to being displaced benefit less from training (compared to their respective comparison groups). For women, no significant differences are observed.

Table 1
Sample means before displacement, by post-secondary attendance status

	Males		Females	
	No post-secondary attendance in 1999	Post-secondary attendance in 1999	No post-secondary attendance in 1999	Post-secondary attendance in 1999
	number			
Age	34.4	31.9	34.2	32.1
Married	0.579	0.491	0.584	0.460
Unionized	0.488	0.469	0.276	0.356
Newfoundland and Labrador	0.040	0.049	0.046	0.034
Prince Edward Island	0.012	0.012	0.022	0.020
Nova Scotia	0.045	0.033	0.043	0.034
New Brunswick	0.058	0.053	0.053	0.043
Quebec	0.330	0.299	0.326	0.312
Ontario	0.231	0.210	0.276	0.292
Manitoba	0.025	0.037	0.028	0.026
Saskatchewan	0.030	0.026	0.021	0.024
Alberta	0.111	0.113	0.076	0.072
British Columbia	0.119	0.166	0.109	0.143
Primary industries	0.109	0.084	0.041	0.038
Construction	0.300	0.176	0.024	0.020
Manufacturing	0.166	0.139	0.142	0.085
Distributive services	0.104	0.090	0.080	0.063
Consumer services	0.130	0.181	0.293	0.244
Business services	0.124	0.171	0.201	0.221
Public services	0.059	0.155	0.216	0.327
Firm size				
0 to 20 employees	0.348	0.284	0.362	0.316
20 to 100 employees	0.258	0.219	0.201	0.166
100 to 500 employees	0.168	0.174	0.141	0.156
500 or more employees	0.226	0.323	0.296	0.363
Sample size	12,669	1,293	5,895	1,086

Notes: The sample comprises workers who were from 25 to 44 years old in 1997, who had been in paid employment from 1993 to 1997, and who were permanently displaced during 1998. All means are caculated using 1997 data.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Chart 2
Estimates of the earnings gap between workers with and without post-secondary education after displacement, men and women



Notes: Estimates of the earnings gap (α^S_t) from Equation (1) controlling for characteristics in 1997, estimated separately from men and women. This is the conditional difference in annual earnings between workers who enter post-secondary education after displacement and those who do not. 95% confidence intervals shown.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Table 2
Fixed-effect estimates of the effect of post-secondary attendance on paid earnings (2007 [000s] constant dollars)

