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Wages, Youth Employment, and School Enrollment: Recent Evidence from Increases in World Oil Prices

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^{p}	preliminary
^{r}	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E}	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

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Abstract

Canada's oil reserves are concentrated in three Canadian provinces: Alberta, Saskatchewan, and Newfoundland and Labrador. Oil prices received by Canadian oil producers more than doubled between 2001 and 2008. The proportion of young men employed in the oil industry differs markedly across provinces and education levels. Taken together, these facts suggest that the increases in world oil prices observed between 2001 and 2008 may have induced cross-educational and cross-provincial variation in labour demand and male wage growth in Canada. Using data from the Canadian Labour Force Survey, this study exploits this variation in wage growth in order to estimate the elasticity of young men's labour market participation and school enrollment with respect to wages. The main finding is that increased wages have a dual impact for young men: they tend to reduce their full-time university enrollment rates• at least temporarily• and to bring (back) into the labour market those who were neither enrolled in school nor employed. Contrary to previous research from the United States, the study finds no evidence that school enrollment rates of less-educated young men fall in response to increased pay rates, whether these are measured in real terms or relative terms. These findings hold under a variety of robustness checks and do not appear to be driven solely by selective migration.

Executive summary

The degree to which increased wages induce students to leave school and encourage youth who are neither employed nor in school to enter the labour market is an important issue highlighting a key aspect of human capital formation: studying and acquiring formal education versus working and gaining labour market experience.

One empirical challenge that researchers face when examining this issue is finding plausibly exogenous variation in the wage offers received by youth.

This study tackles this issue by using variation in wage growth induced by increases in world oil prices observed between 2001 and 2008.

The empirical strategy relies on three facts. First, Canada's oil reserves and, consequently, its oil production are concentrated in three Canadian provinces: Alberta, Saskatchewan, and Newfoundland and Labrador.

Second, the proportion of young men employed in the oil industry differs markedly across provinces and education levels. Within the two largest oil-producing provinces, young men with a high school diploma and young men who have less than a high school diploma are employed in this sector to a greater extent than their better-educated counterparts.

Third, oil prices received by Canadian oil producers more than doubled between 2001 and 2008.

Taken together, these facts suggest that the substantial increases in world oil prices observed between 2001 and 2008 may have induced cross-regional and cross-educational variation in young men's labour demand and, thus, in young men's wage growth.

Using data from the Canadian Labour Force Survey, the study examines this variation in wage growth to assess the causal impact of wages on young men's school enrollment and likelihood of being neither enrolled in school nor employed.

The main finding is that increased wages have a dual impact for young men: they tend to reduce their full-time university enrollment rates• at least temporarily• and to bring (back) into the labour market those who were neither enrolled in school nor employed. Contrary to previous research from the United States, the study finds no evidence that school enrollment rates of less-educated young men fall in response to increased pay rates, whether these are measured in real terms or relative terms. These findings hold under a variety of robustness checks and do not appear to be driven solely by selective migration.

Do increased wages lead to a net increase in youth human capital? The answer depends on whether reductions in school enrollment are permanent or temporary and on the extent to which the long-term employability of lower-skilled youth increases as they are drawn into the labour market. Recent evidence suggests that some previous oil booms (e.g., that observed in Canada during the early 1980s) led to a temporary reduction in school enrollment but had no long-term impact on individuals' educational attainment. Whether a similar scenario has persisted since the end of the 2008-2009 recession and the degree to which increased wages affect the long-term employability of lower-skilled youth are questions for future research.

1 Introduction

To what extent do increased wages induce youth to leave school? To what extent do they attract into the labour market those who were neither enrolled in school nor employed, thereby potentially increasing their labour market experience and long-term employability? While these two questions highlight key aspects of human capital formation—studying and acquiring formal education versus working and gaining labour market experience—they remain largely unanswered.

