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Minimum Wages and Human Capital Investments of Young Workers: Work Related Training and School Enrolment

Michael Baker (University of Toronto)

Working Paper 2005 B-04

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Introduction

Minimum wage legislation is ubiquitous in Canada. While often championed as a policy to alleviate poverty, it most directly affects the employment conditions of young workers (i.e., teenagers and young adults). It is perhaps this misalignment of social goals and impact that explains why regular adjustments to minimum wages take place with either no or scant mention of their possible effects on young workers. Economic theory makes a number of strong predictions of these effects. The most studied are those for the employment of minimum wage workers. The "standard" model of the labour market predicts that minimum wages lower their employment. Empirical investigation of this prediction spans both countries and decades. Much of the evidence is quite mixed. For example, the most recent evidence suggests that minimum wages have almost no effects on employment in the United Kingdom, and quite modest effects in the United States. In contrast, while there are some conflicting studies for Canada, the majority confirms the prediction of the standard model (see Swidinsky 1980, Schaafsma and Walsh 1983, Grenier and Seguin 1991, Baker, Benjamin and Stanger 1999, Campolieti, Fang and Gunderson 2002 and Yuen 2003).

While disemployment is widely regarded as the first order effect of minimum wages, there are others that could have equal or more detrimental impacts on youth. Two that have received limited study in the literature are impacts on human capital investment in the forms of school enrolment and work related training. Any effect on these activities could be particularly important because youth is a period of intense human capital investment, and this investment is critical to successful entry to the labour market. The costs of low levels of formal human capital investment are widely documented. In

figures 1 and 2 real hourly wages and unemployment rates by education levels are graphed for the years 1997 through 2001. In each case and in each year individuals with the lowest educational levels consistently face the worst labour market outcomes (on average). Similarly Vaillancourt (1995) estimates the private return to completing high school relative to dropping out at over 33 percent. These effects are compounded by the fact that individuals with higher levels of education tend to make higher levels of post schooling investments. So low levels of formal investment are correlated with low levels of informal investment.

The predicted effects of minimum wages on work related training are negative. By putting a floor on the price of low skilled labour, minimum wages may undermine the mechanism through which these workers finance their share of these investments. The predicted effects on school enrolments are ambiguous, as minimum wages may shorten the period of investment for some individuals while lengthening it for others. Certainly if minimum wages prove to have negative effects on both school enrolment and the provision of training, they must be viewed as a substantial barrier to the labour market success of low wage workers.

The existing empirical evidence is quite mixed. The vast majority of studies use U.S. data. While the particular strengths and weaknesses of each study are discussed below, one might wonder, a priori, whether the American labour market provides a good forum for this investigation. This is a labour market where there is best mixed evidence that minimum wages have their first order impact on employment. Hamermesh (2002) argues as much, and in particular cites Canada as a particularly attractive labour market for minimum wage study. First and foremost, minimum wages for most workers are

under provincial jurisdiction, so there is variation in their levels both across provinces and within provinces over time. Such time-series cross-section variation is widely acknowledged as providing a firmer basis for inference than either time-series or cross section variation alone. In the current context, there are also the advantages of a periodic survey of training and education activities and a consistent series on school enrolments available through the Labour Force Survey since 1976. As noted below, lack of the appropriate data is an ongoing obstacle to research into these issues.

In this paper I provide estimates of the effect of minimum wages on school enrolment and work related training in Canada. The analysis takes advantage of the widely varying minimum wages across provinces over the period 1983-2000. Using data from the Labour Force Surveys I explore how these minimums affect both the total number of teenagers and young adults enrolled in school, as well as the choice to mix school enrolment with employment. I also investigate the relationship between minimum wages and work related training using the 1992, 1994 and 1998 Adult Education and Training Surveys.

The next section of the paper outlines the predictions of economic theory for the relationships between minimum wages and school enrolment and work related training, respectively. This is followed by a review of the existing literature on these topics and a description of the data used and empirical framework. Next is the presentation of estimates of the effect of minimum wages on these two forms of human capital investment. The paper concludes with a comparison of the results to those in the literature and a discussion of the implication of the findings.

The Predicted Effect of Minimum Wages on School Enrolment and Work Related Training

School Enrolment

Minimum wages may affect human capital acquisition by affecting the decision to attend school. This is a potentially important because many minimum wage workers are teenagers and young adults. Whether the effect is to increase or decrease school enrolment is a priori ambiguous. Changes in the minimum wage potentially affect both the opportunity cost of being in school and the returns to education. Furthermore, if higher minimum wages lower the employment of affected workers the probability of employment if not in school also changes.

Perhaps the simplest argument is that minimum wages raise the short run opportunity cost of being in school for low skilled individuals, and also lower the long run return to further investment. All else equal, this should lead some individuals to leave school for the labour market. Because minimum wages may also lower the employment prospects of these same individuals, however, the decision to remain in school is complicated by the fact that the now higher paying opportunities in the labour market may require longer search or wait unemployment. Assuming that the net return to labour market work has increased, however, the possibility of a negative relationship between minimum wages and enrolment is established.

Another argument leads to the prediction that minimum wages can increase enrolment. Employers facing a higher minimum wage may seek workers with more skills to fill their low skilled jobs. Individuals who are disemployed by the minimum may lack

the skills now required for these jobs. As a consequence, they may return to school to gain more skills and improve their employment prospects.

In sum, it appears that minimum wages can either increase or decrease enrolment and so previous research has appealed to the empirical evidence. There would appear to be more definitive predictions for specific types of workers (e.g., very low skilled), although this sort of heterogeneity can be difficult to identify in the data.

Work Related Training

In contrast, the theoretical prediction of the effect of minimum wages on work related training are unambiguous and well established, at least within a standard model of human capital investment. Within this model workers bear all of the costs of general human capital job related training and some of the costs of specific human capital job related training, typically through a reduced initial wage (e.g., in the training period). Rosen (1972) points out that because minimum wages provide a lower bound on compensation, they put limits on how low the initial wage can be. For low skilled individuals the lower wage necessary to cover the costs of training may lie below the current minimum wage. In this case the training will not take place because there is no incentive for the employer to cover the costs. This argument, then, gives rise to the prediction that minimum wages will lower the training opportunities of low skilled (e.g., minimum wage) workers. The exceptions or special rules for new employees in some minimum wage legislation are testament to the potential importance of this effect of minimum wages.[1]

[1] In Canada these special rules for new employees are disappearing due to concerns that they might violate the equality provisions of the Charter of Rights and Freedom.

Recently, Acemoglu and Pischke (1999) have provided an alternative model of work related training that generates a different prediction for the effect of minimum wages. They relax the assumption that firms operate in competitive labour markets. In this case the incentive for training shifts from the worker to the firm. In the presence of a minimum wage a firm may find it more profitable to train existing workers than to lay them off. Therefore, increases in minimum wages may lead to more training for these workers.

Previous Evidence

School Enrolment

Empirical investigations of minimum wages and school enrolments have come to a variety of conclusions. Almost all previous research uses US data. Some of the earliest evidence is that minimum wages increase aggregate enrolment. Using a time series of enrolment statistics for 1947-1976, Matilla (1978) reports positive effects of minimum wages on enrolments, especially for older students. Ehrenberg and Marcus (1980, 1982) argue that this aggregate inference potentially masks important heterogeneity of the minimum wage effect within the population. Using cross section data from the 1960s, they find that while increases in the minimum wage increase the enrolment of white teenagers from high income families, they lower the enrolment of teenagers from low income families.

A general criticism of this early research is that the identification of the minimum wage effect relies exclusively on either time-series or cross-section variation. In the US the minimum wage is a federal statute, and so is typically uniform across the country.[2] A cross section identification strategy uses the minimum wage relative to average wages.

Because average wages vary geographically, so will the relative minimum wage at a point in time. A time-series identification strategy relies on periodic changes to the federal statute, inflation that erodes the value of the real minimum wage and temporal changes in average wages that induce variation in the relative minimum wage. The criticism of the cross-section approach is that there may be unobserved geographic effects which are correlated with both the relative minimum wage and the school enrolments of affected individuals. In the time-series approach the problem is unobserved time effects that are correlated with school enrolments and the minimum wage measure. In either case the result is an omitted variable bias that potentially masks the true relationship between minimum wages and enrolments.

In the mid 1980s a number of states instituted state specific minimum wages, higher than the federal standard. This followed a relatively lengthy period in which no changes to the federal minimum were enacted. The number of state specific minimums grew until the early 1990s when the federal minimum was finally increased. This episode provides time-series cross-section variation in the minimum wage that potentially provides a firmer basis for inference. This is because it is possible to control for certain types of unobserved geographic and time effects in a time-series cross-section framework. In turn there have been a number of recent studies of the relationship between school enrolment and minimum wages that focus on this time period.

Much of this research has been completed by Neumark and Wascher. Using the May files of the Current Population Survey (CPS) from 1977-1989, Neumark and Wascher (1995) find a negative effect of minimum wages on enrolment. These results are expanded in Neumark and Wascher (1996). Here they use matched CPS data spanning

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[2] There have been periodic instances of higher state specific minimums.

1979-1992. Matching individuals across data sets allows them to examine transitions between school and work in response to changes in the minimum wage. Their estimates indicate that increases in minimum wages increase transitions out of school. While some individuals leave school for jobs, others end up in a state of non-employment ("idle").

These analyses have been criticized for using an inappropriate definition of school enrolment: enrolment is defined on the basis of an individual's major activity in the reference week, which may exclude part time students. Neumark and Wascher (2003) address this criticism, reexamining the issue using a school enrolment supplement to the October CPS that directly measures an individual's enrolment status (the analysis period is again 1977-1989). The new estimates for enrolment are generally negative, small and statistically insignificant.

Another recent study examines the effect of minimum wages using administrative data on school enrolments for the period 1989/90 through 1996/97. Chaplin, Turner and Pape (2003) report a negative effect of minimum wages on enrolment in states where individuals can drop out of school before age 18. This effect appears to be centred in the Grade 9 to Grade 10 transition.