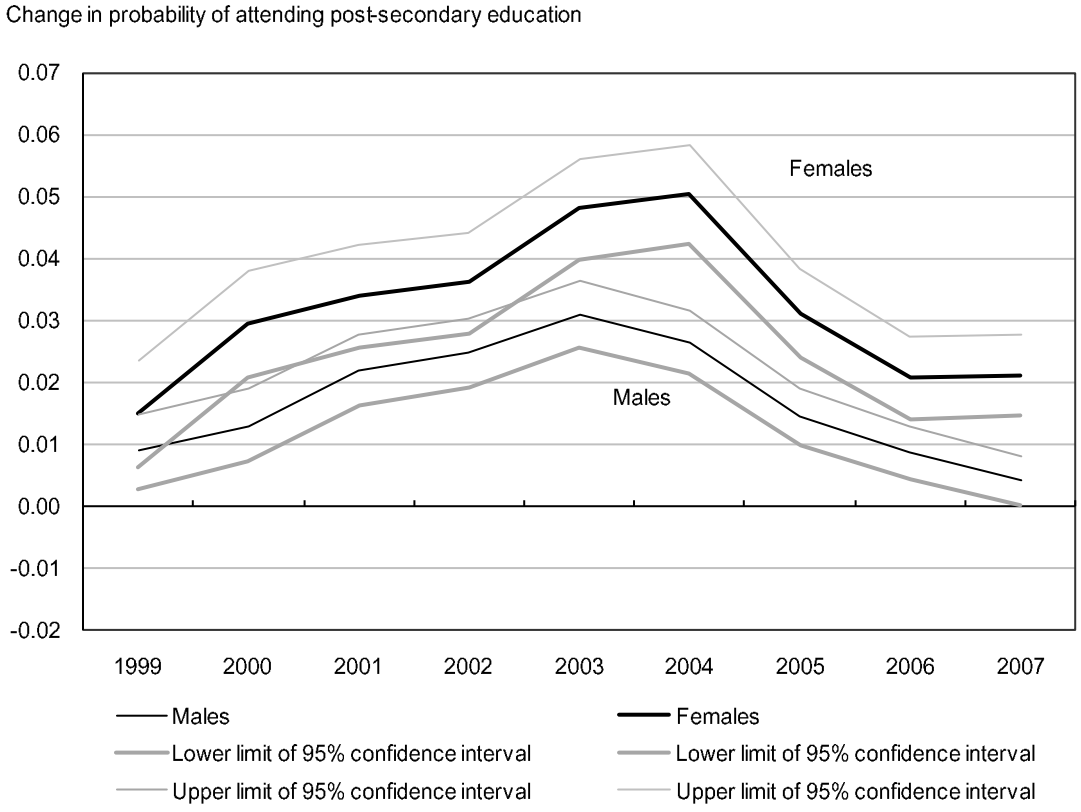
	Males		Females	
	coefficient	standard error	coefficient	standard error
Overall (2007)	6.551 ***	1.107	6.672 ***	0.894
Age group				
25 to 34 years old	8.148 ***	1.341	6.626 ***	1.110
35 to 44 years old	3.144	1.922	6.598 ***	1.578
Gap	-5.004 **	2.344	-0.028	1.929
Marital status				
Married	4.240 ***	1.419	6.794 ***	1.230
Not married	8.662 ***	1.736	7.155 ***	1.334
Gap	4.422 **	2.242	0.361	1.815
Union membership				
Unionized	4.303 ***	1.398	7.498 ***	1.635
Not unionized	8.349 ***	1.696	6.127 ***	1.083
Gap	4.046 *	2.198	-1.372	1.961

*p<0.1,
**p<0.05
***p<0.01
Note: Estimates of Equation (2), estimated using ordinary least squares (OLS).
Source: Authors' calculation from the Longitudinal Worker File (LWF).

5.2 The impact of displacement on post-secondary education attendance

The analysis conducted so far suggests that job training following displacement may increase earnings.[14] Chart 3 displays the gap in post-secondary attendance rates between workers who were displaced and those who were not in 2003 (β^D_t from Equation (3), but without covariates).

Chart 3
Estimates of the gap in post-secondary attendance rates between workers who were displaced in 2003 and those who were not, men and women



Notes: Estimates of the gap in post-secondary attendance rates (β^D_t) from Equation (3) without covariates, estimated separately for men and women. This is the raw difference in the probability of attending post-secondary education between workers who were displaced in 2003 and those who were not. 95% confidence intervals shown. The raw data which lies behind Chart 3 is presented in Text table 3 in the Appendix.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

14. As discussed in the Methodology section, since the outcome—post-secondary education attendance—is available only from 1999 onward, the cohort examined is comprised of workers who are between 25 and 44 years old in 2002, as opposed to 1997. Before turning to the impact of job displacement on training, an examination of whether the findings regarding earnings are sensitive to the choice of cohort was carried out. The first step was to replicate the descriptive earnings analysis on a +/- four year window around 1998, the year of displacement. The size of the window was chosen with a view to matching the one that must be applied in the training analysis. The earnings gap is simply a select portion of the results shown in Chart 1. This analysis was then replicated on the 2003 cohort of displaced workers (See Appendix Chart 5). For women, the earnings gains associated with training are about as large as they are for the earlier cohort. For men, they are substantially larger. Thus, training also confers large benefits for the more recent cohort.

