High School Enrollment, Minimum Wages and Education Spending

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Cet article utilise des données provinciales pour examiner l'impact du salaire minimum et de différentes dépenses d'éducation sur la fréquentation des écoles secondaires. On montre que l'augmentation du salaire minimum a un effet négatif significatif sur l'inscription des garçons agés de 16 et 17 ans et des filles agées de 17 ans. Les résultats des estimations indiquent qu'une augmentation de 50% du salaire minimum a pour conséquence une baisse de 0.7 de 16 et 17 ans (cette chute équivaudrait à une baisse de 1700 étudiants en Ontario). Nos résultats montrent aussi qu'un ratio étudiant-enseignant plus faible, des professeurs mieux payés, des dépenses administratives et de fournitures scolaires plus importantes ainsi que des augmentations des dépenses d'autres commissions scolaires n'ont pas d'éffets symmétriques sur les taux de fréquentation.

The impact on high school enrollment of minimum wages and different types of education spending is examined empirically using Canadian provincial-level data. Increases in the minimum wage are shown to have a significant negative effect on the enrollment rates of 16- and 17-year-old males and 17-year-old females. The empirical estimates imply that a 50 cent increase in the hourly minimum wage causes a 0.7 percentage point fall in the percent of 16- and 17-year-olds enrolled in school (a decline that, in Ontario, would amount to more than 1,700 students). The results also indicate that lower student-teacher ratios, better paid teachers, more administrative spending, increased spending on instructional supplies, and increases in other school board operating expenditures do not have a systematic effect on enrollment rates.

INTRODUCTION

On average, 10 percent of 16-year-olds in Canada were not enrolled in school from 1975 through 1989. For part of this period, this percentage reached almost 20 percent in several provinces. The percentage of 17-year-olds not in school averaged almost 30 percent over the same period, and approached 50 percent in some provinces.[1] In 1988-89, the high school drop-out rate varied from slightly under 21 percent in New Brunswick to over 37 percent in Quebec (Lafleur 1992). A national drop-out rate of 30 percent would mean that approximately 120,000 students were leaving high school each year without having graduated.[2]

Early school leaving may impose important costs on the individuals involved and society as a whole. A large literature has found that drop-outs earn lower salaries and experience higher rates of unemployment than individuals who graduate from high school. In addition, higher drop-out rates have been

shown to lead to more income inequality, increased criminal activity and a greater need for, and reliance on, social and other public services.[3] If a higher drop-out rate results in a larger proportion of low-income earners, there could also be a reduction in the tax revenues available to finance these services as well as other public goods. Lafleur (1992) estimates the present value of the total cost to society of a high school drop-out to be approximately $30,000 (of which almost $20,000 is made up of the private cost to the drop-out). Vaillancourt (1995) calculates the private and social rates of return to completing high school, rather than dropping out, to be 33.4 and 11.9 percent, respectively. These rates of return would suggest that high school completion is a relatively good investment from both a private and social perspective.[4]

Given the predominant view that early school leaving is associated with large social (and private) costs, the determinants of school enrollment have received considerable attention in the education literature. Much of this literature focuses on individual, family, and school characteristics with little or no attention given to the role of economic factors in the drop-out decision.[5] Surveys of drop-outs have, however, identified a close relationship between work and the decision to drop out of school. For example, almost 80 percent of the drop-outs in the Karp (1988) sample indicated that their primary reason for leaving school was work related. Furthermore, in the surveys of both Karp (1988) and Statistics Canada (1991), the principal reason given by drop-outs for leaving school was that they preferred work to school.

The current paper investigates the impact on school enrollment in Canada of minimum wages and spending on different types of education inputs. Both these factors could, at least to some extent, affect the observed preference of drop-outs for work over school. This might occur if the level of the minimum wage had an impact on the employment opportunities of teenagers or if spending on different types of education inputs altered the school experiences of potential drop-outs. Unlike many of the individual and family characteristics associated with the decision to drop out that have been identified in the literature, education spending and the minimum wage are under the direct control of governments. As a result, if there exists a significant relationship between either or both of these factors and the drop-out rate, governments may be able to change their minimum wage or education-spending policies in order to alter the extent of early school leaving.

The balance of the paper is organized as follows. Section two provides a discussion of the relationship between school enrollment and both education spending and minimum wages. The empirical drop-out literature is reviewed in the third section and, in section four, the empirical methodology and data are discussed. The parameter estimates are described in the next section and the magnitude of the impact of the minimum wage on school enrollment is illustrated in the section following. Concluding comments follow.

School Enrollment, Education Spending and Minimum Wages

The rationale for the existence of a relationship between education spending and school enrollment is fairly straightforward. Higher spending on education inputs, lower student-teacher ratios or the provision of a larger variety of programs, for example, may improve the educational experience of students by providing them with more choice or greater attention. By enriching the educational environment, more education spending could also improve the human capital development and earnings potential of students. These factors could alter the relative preference of students for work and school and, consequently, reduce the drop-out rate.

Several different reasons, with contradictory predictions, have been proposed in the literature to explain why minimum wages may affect school

enrollment rates. For example, if a higher minimum wage reduces the number of jobs available, more teenagers may remain in school simply because they cannot find jobs.[6] A minimum wage increase may also raise the minimum level of productivity required for employment and so necessitate greater human capital investment and, thus, a higher level of school participation.[7]

Both these rationales for a positive relationship between school attendance and minimum wages rely on the assumption that minimum wages constrain the employment opportunities of teenagers.[8] An alternative view of the impact of minimum wages on enrollment is that higher minimum wages encourage early school leaving by raising the opportunity cost of education (the income foregone while in school).[9] Furthermore, by increasing the incomes of drop-outs relative to graduates, higher minimum wages may reduce the relative return to higher levels of education. The view that higher minimum wages may induce students to leave school by improving the income prospects of drop-outs is consistent with evidence presented in Baker, Benjamin and Stanger (1995) which indicates that increases in the minimum wage have had a significant positive impact on the wages of employed teens in Canada.

Several other rationales have also been put forward in the literature to explain why minimum wages may reduce school enrollment. For example, Cunningham (1981) suggests that a minimum wage increase encourages firms to shift from part-time to full-time (higher productivity) workers. This shift in demand raises the relative wage of full-time work and causes students, some of whom may be working part-time, to leave school in order to take full-time jobs. Taking a slightly different approach, Ehrenberg and Marcus (1980, 1982) maintain that only the poor will leave school following a rise in the minimum wage. They contend that poor students are dependent on part-time jobs, the supply of which is reduced by an increase in the minimum wage, and thus are forced to seek full-time employment when minimum wages rise.

