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The impact of unionization on the incidence of and sources of payment for training in Canada

David A. Green · Thomas Lemieux

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Abstract This paper uses the Adult Education and Training Survey (AETS) to look at the effect of unions on the incidence and sources of payment for training in Canada. Simple tabulations indicate that union workers are more likely to engage in training activities than nonunion workers. The higher incidence of training among union workers is driven by the fact that they are more likely to take training courses offered by their employers than nonunion workers. This suggests that union workers are more likely to participate in training activities that enhance their firm-specific human capital. This union effect disappears, however, once we control for a variety of factors such as age, education, and in particular, firm size and seniority. Everything else being equal, unions have little effect on the provision of training in Canada. Finally, we present some limited evidence that unions help increase the participation of firms in the financing of training activities.

Keywords Unions · Training · Human capital

1 Introduction

A very large literature has clearly established that unions tend to raise wages in decentralized labour markets like Canada, the United States, or the United Kingdom. Much remains to be learned, however, about the effect of unions on many other important economic outcomes. In particular, if union presence encourages investments in human capital and training, we would expect

D. A. Green · T. Lemieux (✉)
Department of Economics, University of British Columbia,
#997-1873 East Mall, Vancouver, BC, Canada V6T 1Z1
e-mail: tlemieux@interchange.ubc.ca

union workers to be more productive, which would in turn account for part of the union wage gap. Under this scenario, unionism as an institution would be making a positive contribution to the overall skill level of the workforce. Unfortunately, there is little direct evidence on this for Canada. In this paper, we use the Canadian Adult Education and Training Survey (AETS) to answer basic questions about the relationship of unionization to training levels and the sources of payment for training.

Any attempt to study training impacts must start with the important distinction between general and firm specific human capital. There are good reasons to believe that unions will have different impacts on both the levels and funding for the two different types of human capital. For example, unions have been shown to be associated with more stable (i.e., longer tenure) jobs. This could lead to more firm specific investment because firms and workers both believe the relationship will last longer and therefore be willing to invest more into it in the union sector. On the other hand, to the extent that workers invest in general human capital to improve their outside option value should the current job end, greater job stability in the union sector could lead to lower investment in this type of training. In recent years, notions of what constitutes general and specific human capital and who pays for the investment in each have been refined considerably. It is still the case, though, that union impacts are often theoretically ambiguous, implying the need for an empirical investigation. One important advantage of the AETS in this regard is that it contains detailed information on the type and source of payment for training. This enables us to look separately at the effect of unions on general and specific human capital.

In this paper, we will first set out different theories of human capital investment and discuss the role of unions within them. We then turn to the AETS to examine the implications of the various theories. We do this first using simple tabulations and then using econometric techniques to control for the impacts of other worker characteristics the effects of which might otherwise be assigned to unionization. We find that results differ slightly for males and females. For both males and females, unions appear to have only small effects on the amount of either firm specific or general human capital investment. There is some evidence that unions do alter the extent to which firms take part in the investments for males, but little evidence of this for females.

2 Previous literature and theoretical considerations

2.1 Theoretical considerations

Any examination of the impact of unions on training must start with the key distinction between general and firm specific human capital. As is well known (Becker 1964), in a perfectly competitive labour market, workers pay (in terms of lower wages) for all investments in general human capital, since this type of human capital is equally valued in all firms. In contrast firm specific capital is valuable only at a particular firm. This implies that firms can invest in this type

of human capital without fearing that the trained worker will be bid away by another firm.

Several papers have pointed out, however, that the sharp predictions of the human capital approach about who should pay for training does not always hold in practice. For instance, Loewenstein and Spletzer (1998) found that training that appears to be general in nature is not infrequently paid for by the employer. This has led to the development of several models in which firms rationally invest in general as well as specific human capital. Loewenstein and Spletzer (1998) develop a model in which a wage contract is specified with a minimum wage guarantee for future periods. In their model, if the worker's wage option outside the firm is less than the wage guarantee, then a small increase in productivity from a general human capital investment does not need to be matched with a wage increase to keep the worker attached to the firm. This means the firm captures the full return to the investment in either specific or general human capital. A strongly related idea is presented in Acemoglu and Pischke (1999), in which they argue that if there is wage compression, in the sense that the wage that must be paid to keep a worker at a firm rises less rapidly with training than does productivity, then there is again an incentive for firms to invest in general human capital. They discuss several possible sources for such wage compression, including union effects. More generally, Stevens (1994) points out that imperfect competition among firms, or any other imperfections that induce uncertainty in turnover and wages being paid below marginal products, will tend to induce firms to invest in the general human capital of workers.

With these concepts in mind, we now turn to the impact of unions on training. More specifically, we look at the implication for training of two well established effects of unions: (1) unions establish higher wage guarantee levels or, in the extreme, make the guarantee credible and therefore feasible; and (2) unions increase worker attachment to the firm. This first effect of unions has been well documented in multiple empirical investigations of union impacts that show that pay related outcomes are quite different in union versus nonunion firms. The best recorded evidence is in average pay levels, with workers in union firms earning an average of approximately 10–15% more than comparable nonunion workers. Unions also are well documented to be associated with reduced wage differentials by education level, job tenure and gender. Thus, the wage–tenure profiles at union firms are higher but flatter than at nonunion firms. The second effect of unions has also been well documented in the literature that systematically shows that union workers tend to have longer job tenure than nonunion workers. Freeman and Medoff (1984) argue that unions increase tenure because they provide workers with a "voice" to correct perceived difficulties in the workplace. Without unions, individual workers may find they have little ability to induce change at work and thus choose to "exit" the firm when they face difficulties.

We start by discussing the effect of higher union wage guarantees on training. As it turns out, whether or not wage guarantees increase training critically depends on how wage guarantees affect the whole wage–tenure profile. As is well known, by setting high first period wages (i.e., flattening the wage–tenure

profile by raising entry wages), unions may preclude credit constrained workers from being able to finance (through lower wages) investments in either general or firm specific human capital. Mincer (1983), among others, argues this is a plausible union effect. However, to the extent that unions also set wages high enough to have binding wage guarantees in the second period, there will not be a reduction in investment with the introduction of unions. Instead, having a union wage structure will just imply that general human capital investment, and specific human capital investment, will be entirely funded by the employer, as in the model of Loewenstein and Spletzer (1998). The main empirical implication of union wage guarantees is thus that more of the funding for both general and specific human capital investment of union workers should be supplied by employers. In contrast, the effect of union wage guarantees on general or specific human capital investments is ambiguous.

The second effect of unions, namely that they strengthen the attachment of workers to firms, implies that unionized firms should be more willing to invest in the human capital of their workers. This implication holds both for specific human capital and, in the scenarios where firms invest in general human capital, general human capital as well. Quite simply, in any scenario in which firms are willing to invest in human capital, they will be more likely to make such an investment the greater the probability that the trainees will remain with the firm for long enough for the firm to earn a return. Thus, the greater stability engendered by unions should imply more investment. Note that these two effects of unions are linked since the higher wage guarantees in the future reduces turnover. Booth and Chatterji (1998) point out that by preventing monopolistic firms from cutting future wages, unions reduce turnover and thus generate more training.