Four years prior to the year of potential displacement, there is a significant positive gap in the post-secondary education attendance rates of those workers who are subsequently displaced and those who are not. This gap becomes larger the closer one gets to 2003; this finding suggests that workers may have anticipated the possibility of job loss in the future and prepared for this by investing in their human capital.[15] In 2003, the gap is 3 percentage points for males and nearly 5 percentage points for females by 2004. This represents a large proportional difference, since mean attendance rates for non-displaced workers in 2003 are only 8% (males) and 11% (females). However, the difference in participation rates peaks either in 2003 (males) or in 2004 (females), and displacement is *not* associated with a large increase in post-secondary education attendance overall.

Differences in observable characteristics between the displaced workers and the non-displaced workers are shown in Table 3. In general, displaced workers are slightly younger, earn much less prior to displacement, and are less likely to be married. Differences exist in terms of union coverage, but the gap runs in opposite directions for men and women. Some minor differences in province of residence also exist. In terms of pre-displacement firm characteristics, displaced workers are more likely to be employed in primary industries or construction, are less likely to be employed in public services, and are more likely to be employed in a small-to-medium sized firm (no more than 100 employees).

The differences between these displaced workers and those that were not displaced are taken into account in the OLS results shown in Chart 4. Despite the large differences in worker characteristics, the results do not change in any meaningful way. It is observed that the same pattern of a slow upward creep prior to displacement occurs, then a sudden spike during the year of displacement, followed by a downward trend. Again, the spike is larger for women. In general, the magnitudes of these trends are more or less the same as before, and the general conclusion remains the same: displacement does not lead to a large increase in post-secondary attendance.

As a result, differences in pre-displacement and post-displacement education attendance rates are not due to differences in observed characteristics. As before, one can control for fixed unobserved differences between displaced and non-displaced workers by estimating a fixed-effects (difference-in-difference model. Results of this estimation are reported in Table 4. When all displacements are considered (as has occurred so far), the results suggest a small effect on post-secondary attendance (1.6 percentage points for men and 3.3 percentage points for women, both statistically significant at 1%). However, when one estimates the effect of displacement resulting from a mass layoff or firm closure, the effects are much smaller: 0.6 percentage points for men (significant at 5%) and 1.3 percentage points for women (significant at 1%). These are the preferred set of results since they are less likely to be contaminated by differences in unobserved characteristics. Note that these effects are small in relation to the overall rates of post-secondary attendance, which in 1999 were between 13% and 14% for men and between 17% and 19% for women (Appendix Text table 3). The results are also disaggregated by age, marital status, and union coverage. Modest effects are generated for all groups of women. For men who are aged 35 to 44, married, or not unionized, there is no evidence whatsoever of an uptake in post-secondary education.