The Empirical Drop-Out Literature

Much of the literature on early school leaving has focused on surveys of the characteristics and attitudes of drop-outs with some emphasis, as well, on individual school and teacher characteristics.[10] Often cited determinants of the decision to drop out are race, family structure, family income, the drop-out's scholastic ability and attitude toward school, part-time work experience, and pregnancy. School characteristics that are thought to have an impact on the drop-out decision are the attitudes of teachers and administrators, school size, program flexibility, class scheduling, curriculum, academic emphasis, and school-community relations. An important factor linking these studies is that they generally concentrate on individual and school factors while ignoring the wider economic context within which the school exists.[11]

While the primary focus of the minimum wage literature has been on the analysis of the impact of minimum wages on employment, there does exist a small literature that examines the relationship between the school enrollment decisions of teenagers and minimum wages using US data. The papers that make up this literature employ widely differing data sets and reach often contradictory conclusions. Several studies use US census data or National Longitudinal Survey data for single years (Cunningham 1981; and Ehrenberg and Marcus 1980, 1982), others employ time series data (Mattila 1981), data for a cross section of states (Card 1992), or a pooled time series-cross section of aggregate state-level data (Neumark and Wascher 1994*b*). Recently, Neumark and Wascher (1995*a*, *b*) have analyzed the enrollment effect of minimum wages using a combination of time series data from 1979 to 1992 and individual data from the US Current Population Survey.

Given the wide variety of data sets used, it follows that these studies have considered quite different sets of explanatory variables as possible determinants of school enrollment. For example,

several papers include a large number of individual characteristics (Ehrenberg and Marcus 1980, 1982, for example), while Card (1992) chooses a particularly parsimonious specification with the change in enrollment linked only to the overall employment rate in each state and the fraction of teenagers affected by the minimum wage change. Except for Cunningham (1981) and Neumark and Wascher (1994*b*), which each include a single measure of education spending as an explanatory variable, none of the studies cited above incorporate education-spending variables in their estimating equations.

Since the existing literature uses very different data sets and specifications to study the impact of minimum wage changes on school enrollment, it is not surprising that the conclusions of the different studies vary significantly. Some find that the minimum wage has *no* effect on enrollment (Card 1992), others find a *positive* effect (Mattila 1981), others a *negative* effect (Neumark and Wascher 1994*b*, 1995*a* and *b*), and some report results that depend on race (Cunningham 1981) or gender (Ehrenberg and Marcus 1980, 1982).

Sander and Krautmann (1991) and Sander and Schaeffer (1991) analyze the impact of education spending on school participation (without allowing for a minimum wage effect on enrollment). Using county-level data for Illinois from 1986-87, Sander and Krautmann (1991) find school size to be the only school characteristic that has a significant (positive) effect on the drop-out rate. Total school expenditures, teachers' salaries, teachers' experience, teachers' schooling, and the pupil-teacher ratio are all found to have no explanatory power. In contrast, Sander and Schaeffer (1991), using US county-level data for 1980, find that per pupil school expenditures have a significant positive effect on the enrollment of 16- and 17-year-olds. Similarly, Neumark and Wascher (1994*b*), although primarily interested in the effect of minimum wages on enrollment rates, find a positive relationship between average salaries of teachers and school enrollment.[12]

Principal Differences Between the Current Study and the Existing Literature

The current study differs from the existing literature in three ways. First, a time series-cross section of Canadian provincial data is employed. This provides an alternative to the US data used in previous studies and is likely to be of more interest to Canadian policymakers.

Second, rather than using one measure of education spending (or none at all) as in the previous literature, the current paper includes five variables that represent the disaggregated components of education spending as well as three additional explanatory variables which reflect potentially important characteristics of the school system. If education spending is an important determinant of enrollment, the exclusion of education expenditures from the estimating equation may cause the estimate of the minimum wage effect to be biased. In addition, the disaggregated approach employed here allows specific types of school spending (or aggregate school characteristics) that alter drop-out behaviour to be identified.

Finally, the analysis below examines the enrollment rates of 16-year-old and 17-year-old males and females separately. Except for Ehrenberg and Marcus (1980), the existing literature employs data that has been aggregated into broad age categories (16- to 19-year-olds or 14- to 17-year-olds, for example). It is generally possible to graduate from high school when 18 and to leave school legally by age 16. Disaggregation by age and sex avoids the necessity of assuming similar behaviour for different gender and age groups that may face very different opportunity sets.

The Empirical Methodology

Modelling the Enrollment Decision

At each point in time until they graduate, individual students must decide whether to stay in school or

drop out. They will remain in school only if they expect to be better off than if they drop out. The relationship between an individual's welfare from staying in school and their welfare if they drop out will depend on the relative costs and benefits of leaving versus staying in school. Some of these costs and benefits will be earnings related (their wage if they drop out, their wage if they finish school, the probability of finding a job) while others will be school-related (teacher experience, facilities available, program variety) or depend on personal factors (family structure, ethnic or social background, family income). The return to education, in terms of future earnings potential, may depend on both education spending as well as the personal characteristics of individual students.

To model the drop-out choice empirically, the proportion of individuals of type k in province i enrolled in school (P_{ki}) at time t is described by the linear function:

$$P_{ki} = ß_k'X_i + u_{ki}, \quad (1)$$

where X_i is a vector of variables that determine the costs and benefits of enrollment, u_{ki} is a random error and k identifies individuals of a particular age and gender. Ehrenberg and Marcus (1980, 1982), Card (1992) and Neumark and Wascher (1994*b*) use a similar specification. Modelling the enrollment decision using provincial-level proportions data, as in equation (1), is required in order to provide a time series of sufficient length to ensure adequate variation in the minimum wage and education spending data which, in any one year, vary only by province.[13]

The Data[14]

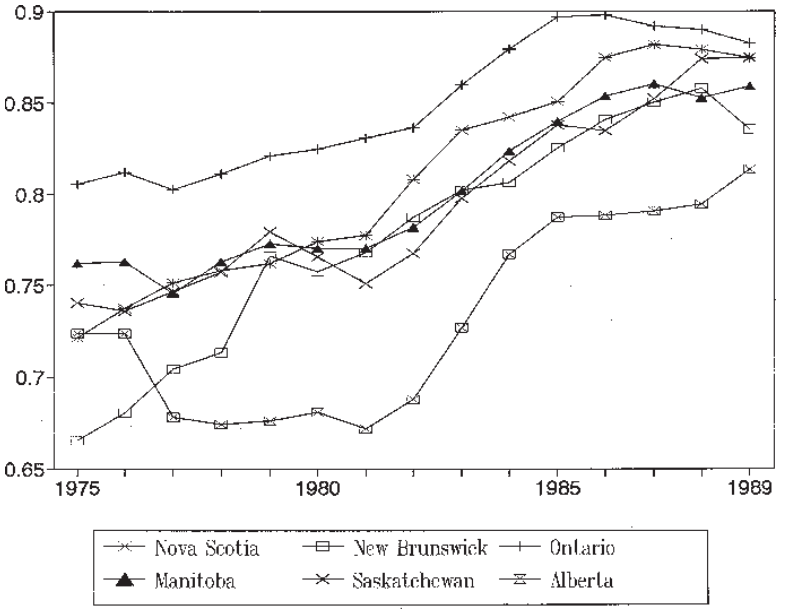
The data set consists of a pooled cross section-time series of annual provincial-level data from 1975 through 1989 for six provinces of Canada (90 observations, 15 for each province). The sample was terminated in 1989 because more recent school board spending data were not available and begins in 1975 in order to ensure that the enrollment series are consistent across provinces.