Card's (1992b) study of the 1988 increase in the California minimum wage also provides information on school enrolment. The study focuses on a 27 percent increase in the state specific minimum wage in this year, and compares outcomes in California to those in some "comparable" states that did not experience an increase in the minimum at this time. He reports a relative decrease in school enrollment in California as the minimum wage increases. He also finds that the employment of teenagers increases with the new minimum. It is possible that these two developments are directly related, but

further analysis reveals that the employment rate of teenagers enrolled in school increased by roughly the same amount as for all teenagers.

Landon (1997) and Campolieti, Fang and Gunderson (2003) are studies of this topic using Canadian data. Landon analyzes the effects of minimum wages and education spending on the enrollment of 16 and 17 year olds using administrative data for the period 1975 through 1989. The identification strategy exploits within province variation in minimum wages over this period. He estimates that higher minimum wages lead to lower enrollments of 17 year olds, and 16 year old males. Campolieti et al. analyze the effect of minimum wages on the probability of being in one of four enrolment/employment states using Survey of Labour and Income Dynamics data for the period 1993-1999. Again the identifying variation is within province variation in the minimum wage. The results for 16-19 year olds indicate that minimum wages have no effect on the "total enrolment" of teenagers, but do reduce the proportion of those who are simultaneously enrolled and employed.

Work Related Training

As noted above, Rosen (1972) pointed out that the standard human capital model predicted that minimum wages can lower the training provided to low skilled workers. Because training is a source of wage growth post school, a secondary prediction is that minimum wages will flatten their age/wage profiles.

The initial empirical investigation of this issue focused on the relationship between minimum wages and wage growth. This appears to be due to a lack of data directly measuring the provision of training. Both Leighton and Mincer (1981) and Hashimoto (1982) provide evidence that minimum wages lower wage growth.

This evidence has recently been challenged, however. First, a negative relationship between minimum wages and wage growth need not imply a negative relationship between minimum wages and the provision of training. For example, minimum wages may merely truncate the lower tail of the wage distribution generating the observed effect on wage growth (Acemoglu and Pishke 1999). Alternatively, the slope of wage profiles may be determined by other factors than training such as mechanisms to reduce worker shirking. If minimum wages affect the incentives to shirk, they may in turn have an effect on wage growth although no effect on the provision of training (Lazear and Miller 1981, Neumark and Wascher 2001). Second, there is new direct empirical evidence that minimum wages may simultaneously have an association with the wage growth of low wage workers but no direct effect on training (Grossberg and Sicilian 1999).

As a result of this critique, the trend in more recent research has been to evaluate the effect of minimum wages on the provision of training. The challenges faced by the earlier research remain, however, as surveys of training are conducted but irregularly.

One of the first studies of this new wave is Grossberg and Sicilian (1999). They use data from the US Employment Opportunities Pilot Project (EOPP) data set. They compare the training provided to workers in minimum wage jobs to the training provided in other low wage jobs (with wages below or above the minimum) at a point in time. They report that males (but not females) in minimum wage jobs receive less training than other workers, but so do individuals in these other low wage jobs.

Arulampalam et al. (2002) examine the effects of the 1999 reintroduction of a national minimum wage in the United Kingdom on the incidence and intensity of

training. They estimate an individual level equation that relates training received in the previous year to an indicator that the person's job was directly affected by the introduction of the new minimum. Because the authors use panel data, they can and do control for unobserved, individual level, fixed effects that might simultaneously be correlated with training propensity and being in a job affected by the introduction of the new minimum. They find no evidence that the reintroduction of the minimum wage reduced the training of workers affected by the introduction of the minimum (either by self identification or by having a wage in 1998 below the new minimum). In fact they report that both the incidence and intensity of training rose for these workers.

Because the new minimum wage was instituted at the national level, identification is achieved through the comparison of individuals affected by the minimum wage and those who weren't because they held a higher paying job. This identification strategy has been criticized when used to estimate the employment effects of minimum wages (see Card and Krueger 1995, Currie and Fallick 1996, Yuen 2003). Individuals in the comparison/control groups are potentially different from individuals in minimum wage jobs in ways that influence their employment propensity or propensity to receive training. For example, workers in jobs paying a little bit more than the minimum wage may have traits that are positively associated with the provision of training. While researchers using panel data can include individual fixed effects to help account for this bias, this strategy will succeed only to the extent that the unobserved individual characteristics that are causing the problem are indeed fixed. Some commentators have asked whether this is a legitimate assumption for minimum wage workers (Card and Krueger 1995).

More generally, we might wonder a priori whether to expect any effect of the UK's new minimum wage on training? The authors cite studies that find the introduction of the new minimum had little to no effect on the employment of low wage workers. Given this evidence that the first order effect of the new minimum was negligible, it would seem unlikely that there would be an effect on training, at least within the context of the standard neoclassical models of employment and human capital investment.

Two recent studies of US data are Acemoglu and Pischke (1999) and Neumark and Wascher (2001). They are of interest here due to similarities of the US and Canadian labour markets, because they analyze a similar time period and come to opposite conclusions (Acemoglu and Pischke 1999 find no effect of minimum wages on training, while Neumark and Wascher 2001 find one), and because each study explicitly comments on the findings of the other.

Acemoglu and Pischke (1999) examine the relationship between minimum wages and training received in the previous year using the National Longitudinal Survey of Youth (NLSY). They use a sample of young adults with a high school diploma or less for the period 1987-1992. The analysis focuses, alternatively, on workers who earn at or near the minimum wage and workers in a wider range of jobs. As in Arulampalam et al. (2002), the analysis controls for individual level fixed effects that may be correlated with training propensities and employment in a job paying the minimum wage. Because there is some cross state variation in minimum wages over the period of analysis, identification does not rely exclusively on differences in training between workers who are or are not in minimum wage jobs at a point in time. Their results indicate no statistically significant, systematic relationship between minimum wages and the provision of training.

Neumark and Wascher (2001) have argued that Acemoglu and Pischke's findings may be a creature of the unique characteristics of their sample. Many minimum wage workers are young and most studies in the area focus on teenagers and young adults. In contrast, the NLSCY sample that Acemoglu and Pischke use is relatively old as sample individuals range between ages 22 and 34. Neumark and Wascher also report that they find no training effects in their analysis sample (described below) when they focus on workers of comparable ages.

Neumark and Wascher (2001) analyze the relationship between minimum wages and training using supplements to the January 1983 and January 1991 Current Population Surveys (CPS). Each survey asks about any training ever received on the present job. One analysis using the 1991 data compares the training received by 16-24 year olds in states with increases in minimum wages in the previous three years and in states where there was no increase. Individuals 35-54 years old are added to the sample to control for any differences in training propensities between states that did or did not experience minimum wage increases. Another analysis uses both the 1983 and 1991 data and only the observations for 16-24 year olds. The authors find that minimum wages do reduce the formal training offered on the current job. They estimate elasticities in the range of -0.65 to -1.8.

While the authors aspire to a full time-series cross-section identification strategy, the reality is somewhat less due to the lack of cross state variation in the minimum wage prior to the 1983 survey and the imprecision of the training question they use (training ever received rather than training in a specific period). Also, Acemoglu and Pischke (1999) have criticized these results as being implausibly large. Neumark and Wascher

have offered a defense pointing out a couple of mistakes in Acemoglu and Pischke's critique.

Summary

The preceding review of the literature on minimum wages, school enrolment and training has at least three messages. First, there is still considerable uncertainty or debate about the signs and magnitudes of the relationships between minimum wages, and school enrolments and training respectively. Second, in either case the most current practice is to use an identification framework that exploits some sort of time-series cross-section variation in the relevant minimum wage measure. Third, data problems—either the required data do not exist or exist but with obvious defects—has hindered consensus in this literature.

From this perspective an analysis based on Canadian data has much to offer. Unlike the American and British record, there is ample evidence that minimum wages have a first order effect on employment in Canada. As noted above, it would not be surprising if minimum wages had no effect on training and enrollments in these other countries, if there is no first order effect on employment. In contrast, in Canada there is a firm basis from which to explore the second order effects of these labour standards. Also, as noted in the Introduction, Canada offers both time-series and cross-section variation in minimum wages, and there are periodic surveys of training and education activities and a consistent series on school enrolments. This means there potentially less debate about identification the effect of minimum wages or about the suitability of the data.

Data and Empirical Strategy

School Enrolment

The analysis of school enrolments draws on data from the public use files of the Labour Force Surveys (LFS) of 1983 through 2000. The LFS collects information on the enrolment status of individuals in the reference week. Both full time and part time enrolment is recorded, and responses are available separately for different levels of schooling. The exact content of the question is described in the appendix.

The highest incidence of both school enrolment and minimum wage work is amongst teenagers and young adults. Therefore the base analysis sample is all individuals aged 15 through 24. Data from both the April and October surveys is drawn for each year. This provides a view of both fall and spring enrolment.

Compulsory school laws, which are legislated at the provincial level, potentially limit individuals opportunities to move between school and work. The laws in effect over the sample period mandated enrolment to age 15 or 16 in most provinces. The exception is New Brunswick, which raised the minimum age for leaving school to 18 in 1999. I take two approaches to accommodating these laws. First, as described below I include controls for the minimum age for leaving school in the estimating equation. Second, I simply separate individuals who are or are not subject to compulsory schooling laws.

The initial analysis is conducted separately for 15-19, and 20-24 year olds. The equation

$$E_{jt} = P_j\lambda + Y_t\alpha + X_{jt}\beta + \theta MW_{jt} + \varepsilon_{jt} \tag{1}$$

is estimated by ordinary least-squares using LFS weights. E_{jt} is the enrolment rate in province j in year t, P_j is a full set of province effects and Y_t is a full set of year effects. MW_{jt} is a variable capturing the minimum wage in province j in year t. It is the minimum wage as a proportion of the industrial aggregate wage in province j in year t. The minimum wage in effect in April or October of the relevant year is used depending on which measure of enrolment is being used. Finally, X_{jt} are variables capturing other determinants of school enrolment such as general economic conditions. They are the prime age (25-54) male unemployment rate, real GDP, and the ratio of the population aged 15-19 or 20-24 to the population aged 15-64 in province j in year t.