It is also interesting to explore how robust are the various predictions about the effect of union on training in more general models of human capital accumulation and union behaviour. Kuhn and Sweetman (1999) propose a more general model of human capital accumulation where they divide general human capital into general human capital that is useful both inside the current firm and in other firms, and general human capital that is useful only at other firms.[1] Individuals may initially invest in skills of various types before they know what firm they will be associated with. Once they join a particular firm, they will likely invest further in some of those skills but let others, which are not directly relevant for their current firm, atrophy. Kuhn and Sweetman argue that workers in firms with more turnover will be more likely to invest in the general human capital that is not directly relevant at the current firm in order to keep their options open. Since unions are associated with more stable employment relationships,

[1] One example of this alternative form of human capital is industry-specific human capital that is useful in an industry other than that of the current firm. Neal (1995) and Parent (2000) show evidence that this is an important form of human capital in practice.

union workers will be more likely to under-invest in general human capital that is not relevant at the firm.[2]

Another extension is to relax the assumption that unions behave myopically by bargaining on wage profiles and work conditions, without taking account of unintended side-effects on training outcomes. Acemoglu and Pischke (1999) consider union impacts on training in a model that is in the spirit of a union monopoly model of wages and employment. In union monopoly models, unions set wages while firms determine employment based on the contract wage, but unions take account of how firms will respond when choosing their preferred wage. In their model, Acemoglu and Pischke consider a union choosing its preferred wage profile in part considering the effect of that profile on firm investment. Acemoglu and Pischke essentially assume that the union wage is above the outside option in all periods. In that situation, unions have an incentive to institute a flat wage profile because, as described earlier, such a profile induces firms to invest in general human capital. Thus, their model provides a rationale for unionized firms having flattened wage profiles. Given that unions raise average wages above those available at nonunion firms, their model also implies that unionized firms will invest more in general human capital than will nonunion firms.

Weiss (1985) also looks at the impact of unions on training in the context of a union model in which senior union members control union decision making. In Weiss's model, senior union members are able to extract a transfer from junior members. When the transfer cannot exceed some maximum size, Weiss shows that it is optimal for the senior members to establish a contract that requires the junior members to train, which effectively limits the amount of labour they actually supply. Barron et al. (1987), however, show that this finding critically depends on the assumption that there is an upper bound on transfers from junior to senior workers. Using the alternative assumption that there is a lower bound on the net wage for new hires (i.e., their wage taking into account lost time due to training and the transfer to senior union members), Barron et al. show that it is then optimal for senior workers to under-train junior members. In this setting, whether unions over-train or under-train depends crucially on the nature of the restrictions faced by senior members in maximizing the transfers from junior members.

Finally, Kennedy et al. (1994) argue that unions may have a negative impact on training through an alternative route. Specifically, strict union rules about job content and assignment may imply that firms have less incentive to train workers for anything other than a very narrowly defined task. Whether this would imply lower training levels is not clear, though it would almost certainly imply a reduction in efficiency.

[2] Kuhn and Sweetman find that post-displacement wages actually decline with the length of job tenure on the pre-displacement job for union workers, but that post-displacement wages rise with pre-displacement tenure for nonunion workers. They interpret this finding as evidence in favour of their hypothesis that union workers stop investing in general human capital relevant in outside firms, while nonunion workers continue to make such investments.

While it is difficult to draw robust empirical implications from these various models, three main messages nonetheless emerge from the existing literature. First, unions should unambiguously increase investment in firm specific human capital because of union effects on worker stability. Earlier empirical results also suggest that most of this investment is borne by the firm. Second, predictions about the effect of unions on general human capital investment are quite ambiguous and depend on the specifics of the different models. It is thus not that surprising that empirical studies on the effect of unions on training have been relatively inconclusive (see below). Third, if anything, the presence of unions will make it more likely that the firm as opposed to the individual pays for general training.

2.2 Empirical results

The empirical papers on the impact of unions on training provide quite mixed results. The first studies of union impacts on training by Duncan and Stafford (1980) and Mincer (1983) used US data. For example, Mincer found that older (48–64 year old) union workers who do not change union status between years (union stayers) had significantly less training than older nonunion workers who did not change status (nonunion stayers). Older workers who moved from a nonunion to a union job (union joiners) also had less training on the union job than older workers who stayed in their nonunion jobs, while the results for younger workers were not significant. Note, however, that conclusions reached from the 1969 to 1971 National Longitudinal Survey data used by Mincer must be interpreted with caution since the question used confuses investment in with use of human capital.[3]

Barron et al. (1987) also find a negative effect of unions on training. In their case, the data is from a survey of employers who are asked about how much and how they provide training to new workers. The questions appear to be geared toward firm specific human capital investment, asking about training provided by specially trained personnel, co-workers and by the employee watching others work. Barron et al. (1987) find that the proportion of the firm's non-supervisory workers covered by collective bargaining is statistically significantly negatively related to measures of management provided training, worker provided training, and total training.

On the opposite side, Lynch (1992) uses data from the National Longitudinal Survey of Youth (NLSY) for 1980 and 1983 to show a positive effect of unions on training. The NLSY training question is closer to the AETS questions we use below, asking "In addition to your schooling, military and government-sponsored training programs, did you receive any other types of training for more than 1 month?" It also asks where the individual received the training. Lynch finds that union membership has an insignificant impact on training

[3] The question used is "Do you receive or use additional training (other than school training) on your job?".

received outside the firm, but positive and strongly significant impacts on training received on the job site and on apprenticeship training. Similarly, using a survey of Australian firms, Kennedy et al. (1994) find that firms where unions are actively involved in bargaining have significantly more training. The authors argue that the distinction between mere union coverage and active unions is crucial in the Australian context, showing that a union density variable does not have statistically significant effects but a measure of union activity does.

The evidence for Britain is also generally supportive of positive effects of unions on training. Green (1993) investigates the inter-relationships among training, firm size and unionization. Green's main finding is that unions have significant positive effects on training in small firms but virtually zero effects in large firms. This is an important result because it is often difficult to separate union effects from the effects of more formal complaint and wage processes instituted in larger firms. More recently, Green et al. (1999), Booth et al. (2003), and Booth and Böheim (2004) have all found positive effects of training in Britain using a variety of data sets and estimation techniques. Dustmann and Schönberg (2004) also find positive effects of unions on training in Germany. They also provide compelling evidence that union wage compressing effects, as opposed to other factors, are the source of the positive link between unions and training.

3 Data

Our main investigation is based on the AETS for 1997. The AETS is a special survey attached to the Labour Force Survey (LFS) which contains both the LFS questions on basic personal characteristics such as age, gender, education level and job tenure and an extended battery of questions on training in the previous calendar year. The AETS is not a perfectly random sample of the Canadian population, and we use the weights provided with the survey in all our calculations. We make several sample cuts to obtain a sample tailored to the issues we are investigating. We are primarily interested in investments in training and education that are related to work after individuals have finished their main formal schooling. For that reason, we omit individuals who are full time students or over age 65 at the time of the survey, and individuals who did not work during the sample year.[4] Because we are interested in how union status affects investments in and by employees, we also cut out individuals who are self-employed on their main job at the time of the survey. The original AETS sample contains 41,645 individuals. Our sample cuts result in a sample size of 18,033 observations.

[4] We excluded all those taking schooling full time since we wanted to focus on job related and funded training. Since we are studying union impacts it seemed necessary to focus on training while employed otherwise we would end up lumping all those who were not employed (or at school full time) into the nonunion category. Note also that though we are only looking at individuals who were employed at some time during the previous year, we do not restrict our analysis of training to training episodes undertaken while the individual was working.