There are indications that increased wages lead to a reduction in school enrollment. In early work that assumed wage exogeneity, Gustman and Steinmeier (1981) found that school enrollment among individuals aged 17 to 22 was negatively correlated with hourly wages. More recently, Black et al. (2005) took advantage of the coal boom and bust that affected the U.S. states of Kentucky and Pennsylvania in the 1970s and 1980s and found that a 10% increase in the wages of lower-skilled workers was associated with a decrease in high school enrollment of 5% to 7%. The finding of Black et al. (2005) suggests that, in the short term, tight labour market conditions adversely affect schooling decisions of individuals with relatively low educational attainment. Whether this is still true in today's labour markets is unclear for a variety of reasons. First, changes in the skill content of jobs (Acemoglu 2002; Autor et al. 2003) likely have lowered employment opportunities of less educated individuals, thereby potentially altering the demand for higher education. Second, the substantial widening of education–wage differentials observed in the United States and many other OECD countries from the early 1980s onwards increased the attractiveness of pursuing higher education.[1] As a result, the degree to which less educated individuals alter their schooling decisions in response to increased pay rates may have fallen markedly over the last few decades.

Apart from their potential impact on school enrollment, increased wages may affect youth employment. Static labour supply models imply that increased wages will unambiguously raise labour supply at the extensive margin (Moffitt 2012). Thus, increased wages may induce young individuals who are neither enrolled in school nor employed to accept new job offers. If such is the case, increased wages may boost the labour market experience and employability of some individuals who were initially disconnected from the labour market and the school system. Hence, analyses that focus solely on the impact of wages on school enrollment miss an important channel through which they may affect human capital formation.

Yet evidence about the relationship between wages and the likelihood of youth being neither enrolled in school nor employed is remarkably scarce. Gustman and Steinmeier (1981) found no consistent pattern between wages and the probability of not being enrolled in school and not in the labour force. Because their analysis did not allow for a correlation between youth wage offers and labour supply, it potentially suffers from omitted-variable bias. To our knowledge, no other study has re-examined this relationship.

In sum, evidence regarding the degree to which wages affect school enrollment or the likelihood of youth being neither enrolled in school nor employed is either scant or based on a natural experiment—the U.S. coal boom and bust of the 1970s and 1980s—which took place in a labour market that had markedly different skill requirements and witnessed much smaller education–wage differentials than those observed today.

The main purpose of this study is to fill this gap. Using data that covers much of the 2000s, the study presents recent evidence regarding the short-term impact of wages on school enrollment and on the likelihood of youth being neither enrolled in school nor employed. To do so, it

1. Lemieux (2008) and Boudarbat et al. (2010) show that education–wage differentials rose in Canada and the United States from the early 1980s to 2005. Gottschalk and Smeeding (1997) document growing returns to education or higher-paid occupations in the United Kingdom, Sweden, Japan, and Israel during the 1980s.

exploits variation in youth wages induced by increases in world oil prices that took place during the expansionary period from 2001 to 2008.

The empirical strategy relies on three facts. First, Canada’s oil reserves and, consequently, its oil production are concentrated in three Canadian provinces: Alberta, Saskatchewan, and Newfoundland and Labrador (Chart 1). Second, the proportion of young men employed in the oil industry differs markedly across provinces and education levels. Within the two largest oil-producing provinces (Alberta and Saskatchewan), young men with a high school diploma and young men who have less than a high school diploma are employed in this sector to a greater extent than their better-educated counterparts (Chart 2). Third, oil prices received by Canadian oil producers more than doubled between 2001 and 2008 (Chart 3). Taken together, these facts suggest that the substantial increases in world oil prices observed between 2001 and 2008 may have induced cross-regional and cross-educational variation in young men’s labour demand and, thus, in young men’s wage growth (Charts 4 and 5). Using data from the Canadian Labour Force Survey (LFS), the study examines this variation in wage growth to assess the causal impact of wages on young men’s school enrollment and on the likelihood of their being neither enrolled in school nor employed.

Apart from assessing the causal impact of wages on these two potential determinants of youth human capital, the study contributes to the labour supply literature by offering recent estimates of the (after-tax) wage elasticity of labour supply at the extensive margin for a subset of workers—young men—who are likely to respond to changes in labour market conditions (Blundell 2011; Blundell et al. 2011). In line with recent research (Chetty et al. 2011; Keane 2011), the study finds substantial wage elasticities of labour supply at the extensive margin, especially for less-educated young men.

The main finding is that increased wages have a dual impact for young men: they tend to reduce their full-time university enrollment rates• at least temporarily• and to bring (back) into the labour market those who were neither enrolled in school nor employed. Contrary to Black et al. (2005), the study finds no evidence that school enrollment rates of less-educated young men fall in response to increased pay rates, whether these are measured in real terms or relative terms. These findings hold under of a variety of robustness checks and do not appear to be driven solely by selective migration.