This specification is fairly common to studies that analyze minimum wages and enrollment using data at the province or state/year level (e.g., Card 1992b, Neumark and Wascher 1995 and 2003, Chaplin, Turner and Pape 2003). Some studies, however, augment this specification with measures of government spending on educational inputs, and in particular the study by Landon (1997) includes a battery of these variables. To assess the robustness of the results and provide a bridge to previous Canadian studies a modified version of equation (1) that adds controls for educational spending is also examined.

Work Related Training

The analysis of work related training uses data from the 1992, 1994 and 1998 Adult Education and Training Surveys (AETS). These are national surveys that are intended to capture the incidence of all types of training in the (preceding) reference year. The surveys are not completely comparable, however, which places some limits on the

types of training that can be examined in the analysis. The appendix contains a review of the relevant issues.

The working sample is all individuals aged 17 through 24 who worked at least some time in the reference year. As is common in training surveys (Acemoglu and Pischke 1999) the activities captured in the data are primarily formal. The exact measures of training utilized here are described in the course of the analysis

The empirical model is

$$\Pr_{ijt} = P_j\lambda + Y_t\alpha + X_{ijt}\beta + \theta MW_{jt} \quad (2)$$

where $\Pr_{ijt}$ is the probability that individual i in province j in year t received the relevant type of training, P_j is a full set of province effects and Y_t is a full set of year effects. MW_{jt} is a variable capturing the minimum wage in province j in year t. It is the minimum wage as a proportion of the industrial aggregate wage in province j in year t. The minimum wage is the calendar month weighted average for the reference year if the minimum changed within the year. Finally, X_{ijt} are variables that capture other determinants of training. At the individual level these are dummy variables for 5 levels of schooling, a dummy variable for individuals aged 20-24 and dummy variables for males and for married individuals. At the province/year level they are the prime age (25-54) male unemployment rate and real GDP. Because the minimum wage variable varies at the province/year level, the standard errors are corrected for random effects at the province/year level. The standard errors are also corrected for heteroskedasticity. Replacing $\Pr_{ijt}$ with a 0/1 indicator of receipt of the indicated training (T_{ijt}), equation (2) is estimated as a logit using AETS weights.[3]

[3] Estimates using a linear probability model lead to very similar conclusions.

Estimates of the effects of minimum wages using equation (2) are potentially biased by a positive correlation between training and ability. While I include controls for some observable skills, training is likely also correlated with unobserved skills. If increases in minimum wages lead employers to hire higher ability workers, and higher ability workers are more likely to receive training, there would be a positive bias in the estimate of θ. A similar effect would arise if it was exclusively the lowest ability workers who were disemployed by a minimum wage increase. As I document below, minimum wages have significant disemployment effects in Canada. This all said, if the estimated effect of minimum wages on training turns out to be negative, any bias from a positive relationship between training and ability would imply that the true relationship is more strongly negative.

Analysis

Employment

While minimum wages can affect human capital acquisition through their effects on the provision of training and decision to enroll in school, it is important to remember that the primary effect may be through their effects on employment. Individuals who are displaced from employment by minimum wages clearly cannot receive work related training. Furthermore, if these same individuals do not respond by upgrading their skills through formal on informal education/training, the impact on their human capital accumulation can be dramatic. This issue may be of less importance in countries where minimum wages are thought to have no (the United Kingdom) or modest (the United States) effects on employment. The most recent evidence for Canada, however, is that

minimum wages have substantive effects on the employment of younger individuals (Baker et al. 1999).

To provide some context for the analysis of training and school enrolment, I update Baker et al.'s (1999) estimates of the relationship between minimum wages and employment to the 1990's. The equation estimated is their "base" specification which involves regressing the teen (15-19 year old) employment population ratio on province effects, a quadratic trend, the prime age (25-54) male unemployment rate, real GDP, the ratio of the population aged 15-24 to the population aged 15-64, and a measure of the minimum wage. The latter is the ratio of the provincial minimum to the provincial industrial aggregate wage, which Baker et al. use in some of their analysis. Estimation is by ordinary least-squares using the population aged 15-64 as weights.

In the first column of the first row table 1, I present an estimate of the minimum wage elasticity for the period 1983-1993 to calibrate the results. Baker et al. present a comparable estimate in their table 3. The estimate compares favourably: the estimated elasticity using the industrial aggregate wage is –0.366 in Baker et al. and –0.323 here. The small difference in the estimates is related to the inclusion of the data for Prince Edward Island here (Baker et al. do not include this province) and Statistics Canada's revisions to employment and population counts since the Baker et al. study was conducted.[4]

In the second column I present an estimate of the minimum wage elasticity for the longer period 1983-2000. It is much larger: -0.572. The third column provides a check on this inference by re-estimating the elasticity conditional on year effects instead of the

[4] Unfortunately changes in the counts as a result of revisions are not tracked in the CANSIM data base.

more restrictive quadratic trend. The result while smaller, -0.488, is still larger than the estimate for the earlier period.

Recall that an elasticity relates changes of two variables in percentage terms. In this case the elasticity indicates the percentage change in employment that results from a given percentage change in the minimum wage ratio. For example, the estimate of –0.488 indicates that a 10 percent increase in the minimum wage ratio leads to a (–0.488*10) 4.88 percent decrease in the teenage employment/population ratio.

One explanation for the higher minimum wage elasticity in the 1990's is that a higher proportion of young individuals are affected by the minimum wage in this period. Baker et al. report that 13 percent of employed teens held jobs paying within 5 cents of the adult minimum wage in 1986. Using LFS data from 1997, I calculate that 26 percent of working teens were earning within 5 cents of their relevant provincial minimum. Since the elasticity estimated for the aggregate of employed teenagers is proportional to the "bite" of the minimum wage in this group, the higher incidence of the minimum may lie behind the larger estimates of the elasticity adding the 1990s. More important for the purposes here, the results indicate that minimum wages have a first order effect on the provision of work related training to young workers through their disemployment effects.

Because the human capital investments of young adults are also analyzed in this study, in the second row I also report estimates of the minimum wage elasticity for 20-24 year olds. As might be expected the estimates are much smaller for this group, and as a consequence the effect on work related training through the disemployment effect is of less concern. Note that the elasticity for this age group is also larger adding the data from the 1990s.

School Enrolment

In table 2 the average characteristics of individuals in the samples for the analysis of school enrolment are reported. The results for teenagers indicate enrolment rates that are fairly constant throughout the school year. Roughly 80 percent of this age group are enrolled in school over the period, almost exclusively full time. About 35 percent of those enrolled also report working in the survey reference week. Enrolment is much less common among 20-24 year olds, averaging just less than one-third. There is a higher proportion of part time enrolment (about 15 percent) and a higher tendency to mix work and school (about 44 percent).

Table 3 contains estimates of equation (1). The reported statistics are the estimated parameters on the minimum/industrial aggregate wage ratio. The first panel contains the results for all teenagers. In the first two columns the effect of minimum wages on different types of enrollment is explored. The estimates are uniformly statistically insignificant at the five percent level. The point estimates tend to be of different signs in April and October, those in April suggesting a decrease in enrolment and those in October indicating an increase. In general we might expect some difference in the results for the two months. October is near the start of the school year, and within a traditional period (the fall) to measure school enrolment. April is near the end of the school year and the start of the summer employment period for students.

The second two columns explore the effect of minimum wages on the joint incidence of enrolment and employment. The results indicate that the disemployment effect of minimum wages documented in table 1 falls in part on students. In either April or October the estimates are negative and statistically significant. The implied elasticity

for all enrollees in April is –0.631, and in October –0.646. The average non zero April over April or October over October minimum wage increase for the period 1983-2000 is 6.7 percent,[5] which would lead to just over a 4 percent decrease in employed enrolment.

As noted above any effect of minimum wages on overall enrolment may be constrained for some teenagers by compulsory schooling laws. In the next two panels I divide teenagers into 15-16 year olds and 17-19 year olds to explore this issue. The minimum age to leave school was 16 in six provinces over the period.[6] Changes from 15 to 16 were enacted in Newfoundland in 1986, in New Brunswick in 1989, in Quebec in 1987 and in British Columbia in 1988. Therefore, the age group 15-16 mostly captures individuals required to be enrolled in school. In creating the enrolment rates for 17-19 year olds I exclude the data from New Brunswick for 1999 and 2000 when the minimum school leaving age was raised to 18. Therefore, the 17-19 age group contains exclusively individuals who are free to leave school if they choose.

The distinction between the two age groups does provide some refinement to the inference. First, the negative effects of minimum wages on employed enrolment are larger for the younger students. For 15-16 year olds the implied elasticity is –0.907 for April and -0.827 for October. Therefore, the average increase in the minimum wage of 6.7 percent lowers employed enrolment by over 6 percent. For 17-19 year olds the implied elasticities are –0.396 for April and –0.464 for October. Therefore the elasticities for the younger age group are double those for the older group.

[5] The maximum April (October) over April (October) increase was 23 percent, while the minimum was 1.5 percent. The average increase in the minimum wages for the period including years of no change is 2.9 percent.

[6] These were Prince Edward Island, Nova Scotia, Ontario, Manitoba, Saskatchewan, and Alberta.

Second, the point estimates for October suggest a different relationship between minimum wages and overall enrolment for the older age group, although the inference is only significant at the 10 percent level. Taken at face value they indicate that enrolment increases with the minimum wage, although the effect is very modest: the implied elasticity for all enrolment is 0.087. Also note, that particularly in October the enrolment of the 15-16 years olds is unresponsive to the minimum wage. This is what we would expect if these individuals are constrained by compulsory schooling laws.