Data for only six provinces — Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, and Alberta — are used because the minimum school-leaving age was 16 from 1975 through 1989 in only these provinces.[15] In the other four provinces the school-leaving age was 15 (or the end of the year in which a student turned 15) and, in three of these four provinces, the school-leaving age was raised to 16 during the last few years of the sample period. The use of data for only those provinces with a minimum school-leaving age of 16 for the entire sample period ensured that all students of the same age in the sample were faced with the same enrollment choice.[16] If the data set had incorporated data from the four excluded provinces, it would have included both students who had just turned 16 and were legally able to quit school for the first time as well as students who were 16, but who could have (or may have) quit school when they were 15.[17]

The enrollment rates — the proportion of 16- and 17-year-olds enrolled in school — for each of the six provinces included in the data set are plotted in Figure 1. These vary from just over 0.65 to just under 0.9. While the enrollment rates generally rose from 1975 to 1989, there are significant differences in the level of these rates, as well as in the direction and magnitude of their changes, across the six provinces.

The enrollment equation, equation (1) above, was estimated for four different enrollment proportions — those for 16-year-old males (PE16M), 16-year-old females (PE16F), 17-year-old males (PE17M) and 17-year-old females (PE17F). Since the minimum school-leaving age is 16 for the provinces included in the sample, and it is usual to graduate from high school in most of these provinces by age 18, it is students in the 16- and 17-year-old age groups that are most likely to leave school without graduating.[18] Disaggregation of the enrollment proportions by age and gender allows the estimates to reflect differences in enrollment behaviour by sex and age. The enrollment rates of both 16-year-old males and females, averaged across provinces, exceeded those of the 17-year-olds of both sexes (although

FIGURE 1
Enrollment Rates by Province – 16- and 17-Year-Old Females and Males



this difference fell over the sample). While the male and female enrollment rates for each age group were not that different, the enrollment rate for males increased for both age categories relative to the female rate over the sample and, for the last half of the sample, the rate for 17-year-old males exceeded that of 17-year-old females.

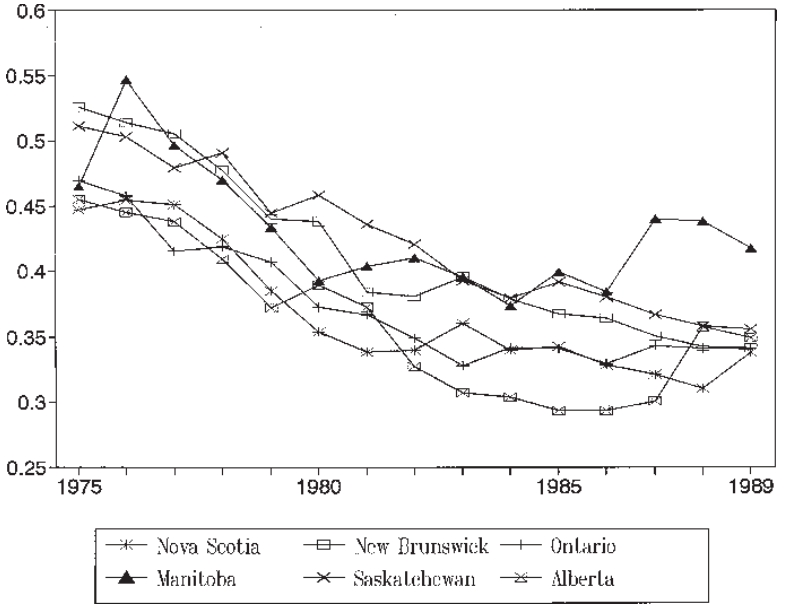
The Explanatory Variables

The explanatory variables included in the enrollment rate equation (the elements of X_i in equation (1)) can be divided into four groups — the minimum wage; education spending and education structure variables; other economic variables; and variables which reflect the social structure of the province. The minimum wage variable (MINWAGE) is the real level of the provincial minimum wage for non-students under the age of 18 as of 30 September of each year.[19] Following the existing literature, MINWAGE is divided by the average hourly wage (HOURLYWAGE).

The minimum wage, relative to the average hourly wage, for each of the six provinces included in the sample is plotted in Figure 2. Although this ratio generally declined in all six provinces over the sample period, in none of the provinces was this decline monotonic, and the relative minimum wage often moved in different directions in the different provinces.

In order to determine the impact of education expenditures on enrollment, the estimating equation includes five variables that represent the disaggregated components of education spending on public elementary and secondary schools.[20] These are the student-teacher ratio (S/T), the average teacher wage relative to the average wage (TWAGE/WAGE), real per student spending by school boards on instructional supplies (INSTSUP), real per student spending on administration (ADMIN) and real per student spending by school boards on all other operating costs (OPEREXP). Three additional variables which may represent potentially important

FIGURE 2
Minimum Wages by Province Relative to Average Hourly Wages



characteristics of the school system are also included in the estimating equation. These are the average number of students per school (S/S), the average age of teachers (TAGE), which may proxy teacher experience, and the proportion of teachers who work part-time (PARTTIME).

The estimating equations also include two additional economic variables which may affect the enrollment decision — the unemployment rate and real per capita income. The unemployment rate (UR) may act as a signal to potential drop-outs of the likelihood of finding employment. A higher unemployment rate would imply a lower probability of finding a job and, thus, may increase enrollment.[21] Real per capita income (INCOME) is included in the estimating equation to allow for the possibility of an income effect on education demand.[22]

In an attempt to at least partly control for differences in the social structures of the provinces, three additional variables are included in the estimating equation — the divorce rate (DIVORCE), the proportion of the provincial population made up of recent immigrants from abroad (IMMIGRANT), and the proportion of provincial GDP from agriculture and related industries (AGRICULTURE).[23] The estimating equation also includes provincial dummy variables in order to control for province-specific differences in tastes and behaviour.

THE PARAMETER ESTIMATES

The estimated parameters of the enrollment proportions equations for the four age-gender groups — 16-year-old females (PE16F), 16-year-old males (PE16M), 17-year-old females (PE17F) and 17-year-old males (PE17M) — are given in Table 1. All estimates were calculated using a pooled cross section-time series estimation procedure which corrects for non-constant variances across