The AETS contains information on up to five education or training spells in each of three categories: programmes, courses, and hobbies. The ordering of the training questions in the questionnaire is important to keep in mind in attempting to understand the content of these three categories. Individuals are first asked, "At any time during 1997, did you receive any training or education including courses, private lessons, correspondence courses (written or electronic), workshops, apprenticeship training, arts, crafts, recreation courses, or any other training or education?" Conditional on answering yes to this first question, respondents are then asked if the training was intended to obtain a high school diploma, a formal apprenticeship certificate, a trade or vocational diploma or certificate, a college diploma or certificate, or a university degree, diploma or certificate. An answer of yes to any of these questions initiates a series of additional questions related to what are called "programmes". Programmes thus consist of training or education spells aimed at obtaining a formal certificate. Whether or not the respondents answer yes to taking programme training, they are then asked whether they took any other courses. Finally, respondents are asked if they took any hobby type courses.

Our focus in this paper is on work related training. For that reason, we do not count hobby spells as training. For both programmes and courses, respondents are asked the main reason for taking the training, with possible answers being: (1) a current or future job; (2) personal interest; (3) other. We select only programme and course spells for which the respondent answered that the main reason for taking the training was the current or future job. Thus, for individuals who have only hobby spells and/or only programmes or courses done for personal interest, we keep the observation but treat it as if there was no training spell. Even after doing this, there are a considerable number of observations for whom we observe both work related programme and course training spells and/or multiple programme or course training spells. We view programme and course spells as potentially quite different, with the first being more like going back for more formal schooling and invariably being associated with obtaining a formal ratifying document of some kind, while the latter may contain a variety of types of work related courses. Indeed, we will argue that programmes can be viewed as relating purely to general human capital formation while at least some courses may be related to firm specific human capital formation. Given this perspective, we elected to keep information on programme and course training separately for each respondent. In order to simplify the exposition, we focus on only one course and/or programme per person. For an individual with multiple course spells, we select only the spell with the longest duration and similarly select the longest duration programme spell for individuals with multiple programme spells. For individuals with both multiple programme and course spells, we record the longest of each.[5]

[5] This choice has little consequence for training programmes since only 3% of individuals taking a programme took more than one programme during the year. The programme of the longest duration represents 99% of the total duration for all programmes taken. It is more common, however, for the same person to take more than one training course during the same year. Thirty-five percent

The discussion in the previous section pointed out that there are good theoretical reasons for anticipating different impacts of unions on specific versus general human capital. More importantly, the distinction between general and firm specific human capital becomes blurred once we introduce frictions between wages paid in the current firm and those offered at outside firms. Thus, a more useful distinction is one between investments in human capital that are easily verified by alternative employers versus ones that are only directly observable by the worker and his or her current employer. The former can provoke offers from alternative employers attempting to poach the investment while the latter cannot. This is a somewhat different distinction from the traditional technologically driven distinction between skills that are useful only with the current firm's technology versus skills that are useful with in the production functions of other firms. With the distinction based on observability in mind, we examine two different schemes for classifying the training spells we are studying into general versus firm specific human capital categories. As stated earlier, we view programme spells as being clearly related to general human capital. In these spells, individuals work toward formal qualifications which by their very nature signal to prospective employers throughout the economy that the individual has acquired a set of skills. Indeed, the point of this type of education is often to prepare individuals for productive work in general not for work at a specific firm. Thus, all the schemes we examined share the feature that all programme spells are always classified as general human capital. This means that the definitional issue comes down to whether and how to classify course spells.

The first, and simplest, classification scheme we use for the course spells is to define all course spells as being related to firm specific human capital. While this is clearly an exaggeration, we believe that the simple association of programme spells with general human capital and course spells with firm specific human capital is the most robust approach for portraying the direction, if not the exact magnitude, of the relationship between unionization and the different types of human capital generation. We also use an alternative classification scheme based on who actually provides the training.[6] The survey asks questions about who provided the training, with possible answers including an educational institution, a private educational or training institution, and the place of work. Under this alternative classification, we assume that training taken at work is specific to the current firm and is not easily observable to alternative firms. Indeed, if the training was intended to generate general skills, it is unlikely that it would be efficient for the course to be provided by the employer since public or private educational institutions would have a comparative advantage

of people who took training courses took more than one course in the same year. Nonetheless, the longest course accounts for 85% of total hours of course training. So even in the case of training courses, we lose little information by focusing on the longest spell of training.

[6] We also explored alternative definitions based on stated reasons for why individuals took courses (e.g. obtaining formal qualifications or upgrading skills for the current job). Unfortunately, we could not use these alternative classifications in practice because of shortcomings in the way the questions were asked and answered.

Table 1 Basic tabulations of training rates

Outcome	All nonunion	All union	Males nonunion	Males union	Females nonunion	Females union
Training	0.28	0.32	0.28	0.29	0.28	0.36
Programme training	0.097	0.076	0.097	0.066	0.098	0.089
Course training	0.20	0.26	0.20	0.23	0.20	0.30
Both prog. and course	0.016	0.018	0.018	0.012	0.014	0.026
General training	0.22	0.21	0.22	0.19	0.23	0.25
Firm spec. training	0.062	0.11	0.062	0.11	0.061	0.12

in providing such training. Thus, all course training provided by the employer is classified as specific training and all other course training plus programme training is defined as general training. This definition fits with standard classification schemes in other papers where training spells are separated into those done on the job versus those done off the job. One caveat to keep in mind, however, is that on-the-job training is not measured in the AETS. Because of this, we may be greatly understating the true importance of specific training.

4 Descriptive statistics

As a first step in characterizing the data, we would like to establish whether unions are associated with different levels of training of any kind. In all the work that follows we use a union dummy variable that equals one if the individual was a member of a union or was covered by a collective agreement on their main job during the previous year. Table 1 provides basic tabulations on whether an individual received training in the previous year (we do not limit the sample to individuals working while taking training). The first row corresponds to whether an individual receives training of any work related type while employed in the previous year, broken down by union status and gender. The first two columns reveal that, overall, union workers are only 4% points more likely to train than nonunion workers. However, this small union effect hides noticeable differences within subgroups. While union and nonunion males are equally likely to train, unionized females are 8% points more likely to train than nonunion females.

The second and third rows of Table 1 contain results relating to our first, simplest definition of general and firm specific human capital: general human capital is equated with programme training while specific human capital is equated with courses. Differences between union and nonunion workers are much sharper when one looks at these subcategories. Thus, for all workers pooled together, union workers are 2% points less likely to get programme training but 6% points more likely to get course training. The direction of these differences holds up in the specific gender groups, with females showing the largest difference in specific training. For females, union workers are 10% points more likely to get course training than nonunion female workers.