The final panel contains the results for 20-24 year olds. Here all the estimates for April are small and statistically insignificant. The results for October suggest two conclusions. First, the relationship between minimum wages and enrolment is positive and small. The implied elasticity for all enrolment is 0.233 and for full time enrolment is 0.278. Therefore, the average minimum wage increase of 6.7 percent led to just under a 2 percent increase in full time enrolment. Second, minimum wages have a larger and positive effect on employed enrolment: the implied elasticity is 0.387 (0.507 for those enrolled full time).

In summary, the results for 17-19 year olds appear to bridge the results for individuals who face compulsory schooling laws (15-16 year olds) and those who don't (20-24 year olds). First the results for 17-19 years olds hint at a small but positive effect of minimum wages on enrolment, that is statistically significant in the 20-24 year old sample. On the other hand, minimum wages reduce the proportions of both 15-16 year old and 17-19 year old students who work. In contrast, minimum wages either have no or a positive effect on the proportion of 20-24 year old students who work.

As noted above the estimating equation used in table 3 is fairly common to previous studies of this subject. Some studies, however, add controls for government spending on education inputs. The working hypothesis is that better financed schools are more attractive places of learning and therefore encourage enrollment. Of interest here is the previous Canadian study by Landon (1997) that 1) includes a battery of controls for educational spending and 2) finds that minimum wages have a negative effect on the enrollment of 17 year olds.

To provide a point of comparison to this previous study, in table 4 are a set of estimates from a modified version of equation (1) that adds Landon's educational spending variables. These variables, which are described in the appendix, include measures of educational spending per student in primary and secondary schools, as well as student /teacher ratios and average teacher salaries. Because the spending variables are for primary and secondary schools, the augmented equation only makes sense for 15-16 year olds, and perhaps 17-19 year olds. The sample period is restricted to 1983-1998 because some of these variables are only available for this period.

In the first and third panels of table 4 the original specification of equation (1) is estimated for this shorter time period to check whether the change in time frame has any effect on the results. Most of the estimates are very similar to their counterparts in table 3. The one exception is the modest evidence of a positive relationship between October enrollment and minimum wages for 17-19 year olds is no longer evident.

Panels 2 and 4 contain the estimates conditional on the measures of educational spending. The estimated relationship between minimum wages and October enrollment is effectively unchanged with this modification. The estimated relationship with April

enrollment is different, however, and more in line with Landon's results. In particular the relationship is negative and statistically significant, particularly for 17-19 year olds. There are also some changes in the estimates for enrollment and employment. For 15-16 year olds the estimates for October are now positive and statistically insignificant, while the estimates for April, while still negative, are smaller.

At face value these new results would appear to change the inference and bring some of the results more in line with Landon's conclusions. There are a couple of issues, however, which make these new results hard to interpret. First, the spending variables do not change the inference for minimum wages and October enrolment. Landon's measures of enrolment are for September, another month in the fall. Second, the April results suggest that minimum wages have a negative effect on the enrollment of 15-16 year olds, who are mostly subject to compulsory schooling laws. Landon reports small to no effects for these individuals. Finally, the results for October indicate that minimum wages have no effect on the employment of 15-16 year olds who are employed and at school, which contrasts with previous evidence on this issue.

To investigate which spending variables were leading to these changes in the results, the equations were re-estimated entering the variables sequentially. This process revealed that it is the addition of the lagged student/teacher ratio and the per student real expenditure of instructional supplies that is key. Mechanically, it is a correlation between the minimum wage ratio and these variables (as well as their correlation with enrollment) that is leading to the change in results. Why minimum wage policy would be systematically correlated with system wide (i.e., both primary and secondary school) student/teacher ratios and supply spending is not obvious.

Given these caveats, and the fact that the October results are not sensitive to the inclusion of the spending variables, it seems incautious to overturn the inference from table 3 based on the results for April from table 4. That said, table 4 does present some puzzles that require further explanation.

Table 5 provides a broader picture of the how the labour force status of youth changes with the minimum wage and how those changes are distributed across students and non-students. In each case the regression is the indicated labour force status rate (the ratio of the number of individuals in the indicated state to the population of the relevant age group) on the explanatory variables in the base specification of equation (1). The reported statistics are again the estimated parameters on the minimum wage ratio.

The bulk of the negative employment effect of minimum wages for 15-16 year olds is associated with students. The estimated effects for non students are statistically insignificant for both months. Correspondingly the large positive effect of minimum wages on not in the labour force is also associated with students. While it is not possible to conclude that the relationship between these two results is one to one, without viewing the relevant transition probabilities, the evidence is suggestive. Certainly, the primary human capital effect of minimum wages here is to limit any investment associated with labour market participation. Whether there might be an offsetting effect because school study is more effective without the "distraction" of employment is an open question.

For 17-19 year olds, a majority of the disemployment effect is still associated with students. Recall that the results for October in table 3 for this age group hint at a modest rise in enrolment with higher minimum wages. This can be seen here as the reduction in employed enrolment is more than offset by the increases in the proportions of students in

the unemployed and not in the labour force states. While again the flows between different states cannot be tracked in these data, the results for non-students suggest a story. For this group, the decline in employment and unemployment is not offset by the increase in not in the labour force so it is possible that some of those displaced by minimum wages return to school.

For 20-24 year olds, the results make clear that the positive relationship between minimum wages and enrolment in October is driven by the increase in the proportion of individuals in the enrolled/employed state. One possible explanation of this result is that employers substitute students for non-students when faced with minimum wage increases. The underlying rationale would be that the students are higher ability, and that employers seek more productive employees when forced to pay higher wages. Of course, in the absence of information on flows between states any number of alternative hypotheses may also be true. For example, some part of the effect may be a movement of individuals from employed non-enrolment to employed enrolment. Note that in either month the aggregate effect of minimum wages is to reduce the proportion of individuals gaining labour market experience.

Work Related Training

Table 6 contains the summary characteristics for the AETS samples used for the analysis of work related training. As noted above, the sample is 17 to 24 year olds and conditions on employment in the reference year. That said, it is not surprising that two-thirds of individuals are between the ages of 20 and 24. The educational attainment likely reflects of the ongoing investments of this age group: heavy at the lower end but no doubt still in progress.

The second panel of the table provides the means of the different measures of training used in the analysis. The predicted effect of minimum wages on training is for general and certain specific human capital investment that are related to an individual's job and provided by his/her employer. Each of the 1992, 1994 and 1998 AETS's begin with two screening questions: 1) a question asking whether the individual received "any training or education including courses, private lessons, correspondence courses, workshops, apprenticeship training, arts, crafts, recreation courses or any other training or education?"[7] during the reference year, and 2) a question asking did the individual's employer support the training or education (i.e., did the employer "provide the training, pay for the courses or transportation, give time off or give support in any other way"). Individuals who answer affirmatively to both these questions are directed to the section of the survey on "employer related training" while the rest proceed to a section on "non-employer" training. The section on employer related training asks, in series, if the training in question was related to 1) an elementary or high school diploma, 2) a registered apprenticeship certificate, 3) a trade-vocational diploma/certificate, 4) a college diploma/certificate, 5) a university degree/diploma/certificate or 6) was training or education given as courses, workshops, seminars or tutorials.

Three measures of training are constructed from this information. Because the prediction is for training received on the job, I exclude instruction provided towards diplomas and degrees from the traditional institutions of the primary, secondary and tertiary education sectors. The first measure combines training towards an apprenticeship certificate, a trade-vocational diploma/certificate and training given as courses,

[7] The 1992 survey also lists on-the-job training, while the 1998 survey asks for "…correspondence courses (written or electronic)…".

workshops, seminars or tutorials. The second measure focuses on the more informal component of the first measure by including only training given as courses, workshops, seminars or tutorials. Finally, the last measure captures the least formal training. It captures individuals who indicated through the initial screening questions that they received employer related training, and that it did not belong to the one of the training categories subsequently listed. Note that this measure captures individuals who exclusively received exclusively this "residual" training.

Further refinements of these measures are considered in the course of the analysis to better identify work related training. Also, results from both the pooled 1992/1994/1998, and the pooled 1994/1998 surveys are reported. This is because the 1992 survey differs slightly from the others. In 1994 and 1998 individuals could only reach the employer related training section of the survey if they reported being employed when the training was received. In 1992, this condition was not imposed on those employed at the survey date. Since this may lead to incompatibilities in the training captured across the surveys, results with and without the 1992 data are reported

As a point of reference in the first row of panel 2 I report the incidence of training captured by the initial screening question, denoted "Any~Screening Question". It is 17 percent. In the next three rows I report the incidence of the training measures analyzed. The incidence of apprenticeship, vocational-trade, courses/seminars (etc.) is 10 percent or (10/17) 59 percent of the training captured by the screening question. The next row reveals that the lion's share of this training is through courses/seminars; (8/10) 10 percent. Finally, the incidence of "residual" training captured by the screening question

is 4 percent. Note that the measures of training analyzed capture (14/17) 82 percent of the training recorded by the screening question.

It is of some interest to compare these statistics to the estimates of job related training reported in Neumark and Wascher (2001). For 1991 they report that the incidence of "any training to improve skills on the current job" among 16-24 year old Americans was just under 27 percent. The percentage varied from 18 percent among 16-19 year olds to 30 percent among 20-24 year olds. The incidence of the "Any~Screening Question" measure of training in the 1992 AETS (1991 reference year) is 24 percent. Since this question casts a wider net than training to improve skills on the current job, this comparison indicates either a Canada/US difference in work related training, or some fundamental differences between the AETS and CPS—Training Supplement surveys.

The first column of table 7 contains some base estimates of equation (2). The reported statistics are the marginal effects implied by the underlying logit estimates. These are evaluated at the sample mean values of the explanatory variables. The first panel contains the estimates using the 1992, 1994 and 1998 data. The estimate for first measure of training is negative as predicted, but very small and statistically insignificant. Deleting training through apprenticeship and vocational courses leads to the larger estimate but it is still statistically insignificant. Finally the estimate is for the training captured by the residual measure is effectively zero and again statistically insignificant.