TABLE 1
Enrollment Equation Estimates for 16- and 17-Year-Old Females and Males

Explanatory Variable	*Dependent Variable*			
	PE16F	*PE16M*	*PE17F*	*PE17M*
MINWAGE/HOURLYWAGE	.0246 (.26)	-.1775*** (1.99)	-.2392*** (2.82)	-.2983*** (2.58)
S/T	-.00328 (.37)	.00855 (.99)	-.00548 (.71)	.00171 (.18)
TWAGE/WAGE	.01404 (.35)	.05603** (1.67)	-.04336 (1.25)	-.01124 (.27)
INSTSUP	.00043 (1.37)	.00052* (1.63)	-.00043** (1.68)	.00014 (.40)
ADMIN	.0053 (1.37)	.0014 (.45)	.0046 (1.29)	.0046 (.96)
OPEREXP	-.0017 (.24)	.0013 (.20)	-.0119*** (2.00)	-.0042 (.54)
S/S	.00091*** (3.67)	.00128*** (5.48)	.00146*** (5.74)	.00152*** (5.27)
TAGE	.00976*** (2.26)	.01194*** (3.06)	.02426*** (7.25)	.02248*** (5.01)
PARTTIME	.7993* (1.47)	.6953 (1.29)	1.868*** (3.97)	2.2443*** (3.80)
UR	.00405*** (2.23)	.00556*** (3.41)	.00027 (.17)	.0054*** (2.50)
INCOME	.0022 (1.05)	.0031 (1.42)	.00073 (.38)	.0014 (.56)
DIVORCE	-.0109*** (2.18)	-.0056 (1.18)	.0056 (1.23)	.00015 (.02)
IMMIGRANT	.05535 (.08)	.6908 (.97)	.19277 (.24)	1.3007* (1.52)
AGRICULTURE	-.02590 (.19)	-.1409 (.96)	-.12419* (1.61)	-21493*** (2.69)
NSD	.1016*** (3.26)	.1127*** (3.68)	.1147*** (3.29)	.1065*** (2.88)
NBD	.0428 (1.28)	.0789*** (2.50)	-.0025 (.07)	.0200 (.46)
MD	.0561*** (2.21)	.1390*** (5.65)	.0960*** (3.38)	.1022*** (3.12)
SD	.1451*** (3.73)	.2451*** (6.48)	.2371*** (5.63)	.2341*** (5.19)

... continued

TABLE 1 (CONT'D.)

Explanatory Variable	*Dependent Variable*			
	PE16F	*PE16M*	*PE17F*	*PE17M*
AD	.0700*** (2.34)	.0946*** (3.11)	-.0556*** (1.96)	-.0116 (.33)
CONSTANT	.15057 (.62)	-.3963* (1.64)	-.4654*** (1.97)	-.7339*** (2.47)
Buse R^2	.7303	.8756	.9363	.9753
Reset Test	.31	.25	.28	.40
Test for AR1 on the Transformed Residuals	.58	.73	1.76	.45
Non-Nested P_E Test Against log(PE)	.34	.26	.19	.31
Non-Nested P_E Test Against exp(PE)	.30	.24	.31	.43
Non-Nested P_E Test Against log(PE/(1-PE))	.04	.04	.60	.51
Minimum Wage Elasticity of Enrollment (Evaluated at the Sample Mean)	.011	-.080***	-.136***	-.169***

Note: The absolute value of the t-statistic is in brackets below each coefficient.

*** Significant at 5 percent.
** Significant at 10 percent.
* Significant at 15 percent.

PE = the enrollment rate.

The RESET test, AR1 test and the P_E test statistics are all distributed as t-statistics. In none of the cases do these tests reject the model at 95 percent.

Source: Author's compilation.

provinces as well as for province-specific serial correlation.[24]

The robustness of the parameter estimates presented in Table 1 was examined by adding grouped time-period dummy variables (Y7577, Y7880, Y8183, Y8486, Y8788) to the enrollment equations (see Table 2). A comparison of the results presented in Tables 1 and 2 indicates that, although several of the time dummy variables are significant, their addition has almost no effect on the estimated coefficients associated with the minimum wage variable (although the estimated t-statistic falls from 1.99 to 1.91 in the PE16M equation) and only a minimal effect on the estimated coefficients of the education spending and other variables. Those variables that

TABLE 2
Estimates of the Enrollment Equations with Time Dummy Variables Included

Explanatory Variable	*Dependent Variable*			
	PE16F	*PE16M*	*PE17F*	*PE17M*
MINWAGE/HOURLYWAGE	.0262 (.29)	-.1777** (1.91)	-.2379*** (2.65)	-.2858*** (2.32)
S/T	-.01118* (1.45)	.00567 (.76)	-.00930 (1.10)	-.00664 (.64)
TWAGE/WAGE	-.04489 (1.25)	.02580 (.76)	-.03062 (.83)	.00573 (.12)
INSTSUP	.00011 (.38)	.00038 (1.28)	-.00043* (1.58)	-.000085 (.23)
ADMIN	.00076 (.25)	.0014 (.45)	.0024 (.63)	-.0029 (.56)
OPEREXP	-.00019 (.03)	-.0023 (.41)	-.0115** (1.74)	-.0054 (.65)
S/S	.00066*** (3.16)	.00090*** (4.56)	.00131*** (4.68)	.00144*** (4.47)
TAGE	.01054*** (2.63)	.01252*** (3.26)	.02255*** (6.09)	.02015*** (4.04)
PARTTIME	-.3958 (.74)	.2191 (.41)	1.173*** (2.04)	1.0827* (1.49)
UR	.00672*** (3.80)	.00731*** (4.16)	.00025 (.14)	.00704*** (2.95)
INCOME	-.00027 (.14)	.00038 (.19)	-.000048 (.02)	.0012 (.46)
DIVORCE	-.0135*** (3.04)	-.0086*** (2.10)	.0062 (1.05)	-.0025 (.37)
IMMIGRANT	-.27255 (.36)	1.8924*** (2.64)	.02657 (.03)	1.1288 (1.08)
AGRICULTURE	.03513 (.29)	-.03632 (.29)	-.13703 (1.35)	-.21056** (1.69)
NSD	-.0089 (.25)	.0528* (1.45)	.0761** (1.82)	.0271 (.52)
NBD	-.0439 (1.32)	.0138 (.42)	-.0188 (.44)	-.0048 (.09)
MD	.0248 (1.08)	.0973*** (4.19)	.0794*** (2.68)	.0984*** (2.84)
SD	.0805*** (2.42)	.1801*** (5.58)	.2118*** (4.60)	.2146*** (4.17)

... continued

TABLE 2 (CONT'D.)

Explanatory Variable	*Dependent Variable*			
	PE16F	*PE16M*	*PE17F*	*PE17M*
AD	.0547*** (2.20)	.0827*** (3.33)	-.0695*** (2.26)	-.0216 (.60)
Y7577	-.05468*** (2.59)	-.04777*** (2.29)	-.01188 (.64)	-.04399** (1.65)
Y7880	-.04922*** (2.82)	-.02732* (1.57)	-.01819 (1.15)	-.04227** (1.91)
Y8183	-.04954*** (3.97)	-.03345*** (2.60)	-.01595 (1.34)	-.03315*** (2.01)
Y8486	-.02570*** (2.65)	-.00895 (.91)	-.00158 (.16)	-.01000 (.78)
Y8788	-.00027 (.04)	.01067* (1.49)	.00049 (.07)	.00907 (.99)
CONSTANT	.64425*** (2.49)	-.04672 (.18)	-.2387 (.90)	-.3447 (.96)
Buse R^2	.8498	.9199	.9210	.9564
Reset Test	.71	1.39	.27	1.92
Test for AR1 on the Transformed Residuals	.53	.01	2.12	.18
Non-Nested P_E Test Against log(PE)	.71	1.42	.17	1.82
Non-Nested P_E Test Against exp(PE)	.71	1.37	.31	1.93
Non-Nested P_E Test Against log(PE/(1-PE))	.72	.68	.60	1.77

See notes to Table 1.