The paper is organized as follows. Section 2 provides evidence that increases in world oil prices raised real wages of young Canadian men during the 2000s and that the resulting wage growth led to a reduction in full-time university attendance and in the proportion of youth who are neither enrolled in school nor employed. Section 3 presents the data and estimation strategy used in the study. Results are shown in Section 4. Robustness checks are conducted in Section 5. Concluding remarks follow, in Section 6.

2 Oil prices, wages, and youth outcomes

The 2000s witnessed a sharp increase in world oil prices, as increases in oil consumption from India and China and growth in global GDP raised aggregate demand for crude oil (Rowat 2006; Cheung and Morin 2007). From the late 1990s to 2008, the industrial product price index for petroleum and coal products doubled in Canada (Chart 3).[2]

2. Since the relative importance of coal products in this price index is only 5%, most of its variation is driven by changes in the price of petroleum products.

This significant change in oil prices likely affected the economies of the Canadian provinces differentially. The reason is simple: Canada's oil reserves vary markedly across provinces. According to the Natural Resources Canada website:

> "Most of Canada's oil reserves are found in the Western Canadian Sedimentary Basin, which underlay Alberta, Saskatchewan and part of the Northwest Territories.
>
> East coast offshore conventional crude oil reserves are now estimated to be larger than Alberta's conventional crude oil reserves (1,704 million barrels)."[3]

As a result, Alberta, Saskatchewan, and Newfoundland and Labrador account for most of Canada's total production of crude oil. Between 1997 and 2008, Alberta, Saskatchewan, and Newfoundland and Labrador accounted for roughly 96% of Canada's total production of crude oil and 97% of the total production of crude oil by the ten Canadian provinces (Chart 1).[4] Consistent with the view that the oil shock induced differential growth in young men's labour demand across provinces, real wages of men aged 17 to 24 increased at a much faster pace in these three provinces than in the remaining provinces from 2004 to 2008 (Chart 4). In addition, young men's employment rates increased more in Alberta and Saskatchewan than in the non-oil-producing provinces during that period (Chart 6).

This cross-provincial variation in the production of crude oil and in young men's wage growth coincided with cross-provincial variation in school enrollment. From 2003 to 2008, the percentage of young men enrolled in school dropped by almost 9 percentage points in Alberta, from 46.2% in 2003 to 37.5% in 2008 (Chart 7). It also decreased—although to a lesser extent—in Saskatchewan, falling from 46.9% in 2003 to 44.3% in 2008. In contrast, it increased from 49.9% to 52.7% in the provinces other than Alberta, Saskatchewan, and Newfoundland and Labrador (hereinafter, "the other provinces").

These differential movements in school enrollment partly reflected cross-provincial variation in university attendance. While the percentage of young men enrolled in university full-time displayed no upward trend in Alberta or Saskatchewan from 2003 to 2008, it increased by about 4 percentage points in the other provinces during that period (Chart 8). [5,6]

The aforementioned changes in school enrollment coincided with differential changes in the proportion of young men who were neither enrolled in school nor employed. Although this proportion was initially lower in Alberta and Saskatchewan than in the other provinces,[7] it fell more (by about 3 percentage points) from the early 2000s to the late 2000s in Alberta and Saskatchewan among young men with at least some postsecondary education (Chart 9) and those aged 21 to 24 (Chart 10) than it did in the other provinces.

3. See http://www.nrcan.gc.ca/energy/sources/crude/1165 (accessed March 15, 2013).
4. The Northwest Territories accounted for about 1% of Canada's total production of crude oil during that period.
5. School enrollment and full-time university attendance in Newfoundland and Labrador increased during that period. One potential explanation for this increase is that young men who were no longer attending school in Newfoundland and Labrador may have migrated to Alberta in order to search for a job or after finding a job in that province. This issue—selective migration—is addressed in Section 5.2.
6. Data from the Post-Secondary Information System (PSIS) also indicate that full-time university enrollment rates in Alberta and other provinces diverged during the 2001-to-2008 period. When the number of young men aged 17 to 24 enrolled in university full-time (as measured from PSIS) is divided by LFS estimates of the number of potential young male university enrollees, full-time university enrollment rates in Alberta fall from 17.3% in 2001 to 15.8% in 2008. In contrast, full-time university enrollment rates in non-oil-producing provinces increase from 20.2% to 24.3% during that period.
7. For instance, 9.8% of men aged 21 to 24 living in Alberta in 2001/2002 were neither enrolled in school nor employed. The corresponding proportion was 13.8% in other provinces.