The first column of the second panel provides a corresponding set of results using only the 1994 and 1998 data. For the first two measures of training the estimated response is now larger and statistically significant. The elasticities implied by the

estimates are –1.95 and –2.63, respectively.[8] An estimate for the residual training cannot be constructed. The incidence of this training falls to less than one percent in the 1994 and 1998 surveys, and is perfectly predicted by a combination of the regressors in the model. The content of this measure is likely different in the 1992 survey due to the different filter for the employer related training section.

The message of this first set of results is mixed. The results suing the full set of data indicate minimum wages have no effect on training, while the results using the 1994 and 1998 data indicate an effect.

An obvious criticism of these initial results is that the training measures may capture activities that have little or no relationship to an individual's employment. For example, the training may simply be an interest course that happens to be offered at an individual's place of work. The estimates in the second column of table 7 attempt to address this criticism. For the first two measures of training/education there is a supplementary question asking whether the individual's employer suggested it. Positive answers to this question, therefore, provide a focus on training more likely related to the individual's employment.

The result of this more narrow focus in the first panel is reassuring. It leads to larger and more precise estimates. The implied elasticities are –1.11 and –2.09. On the other hand, the changes in the second panel are more dramatic. The implied responses are also now much larger: the implied elasticity for the first measure of training is –5.85 and for the second measure –7.29.

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[8] While it may not appear intuitive to calculate an elasticity when the dependent variables is discrete (0/1), recall that the logit model is implicitly a model of the underlying probability of receiving training. This probability is continuous on the [0,1] interval. Therefore, the elasticity is relates the proportionate response of this probability to a change in the minimum wage ratio.

Another potential problem with the estimates in the first column is they make no allowance for any government subsidy for, or participation in, the training. Training in Canada is a joint federal and provincial responsibility (Gunderson and Ridddell 2001, Meltz 1990), and historically both levels of government have promoted this activity through subsidies, income support and direct provision. Government participation in the training may offset any effects of minimum wages, as it may distort the underlying economic rationale of the human capital investment decision. In column 3 I exclude all training for which the individual reports that the government provided some financial support to investigate the importance of this issue.[9] This innovation leads to very little change in the results. In either panel the estimates are similar to those in column 1. This is primarily because the measured participation of the government is very small in the training captured by the measures. This evidence does not necessarily rule out the potential importance of this issue, because certain forms of government support may not be visible to the employee receiving the training.

The 1994 and 1998 data allow one further refinement of the inference. In these years individuals were asked the main reason they took the training. One of the recorded responses is for "a current or future job". Restricting training to individuals who reported this reason may better focus on work related training. The results are reported in the fourth column of the second panel. The estimates are again similar to those in columns 1 and 3.

The evidence thus far is very mixed. The estimates display a disturbing sensitivity to time period, and the only ones that are consistently statistically significant (from the 1994/1998 data) imply elasticities that are very, some might argue implausibly,

[9] The question asks "Other than the employer, who paid for this training or education?".

large. Note that any bias from a positive relationship between the provision of training and unobserved skill would imply the true elasticities are even larger. I therefore conduct some sensitivity analysis in attempt to shed further light on this issue.

One potential problem is the specification of the minimum wage variable.[10] I have used the ratio of the minimum wage to the industrial aggregate wage. While this ratio is common in studies of the effects of minimum wages on employment, there is less consensus in studies of training. As a check, I have re-estimated the equations using two alternative minimum wage measures. The first is the real minimum wage, defined as the minimum wage deflated by the relevant provincial consumer price index. This measure addresses the criticism that the industrial aggregate wage may be correlated with unobserved determinants of work related training. The second is the ratio of the minimum wage to the average of the industrial aggregate wage over the reference years. This measure potentially addresses any fault in the real minimum wage measure, through any correlation between unobserved determinants of training and general economic conditions, and therefore the consumer price index. In either case, however, the results (not reported) are very similar to those reported in table 7.

I have also checked the sensitivity of the results to the specification of the explanatory variables. In table A1 of the appendix I report estimates when I do not include the individual characteristics (e.g., education, gender) as control variables. Again most of the results are very similar to the estimates reported in table 7.

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[10] Sub-minimum wages legislated in some provinces also potentially an issue. Only one province, Nova Scotia, had a sub-minimum wage for inexperienced workers in the sample. Five provinces (Alberta, British Columbia, Nova Scotia, Ontario, Prince Edward Island) had sub-minimum wages for young workers in all (Alberta and Ontario) of some of the sample period. Alberta and Ontario's sub-minimum's, however, are restricted to students.

Another possible problem is province specific trends or time effects which are correlated with both the provision of training and the minimum wage. In this case the minimum wage is simply a proxy for unobserved determinants of training at the provincial level. One, increasingly common, approach to addressing this problem is to add an additional control group to the analysis who are arguably not affected by the "treatment" of interest (e.g., minimum wages). In the current context, an obvious choice is older age groups in which the incidence of minimum wage workers is very low, but are similar to younger individuals in other ways. To investigate this issue I present estimates adding individuals aged 35-44 as an additional control group. This involves adding these individuals to the sample, and defining a dummy variable for those aged 17-24. Equation (2) is then modified, adding this dummy variable as well as its interaction with the province effects, all the year effects and the minimum/industrial aggregate wage ratio.

Note there are at least two potential limitations to this analysis. The first is that while the incidence of low wage workers is low in the older age group, they may be disproportionately represented in the group receiving training. The second is that employers' training programs may be primarily designed and provided for younger low wage workers. In either case, the older age group is indirectly affected by the minimum wage, and so adding them to the analysis potentially nets out what is in reality a real effect of minimum wages.

The results are reported in table 8. I report two statistics. The first, denoted "Main", is the effect of the minimum wage ratio on the provision of training to 17-24 year olds and 35-44 year olds. The second, denoted "Interaction", is the estimated parameter on the interaction of the dummy for individuals aged 17-24 and the minimum

wage ratio, and captures any difference in the response of the training of these individuals to the minimum wage from the response for 35-44 year olds.

The story told by these estimates is not encouraging. In almost all cases it is not possible to reject the hypothesis that there is no difference in the relationship between minimum wages and training between the older and younger workers. Perhaps even more worrying, the point estimates of the main effect using the 1994 and 1998 data suggest a negative relationship between minimum wages and training for the older age group. This is consistent with the hypothesis that the minimum wage ratio is merely a proxy for some province wide determinant of training that affects all workers. The only mildly supportive result is the estimate for job related training using the 1994/1998 data. While the interaction effect is not statistically significant, it is right signed.

This analysis raises the possibility that the AETS surveys do not permit precise isolation of the types of training affected by minimum wages. For example, perhaps the majority of courses and seminars are general interest or non core training, and employers' offerings to both young and older adults varies with general economic conditions that are somehow proxied by variation in the minimum wage.

An examination of the estimates of equation (2) for the sample of older workers reveals the following "mechanical" explanation for these results. Minimum wages have a negative, relatively large but imprecisely estimated relationship with the training of older workers. In most cases we cannot reject the relationship that it is 0. That said, in the pooled regression of table 8, it is not possible to distinguish this relationship from the sometimes more precisely estimated relationship for younger workers.

Given this evidence and the contradictory estimates from the full and 1994/98 samples in table 7, a prudent conclusion would be that at this stage the analysis is uninformative about the relationship between minimum wages and training. This may be because the minimum wage ratio, is as hypothesized merely a proxy for some other determinant of training. Alternatively, the AETS surveys miss the types of training affected by minimum wages, perhaps because they do not permit an exclusive focus on training related to skills on the current job, or because of changes in survey design do not provide a consistent series on training over time.

Comparison of the Results to Those in the Literature

School Enrolment

The estimated effects of minimum wages on school enrolment clearly contrast with the majority of the US evidence and the conclusions of Landon (1997). The results from these studies suggest small but negative effects of minimum wages on enrolment. The estimates here indicate no to small positive effects. My estimates for 15-19 year olds do agree, however, with the results for 16-19 year olds in Campolieti, Fang and Gunderson (2003): no effect on total enrolment and negative effects on the enrolled employed state.

Most estimates for 15-16 years olds indicate that enrolment is unresponsive to minimum wage laws, which is what we would expect if compulsory school laws are enforced. The results for 17-19 year olds both match and contrast with the results for 20-24 year olds. For both groups there is some evidence of a positive relationship between minimum wages and enrolment in the October data. For 17-19 year olds the increase is

associated with an increase in the proportion of the population who are students who do not work, while for 20-24 year olds the correlate is an increase in the proportion of the population who are students who do.

Work Related Training

As noted above the existing literature of work related training is very mixed. Some of the estimates in table 7 are certainly among the largest available. The results in table 8, of course, cast doubt on a conclusion that minimum wages affect training.

Conclusions

Human capital investment over the teenage and young adult years is an important input to successful labour market entry. Because minimum wage legislation is a labour market policy that directly affects this age group, it can potentially affect this investment activity. In fact economic theory predicts that minimum wages will reduce the work related training provided to young workers. While the prediction for the effect of minimum wages on the school enrolment decision is ambiguous, any distortion is potentially of concern.

The preceding analysis provides estimates of the effect of minimum wages on the school enrolment and work related training of youth in Canada. The primary message of the results is that the first order and largest effect of minimum wages on human capital investment is through the disemployment effect. Individuals who are not employed cannot receive work related training and also miss out on general labour market experience. The effect of minimum wages on employment in Canada is negative and large relative to the effects estimated for other developed countries. For example, for the

period 1983-2000, a 10 percent increase in the minimum/average wage ratio is estimated to reduce teenage employment/population ratio by roughly 5 percent, and young adult employment/population ratio by just under 2 percent. Also, minimum wages appear to be having a larger impact on the employment of this age group in the 1990s as the proportion of these individuals who are minimum wage workers increases.