Source: Author's compilation.

are significant in Table 1 generally remain significant in Table 2.[25]

The Impact of the Minimum Wage on School Enrollment

The minimum wage has a significant negative effect on the enrollment rates of 17-year-old males and females and 16-year-old males. The coefficient associated with the minimum wage variable in the equation describing the enrollment rate of 16-year-old females is positive, but small and insignificant. The estimated coefficients associated with the minimum wage in the two male enrollment rate equations are both larger than those in the female equations.

This implies that a greater number of males than females are likely to leave school in response to a minimum wage increase.

The Impact on Enrollment of the Education Variables

The coefficient estimates associated with the five education spending variables — the student-teacher ratio (S/T), the average teacher wage (TWAGE/WAGE), spending on instructional supplies (INSTSUP), administrative spending (ADMIN), and other operating expenditures (OPEREXP) — are all generally insignificant.[26] This result implies that none of these broad categories of education spending have an important impact on school drop-out rates.[27]

The three variables that represent different characteristics of the school system have a much more systematic effect on enrollment rates than does education spending. The number of students per school (S/S) has a positive and significant effect on the enrollment of both males and females in both age groups. The effect of this variable on the enrollment rate of 17-year-olds is larger than that on the enrollment rate of 16-year-olds, and the effect on males is larger than the effect on females. One possible explanation for the positive impact of school size on enrollment is that larger schools may be able to offer a wider variety of educational and extracurricular programs, and these may encourage students to remain in school.

The estimates in Table 1 imply that the higher the average age of teachers in a jurisdiction (TAGE), the higher the enrollment rate, particularly of 17-year-olds. One explanation for this is that TAGE is acting as a proxy for teacher experience.[28] After examining the evidence in the empirical literature, Hanushek (1986) concluded that teacher experience is more likely to have a significantly positive impact on educational outcomes than any other education variable.

The percentage of teachers that are part-time (PARTTIME) has a positive and significant effect on the enrollment rate of 17-year-olds. Without information on the exact role played by part-time teachers in schools, it is not clear which underlying factors may be causing this result. One possible explanation is that part-time teachers may help provide a greater variety of course offerings or special help for at-risk students.

The Impact on Enrollment of the Other Economic Variables

The four estimating equations also include two additional economic variables that may affect the enrollment decision — UR and INCOME. The results in Table 1 indicate that higher rates of unemployment have a significant and positive effect on the enrollment rate (except for that of 17-year-old females).[29] On the other hand, higher real per capita income has an insignificant effect on the enrollment decisions of both 16- and 17-year-old males and females.

The Social Structure Variables and the Enrollment Rate[30]

The three variables added to the estimating equation to represent differences in the social structures of the provinces generally have little explanatory power. The divorce rate (DIVORCE) has only a significant negative effect on the proportion of 16-year-old females enrolled. The proportion of immigrants (IMMIGRANT) is not significant at 90 percent in any of the four enrollment equations while the percentage of GDP from agriculture (AGRICULTURE) has no effect on 16-year-old enrollment. It does, however, have a significant negative effect on the enrollment rates of 17-year-old males and females (with the effect on males being almost twice as large, and much more significant, than that on females).

The Magnitude of the Minimum Wage Effects

It is possible to ascertain the quantitative importance of the impact of minimum wages on enrollment by calculating the elasticity of enrollment with respect

to the minimum wage as well as by simulating the effect of minimum wage changes on enrollment. The elasticities of enrollment for each of the four age/sex groups with respect to the minimum wage (evaluated at the sample mean) are reported at the bottom of Table 1. The three elasticities which correspond to significant minimum wage effects indicate that a 10-percent increase in the mean minimum wage would cause a decline of 0.8, 1.4, and 1.7 percent in the number of 16-year-old males, 17-year-old females and 17-year-old males enrolled, respectively.

The estimated coefficients in Table 1, in conjunction with population data, can also be used to calculate the model's prediction of the number of students who would leave school for a given change in the minimum wage. The predicted change in enrollment in response to the last minimum wage increase that took place in each of the six provinces included in the data set is reported in Table 3. These minimum wage changes, which ranged from 3.3 percent in Manitoba to over 23 percent in Alberta, led to changes in enrollment in the six provinces of from 0.2 percent to 1.2 percent of the 16- and 17-year-old age group. In Ontario, for example, the results in Table 3 indicate that the 4.4-percent increase in the minimum wage in 1988 induced over seven hundred 16- and 17-year-olds to leave school.

Table 4 presents the prediction of the number of 16- and 17-year-old students that would have left school in each province following a $0.50 increase in the hourly minimum wage in the final year of the

TABLE 3
Decrease in Enrollment Due to Last Minimum Wage Change in the Data Set

Province	*Change in Minimum Wage*	*Percentage Change*	*Effective Date*
Nova Scotia	$3.55 to $4.05	14.1	1 January 1989
New Brunswick	$4.00 to $4.25	6.3	1 April 1989
Ontario	$4.55 to $4.75	4.4	1 October 1988
Manitoba	$4.55 to $4.70	3.3	1 April 1988
Saskatchewan	$4.25 to $4.50	5.9	1 August 1985
Alberta	$3.65 to $4.50	23.3	1 September 1988

Impact of Last Minimum Wage Change on Enrollment

Change in the Number of Students Enrolled

Province	*E16F*	*E16M*	*E17F*	*E17M*	*Total of Four Groups*	*Percent of 16/17 Age Group*
Nova Scotia	7	-52	-70	-91	-206	.7
New Brunswick	3	-22	-28	-38	-85	.3
Ontario	23	-179	-237	-312	-705	.3
Manitoba	3	-21	-28	-36	-82	.2
Saskatchewan	4	-32	-41	-53	-122	.4
Alberta	28	-215	-298	-387	-872	1.2

Note: This table is calculated using the parameter estimates from Table 1. The estimated coefficient associated with the minimum wage variable in the equation for 16-year-old females is insignificant.

Source: Author's compilation.

TABLE 4
Change in the Number of Students Enrolled Due to a $0.50 Increase in the Minimum Wage in 1989

Province	*E16F*	*E16M*	*E17F*	*E17M*	*Total of the Four Age Groups*	*Percent of 16/17 Age Group*
Nova Scotia	7	-52	-70	-91	-206	.7
New Brunswick	6	-44	-57	-77	-172	.7
Ontario	59	-447	-592	-781	-1761	.6
Manitoba	9	-65	-85	-111	-252	.8
Saskatchewan	7	-54	-69	-91	-207	.7
Alberta	16	-122	-160	-210	-476	.7

Source: Author's compilation.

sample — an average increase of 11 percent. The results in this table indicate that in Ontario, for example, a $0.50 increase in the minimum wage would have caused enrollment to decline by 1,761 students. For all six provinces, the predicted reductions in enrollment given in Table 4 are equivalent to approximately 0.7 percent of the population of 16- and 17-year-olds.