In sum, descriptive evidence suggests that increases in world oil prices triggered differential increases in labour demand for young Canadian men during the 2000s, which in turn appear to have induced cross-educational and cross-provincial variation in young men's wage growth. The resulting sharp wage growth observed in the oil-producing provinces seems to have caused a reduction in school enrollment and in university enrollment rates as well as in the proportion of young men who are neither enrolled in school nor employed. The remainder of the study assesses whether these findings hold in multivariate analyses.

3 Data and methods

The data used in this study come mainly from the Canadian Labour Force Survey (LFS). The LFS is a monthly household survey conducted by Statistics Canada. It has been collecting information on the labour force status of Canadians, their weekly hours of work, their hourly wages, and their weekly wages on a consistent basis since 1997. The LFS is a rotating-panel survey in which households are interviewed for six consecutive months. The total sample consists of six representative sub-samples, one of which is replaced each month after it has completed the six-month stay in the survey. To increase sample sizes while focusing on months during which schools, colleges and universities are operating, the February, March, September and October files of LFS are combined.[8] The focus of this study is the expansionary period from 2001 to 2008, a period that witnessed sharp increases in both world oil prices and young men's wages (Charts 3 and 4).

The sample consists of unmarried men aged 17 to 24, who have no children, are not members of the Armed Forces, are not permanently unable to work, live in one of the ten Canadian provinces, and are either employed as paid workers or not employed.[9,10] When selecting individuals who are employed as paid workers, attention is restricted to individuals who worked no more than 85 hours per week and who earned at least $5.00 per hour in 2002 dollars.[11] Individuals aged 17 to 20 with a university degree and those aged 17 to 18 with trades' certificates or diplomas represent a negligible fraction of unmarried men aged 17 to 24 and thus are excluded from the analyses. As Table 1 shows, roughly half of the individuals in the resulting sample were enrolled in school during the period from 2001 to 2008, with the vast majority being enrolled full-time. About 60% were employed, and 11.4% were neither enrolled in school nor employed during that period.

The study examines five binary outcomes: 1) being employed; 2) being enrolled in school; 3) being enrolled in college full-time; 4) being enrolled in university full-time; and 5) being neither enrolled in school nor employed.

8. This sample selection scheme implies that some individuals may be observed twice in a given year (or two different years) within a given age, education and region combination. Since the regression analyses used in the study are based on standard errors clustered at the age, education and region level, these analyses allow arbitrary serial correlation that could result, among other factors, from multiple observations originating from the same individuals. Another concern is that as they get older or increase their education level, some individuals may contribute one observation to a given age, education and region cluster and another observation to a different cluster. This might induce cross-cluster correlation. Removing these individuals from the basic sample reduces sample sizes by about 3% and does not alter the main findings of this study.
9. Self-employed individuals are excluded. Self-employment rates of unmarried men aged 17 to 24 averaged about 2% during the 2001-to-2008 period and displayed no trend. As a result, excluding self-employed individuals is unlikely to bias our results.
10. Analyses are limited to young men because the instrumental variable used in this study—which equals the product of oil prices in year $t-1$ and the share of youth employment in the oil industry during the 1997-to-2000 period—is not strongly correlated with young women's hourly wages, thereby precluding the use of an instrumental variable estimator for young women. This finding is expected given that relatively few young women are employed in the oil industry.
11. Since province-specific minimum wages ranged from $5.63 to $8.00 (in 2002 dollars) between 2001 and 2008, the $5.00 wage restriction rules out unusually low wages.