The analysis of school enrolment offers a number of conclusions. Not surprisingly, most of the evidence indicates that minimum wages have no effect on the overall school enrolment of individuals (aged 15-16) subject to compulsory schooling laws. They do lead to a change in the distribution of students in this age group across labour market states: an increase in the proportion not employed and a decrease in the proportion employed. The effect of minimum wages on the enrolment of individuals who have a choice (age 17-19 and 20-24) appears to be modestly positive. For 17-19 year olds this is associated with an increase in the proportion of the population who are enrolled and not employed, while for 20-24 year olds this is associated with an increase in the proportion who are enrolled and employed. While these results suggest a number of interesting hypotheses, they cannot be tested with the data used here.

The analysis of work related training has more decisive implications for the collection of data on this activity in Canada, than it does for its relationship to minimum wages. The estimates are sensitive to time period, but the analysis is limited by incompatibilities of AETS surveys over time, and their failure to definitively identify the reasons for the variety of training they canvas. As consequence, more definitive evidence on this issue awaits new data on training which is comparable over time, and spans the full spectrum of job related investment.

More generally, the results provide broader context for the oft studied relationship between minimum wages and teenage employment. As noted in the introduction, most discussion about minimum wages in Canada focuses on the living standards of the working poor or the labour costs of small business. The most direct effects of these minimums, however, are on youth. The results document how these rules interact with the enrolment and employment decisions of these individuals

Appendix

Variable Construction

School Enrolment

The data on school enrolments are drawn from the public use files of the Labour Force Survey for the period 1983-2000. The survey question on school enrolment captures the following mutually exclusive categories:

Current student status and type of school

Non-student	1
Primary or secondary school, full-time	2
Primary or secondary school, part-time	3
University full-time	4
University part-time	5
Community college or CEGEP full-time	6
Community college or CEGEP part-time	7
Other full-time	8
Other part-time	9

Cross reference to the variables recording employment status allows a further classification of students into those employed and not employed.

Work Related Training

There are four Adult Education and Training Surveys (AETS) conducted in 1990, 1992, 1994 and 1998, as well as the 1986 Adult Training Survey (ATS). By survey design it is possible to classify these surveys in two groups. The 1986 ATS and 1990 AETS use a roughly similar design, as does the 1992, 1994 and 1998 AETS's. The 1986 ATS and 1990 AETS focus on specific types of training and make initial screen on the basis of full time and part time participation. The 1992, 1994 and 1998 AETS's begin by capturing a much wider variety of training, although they also collect details on some of the specific types of training captured in the 1986 ATS and 1990 AETS. Attempts to find a common denominator across these five surveys ultimately failed. Even when focusing on such narrow categories as full-time apprenticeship programs, the jumps in incidence between the 1986/90 and 1992/94/96 data indicated fundamental differences in the information collected by the two survey designs. As a consequence the data from the 1986 and 1990 surveys was not used in the analysis.

While the 1992, 1994 and 1996 surveys nominally have the same design there are some non trivial differences. First, in both the 1994 and 1998 surveys only individuals who report employment while they were receiving training are asked whether their employer supported the training. In the 1992, individuals who were currently employed were not subject to this screen. Second, the 1992 survey contains questions collecting details of

"on-the-job" training in the employer supported training section, while the 1994 and 1998 surveys do not.

Training, broadly defined, covers a very wide range of activities. The evolution of the AETS appears to have put a premium on capturing this heterogeneity. The reason for this orientation is, perhaps, the desire to document the extent of training activities in the country. The cost is that these surveys are best viewed as independent cross section snapshots. They provide a poor basis for constructing a consistent series on training activities over time. As a consequence there is a need for ongoing, timely and consistent collection of information on a narrower range of training activities that satisfy the needs of researchers and policy makers.

Minimum Wages

The information on adult minimum wages was obtained from the Human Resources Development Canada website

http://labour.hrdc-drhc.gc.ca/psait_spila/lmnec_eslc/index.cfm/doc/english

The information on sub-minimum wages for young and inexperienced workers was collected from various issues of *Employment Standards in Canada*.

Educational Spending and Other Variables from Landon's (1997) Study

ADMIN – Real per student expenditures on administration. The sum of school board expenditures on administration (Statistics Canada, CANSIM II database, series – V1026756, V1026767, V1026778, V1026789, V1026800, V1026811, V1026833, V1026822, V1026844, V1026855) and provincial departmental expenditures on administration (Statistics Canada, CANSIM II database, series – V1200397, V1200418, V1200439, V1200460, V1200481, V1200502, V1200544, V1200523, V1200565, V1200586), and provincial government services to school boards (Statistics Canada, CANSIM II database, series – V1200383, V1200404, V1200425, V1200446, V1200467, V1200488, V1200530, V1200509, V1200551, V1200572) divided by **ENROLL** and **PRICE**.

DIVORCE – The divorce rate. The sum of the divorce rate per 1,000 population for current and two previous years. Source: Statistics Canada, *Annual Demographic Statistics* (91-213), various issues.

ENROLL – Total elementary and secondary enrolment in public schools. Source: 1982-1984: Statistics Canada, *Education in Canada 1986-87* (81-229); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1987-88 to 1989-90* (81-229); 1990-1994: Statistics Canada, *Education in Canada 1996* (81-229); 1995-1998: Statistics Canada, *Education in Canada 2000* (81-229).

IMMIGRANT – Immigrants as a proportion of the provincial population. This is the sum of the number of immigrants that chose a province as their destination for the current and two previous years (Statistics Canada, CANSIM II database, series – V11876, V11883, V11884, V11885, V11886, V11887, V11889, V11888, V11890, V11877) divided by three times the current provincial population (see **POP**).

INSTSUP – Real per student spending on instructional supplies by school boards. This is total spending on instructional supplies (Statistics Canada, CANSIM II database, series – V1026755, V1026766, V1026777, V1026788, V1026799, V1026810, V1026832, V1026821, V1026843, V1026854) divided by **ENROLL** and **PRICE**.

OPEREXP – School board total operating expenditures (Statistics Canada, CANSIM II database, series – V1026753, V1026764, V1026775, V1026786, V1026797, V1026808, V1026830, V1026819, V1026841, V1026852) minus spending on teachers' salaries (Statistics Canada, CANSIM II database, series – V1026754, V1026765, V1026776, V1026787, V1026798, V1026809, V1026831, V1026820, V1026842, V1026853), instructional supplies (see **INSTSUP**), and administration (see **ADMIN**) divided by **ENROLL** and **PRICE**.

PARTTIME – The proportion of teachers that are part-time (lagged one year to reflect students' experience from the previous year). This is the number of full-time equivalent part-time teachers in public schools divided by the sum of the number of full-time teachers and the number of full-time equivalent part-time teachers. Source: 1982-1984: Statistics Canada, *Education in Canada: A Statistical Review for 1985-86* (81-229); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1987-88 to 1989-90* (81-229); 1990-1993: Statistics Canada, *Education in Canada 1996* (81-229); 1994-1998: Statistics Canada, *Education in Canada 2000* (81-229).

POP – Population by province. Source: Statistics Canada, CANSIM II database, series – V466983, V467298, V467613, V467928, V468243, V468558, V469188, V468873, V469503, V469818.

PRICE – Implicit price index by province (1997=100). Source: Statistics Canada, CANSIM II database, series – V3839802, V3839805, V3839808, V3839811, V3839814, V3839817, V3839823, V3839820, V3839826, V3839829.

S/S – The average number of students per school. This is **ENROLL** (data include public, private, federal schools and schools for the visually and hearing impaired) divided by the number of all elementary and secondary schools (lagged one year to reflect students' experience for previous year). Enrolment source: 1982-1984: Statistics Canada, *Education in Canada 1986-87* (81-229); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1987-88 to 1989-90* (81-229); 1990-1994: Statistics Canada, *Education in Canada 1996* (81-229); 1995-1998: Statistics Canada, *Education in Canada 2000* (81-229); 1999-2001: Statistics Canada, *Education Quarterly Review 2002, vol. 8, no.3* (81-003). Number of schools source: 1982-1991: Statistics Canada, *Elementary-Secondary School Enrollment* (81-210), various issues; 1992-1998: Statistics

Canada, *Education in Canada* (81-229), various issues; 1999-2001: Statistics Canada, *Education Quarterly Review 2002, vol. 8, no.3* (81-003).

S/T – The student-teacher ratio (lagged one year to reflect students' experience from previous year). This is **ENROLL** divided by the number of teachers (the sum of the number of full-time teachers and the number of full-time equivalent part-time teachers, see **PARTTIME**).

TAGE – Average teacher age. Source: 1983-1984: Statistics Canada, *Characteristics of Teachers in Public Elementary and Secondary Schools 1985-86* (81-202); 1983-1984 (Quebec): Quebec, Ministry of Education, *Statistiques de l'Education 1985*; 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1987-88 to 1989-90* (81-229); 1990-1993: Statistics Canada, *Education in Canada 1996* (81-229); 1994-1998: Statistics Canada, *Education in Canada 2000* (81-229).

TWAGE – The average real teacher wage. This is total spending by school boards on teachers' wages and fringe benefits (see **OPEREXP**) divided by the number of full-time equivalent teachers (see **S/T**) and **PRICE**.

Table A1: Additional Estimates of the Effect of Minimum Wages on Work Related Training

	All	Employer Suggested	Non Government Supported	Job Related
1992, 1994, 1998 AETS				
Apprenticeship, Vocational-Trade, Courses/Seminars	0.052 (0.224)	-0.005 (0.003)	-0.002 (0.007)	
Courses/Seminars, Only	0.001 (0.004)	-0.399 (0.181)	-0.251 (0.170)	
Residual Training Captured by Global Question	-0.000 (0.003)			
1994, 1998 AETS				
Apprenticeship, Vocational-Trade, Courses/Seminars	-0.461 (0.171)	-0.964 (0.232)	-0.175 (0.180)	-0.483 (0.147)
Courses/Seminars, Only	-0.489 (0.113)	-1.027 (0.361)	-0.211 (0.097)	-0.370 (0.139)
Residual Training Captured by Global Question				

Notes: Source is 1992, 1994 and 1998 Adult Education and Training Surveys. The reported statistics are the marginal effects of the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage) evaluated at the sample means, calculated using the estimated logit parameter on this variable. The other explanatory variables are province and year effects, real GDP and the prime age (25-54) male unemployment rate. The empirical model is estimated as a logit using AETS weights. Robust and cluster corrected standard errors in parentheses.