CONCLUSION

This paper examines the impact of minimum wages and education spending on the school enrollment rates of 16- and 17-year-old males and females using a cross section-time series of Canadian provincial-level data. Increases in provincial minimum wages are found to have a significant negative effect on the enrollment rates of 16- and 17-year-old males and 17-year-old females. A 50-cent increase in the hourly minimum wage causes a fall in the number of 16- and 17-year-olds in school equal to just under 1 percent of the total population of these two age groups.

At least two explanations are consistent with the negative effect of minimum wages on enrollment found here. The first of these suggests that higher minimum wages reduce the number of part-time jobs and induce individuals who were working part-time and attending school to quit school in order to work full-time. The second explanation suggests that by increasing the relative wage of low-skilled workers, and, thus, by both increasing the opportunity cost of education and decreasing its relative benefit, a higher minimum wage encourages early school leaving.

The potential impact of the minimum wage on school enrollment has not generally been considered in discussions of the appropriate level of the minimum wage. However, given the significant relationship between minimum wages and the enrollment rate found above, it may be important to take this effect into account when evaluating minimum wage changes. This would be particularly important if the social cost of a greater number of drop-outs is large.

In general, the empirical results indicate that lower student-teacher ratios, better paid teachers (holding experience constant), more administrative spending, as well as spending on instructional supplies and other inputs do not have a systematic impact on enrollment rates. These results suggest that the return to increased education spending in terms of drop-out prevention is likely to be small and, thus, that the need to reduce the drop-out rate cannot be

used to justify increased education spending. It is possible, however, that the use of aggregate (by province and for all schools) education spending data has caused the relationship between spending and the enrollment rates of 16- and 17-year-olds to be measured imprecisely.

In contrast to the insignificant role played by the education spending variables, more students per school, older (more experienced) teachers, and more part-time teachers all have a *positive* effect on enrollment. The estimated positive relationship between enrollment and both school size and the percentage of teachers who are part-time may be reflecting the impact of other factors on enrollment such as program variety or more support for *exceptional* students. More research is required to determine the underlying factors which are actually causing these results.

Notes

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[1]These averages exclude data for Prince Edward Island, Quebec, and Newfoundland since there are shortcomings with the enrollment data available for these provinces (see note 16 for details).

[2]Evidence in Karp (1988) and Statistics Canada (1991) indicates that approximately half of all drop-outs return to school at some point, although many of these returnees do not graduate.

[3]See Lawton (1994) for a review of this literature.

[4]Vaillancourt's estimates include only explicit income-related factors and, thus, do not incorporate any costs imposed on society that follow from the greater income inequality and reliance on social services that may result from a higher drop-out rate. Alternative evidence presented in Donald, Green and Paarsch (1995) indicates that the wages of high school drop-outs and high school graduates in Canada are not significantly different. Whether or not there exists an income differential between graduates and drop-outs is not sufficient to determine whether the decision to drop out is optimal for an individual. Individuals should choose to drop out of school, and it is at least privately optimal for them to do so, when, knowing their own abilities, future employment prospects, and tastes, the benefits from completing high school (potentially higher income, more job satisfaction, etc.) do not outweigh the costs (foregone income, the necessity of attending classes, etc.). On the other hand, before concluding that the drop-out decision is always optimal, it is necessary to consider, and determine the implications for the optimality of the drop-out decision, whether 16- and 17-year-olds are capable of undertaking this type of cost-benefit analysis, whether they possess and use the available information (for example, with respect to their own abilities or future employment opportunities), and whether they are subject to external pressures (from family or peers). Even if individual drop-out decisions are optimal from a private perspective, there is no reason for this decision to reflect the social costs of early school leaving.

[5]Lawton (1994) provides an extensive review of the recent literature while Olsen and Farkas (1989) provide a much briefer review of some of the earlier empirical literature.

[6]See Ehrenberg and Marcus (1980) and Mattila (1981).

[7]Agell and Lommerud (1995) develop a formal model that predicts this type of behaviour.

[8]There is a large literature that examines the impact of minimum wages on employment. See Card (1992) for one study that finds no impact of minimum wage changes on teenage employment and Neumark and Wascher (1992) for a study that finds a significant negative relationship between minimum wages and teenage employment. Other recent examples of the debate in the literature on the employment effects of minimum wages are Card, Katz and Krueger (1994); Card and Krueger (1994); and Neumark and Wascher (1994*a*). Recent evidence for Canada provided by Baker, Benjamin and Stanger (1995) indicates that there are significant long-run negative effects of minimum wage increases on teenage employment. On the other hand, Dickens, Machin and Manning (1994) provide evidence from the United Kingdom that suggests that minimum wages have a positive effect on employment.

[9]See Neumark and Wascher (1995*b*), for example.

[10]Examples of this literature can be found in Karp

(1988); Lawton *et al.* (1988); Morris, Pawlovich and McCall (1991); Evans, Oates and Schwab (1992); Evans and Schwab (1995); and Sander and Krautmann (1995).

[11]In their analysis of the determinants of early school leaving using individual data from a small set of metropolitan areas, Olsen and Farkas (1989) do not include minimum wage effects or education spending variables, but do control for local labour market conditions.

[12]Although he includes school spending per student in his enrollment rate estimating equation, Cunnigham (1981) does not report the parameter estimates associated with this variable.

[13]The disadvantage with using provincial-level data is that it obscures individual effects and makes it almost impossible to control for individual characteristics which may be important determinants of behaviour at the aggregate level. Maddala (1983) discusses the use of grouped proportions data.

[14]Variable definitions and data sources are given in Appendix I. Appendix II provides descriptive statistics for all the dependent and explanatory variables.

[15]Manitoba was included in the sample even though students cannot leave upon turning 16, but must complete the term in which they are enrolled. Since enrollment is measured for each age group at the end of September, this restriction is unlikely to be very important.

[16]In addition to differences in the minimum school-leaving age, the data for Prince Edward Island, Quebec, and Newfoundland were characterized by other problems which limited their usefulness. Population numbers are rounded to the nearest hundred by Statistics Canada and, thus, in Prince Edward Island, where there are only in the neighbourhood of 1,000 individuals in each age-sex group, this rounding caused wide fluctuations in the enrollment rate. Enrollment data for Quebec by age were only available from 1982. This severely limited the number of observations available to adjust the parameter estimates for cross-sectional heterogeneity. In addition, because of the existence of the CEGEP system in Quebec, many students leave school after grade eleven (the enrollment rate of 17-year-olds in Quebec is approximately one-third of the average level in the other provinces). This difference in the institutional structure of the education system implies that Quebec students are unlikely to be faced with the same choices at both 16 and 17 as students in the other provinces. Finally, the enrollment data for 17-year-old students in Newfoundland jumps inexplicitly by a magnitude of more than two approximately half-way through the sample period, a shift that casts doubt on the accuracy of the whole series.

[17]Evidence in Angrist and Krueger (1991) that a higher compulsory schooling age prevents dropping out implies that different minimum school-leaving ages will affect the composition of the enrolled and not-enrolled cohorts.

[18]In a survey of Ontario drop-outs, Sullivan (1989) found the median drop out age to be 16.6.