The empirical strategy relates the outcome of individual i in age group a with education level e, living in region r in year t, Y_{iaert}, to his/her log after-tax hourly wages, lnW_{iaert}, a vector of individual-level control variables, X_{iaert}, and a vector of age/education/region-specific controls, Z_{aert}, through the following equation:

$$Y_{iaert} = \theta_{aer} + \theta_t + \beta_1 * lnW_{iaert} + \beta_2 * X_{iaert} + \beta_3 * Z_{aert} + \varepsilon_{iaert} \qquad t = 2001, \ldots 2008 \qquad (1)$$

where θ_{aer} and θ_t capture age-education-region fixed effects and year effects, respectively, and where ε_{iaert} is an error term.[12,13] The vector X_{iaert} consists of binary indicators for individuals: 1) living in a census metropolitan area (CMA) or a census agglomeration (CA); 2) belonging to a household that rents its dwelling; and 3) sampled in February, March or October (September being the reference month). The vector Z_{aert} controls for labour market conditions and includes the unemployment rate and the rate of involuntary part-time employment of young men in age group a, with education level e, living in region r in year t.

Since wages are unobserved for non-employed men, wage offers for these individuals are imputed using various percentiles, $PCTL^p{}_{aert}$, of the log after-tax wage distribution of employed men in age group a, with education level e, living in region r in year t.[14] The resulting wage variable, $lnW^p{}_{iaert}$, combines these imputed values for non-participants and the observed wages for participants, thereby yielding the following equation:

$$Y_{iaert} = \theta_{aer} + \theta_t + \beta_1 * lnW^p{}_{iaert} + \beta_2 * X_{iaert} + \beta_3 * Z_{aert} + \varepsilon_{iaert} \qquad t = 2001, \ldots 2008 \qquad (2)$$

To ensure that results are robust to the choice of imputed values, various estimates of $lnW^p{}_{iaert}$ are constructed, based on the 15th, 25th, 35th, or 45th percentile of the cell-specific wage distributions defined above.

12. After-tax hourly wages are computed as follows. First, weekly earnings of paid workers (measured in current dollars) are multiplied by 52 weeks and converted into hypothetical annual earnings. Second, a Canadian tax calculator provided by Milligan (2012) is used to calculate after-tax hourly wages in current dollars. Third, using province-specific Consumer Price Indexes (All items), real after-tax hourly wages are constructed.
13. Four age groups (17 to 18; 19 to 20; 21 to 22; 23 to 24), seven education levels (Grade 10 or lower; Grade 11, 12, or 13, with no high school diploma; high school diploma; trades certificate or diploma; some postsecondary education; college, CEGEP, and university certificate below bachelor's degree; and bachelor's degree or above), and eight regions (one region encompassing New Brunswick, Nova Scotia, and Prince Edward Island, and one region for each of the remaining provinces) are considered each year.
14. Note that LFS captures individuals' province of residence, which might differ from their province of work.

Since lnW^{p}_{iaert} and ε_{iaert} may be correlated because of unobserved heterogeneity or measurement error in after-tax hourly wages, an instrumental variable is used for lnW^{p}_{iaert}. The instrument is the following: $OIL_{aert} \equiv \left(OIL\_PRICE_{t\text{-}1} / 100\right) * OIL\_SHARE_{aer\_9700}$. It is the product of last year's oil prices and the share of employed young men (in age group a and at education level e living in region r) working in the oil industry between 1997 and 2000 ($OIL\_SHARE_{aer\_9700}$).[15]

The rationale for this instrument is simple: for a given increase in oil prices, labour demand and, thus, wages should grow faster among groups of young men who were heavily involved in the oil industry prior to the 2000s than among other groups.[16] Since increases in world oil prices may trigger increases in youth wages with a certain lag, the one-year lagged value of oil prices is used when constructing OIL_{aert}.

The instrument above is defined for 200 groups of workers tracked over 8 years, thereby potentially yielding variation based on up to 1,600 observations at the age, education, region and year level.[17] To ensure that imputed wage offers are based on reasonable samples of employed young men, the analysis is restricted to groups of individuals for whom wages are imputed on the basis of at least 20 (microdata observations of) employed individuals. These restrictions yield a basic sample of 170,632 observations, from which 1,128 age, education, region and year grouped observations on OIL_{aert} and Z_{aert} can be obtained. These 1,128 grouped observations are related to 164 (age/education/region-specific) groups of individuals and are based on microdata samples that contain 151.3 observations, on average (Table 3).