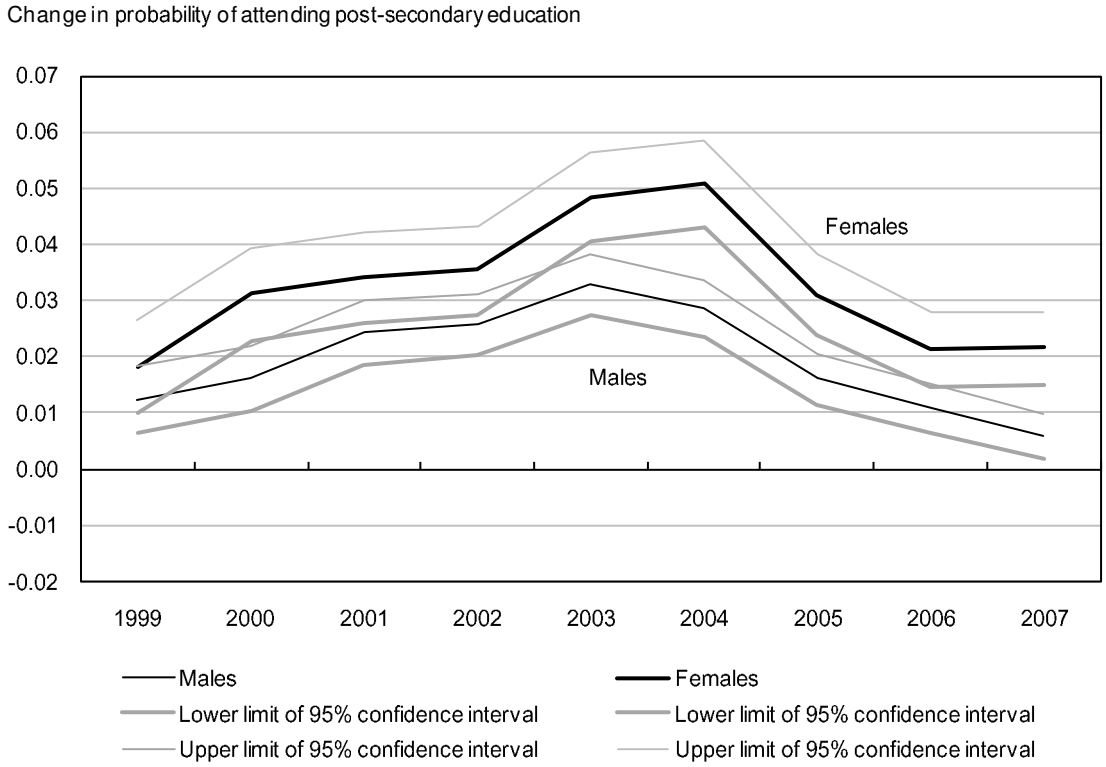
15. The workers who left the paid workforce entirely in order to attend school prior to the year of potential displacement are dropped from the sample since the focus of the study is on those with paid employment in each pre-displacement year.

Table 3
Differences in observable characteristics between workers who are displaced in 2003 and those who are not

	Males		Females	
	Not displaced	Displaced	Not displaced	Displaced
	2007 constant dollars			
Paid earnings	54,538	34,118	35,523	21,733
	number			
Age	35.4	34.2	35.3	34.4
Married	0.663	0.541	0.641	0.521
Unionized	0.387	0.429	0.400	0.283
Newfoundland and Labrador	0.016	0.034	0.017	0.034
Prince Edward Island	0.005	0.010	0.005	0.018
Nova Scotia	0.031	0.042	0.031	0.036
New Brunswick	0.027	0.049	0.027	0.046
Quebec	0.277	0.309	0.262	0.299
Ontario	0.368	0.271	0.376	0.289
Manitoba	0.036	0.029	0.037	0.032
Saskatchewan	0.029	0.027	0.031	0.021
Alberta	0.108	0.123	0.102	0.084
British Columbia	0.104	0.106	0.111	0.142
Primary industries	0.043	0.086	0.015	0.032
Construction	0.078	0.260	0.014	0.027
Manufacturing	0.242	0.200	0.105	0.152
Distributive services	0.128	0.098	0.067	0.073
Consumer services	0.160	0.131	0.212	0.258
Business services	0.173	0.154	0.215	0.231
Public services	0.164	0.065	0.367	0.225
Firm size				
0 to 20 employees	0.195	0.308	0.194	0.314
20 to 100 employees	0.185	0.259	0.148	0.210
100 to 500 employees	0.155	0.170	0.135	0.143
500 or more employees	0.465	0.263	0.523	0.333
Sample size	233,953	13,481	229,849	8,135

Note: All characteristics are measured in 2002, one year prior to displacement.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Chart 4
Estimates of the gap in post-secondary attendance rates between workers who were displaced in 2003 and those who were not, men and women



Notes: Estimates of the gap in post-secondary attendance rates (β^{D}_{t}) from Equation (3) conditional on covariates, estimated separately for men and women. This is the conditional difference in the probability of attending post-secondary education between workers who were displaced in 2003 and those who were not. 95% confidence intervals shown.