[19]Most of the explanatory variables are only available on an annual basis, but the minimum wage can change at any time during the year. The level of the minimum wage on 30 September of each year was used because the enrollment data for four of the six provinces included in the sample were collected as of this date. Enrollment in Alberta was measured on 1 September while, in New Brunswick, it was measured on 30 September for 1979 through 1989 and on 30 June for 1975 through 1978.

The youth minimum wage (where there is one), rather than the adult minimum wage, is employed because it is the appropriate minimum wage for 16- and 17-year-olds. However, if 16- and 17-year-olds are sufficiently forward looking, unaware that the minimum wage generally referred to does not apply to them, or if employers pay the adult minimum irrespective of age, it would be more appropriate to use the adult minimum wage. The empirical results are basically unchanged if the youth minimum wage is replaced by the adult minimum. The results are also generally unaltered if the minimum wage variable is not divided by the average hourly wage.

[20]It would be preferable if the education variables related directly to the two age groups being studied, but this data is not available.

[21]On the other hand, higher unemployment could reduce enrollment if the unemployment of a parent caused children to quit school and enter the workforce in order to support themselves or their family.

The estimating equation does not include a variable representing expected unemployment insurance benefits because there is no obvious proxy for this variable and, more importantly, because most drop-outs are unlikely to qualify for benefits (at least initially).

[22]Mattila (1981) also employs an income variable to control for income effects on education demand.

[23]The number of these variables is principally restricted by data availability.

[24]The estimates of the parameters and standard errors were calculated using the POOL command of the SHAZAM econometric program with cross-sectional independence imposed (see White 1993). Ordinary least squares (OLS) estimates are very similar to the adjusted estimates presented in Table 1. When OLS is used rather than the pooled technique, the estimated minimum wage effects are slightly larger and the estimated standard errors are slightly smaller. A pooled methodology with correction for heteroscedasticity and serial correlation is also used by Neumark and Wascher (1994*b*).

[25]Since theory provides no indication of the appropriate functional form for the enrollment rate estimating equation, a simple linear form was chosen. The appropriateness of this form was tested using RESET tests and non-nested hypothesis tests. While the RESET test is generally considered to be a test of functional form, it also has power as a test for omitted variables. This test involves adding the square of the predicted value of the dependent variable to the estimating equation and testing whether this additional explanatory variable is significant. If it is not, then the hypothesis that the model is not misspecified cannot be rejected. As can be seen from the test statistics reported in Table 1, for all four enrollment equations, the RESET test does not reject the specification used.

The functional form of the estimating equation was also tested using the non-nested P_E test of MacKinnon, White and Davidson (1983). This tests the form of the estimating equation against specifications which incorporate different transformations of the dependent variable. Table 1 provides the test statistics for P_E tests of the linear specification against the logarithmic, exponential and logit specifications. The logit specification of the dependent variable for the 16-year-old female equation, for example, would be log(PE16F/(1-PE16F)). These test statistics imply that none of these alternative specifications can reject the linear specification. In contrast, the logit specification is rejected by the RESET test in two of the four cases and rejected by the P_E test with the linear specification as the alternative model in two cases, one of which differs from the cases rejected by the RESET test. (These logit estimates are not reported in Table 1, but are available from the author.)

In order to determine whether the estimation method used actually adjusted for serial correlation, the transformed residuals were tested for first order serial correlation using a t-test suggested by Davidson and MacKinnon (1993, p. 359). In none of the four cases in Table 1 could this test reject the hypothesis that the transformed residuals were not serially correlated.

[26]Several of the papers cited above use total education spending per student as an explanatory variable in the enrollment equation. If aggregate real operating expenditures per student are entered in the estimating equation (and TWAGE, INSTSUP, OPEREXP and ADMIN are deleted), this aggregate spending variable is insignificant in all four cases and the other estimated parameters are generally unaffected.

[27]In his review of the empirical literature, Hanushek (1986) concludes that spending per pupil has no systematic effect on educational outcomes.

[28]If TAGE is excluded from the estimating equation, the estimated coefficient on TWAGE/WAGE becomes positive in all four cases and is significant at 95 percent in three of these (in the fourth it is significant at 90 percent). This suggests that if the estimating equation does not include an experience proxy, the teacher wage takes on this role. This could account for the positive effect on enrollment of average teacher wages found by Neumark and Wascher (1994*b*). Note further that, if TAGE is excluded from the estimating equation, the estimated coefficients (and the t-statistics) associated with the minimum wage variable are larger.

[29]A similar result is found in Olsen and Farkas (1989) using US individual data and an estimating equation which does not include minimum wages, but Ehrenberg and Marcus (1980) find the unemployment rate has no effect on the drop-out rate.

[30]Two additional variables — the percentage of low-income families (as defined by Statistics Canada) and the percentage of provincial GDP accounted for by fishing and trapping — were insignificant when added to all four equations and had t-statistics that were less than one (in absolute value) in every case.

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APPENDIX I
DATA DEFINITIONS AND SOURCES

AD, **MD**, **NBD**, **NSD**, **SD** — Zero-one provincial dummy variables for Alberta, Manitoba, New Brunswick, Nova Scotia and Saskatchewan, respectively.

ADMIN — Real per student expenditures on administration (in hundreds of dollars). The sum of school board and departmental (provincial) expenditures on administration, and provincial government services to school boards deflated by **ENROLL** and **PRICE**. Source: 1975-1979: Statistics Canada, *A Decade of Education Finance, 1970-71 to 1979-80* (81-560): 1980-1983: Statistics Canada, *Financial Statistics of Education 1984-85* (81-208); 1984-1988: Statistics Canada, *Financial Statistics of Education 1988-89* (81-208); 1989: Statistics Canada, *Financial Statistics of Education 1989-90* (81-208).

AGRICULTURE — The proportion of provincial GDP accounted for by agriculture. Source: GDP from agriculture (in constant dollars), Statistics Canada, CANSIM database, series — I206001, I339001, I207001, I340001, I209001, I342001, I210001, I343001, I211001, I344001, I212001, I345001, divided by real provincial GDP (**INCOME** multiplied by **POP**).

DIVORCE — The divorce rate. The sum of the divorce rate per 1,000 population for the current and two previous years. Source: Statistics Canada, *Vital Statistics, Marriages and Divorces*, 84-205, various issues.

ENROLL — Total elementary and secondary enrollment in public schools. Source: 1975-1979: Statistics Canada, *A Decade of Education Finance, 1970-71 to 1979-80* (81-560); 1980-1984: Statistics Canada, *Education in Canada: A Statistical Review for 1984-85* (81-229); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1989-90* (81-229).

E16F, **E16M**, **E17F**, **E17M** — The number of 16-year-old females, 16-year-old males, 17-year-old females, and 17-year-old males enrolled in all schools, respectively. Source: Statistics Canada, *Elementary-Secondary School Enrollment*, 81-210, various issues.