Table 2 Training types and payment sources

Payer	Programme training		Course training		General training		Firm-specific training	
	Non-union	Union	Non-union	Union	Non-union	Union	Non-union	Union
Employer	0.42	0.48	0.88	0.90	0.67	0.73	0.99	0.97
Self	0.67	0.65	0.16	0.16	0.40	0.36	0.047	0.076
Government	0.12	0.13	0.043	0.076	0.081	0.097	0.021	0.076
Union	0.006	0.031	0.026	0.045	0.019	0.053	0.018	0.021
Shared	0.18	0.22	0.075	0.090	0.13	0.15	0.041	0.069

Note All proportions are computed for men and women pooled together. The "shared" category consists of training jointly funded by the employer and the worker. "General training" refers to either programme training or course based training that is not provided directly by the employer. "Firm specific training" refers to course based training that is provided directly by the employer

The last two rows of the table present results relating to our alternative definition of general and specific human capital investment, in which specific training is defined as only course training that is directly provided by the employer. By this definition as well, union workers get more specific human capital training than their nonunion counterparts. The general training again favours nonunion workers for males but union females are now more likely to train than their nonunion counterparts. Thus, for males the patterns fit with a model in which union firms are willing to invest more in specific human capital because of added worker stability, but this is partially offset by reduced investment in general human capital. For females there is no such trade-off using the second definition of specific human capital: union and nonunion workers receive very similar levels of general training but union workers get more firm specific training. The same trade-off between general and specific human capital investment witnessed for males is seen for females if we use the first definition of specific and general human capital.

As discussed in the previous section, considerable attention has been paid to the issue of who actually pays for training. Table 2 contains a breakdown of the source of payment by training type, again separated by union status for men and women pooled together (the results are quite similar for men and women analysed separately). The numbers in the table correspond to the proportion of trainees of a particular type who state that some or all of the training was funded by a given source. Note that respondents are able to list multiple funding sources so there is no reason to expect the reported proportions to sum to one. While it is hard to be certain, the wording of the funding questions in the survey point toward individuals interpreting this as direct payment for training as opposed to indirect payments through accepting lower wages on the part of the workers or paying wages above marginal product on the part of the firm. This presumably understates the participation of workers in the funding of training.

For programme training, which we argue is one way one might define general human capital investment, the patterns fit broadly with the discussion in

the previous section. In particular, the majority of the direct payment for this training is made by some combination of individuals and the government. This fits with the traditional view that general human capital investment should be done by either the worker or by society. However, as in earlier studies, we find evidence of a substantial amount of investment by employers as well. For course training, close to 90% of the funding is carried out in whole or in part by employers. Financing by the worker is much smaller than with programme training and in close to half the cases where there is investment by the worker, that investment is shared with the firm. The government also plays a much smaller role in this type of investment than in programme training. The payment proportions fit with findings in earlier studies indicating that employers pay for most of firm specific investments on their own. For nonunion workers, for example, 88% of course training involves some firm investment and in 80% of cases, it involves firm investment with no sharing of the investment with the worker.

The last two sets of columns regroup training spells according to the alternative definition of specific human capital based on whether the firm provided the training directly. Not surprisingly, employers took part in funding for close to 100% of firm specific training defined in this way. Individuals take only a very limited role in funding this firm specific training, with much of that limited involvement shared with firms. For general human capital defined in this way, employers are actually involved in funding a greater proportion of spells than individuals, with governments playing a smaller, though still substantial role.

In terms of union effects, recall the earlier prediction that investment in general human capital should be funded more by the firm and less by the worker in the union versus the nonunion sector. Examining the programme based definition of human capital, there is limited evidence in support of this conclusion. Employers are more likely to take part in funding general human capital in the union sector but workers themselves are investing to the same degree in both sectors. Indeed, we could follow Kuhn and Sweetman in assuming that general human capital can be divided between capital useful in the firm and capital useful outside the current firm (alternative capital). Then, we could define the worker investment in general training useful within the firm as being reflected only in the investments they share with the firm. By that measure, union workers actually invest more in this type of general human capital than do nonunion workers. Staying with these definitions, there are more spells with worker investment but without firm investment in the nonunion than the union sector (the difference between the "self" and "shared" rows is 0.49 vs. 0.43). If we assume such funding reflects investment in alternative human capital (or at least general human capital investment from which firms cannot capture the return), this could correspond to union workers investing less in alternative capital because of greater perceived job stability. Note also that using the broader definition of general training given in columns 5 and 6 yield very similar results.

Implications of the models for firm specific investment patterns are unclear. One would generally expect firms to play a large role in such investment and ear-

lier empirical work suggests that they handle this investment almost exclusively. According to traditional models of firm specific human capital investment, firms may require workers to share in the investment in order to ensure that workers maintain an attachment to the firm and do not walk away with the investment. One might hypothesize that firms will require less investment from workers in situations of greater job stability, such as that engendered by unions. However, Hashimoto (1981) shows that as long as the separation rate is known, there is no necessity in a firm sharing the investment with the worker. Any sharing rule can be optimal. Thus, there is no direct implication for differences in funding sources between the union and nonunion sectors for firm specific training. The results for either the course training or the alternative definition of firm specific training are consistent with these ambiguous predictions. They show no sizable difference between employers and workers involvement in the union and nonunion sectors.

All of the discussion to this point has been based upon models in which union impacts on training are indirect. It is also possible that unions affect training investment directly by helping to pay for it themselves or by bargaining for it as part of the collective agreement. This might be a reasonable approach if training was perceived by members as something to which they had insufficient access on their own. The results in Table 2 reveal that unions play a very small direct funding role, taking part in investing in at most about 5% of spells of any type. Impacts through collective agreements are similarly small. The AETS contains a question on whether the training was specified as part of a collective agreement. Only 0.56% of trainees specify that their training was part of a collective agreement. This is in accord with earlier studies that find that unions rarely bargain directly over training.

5 Probit analysis of training incidence

The results in Tables 1 and 2 suggest that unions have some impacts both on the incidence of sub-categories of training, and on the overall training levels. In particular, unions appear to slightly reduce the incidence of general training while increasing the incidence of specific training. However, this conclusion is based upon simple tabulations. Union and nonunion workers differ in observable characteristics that are themselves related to training propensity. In this section, we first present tabulations showing union/nonunion differences in individual and firm characteristics and then re-examine union impacts controlling for such differences.

Table 3 shows variable means for various personal and firm characteristics, broken down by union status for the whole (men and women pooled) sample. The table reveals that there are substantial differences between union and nonunion workers in many dimensions. In terms of education levels, for example, union workers are less likely to have a high school or less education and more likely to have at least some post-secondary education. The high unionization rate in the public sector in Canada is reflected in the fact that approximately

Table 3 Variable means by union coverage status

Variable	Nonunion	Union
Education		
Not a high school graduate	0.17	0.15
High school graduate	0.24	0.18
Some post secondary	0.09	0.08
Completed post secondary	0.33	0.37
University	0.17	0.22
Public sector	0.07	0.41
Firm size		
Less than 20 employees	0.34	0.058
20–99 employees	0.21	0.12
100–199 employees	0.068	0.077
200–499 employees	0.077	0.11
500 or more employees	0.31	0.64
Female	0.49	0.45
Age		
17–19	0.025	0.008
20–24	0.12	0.046
25–34	0.31	0.24
35–44	0.29	0.32
45–54	0.19	0.30
55–64	0.079	0.099
Years of job tenure	5.6	10.1

41% of union workers are employed in the public sector, compared to only 7% of nonunion workers. Union workers are also much less likely to be employed in firms with fewer than 20 employees and much more likely to be employed in firms with over 500 employees than their nonunion counterparts, though this may in part just reflect the public/private sector difference. Union workers are also more likely to be male and tend to be older, with 30% of union workers being of age 45–54 compared to only 19% of nonunion workers. This reflects recent declines in access to unionization among new cohorts of labour market entrants (Beaudry et al. 2001). Finally, the average (interrupted) years of job tenure is substantially higher for union workers, reflecting the higher job stability in the union sector that is at the heart of some of theoretical claims about how unions affect training.