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Tables

Table 1: Estimates of the Effect of Minimum Wages on the Employment of Young Workers

	1983-1993	1983-2000 (Quadratic Trend)	1983-2000 (Year Effects)
15-19 Year Olds			
Minimum Wage Ratio	-0.371 (0.099)	-0.597 (0.075)	-0.509 (0.058)
Minimum Wage Elasticity	-0.323 (0.086)	-0.572 (0.072)	-0.488 (0.056)
20-24 Year Olds			
Minimum Wage Ratio	-0.157 (0.084)	-0.278 (0.050)	-0.317 (0.051)
Minimum Wage Elasticity	-0.092 (0.049)	-0.170 (0.030)	-0.195 (0.031)

Notes: Source is 1983-2000 Labour Force Surveys. The reported statistics are from a regression of the employment/population ratio of 15-19 or 20-24 year olds on province and year effects, the prime age male (25-54) unemployment rate, real GDP, the ratio of the population of 15-19 or 20-24 year olds to the population of 15-64 year olds. Robust standard errors in parentheses.

Table 2: Mean Characteristics of the School Enrolment Analysis Sample

	April	October
15-19 Year Olds		
Age 15 or 16	0.39	0.39
Male	0.51	0.51
Enrolled	0.81	0.81
Enrolled Full time	0.79	0.78
Enrolled and Employed	0.28	0.29
Enrolled Full Time and Employed	0.27	0.27
Minimum Wage Ratio	0.422 (0.038)	0.426 (0.037)
Sample Size	191633	187713
20-24 Year Olds		
Age 20 or 21	0.39	0.40
Male	0.51	0.51
Enrolled	0.30	0.31
Enrolled Full time	0.26	0.26
Enrolled and Employed	0.13	0.14
Enrolled Full Time and Employed	0.10	0.10
Minimum Wage Ratio	0.421 (0.038)	0.424 (0.037)
Sample Size	180267	177270

Notes: Source is 1983-2000 Labour Force Surveys. All statistics calculated using LFS weights.

Table 3: Estimates of the Effect of Minimum Wages on School Enrolment

	Enrolled		Enrolled and Employed	
	April	October	April	October
15-19 Year Olds				
All	-0.098	0.052	-0.426	-0.440
	(0.053)	(0.059)	(0.066)	(0.070)
Full Time	-0.110	0.066	-0.418	-0.429
	(0.059)	(0.063)	(0.068)	(0.070)
Part Time	0.012	-0.013	-0.008	-0.011
	(0.019)	(0.020)	(0.015)	(0.016)
15-16 Year Olds				
All	-0.039	-0.005	-0.552	-0.538
	(0.047)	(0.044)	(0.085)	(0.105)
Full Time	-0.038	-0.031	-0.545	-0.519
	(0.048)	(0.046)	(0.084)	(0.104)
Part Time	-0.002	-0.026	-0.007	-0.019
	(0.012)	(0.011)	(0.006)	(0.006)
17-19 Year Olds				
All	-0.086	0.147	-0.284	-0.325
	(0.072)	(0.082)	(0.077)	(0.072)
Full Time	-0.115	0.158	-0.285	-0.313
	(0.080)	(0.089)	(0.079)	(0.076)
Part Time	-0.029	-0.011	-0.001	-0.012
	(0.029)	(0.029)	(0.024)	(0.024)
20-24 Year Olds				
All	0.086	0.173	-0.058	0.133
	(0.068)	(0.070)	(0.049)	(0.048)
Full Time	0.086	0.172	-0.050	0.124
	(0.065)	(0.065)	(0.044)	(0.045)
Part Time	0.000	0.000	-0.008	0.009
	(0.028)	(0.026)	(0.022)	(0.025)

Notes: Source is 1983-2000 Labour Force Surveys. The reported statistics are the estimated parameters on the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage) from a regression of the indicated enrolment rate on the minimum wage ratio, province and year effects, real GDP, the prime age (25-54) male unemployment rate and the ratio of the population aged 15-19 or 20-24 to the population aged 15-64. The regressions for 15-19 year olds and 15-16 year olds also include dummy variables for compulsory schooling laws (age 16, age 18). All estimation by OLS using LFS weights.

Table 4: Further Estimates of the Effect of Minimum Wages on School Enrolment

	Enrolled		Enrolled and Employed	
	April	October	April	October
15-16 Year Olds 1983-1998				
All	-0.063	-0.031	-0.558	-0.556
	(0.051)	(0.048)	(0.092)	(0.113)
Full Time	-0.066	-0.009	-0.554	-0.538
	(0.052)	(0.049)	(0.092)	(0.112)
Part Time	0.003	-0.023	-0.004	-0.018
	(0.011)	(0.010)	(0.006)	(0.005)
15-16 Year Olds 1983-1998 with Controls for School spending				
All	-0.181	0.091	-0.355	0.096
	(0.091)	(0.075)	(0.170)	(0.154)
Full Time	-0.195	0.105	-0.345	0.098
	(0.093)	(0.077)	(0.169)	(0.153)
Part Time	0.015	-0.014	-0.104	-0.003
	(0.024)	(0.018)	(0.012)	(0.009)
17-19 Year Olds 1983-1998				
All	-0.094	0.044	-0.298	-0.422
	(0.077)	(0.079)	(0.081)	(0.070)
Full Time	-0.110	0.035	-0.302	-0.430
	(0.087)	(0.085)	(0.084)	(0.073)
Part Time	0.016	0.009	0.005	0.009
	(0.033)	(0.030)	(0.027)	(0.025)
17-19 Year Olds 1983-1998 with Controls for School spending				
All	-0.401	0.027	-0.290	-0.288
	(0.150)	(0.129)	(0.147)	(0.108)
Full Time	-0.374	0.027	-0.312	-0.301
	(0.177)	(0.143)	(0.155)	(0.112)
Part Time	-0.028	0.001	0.021	0.013
	(0.066)	(0.052)	(0.056)	(0.044)

Notes: Source is 1983-1998 Labour Force Surveys. The reported statistics are the estimated parameters on the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage). The equation estimated is similar to that used for the results reported in table 3. In panels 2 and 4 education spending variables as described in Landon (1997) and in the appendix are added to the estimating equation. All estimation by OLS using LFS weights.

Table 5: The Relationship Between Minimum Wages and Labour Force Status

	15-16 Year Olds		17-19 Year Olds		20-24 Year Olds	
	April	October	April	October	April	October
Employment						
All	-0.560	-0.566	-0.309	-0.492	-0.343	-0.150
	(0.081)	(0.102)	(0.083)	(0.079)	(0.069)	(0.076)
Enrolled	-0.552	-0.538	-0.284	-0.325	-0.058	0.133
	(0.085)	(0.105)	(0.077)	(0.072)	(0.049)	(0.048)
Not Enrolled	-0.008	-0.028	-0.025	-0.167	-0.285	-0.283
	(0.017)	(0.025)	(0.055)	(0.065)	(0.077)	(0.067)
Unemployed						
All	-0.069	-0.098	0.078	0.019	0.045	-0.033
	(0.049)	(0.041)	(0.048)	(0.053)	(0.040)	(0.041)
Enrolled	-0.060	-0.083	0.077	0.024	0.019	-0.008
	(0.042)	(0.037)	(0.033)	(0.043)	(0.011)	(0.014)
Not Enrolled	-0.009	-0.015	0.001	-0.005	0.026	0.025
	(0.018)	(0.014)	(0.036)	(0.036)	(0.037)	(0.040)
Not in Labour Force						
All	0.629	0.664	0.231	0.472	0.260	0.163
	(0.082)	(0.099)	(0.079)	(0.092)	(0.064)	(0.064)
Enrolled	0.573	0.626	0.122	0.447	0.119	0.049
	(0.086)	(0.094)	(0.078)	(0.079)	(0.053)	(0.060)
Not Enrolled	0.055	0.038	0.109	0.025	0.141	0.114
	(0.031)	(0.026)	(0.033)	(0.038)	(0.043)	(0.044)

Notes: Source is 1983-2000 Labour Force Surveys. The reported statistics are the estimated parameters on the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage) from a regression of a the indicated labour force status rate on the minimum wage ratio, province and year effects, real GDP, the prime age (25-54) male unemployment rate and the ratio of the population aged 15-19 or 20-24 to the population aged 15-64. All estimation by OLS using LFS weights.

Table 6: Mean Characteristics of the Work Related Training Analysis Sample

Demographic Characteristics	
Male	0.52
Married	0.19
Age 20-24	0.67
Less than High School Diploma	0.34
Some Post Secondary Education	0.22
Post Secondary Diploma or Certificate	0.14
University Degree	0.04
Minimum Wage Ratio	0.424 (0.33)
Work Related Training	
Any~Screening Question	0.17
Apprenticeship, Vocational-Trade, Courses/Seminars	0.10
Courses/Seminars Only	0.08
Residual Training Captured by Global Question	0.04
Sample Size	9882

Notes: Source is 1992, 1994 and 1998 Adult Education and Training Surveys. All statistics calculated using AETS weights.