Source: Authors' calculation from the Longitudinal Worker File (LWF).

Table 4
Difference-in-difference estimates of the effect of displacement on post-secondary attendance

	Males		Females	
	coefficient	standard error	coefficient	standard error
All displacements				
Overall	0.016 ***	0.004	0.033 ***	0.005
Displacements due to a mass layoff or firm closure				
Overall	0.006 **	0.003	0.013 ***	0.004
Age group				
25 to 34 years old	0.015 ***	0.005	0.010 *	0.006
35 to 44 years old	0.000	0.003	0.014 ***	0.004
Gap	−0.015 **	0.006	0.004	0.007
Marital status				
Married	0.004	0.003	0.013 ***	0.004
Not married	0.009 *	0.005	0.013 **	0.006
Gap	0.005	0.006	0.001	0.008
Union membership				
Unionized	0.012 ***	0.004	0.015 **	0.006
Not unionized	0.002	0.004	0.011 **	0.004
Gap	−0.010 *	0.006	−0.004	0.007

*p<0.1
**p<0.05
***p<0.01
Note: Estimates of Equation (4), estimated using ordinary least squares (OLS).
Source: Authors' calculation from the Longitudinal Worker File (LWF).

6 Conclusion

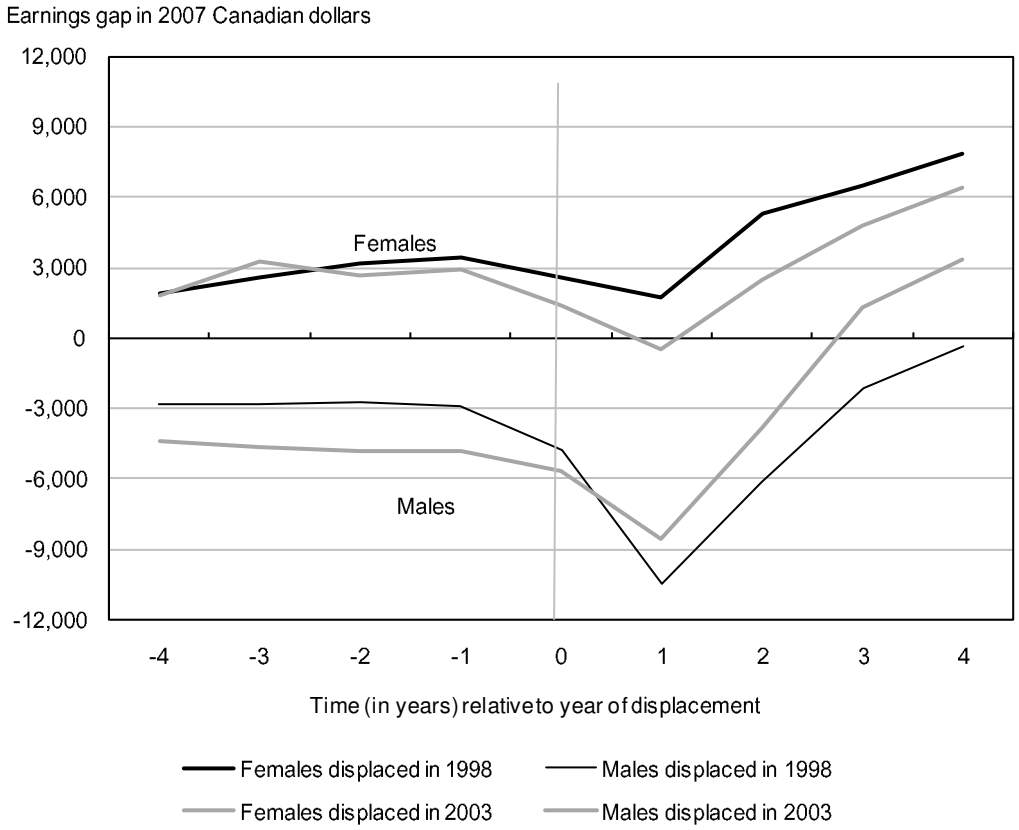
The economic downturn that began in late 2008 and the resultant job losses have renewed interest in the outcomes of displaced workers. The purpose of this study was to investigate the effectiveness of one response to mitigating earnings losses following job displacement: training in a post-secondary institution. Given the possibility of selection into the treatment, the approach used in this paper has been to estimate a difference-in-difference (fixed-effects) model.