Given these substantial differences in observable characteristics, we need to examine union impacts controlling for other covariates to be sure that what is being observed in Table 1 is a true union impact. To do this, we use a probit estimator controlling for various combinations of observable individual and firm characteristics. Because some of the results to this point indicate substantial differences by gender, we present all of our results separately for males and females. Rather than present the estimated probit coefficients, which do not have an interpretable magnitude, the tables report the marginal effects (derivatives, or discrete changes for dummy variables, of the probability of obtaining training with respect to the specified covariates) along with their standard errors.

Table 4 presents results for males in which the dependent variable is a dummy variable corresponding to overall training (i.e., either programme or course training related to current or future employment). The first column specification contains union status (whether the individual was covered by a collective agreement) and a constant as its only covariates. This demonstrates a union impact of the same order of magnitude as was observed in Table 1: unions increase the incidence of training among males by about 1% point relative to a nonunion average of 28%. The column two specification adds in covariates related to education and age. The education covariates are intended to pick up the extent to which formal schooling alters the costs and benefits of obtaining further education and training. The estimates indicate that more educated workers obtain substantially more and less educated workers obtain less training than those whose highest level of education is high school graduation (the base group). This fits either with formal schooling and further training being complements in production and/or formal schooling reducing the costs of further training, perhaps because those with more schooling have "learned how to learn". The age variables reveal a strong pattern in which younger individuals have much higher training rates than older individuals, as one would predict in models of rational investment in training. Most importantly from our perspective, adding these variables strengthens a bit the union status impact on training, making it statistically significant. In column 3 we add a variable corresponding to whether the individual had managerial responsibilities to the specification to find out whether managers are more or less likely to get trained. The estimated coefficient indicates that workers with managerial or supervisory responsibilities are substantially more likely to obtain training than those without and adding this variable increases the union impact variable by another percentage point.

In the remaining columns of Table 4 we investigate the impacts of sector, firm size, seniority and province. In column 4, we add in a set of dummy variables for public sector employment and firm size as well as years of tenure and years of tenure squared. [7] We add the firm size variables because of results in earlier work showing a correlation between firm size and training incidence, and because of the strong correlation between firm size and union status shown in Table 3. The public sector variable is included to control for the possibility that training is done differently in the public and private sectors and to allow for purer estimates of the firm size effect. Years of tenure are introduced to capture two potential effects. The first effect is that training is expected to take place early on the job for the standard reasons given by human capital theory (maximizing the number of periods for which the training will be productive). This effect is consistent with wage studies that show that the effect of tenure is larger early in the job (concave effect of tenure on wages), suggesting that most productive training takes place early on. The other potential effect is that

[7] We use a quadratic specification for years of tenure with the firm by analogy with the wage studies that typically find a positive but declining (negative coefficient on the squared term) effect of tenure on wages.

Table 4 Simple probit results (marginal effects) for training status, males

Variable	(1)	(2)	(3)	(4)	(5)
Union	0.007 (0.010)	0.021 (0.011)*	0.036 (0.011)*	−0.041(0.012)*	−0.030 (0.013)*
Education					
No HS degree	–	−0.087 (0.016)*	−0.082 (0.016)*	−0.059 (0.017)*	−0.044 (0.017)*
Post-secondary	–	0.17 (0.024)*	0.16 (0.024)*	0.17 (0.024)*	0.18 (0.024)*
Post-sec degree	–	0.14 (0.015)*	0.13 (0.015)*	0.13 (0.015)*	0.14 (0.016)*
University deg.	–	0.25 (0.018)*	0.22 (0.018)*	0.19 (0.019)*	0.21 (0.020)*
Age					
17–19	–	0.26 (0.042)*	0.28 (0.041)*	0.30 (0.042)*	0.32 (0.042)*
20–24	–	0.080 (0.020)*	0.088 (0.021)*	0.11 (0.021)*	0.12 (0.022)*
35–44	–	−0.005 (0.013)	−0.013 (0.013)	−0.032(0.013)*	−0.037 (0.013)*
45–54	–	−0.024 (0.014)	−0.039 (0.014)*	−0.068(0.015)*	−0.075 (0.015)*
55–64	–	−0.110 (0.017)*	−0.12 (0.016)*	−0.13 (0.016)*	−0.14 (0.016)*
Manager	–	–	0.11 (0.012)*	0.090 (0.012)*	0.079 (0.012)*
Public sector	–	–	–	0.090 (0.016)*	−0.030 (0.020)
Firm size					
1–20	–	–	–	−0.13 (0.013)*	−0.13 (0.013)*
20–99	–	–	–	−.086 (0.013)*	−0.069 (0.014)*
100–199	–	–	–	−0.051 (0.018)*	−0.041 (0.019)*
200–499	–	–	–	−0.041 (0.017)*	−0.031 (0.018)
Tenure/10	–	–	–	0.045 (0.030)	0.044 (0.030)
Ten. Sq./100	–	–	–	−0.013 (0.015)	−0.010 (0.015)
Ind. and Prov. Dummies	No	No	No	No	Yes
Pseudo R^2	0.0001	0.056	0.066	0.087	0.109

Note 8,074 observations used in the estimation. Standard errors are in parentheses

*,+ Mean effect is significantly different from zero at the 5 and 10% significance level, respectively

in the case of specific capital, firms may prefer to invest in more senior workers who are less likely to turnover than workers who just joined in. Since these two effects go in opposite directions, the effect of tenure on training is ambiguous.

The results indicate that public sector workers are substantially more likely to obtain training than their private sector counterparts. The estimated firm size effects reveal a clear pattern of training increasing with firm size. This fits with results from earlier papers. It also causes the union effect to move from significantly positive to significantly negative, indicating that some positive perceived union effects on training are really just disguised firm size effects. The effect of tenure is not significant, indicating that the two above discussed effects may indeed be offsetting each other. In the final column, we add a set of nine industry dummy variables and nine provincial dummy variables to the specification. This changes the magnitude of the other estimated coefficients very little and does not change the implications drawn from those coefficients at all. The union impact remains negative and significant though smaller (in absolute value) than in column 4.

As we saw in Table 1, patterns for overall training incidence can hide large differences within specific training categories. In Table 5, we re-estimate the most complete specification from Table 4 for four different training status dependent variables. The first column contains the results using programme training as our dependent variable. The estimates again indicate some positive relationship between education and programme training, though that relationship is not monotonic. In particular, post-secondary graduates and university graduates do less training of this type than do those with some (but not completed) post-secondary education. Since programme training really corresponds to going back to school, this result is not surprising: individuals with a university education need to get less new education because they are already highly educated. The age variables again indicate a strong negative relationship between age and training, and being in the public sector has a positive impact on training. Interestingly, there is no clear relationship between firm size and training. This may fit with the claim that programme training is true general human capital training that occurs off the firm site: there is no reason to believe that larger firms have a comparative advantage in providing such training. Nonetheless, this result is somewhat surprising because in models in which firms help pay for general human capital investment, increased job stability should lead to higher investment levels, and larger firms tend to have more job stability. Interestingly, years of tenure have a negative and significant (though declining) effect on training, which is hard to reconcile with standard human capital theory. Including all of these covariates dramatically reduces the size of the union impact on programme training. Table 1 indicated that unionized males obtained approximately 3% points less programme training than nonunion males. However, the results from column 1 indicate that training rates are essentially the same for union and nonunion males once one controls for other characteristics. Thus, the evidence that unions lead to a reduction in general human capital investment is not strong.