Table 7: Estimates of the Effect of Minimum Wages on Work Related Training

	All	Employer Suggested	Non Government Supported	Job Related
1992, 1994, 1998 AETS				
Apprenticeship, Vocational-Trade, Courses/Seminars	-0.017 (0.214)	-0.213 (0.107)	-0.022 (0.228)	
Courses/Seminars, Only	-0.187 (0.144)	-0.361 (0.165)	-0.234 (0.160)	
Residual Training Captured by Global Question	-0.000 (0.002)			
1994, 1998 AETS				
Apprenticeship, Vocational-Trade, Courses/Seminars	-0.466 (0.194)	-0.831 (0.176)	-0.497 (0.214)	-0.478 (0.179)
Courses/Seminars, Only	-0.445 (0.124)	-0.904 (0.295)	-0.425 (0.136)	-0.323 (0.152)
Residual Training Captured by Global Question				

Notes: Source is 1992, 1994 and 1998 Adult Education and Training Surveys. The reported statistics are the marginal effects of the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage) evaluated at the sample means, calculated using the estimated logit parameter on this variable. The other explanatory variables are province and year effects, real GDP, the prime age (25-54) male unemployment rate, and dummy variables for males, being married, ages 20-24 and 5 education levels. The empirical model is estimated as a logit using AETS weights. Robust and cluster corrected standard errors in parentheses.

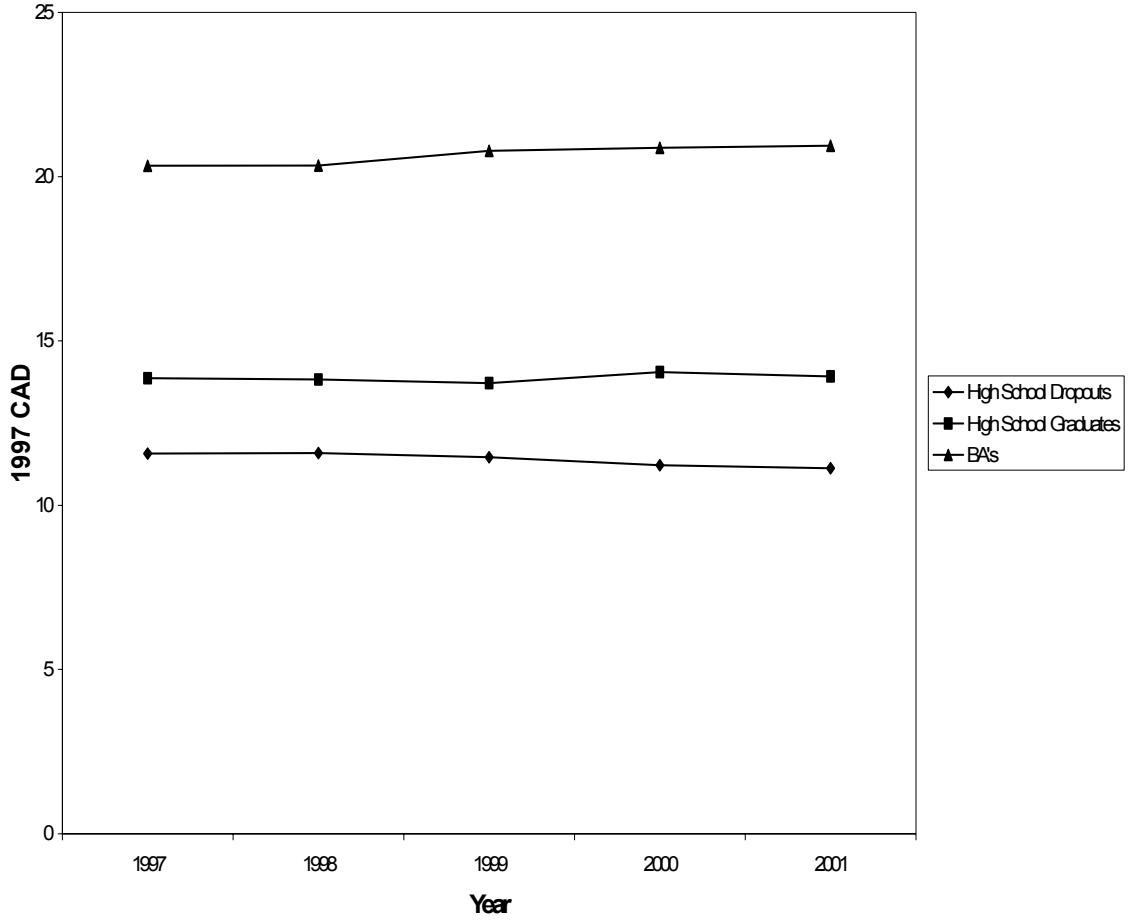
Table 8: Estimates of the Effect of Minimum Wages on Work Related Training on 17-24 Year Olds Using Aged 35-44 Year Olds as an Additional Control Group

	All		Employer Suggested		Job Related	
	Main	Interaction	Main	Interaction	Main	Interaction
1992, 1994, 1998 AETS						
Apprenticeship, Vocational-Trade, Courses/Seminars	-0.327 (0.299)	0.172 (0.259)	-0.756 (0.519)	0.492 (0442)		
Courses/Seminars, Only	-0.396 (0.301)	0.086 (0.225)	-0.859 (0.528)	0.399 (0.413)		
1994, 1998 AETS						
Apprenticeship, Vocational-Trade, Courses/Seminars	-0.922 (0.267)	-0.320 (0.428)	-2.253 (0.551)	1.085 (0.634)	-0.754 (0.274)	-0.477 (0.414)
Courses/Seminars, Only	-1.060 (0.259)	0.170 (0.352)	-2.239 (0.546)	1.176 (0.522)	-0.906 (0.250)	0.106 (0.362)

Notes: Source is 1992, 1994 and 1998 Adult Education and Training Surveys. The estimated regression is of a 0/1 indicator of the indicated training on the minimum wage ratio, province and year effects, real GDP, the prime age (25-54) male unemployment rate, and dummy variables for males, being married, ages 20-24 and 5 education levels and the minimum wage ratio (the ratio of the adult minimum wage to the industrial aggregate wage). The regression also includes a dummy variable for 17-24 year olds and its interactions with the province effects, the year effects and the minimum wage ratio. The reported statistics are Main: the estimated parameter on the minimum wage ratio, and Interaction: the interaction of the dummy variable for individual aged 17-24 and the minimum wage ratio. All estimation by OLS using AETS weights. Robust and cluster corrected standard errors in parentheses.

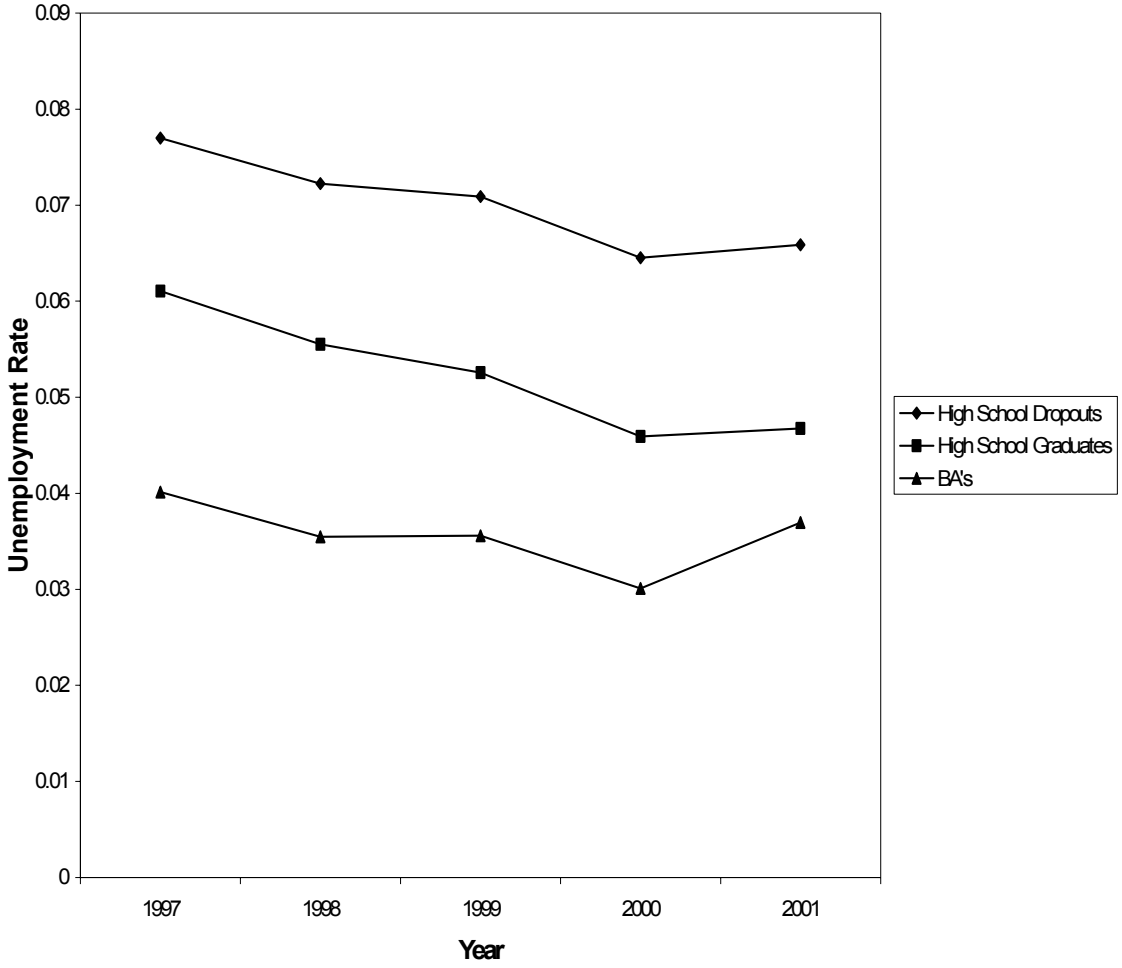
Figures

Figure 1: Real Wages by Education Group 1997-2001.



Source: 1997-2001 Labour Force Surveys

Figure 2: Unemployment Rates by Education Group 1997-2001.



Source: 1997-2001 Labour Force Surveys