HOURLYWAGE — Real average hourly earnings in manufacturing. Nominal hourly earnings source: 1975-1982: Statistics Canada, CANSIM database, series D708660, D708710, D708963, D709312, D709411, D709513; 1983-1989: L66489, L68992, L76135, L79280, L82080, L85203. The two series were made consistent by multiplying by the ratio of their overlap for the first quarter of 1983.

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 database, series — D77, D78, D80, D81, D82, D83) divided by three times the current provincial population (**POP**).

INCOME — Real GDP per capita in thousands of dollars. This is gross domestic product by province at market prices (Statistics Canada, CANSIM database, series — D31572, D31586, D31614, D31628, D31642, D31656) divided by **POP** and **PRICE**.

INSTSUP — Real per student spending on instructional supplies by school boards. This is given by total spending on instructional supplies (Statistics Canada, *Financial Statistics of Education*, annual issues — 1979-80, 1982-83, 1984-85, 1989-90) divided by **PRICE** and **ENROLL**.

MINWAGE — The real provincial minimum wage applying to young workers (under 18). This is given by the nominal minimum wage on September 30th of each year deflated by **PRICE**. Source: Labour Canada, *Employment Standards Legislation in Canada*, various issues; Labour Canada, *Labour Standards in Canada*, various issues; "Changements dans les législations du travail au Canada," *Relations Industrielles*, various issues; Human Resources Development Canada, *Labour Law Update*, various issues; Ministry of Labour, Ontario, *Annual Report 1988/89*.

OPEREXP — School board operating expenditures (in hundreds of dollars), other than spending on teachers' salaries, instructional supplies and administration, deflated by **ENROLL** and **PRICE**. Source: 1975-1979: Statistics Canada, *A Decade of Education Finance, 1979-71 to 1979-80* (81-560): 1980-1983: Statistics Canada, *Financial Statistics of Education 1983-84* (81-208); 1984-1987: Statistics Canada, *Financial Statistics of Education 1987-88* (81-208); 1988: Statistics Canada, *Financial Statistics of Education 1988-89* (81-208); 1989: Statistics Canada, *Financial Statistics of Education 1989-90* (81-208).

PARTTIME — The proportion of teachers that are part-time (lagged so that it reflects students' experiences from the previous year). Equal to 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: 1974-1979: Statistics Canada, *A Decade of Education Finance, 1970-71 to 1979-80* (81-560); 1980-1984: Statistics Canada, *Education in Canada: A Statistical Review for 1984-85* (81-229); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1989-90* (81-229). The number of full-time equivalent part-time teachers was not available for 1980 to 1984 and so was approximated by a linear interpolation for each province of the data from the immediately preceding and immediately following years.

PE16F, **PE16M**, **PE17F**, **PE17M** — The proportion of 16-year-old females, 16-year-old males, 17-year-old females, and 17-year-old males enrolled in all schools, respectively. Enrollment is given by **E16F**, **E16M**, **E17F** and **E17M**. Population by sex/age group are from Statistics Canada, CANSIM database, series — C893284, C893602, C894238, C894556, C894874, C895192, C893283, C893601, C894237, C894555, C894873, C895191, C893287, C893605, C894241, C894559, C894877, C895195, C893286, C893604, C894240, C894558, C894876, C895194.

POP — Population by province. Source: Statistics Canada, CANSIM database, series — C893222, C893540, C894176, C894494, C894812, C895130.

PRICE — Implicit price index for final domestic demand by province (1986=100). Source: Statistics Canada, CANSIM database, series — D44792, D44806, D44834, D44848, D44862, D44876.

S/S — The average number of students per school. This is **ENROLL** divided by the number of public elementary and secondary schools (lagged one year to reflect the students experience from the previous year). Number of schools source: 1975-1979: Statistics Canada, *Education Statistics for the Seventies 1979* (81-569); 1982-1989: Statistics Canada, *Elementary-Secondary School Enrollment* (81-210), various issues; 1980/81-1981/82: Statistics Canada, *Education in Canada* (81-229), various issues. For 1980/81 and 1981/82 data were only available for all schools (including federal schools and private schools). The data for these two years were adjusted by taking the average difference between the data for the previous year and the following year for both definitions and subtracting this from the 1980/81 and 1981/82 data to give an estimate of the number of public elementary and secondary schools. This adjustment is quite small.

S/T — The student-teacher ratio (lagged so that it reflects students' experiences from the previous year). Source: **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). Number of teachers source is as in **PARTTIME** above.

TAGE — Average teacher age. Source: 1975-1984: Statistics Canada, *Characteristics of Teachers in Public Elementary and Secondary Schools 1985-86* (81-202); 1985-1989: Statistics Canada, *Education in Canada: A Statistical Review for 1989-90* (81-229).

TWAGE — The average real teacher wage (in thousands of dollars). Total spending by school boards on teachers' wages and fringe benefits divided by the number of full-time equivalent teachers (see **S/T**) and **PRICE**. Source for spending on wages and fringe benefits: 1975-1979: Statistics Canada, *A Decade of Education Finance, 1970-71 to 1979-80* (81-560); 1980-1983: Statistics Canada, *Financial Statistics of Education 1983-84* (81-208); 1984-1987: Statistics Canada, *Financial Statistics of Education 1987-88* (81-208); 1988: Statistics Canada, *Financial Statistics of Education 1988-89* (81-208); 1989: Statistics Canada, *Financial Statistics of Education 1989-90* (81-208).

UR — Unemployment rate. Source: Statistics Canada, CANSIM database, series D768752, D769893, D769905, D769949, D769970, D769991.

WAGE — Average real wage (in thousands of dollars). This is average weekly wages and salaries for an industrial composite (multiplied by 52) divided by **PRICE**. Source: 1975-1985: Statistics Canada, CANSIM database, series — D703360, D703410, D703660, D704010, D704060, D704160; 1986-1989: Statistics Canada, *Canadian Economic Observer, Historical Supplement 1991/92*, 11-210. The 1986-89 values were made consistent by using the average multiple by province for the 1983-85 overlap of the two data sets.

Note: The CANSIM series refer to the provinces in the following order: Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan and Alberta.

APPENDIX II
DATA – DESCRIPTIVE STATISTICS

Variable	*Mean*	*Minimum*	*Maximum*
ADMIN	3.9019	1.8107	9.7706
AGRICULTURE	.0410	.0105	.1664
DIVORCE	7.3238	3.1450	11.419
HOURLYWAGE	10.83	8.86	12.78
IMMIGRANT	.0117	.0024	.0386
INCOME	16.786	9.2966	27.859
INSTSUP	91.02	27.49	179.25
MINWAGE	4.25	3.34	5.23
OPEREXP	7.0643	4.1721	10.1640
PARTTIME	.0337	.0057	.0717
PE16F	.9021	.8176	.9649
PE16M	.8826	.7707	.9696
PE17F	.6976	.5269	.8639
PE17M	.6982	.5157	.8661
S/S	306.88	207.49	418.92
S/T	18.40	15.94	21.07
TAGE	37.44	34.5	40.5
TWAGE	37534	25523	47643
UR	8.43	2.90	15.1
WAGE	22.079	18.408	26.544

Note: There are 90 observations, 15 for each of six provinces — Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, and Alberta.