Table 5 Probit results (marginal effects) for different types of training, males

Variable	Programme training	Course training	General training	Firm spec. training
Union	−0.003 (0.0064)	−0.027 (0.011)*	−0.022 (0.011)*	−0.0054 (0.0067)
Education				
No HS degree	−0.007 (0.009)	−0.040 (0.015)*	−0.024 (0.016)	−0.017 (0.007)*
Post-secondary	0.094 (0.018)*	0.100 (0.022)*	0.172 (0.024)*	0.005 (0.011)
Post-sec degree	0.065 (0.010)*	0.085 (0.014)*	0.129 (0.015)*	0.015 (0.007)*
University deg.	0.075 (0.014)*	0.145 (0.018)*	0.189 (0.019)*	0.018 (0.009)*
Age				
17–19	0.25 (0.039)*	0.015 (0.040)	0.287 (0.043)*	0.026 (0.027)
20–24	0.073 (0.013)*	0.025 (0.019)	0.122 (0.020)*	−0.013 (0.010)
35–44	−0.032 (0.006)*	0.0033 (0.012)	−0.035 (0.011)*	−0.0003 (0.006)
45–54	−0.063 (0.005)*	−0.0027 (0.014)	−0.072 (0.012)*	−0.002 (0.007)
55–64	−0.063 (0.004)*	−0.059 (0.016)*	−0.126 (0.012)*	−0.005 (0.009)
Public sector	0.0066 (0.0108)	−0.021 (0.017)	−0.016 (0.018)	−0.010 (0.008)
Firm size				
1–20	0.010 (0.008)	−0.135 (0.010)*	−0.043 (0.013)*	−0.062 (0.005)*
20–99	0.012 (0.008)	−0.073 (0.011)*	0.003 (0.013)	−0.045 (0.005)*
100–199	0.007 (0.011)	−0.034 (0.015)*	0.015 (0.018)	−0.029 (0.006)*
200–499	0.025 (0.012)*	−0.048 (0.014)*	0.017 (0.017)	−0.028 (0.005)*
Tenure/10	−0.058 (0.016)*	0.107 (0.026)*	0.004 (0.026)	0.024 (0.014)$^{+}$
Ten. Sq./100	0.029 (0.008)*	−0.042 (0.013)*	0.003 (0.013)	−0.009 (0.007)
Pseudo R^2	0.058	0.12	0.21	0.13

Note 8,074 observations used in the estimation. Standard errors are in parentheses. Controls for managerial responsibility, industry and province are included but not reported in the table

*,$^{+}$Mean effect is significantly different from zero at the 5 and 10% significance level, respectively

In column 2, we present results from the same specification with a dummy variable corresponding to course training as the dependent variable. We argued earlier that course training could be viewed as providing a relatively broad definition of firm specific training. For training of this type, education again has a strong and positive effect on training. Interestingly, the effects of age are no longer as clear, with all age groups below age 55 having quite similar training rates. This appears to indicate that as long as there is at least ten years of an individual's working life left, firms and workers believe it is worthwhile continuing to invest in this type of training. While this is a reasonable use of training, the fact that it does not decline at all with age below 55 years old is surprising. In contrast to programme training, firm size shows up with a strong pattern, positively related to course training. Tenure has a positive and declining effect on course training, which is consistent with standard human capital theory. The impact of adding these controls is quite dramatic. The union effect on course training goes from positive 3% points in Table 1 to negative 3% points in this table.

Column 3 contains results using our second definition of general human capital, which includes both programme training and any course training not provided by the employer. The results using this definition are quite similar to those presented in column 1 except for the effect of tenure which is now positive,

as expected, but not significant. The union impact estimated with the second definition of general training is again negative and larger than that estimated with the first definition, though still not very substantial.

Finally, column 4 contains estimates using our more restricted definition of firm specific training: course training that is directly provided by the employer. The patterns again indicate positive education effects but, as in column 2, there is no clear age pattern. There is again a relatively clear firm size pattern but a weaker tenure effect. The union impact is both economically insubstantial and statistically insignificant. If we use column 1 as our most precise definition of general human capital training and column 4 as our most precise definition of firm specific training, then the conclusion from Table 5 is that unionization has essentially no impacts on either general or firm specific human capital investment once one controls for other covariates. Further investigation indicates that the sizeable reduction in the union impact on programme training witnessed in Table 5 relative to Table 1 arises primarily because of the introduction of controls for age, which has negative effects on training and is positively related to union status. In contrast, the reduction in the impact of unionization on firm specific training stems mainly from the introduction of firm size variables.

Results from the same exercises for females are presented in Tables 6 and 7. In Table 6, we recreate the exercise from Table 4 in which we introduce sequentially a set of covariates to investigate the impact of controlling for them upon our union effect estimate. For males, this exercise ultimately had very little impact on the estimated union effect. However, for females, introducing the covariates reduces the impact of unionization on overall training from 0.080 to −0.036. The latter estimate is very similar to that found for males, suggesting that the large differences between males and females in the first row of Table 1 arise from differences in the distributions of observable covariates between males and females. The patterns in training relative to the other observed characteristics are quite similar to those found for males: both education and firm size have positive effects on training, while age has a negative impact. In Table 7, we present the results of probits estimated with different definitions of general and firm specific training as the dependent variables for females. As for males, the union impact is small and negative both for programme and course training. The alternative human capital investment measures also yield similar conclusions for females than for males. In particular, the impact of unionization on general training is negative and statistically significant, while the impact of unionization on firm specific training is not statistically significant.

Overall, once one controls for the impacts of other covariates, the impacts of unions on training are generally small for both males and females. The only exception is the broader measure of general training for which the union impact is negative and significant for both men and women.

6 Probit estimates of source of payment

As with the study of the incidence of training, correlations between unionization status and other covariates raise questions of whether simple tabulations

Table 6 Simple probit results (marginal effects) for training status, females

Variable	1	2	3	4	5
Union	0.080 (0.011)*	0.060 (0.011)*	0.069 (0.011)*	−0.020(0.013)	−0.036 (0.013)*
Education					
No HS degree	–	−0.120 (0.017)*	−0.109 (0.017)*	−0.088 (0.018)*	−0.073 (0.019)*
Post-secondary	–	0.123 (0.022)*	0.122 (0.022)*	0.111 (0.022)*	0.093 (0.022)*
Post-sec degree	–	0.155 (0.014)*	0.153 (0.014)*	0.154 (0.015)*	0.140 (0.015)*
University deg.	–	0.260 (0.018)*	0.247 (0.018)*	0.219 (0.018)*	0.193 (0.019)*
Age					
17–19	–	0.174 (0.045)*	0.185 (0.046)*	0.202 (0.046)*	0.235 (0.047)*
20–24	–	0.076 (0.021)*	0.086 (0.021)*	0.103 (0.022)*	0.128 (0.023)*
35–44	–	−0.004(0.013)	−0.005 (0.013)	−0.019 (0.013)	−0.027 (0.013)*
45–54	–	0.001 (0.014)	−0.003 (0.014)	−0.018 (0.015)	−0.027 (0.015)$^{+}$
55–64	–	−0.109(0.018)*	−0.115 (0.018)*	−0.112 (0.019)*	−0.124 (0.018)*
Manager	–	–	0.131 (0.012)*	0.119 (0.013)*	0.109 (0.013)*
Public sector	–	–	–	0.093 (0.015)*	0.051 (0.018)*
Firm size					
1–20	–	–	–	–0.162 (0.012)*	−0.152 (0.013)*
20–99	–	–	–	−0.059 (0.014)*	−0.058 (0.014)*
100–199	–	–	–	−0.030 (0.020)	−0.029 (0.020)
200–499	–	–	–	−0.009 (0.018)	−0.002 (0.018)
Tenure/10				0.020 (0.029)	0.002 (0.029)
Ten. Sq./100				−0.007 (0.014)	0.001 (0.014)
Ind. and prov. dummies	No	No	No	No	Yes
Pseudo R^2	0.0054	0.059	0.071	0.094	0.116