The results suggest that, over the period spanning five years preceding and nine years following job loss, workers who attended post-secondary education shortly following displacement saw their earnings increase by almost $7,000 more than displaced workers who did not attend post-secondary education. Significant benefits are found by sex, age, marital status, and union coverage, with the exception of men aged 35 to 44. Despite the benefits of training, job displacement is found to be associated with only a modest increase in post-secondary attendance for all groups examined.

These results suggest a substantial benefit of post-secondary education for displaced workers. The key issue is whether one can interpret these earnings differences as the causal impact of education, or whether the different earnings paths of the treatment and control groups are the result of non-random selection into the training program. Further analysis will allow for worker-specific time-trends in earnings, because workers who choose training after displacement may have a different pre-displacement pattern of earnings growth.

Appendix

Chart 5
Estimates of the earnings gap between workers with and without post-secondary education after displacement, men and women



Notes: Estimates of the earnings gap (α^S_t) for two different cohorts. The results for the 1998 cohort are a subset of those results in the paper for a shorter time period. Estimates of the earnings gap from the more recent cohort are larger for males and slightly smaller for females.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Text table 1
Paid earnings (2007 constant dollars) by post-secondary attendance following displacement

	Men		Women	
	No post-secondary attendance	Post-secondary attendance	No post-secondary attendance	Post-secondary attendance
	2007 constant dollars			
1993	25,767	22,817	16,724	18,584
1994	28,347	25,544	18,273	20,138
1995	30,443	27,626	18,533	21,109
1996	30,675	27,964	18,452	21,652
1997	32,421	29,544	19,169	22,609
1998	31,814	27,066	18,830	21,423
1999	34,143	23,662	19,138	20,876
2000	38,904	32,800	22,546	27,814
2001	39,127	36,969	23,736	30,242
2002	40,170	39,783	24,677	32,579
2003	41,665	42,901	25,848	34,455
2004	42,667	44,695	26,856	35,406
2005	46,320	49,317	28,288	38,779
2006	47,599	52,726	29,116	40,253
2007	49,840	56,560	30,655	42,196

Note: The sample includes 25- to 44-year-old paid workers in 1997, one year prior to displacement.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Text table 2
Difference-in-difference regression results, paid earnings (2007 [000s] constant dollars)

	Males		Females	
	coefficient	standard error	coefficient	standard error
Determinants				
Postsecondary attendance	6.551 ***	1.107	6.672 ***	0.894
Age	-5.125 ***	0.697	-2.509 ***	0.725
Age squared	0.058 ***	0.010	0.027 **	0.011
Prince Edward Island	-4.591 *	2.743	1.556	2.012
Nova Scotia	-3.626 *	2.149	4.332 **	2.001
New Brunswick	-7.969 ***	1.867	3.092 *	1.629
Quebec	-8.604 ***	1.634	3.254 **	1.487
Ontario	-4.480 **	1.806	2.572	1.643
Manitoba	-3.279	2.671	-2.302	2.975
Saskatchewan	-0.882	2.434	4.756	2.950
Alberta	1.213	2.060	6.299 ***	2.335
British Columbia	-2.477	1.975	0.164	1.965
Married	1.225 **	0.598	0.047	0.593
Unionized	5.202 ***	0.642	2.865 ***	0.799
Construction	1.923 *	1.102	1.394	3.111
Manufacturing	-6.649 ***	1.138	-7.301 ***	1.540
Distributive services	-4.773 ***	1.268	-5.584 ***	1.699
Consumer services	-8.483 ***	1.178	-5.339 ***	1.405
Business services	-1.956	1.532	-4.303 ***	1.537
Public services	-3.825 ***	1.406	0.540	1.566
Firm size				
20 to 100 employees	2.409 ***	0.773	0.750	0.726
100 to 500 employees	3.777 ***	0.930	2.343 **	1.022
500 or more employees	3.821 ***	0.843	1.241	0.847
Intercept	129.177 ***	-11.907	65.533 ***	-12.094