Note 8,608 observations used in the estimation. Standard errors are in parentheses

*,$^{+}$ Mean effect is significantly different from zero at the 5 and 10% significance level, respectively

Table 7 Probit results (marginal effects) for different types of training, females

Variable	Programme training	Course training	General training	Firm spec. training
Union	−0.006 (0.007)	−0.025 (0.011)	−0.044 (0.012)*	0.006 (0.006)
Education				
No HS degree	−0.003 (0.012)	−0.068 (0.016)*	−0.053 (0.017)*	−0.020 (0.008)*
Post-secondary	0.075 (0.017)*	0.039 (0.019)*	0.081 (0.021)*	0.013 (0.010)
Post-sec degree	0.076 (0.010)*	0.076 (0.013)*	0.128 (0.014)*	0.009 (0.006)
University deg.	0.093 (0.015)*	0.123 (0.017)*	0.175 (0.018)*	0.012 (0.008)
Age				
17–19	0.185 (0.040)*	0.033 (0.045)	0.223 (0.046)*	−0.024 (0.019)
20–24	0.117 (0.016)*	−0.052 (0.017)*	0.101 (0.020)*	0.008 (0.011)
35–44	−0.024 (0.006)*	0.007 (0.012)	−0.034 (0.011)*	0.009 (0.006)
45–54	−0.035 (0.007)*	0.012 (0.014)	−0.044 (0.013)*	0.013 (0.007)$^{+}$
55–64	−0.062 (0.006)*	−0.052 (0.017)*	−0.113 (0.015)*	−0.0002 (0.010)
Public sector	0.0005 (0.0090)	0.042 (0.015)*	0.017 (0.015)	0.021 (0.008)*
Firm size				
1–20	−0.026 (0.007)*	−0.129 (0.010)*	−0.071 (0.012)*	−0.064 (0.005)*
20–99	−0.010 (0.007)	−0.052 (0.012)*	−0.008 (0.013)	−0.028 (0.005)*
100–199	−0.015 (0.010)	−0.007 (0.017)	−0.009 (0.018)	−0.004 (0.005)
200–499	−0.011 (0.009)	0.013 (0.016)	0.006 (0.017)	−0.001 (0.007)
Tenure/10	−0.0078 (0.016)*	0.087 (0.025)*	−0.081 (0.026)*	0.048 (0.012)*
Ten. Sq./100	0.024 (0.008)*	−0.032 (0.012)*	0.042 (0.013)*	−0.024 (0.006)*
Pseudo R^2	0.126	0.137	0.088	0.137

Note 8,608 observations used in the estimation. Standard errors are in parentheses. Controls for managerial responsibility, industry and province are included but not reported in the table

$^{*,+}$ Mean effect is significantly different from zero at the 5 and 10% significance level, respectively

of union impacts on the sources of payment for training reported in Table 2 reflect true union impacts. Again, we wish to control for other covariates and re-estimate the union impact. To do this, we run the same specification as was used in Tables 5 and 7 with two new dependent variables: (1) a dummy variable corresponding to whether an employer helped pay for the training; and (2) a dummy variable equal to one if the individual helped pay for the training but the employer did not. The first dependent variable is intended to capture any employer involvement in financing training. The second focuses exclusively on individual contributions. We examine sources of payment for our two definitions of general human capital and one (all courses) definition of specific human capital.

Table 8 reports the marginal effects calculated using estimated coefficients from a probit with the first dependent variable. We only report the marginal effects associated with union and tenure, since few interesting patterns emerged for the other regressors such as age or education. The first column of the first panel shows results for males who reported taking programme training. Recall that the results in Table 2 indicate that unionized employers are more likely to pay for such training than are nonunion employers. This result appears to hold up once one controls for other covariates, although the union differential is both smaller than in Table 2 and not statistically significant. Tenure has a large

Table 8 Probit results (marginal effects) for who paid for training

Variable	Programme training	Course training	General training
Males: employer paid for training			
Union	0.042 (0.062)	0.023 (0.015)	0.022 (0.028)
Tenure/10	0.882 (0.160)*	0.173 (0.035)*	0.582 (0.071)*
Ten. Sq./100	−0.319 (0.087)*	−0.058 (0.018)*	−0.203 (0.037)*
Males: worker alone paid for training			
Union	−0.056 (0.054)	−0.025 (0.011)*	−0.034 (0.022)
Tenure/10	−0.673 (0.148)*	−0.154 (0.029)*	−0.474 (0.060)*
Ten. Sq./100	0.270 (0.081)*	0.058 (0.014)*	0.185 (0.032)*
Females: employer paid for training			
Union	−0.008 (0.050)	−0.015 (0.016)	−0.022 (0.030)
Tenure/10	0.579 (0.110)*	0.233 (0.034)*	0.661 (0.067)*
Ten. Sq./100	−0.202 (0.064)*	−0.091 (0.017)*	−0.233 (0.035)*
Females: worker alone paid for training			
Union	−0.071 (0.055)	0.027 (0.014)*	−0.003 (0.027)
Tenure/10	−0.379 (0.125)*	−0.111 (0.027)*	−0.418 (0.060)*
Ten. Sq./100	0.130 (0.071)$^{+}$	0.046 (0.013)*	0.148 (0.031)*

Note Standard errors in parentheses. The table entries correspond to probability derivatives. The estimated models include the same regressors as in Tables 5 and 7, but only the estimates for union and tenure are reported.

$^{*,+}$ Mean effect is significantly different from zero at the 5 and 10% significance level, respectively

and positive (but declining) effect, which is consistent with employers investing in more stable workers. Results using the broader definition of general human capital, given in column 3, are very similar. According to the course based definition of firm specific training, firms also play a greater funding role in this type of investment in the union versus the nonunion sector. Tenure has a positive though smaller effect than in the case of programme training.

The second panel of results in Table 8 reports the marginal effects for the probability that the individual alone (without the help of the firm) pays for the investment with respect to our various covariates. In this case, for programme training there is no evidence of a substantial relationship between union status and self-payment for training. The same result holds for the alternative definition of general training in column 3. Interestingly, the effect of tenure now turns negative. The same patterns hold true for investment in course training in column 2. Here, though, the union effect is negative and statistically significant.

The last two panels of Table 8 report the corresponding results for females. The estimates of employer contributions to training indicate union impacts that are economically smaller than those for males. In terms of worker payment for training, the results indicate that unionization leads to a decline in such payment for general training but a statistically significant increase for specific training. Overall, the results of these exercises indicate that unions have little impact on the involvement of firms and workers in paying for both general and firm specific training while leading to a decline in the proportion of workers investing in firm specific training.