	Males	Females
Diagnostic statistics		
Number of observations	13,962	6,981
Adjusted R-squared	0.112	0.099

*p<0.1
**p<0.05
***p<0.01

Note: Estimates of Equation (2) by using ordinary least squares (OLS). Census Metropolitan Area (CMA) fixed effects are also included in the models.

Source: Authors' calculation from the Longitudinal Worker File (LWF).

Text table 3
Post-secondary attendance rates by displacement status

	Males		Females	
	Not displaced	Displaced	Not displaced	Displaced
		rate		
1999	0.133	0.142	0.172	0.187
2000	0.121	0.134	0.156	0.186
2001	0.104	0.126	0.139	0.173
2002	0.092	0.117	0.126	0.162
2003	0.080	0.111	0.113	0.161
2004	0.070	0.096	0.102	0.152
2005	0.059	0.074	0.090	0.121
2006	0.054	0.062	0.084	0.104
2007	0.048	0.052	0.076	0.098

Note: The sample includes 25- to 44-year-old paid workers in 2002, one year prior to potential displacement.
Source: Authors' calculation from the Longitudinal Worker File (LWF).

Text table 4
Difference-in-difference regression results, post-secondary attendance

	Males		Females	
	coefficient	standard error	coefficient	standard error
Determinants				
Displaced due to mass layoff or firm closure	0.006 **	0.003	0.013 ***	0.004
Age	0.074 ***	0.002	0.098 ***	0.002
Age squared	−0.001 ***	0.000	−0.001 ***	0.000
Married	0.008 ***	0.002	0.008 ***	0.002
Unionized	0.000	0.002	−0.019 ***	0.002
Paid earnings (2007 constant dollars)	0.000	0.000	0.000 ***	0.000
Prince Edward Island	−0.015	0.016	0.004	0.018
Nova Scotia	0.009	0.010	0.017	0.010
New Brunswick	0.020 **	0.010	0.018 *	0.010
Quebec	−0.003	0.009	0.010	0.009
Ontario	−0.008	0.009	0.003	0.009
Manitoba	0.009	0.011	0.003	0.011
Saskatchewan	0.015	0.011	0.013	0.011
Alberta	−0.006	0.009	0.000	0.009
British Columbia	0.000	0.010	−0.002	0.010
Construction	0.006	0.004	0.008	0.009
Manufacturing	0.005	0.003	0.020 ***	0.006
Distributive services	−0.003	0.004	0.014 **	0.007
Consumer services	0.006 *	0.004	0.033 ***	0.006
Business services	−0.049 ***	0.004	−0.016 **	0.006
Public services	−0.047 ***	0.004	−0.022 ***	0.006
Firm size				
20 to 100 employees	−0.011 ***	0.002	−0.004	0.003
100 to 500 employees	−0.016 ***	0.003	−0.001	0.003
500 or more employees	−0.026 ***	0.002	−0.006 **	0.003
Intercept	−1.440 ***	0.037	−1.895 ***	0.041

	Males	Females
Diagnostics statistics		
Number of observations	235,923	230,891
Adjusted R-squared	0.034	0.034

*p<0.1
**p<0.05
***p<0.01

Note: Estimates of Equation (4) by using ordinary least squares (OLS). Census Metropolitan Area (CMA) fixed effects are also included in the models.

Source: Authors' calculation from the Longitudinal Worker File (LWF).

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