Once one controls for other covariates, then, our results paint slightly different pictures for men and women. For both men and women, unionization is related to small decreases in either general of firm specific human capital investment. There is also weak evidence that unions generate greater employer involvement in payment for both general and firm specific human capital for men. Thus, unionization appears to shift the means of payment more than the amount of investment for men. This fits with the kinds of models in which union pay structures lead to unionized firms taking a greater role in funding general human capital investment but do not necessarily change the amount of investment. To explain the small declines in general human capital investment, one could then graft onto these types of models the type of distinction between alternative human capital (useful only outside the firm) and general human capital (useful both inside and outside the current firm) proposed by Kuhn and Sweetman. In that case, more stable union work arrangements could lead to lower investment by workers while firms play an expanded role in funding general human capital. The finding that tenure has a positive effect on whether employers pay for training is quite consistent with this view. In that case, one would also expect to see the proportion of non-specific training spells funded by workers alone decrease as firms expand their role while workers invest less in alternative human capital. The negative effect of tenure on the probability of workers paying for training alone is also consistent with this view.

For women, the results again indicate small and negative effects of unionization on both general and firm specific human capital investment. Both of these effects are more or less comparable to similarly estimated effects for men. In terms of payment, unionization appears to have little impact on the proportion of spells in which firms help in the funding but it does have negative (though not significant) effects on the proportion of general human capital training invested in by workers alone. As in the case of men, the most robust result is that employer involvement in training increases with tenure while the opposite happens to worker involvement.

7 Robustness checks

As a further check of the robustness of the results, we re-estimated our main models using an earlier (1993) version of the AETS. The results were very similar to those obtained with the 1997 AETS. For instance, in both years the raw difference in training rates between union and nonunion workers (for men and women pooled) is 4% points to the advantage of union workers. The union advantage turns negative in both years, however, once other characteristics are controlled for using the probit models. We also re-estimated these main models using a more recent version of the AETS (2002) that asks slightly different questions about training, but found once again very similar results.

All through the empirical analysis, we have assumed that the union status of workers was exogenous. As in any study of union impacts, however, this assumption may be violated if workers are selected endogenously into union

jobs. To address this issue, we tried to use interprovincial changes in unionization rates as an underlying source of variation in union status in a setting were we pooled the years of available data (1993, 1997, and 2002) together. The hope was that changes in labour legislation, which are mostly determined at the provincial level in Canada, would provide enough variation in unionization rates to provide credible estimates of the union effect. Unfortunately, there was not enough interprovincial variation in unionization rates (weak instrument problem) for this estimation strategy to work in practice.

8 Conclusions

In this paper, we have implemented an empirical investigation of the impact of unionization on training in Canada using the AETS. Simple tabulations indicate that unions have positive though small direct impacts on overall training levels. However, these overall effects hide larger differences for specific sub-groups and for different types of human capital investment. In particular, there are substantial differences between males and females. Basic tabulations also indicate some substantial differences in sources of funding for training between the union and nonunion sectors.

Our main results stem from exercises in which we control for the effects of other covariates to get a cleaner picture of union impacts. Once one controls for other covariates, our results paint relatively similar pictures for men and women. If anything, these effects are typically small and negative, in the range from −4% points to 0. By contrast, when we do not control for other covariates, union effects range from 10% points (course training for women) to −3% points (programme training for men). So it appears that most of the difference in the raw union effect across subgroups is a spurious consequence of failing to control for other covariates. What unionization does to some extent do is generate greater employer involvement in payment for both general and firm specific human capital for men, though these effects are typically not significant. Thus, unionization appears to shift the means of payment more than the amount of investment for men. This fits with the kinds of models in which union pay structures lead to unionized firms taking a greater role in funding general human capital investment but do not necessarily change the amount of investment. To explain the small declines in general human capital investment for men, one could then graft onto these types of models the type of distinction between alternative human capital (useful only outside the firm) and general human capital (useful both inside and outside the current firm) proposed by Kuhn and Sweetman. In that case, more stable union work arrangements could lead to lower investment by workers while firms play an expanded role in funding general human capital. The pattern of tenure effects is also consistent with this view.

For women, the results indicate effects of unionization on general and firm specific human capital investment similar to those for men. But in terms of payments, unionization appears to have, if anything, a negative impact on the

proportion of spells in which firms help in the funding. It does not have any substantial effects on the proportion of general human capital training invested in by workers alone. As in the case of men, the most robust finding is that employer involvement increases with tenure while the opposite is true for worker involvement. One possible explanation for the generally weak union effects is that most of the effect of unions operates indirectly by increasing tenure and job stability, which in turns get employers more involved in the provision of training for workers.

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References

Acemoglu D, Pischke JS (1999) The structure of wages and investment in general training. J Polit Econ 107:539–572
Beaudry P, Green DA, Townsend J (2001) An investigation of changes in wage outcomes across cohorts in Canada. University of British Columbia
Barron JM, Fuess SM, Loewenstein MA (1987) Further analysis of the effect of unions on training. J Polit Econ 95:632–640
Becker G (1964) Human Capital. Columbia University Press, New York
Booth AL, Chatterji M (1998) Unions and efficient training. Econ J 108:328–345
Booth AL, Francesconi M, Zoega G (2003) Unions, work-related training, and wages: evidence for British Men. Indust Labor Relat Rev 57:68–91
Booth AL, Böheim R (2004) Trade union presence and employer-provided training in Great Britain. Ind Relat 43:520–545
Duncan G, Stafford F (1980) Do union members receive compensating wage differentials? Am Econ Rev 70:355–371
Dustmann C, Schönberg U (2004) Training and union wages. IZA working paper no. 1435
Freeman RB, Medoff JL (1984) What do unions do? Basic Books, New York
Green F (1993) The impact of trade union membership on training in Britain. Appl Econ 25:1033–1043
Green F, Machin S, Wilkinson D (1999) Trade unions and training practices in British Workplaces. Ind Labor Relat Rev 52:179–195
Hashimoto M (1981) Firm specific human capital as a shared investment. Am Econ Rev 71:1070–1087
Kennedy S, Drago R, Sloan J, Wooden M (1994) The effect of trade unions on the provision of training: Australian Evidence. Br J Ind Relat 32:565–578
Kuhn P, Sweetman A (1999) Vulnerable seniors: unions, tenure, and wages following permanent job loss. J Labor Econ 17:671–693
Loewenstein MA, Spletzer JR (1998) Dividing the costs and returns to general training. J Labor Econ 16:142–171
Lynch L (1992) Private sector training and the earnings of young workers. Am Econ Rev 82:299–312
Mincer J (1983) Union effects: wages, turnover and job training. In: Reid JD (ed) Research in labor economics: new approaches to labor unions, Suppl 2. JAI Press, Greenwich, pp 217–252
Neal D (1995) Industry-specific human capital: evidence from displaced workers. J Labor Econ 13:653–677
Parent D (2000) Industry specific capital and the wage profile: evidence from the National Longitudinal Survey of Youth and the Panel Study of Income Dynamics. J Labor Econ 18:306–323
Stevens M (1994) A theoretical model of on-the-job training with imperfect competition. Oxford Econ Papers 46:537–562
Weiss Y (1985) The effect of labor unions on investment in training: a dynamic model. J Polit Econ 93:994–1007