While the instrumental variable estimation strategy described above takes advantage of cross-group variation in wage growth induced by a specific shock—increases in world oil prices—an alternative is to use a grouping estimator that exploits all cross-group variation in wage growth. If one assumes that changes in wages across groups (defined by age, education, and region) are driven by shifts in labour demand unrelated to Canadian young men's school enrollment and labour supply decisions,[18] a grouping estimator can be used to estimate the following model:[19]

$$Y_{aert} = \theta_{aer} + \theta_{t} + \beta_1 * lnW^{p}_{aert} + \beta_2 * X_{aert} + \beta_3 * Z_{aert} + \varepsilon_{aert} \quad t = 2001, \ldots 2008 \qquad (3)$$

15. The fraction of young male workers employed in one of the following four-digit North American Industry Classification System (NAICS) industries is computed: oil and gas extraction (2111); coal mining (2121); support activities for mining and oil and gas extraction (2131); and utility system construction (2371). Of all men aged 17 to 24 employed in these industries between 1997 and 2000, about three quarters were employed in oil and gas extraction or in support activities for mining and oil and gas extraction. Oil prices are obtained from CANSIM table 329-0065 and are based on the industrial product price index for petroleum and coal products, which is indexed to 100.0 in 2002.
16. An alternative scenario is that, as energy prices rise, the use of capital decreases, and the demand for unskilled labour—relative to skilled labour—increases, thereby lowering the skill wage premium within provinces (Polgreen and Silos 2009), a pattern observed in Chart 5.
17. The 200 groups result from the interaction of eight regions and 25 age-education cells. These 25 age-education cells in turn are obtained by removing three age-education combinations (individuals aged 17 to 18 with trades' certificates or diplomas; individuals aged 17 to 18 with a bachelor's degree or above; and individuals aged 19 to 20 with a bachelor's degree or above) from a set of seven education levels interacted with four age groups.
18. Differential changes in the worldwide supply of workers across skill groups, the appreciation of the Canadian dollar on the foreign exchange market, and the drop in real interest rates during the 2000s may have generated differential changes in domestic labour demand across industries and, thus, in youth labour demand across groups.
19. Several studies (Blundell et al. 1998; Devereux 2004, 2007; Blau and Kahn 2007) used grouping estimators to estimate labour supply models.

where the dependent variable and the regressors have been redefined at the group level. Equation (3) is estimated using weighted least squares, where the weights represent population estimates in a given cell.[20]

As they consider whether to stay in school, individuals may compare their current wage offers to those they are likely to receive after completing additional schooling (Becker 1964; Black et al. 2005). If so, equations (2) and (3) should be re-estimated using a variable that captures relative wages rather than real wages. For this reason, alternative versions of equations (2) and (3) are also considered. In the alternative versions of equation (2), log real wages (lnW^{p}_{iaert}) are replaced by $lnW^{p^*}_{iaert} \equiv ln\left[W^{p}_{iaert} / W_{25\text{-}29\_RF\_rt,t\text{-}1}\right]$, where $W_{25\text{-}29\_RF\_rt,t\text{-}1}$ denotes the average after-tax real hourly wages received in region r in years t and $t\text{-}1$ by employed young men aged 25 to 29 belonging to a given reference group.[21] In the alternative versions of equation (3), lnW^{p}_{aert} is replaced by $lnW^{p^*}_{aert} \equiv ln\left[W^{p}_{aert} / W_{25\text{-}29\_RF\_rt,t\text{-}1}\right]$.

Apart from variability in the temporal patterns observed across age groups and education levels, the identification strategy relies on cross-provincial variation in the evolution of young men's outcomes and wages. Because the analysis is based on a time series of cross-sections from the LFS, the findings might be affected by selective inter-provincial migration. While the LFS contains no information that distinguishes stayers from migrants, Statistics Canada's Longitudinal Administrative Databank (LAD) can be used to deal with selective inter-provincial migration. One can examine whether the oil-producing provinces lost (gained) ground relative to the other provinces, in terms of university enrollment (employment) rates, to a similar extent in a basic sample—which includes migrants and stayers—versus a sample that consists exclusively of stayers. As will be shown below, these comparisons reveal that cross-provincial movements in university enrollment and employment are not driven simply by selective inter-provincial migration.

3.1 Instrument validity

There are several threats to the validity of the instrumental variable selected in this study. Equation (2) assumes that increases in oil prices affect young men's school enrollment only through increased wages. Yet positive oil price shocks may affect enrollment through other channels as well. *A priori*, oil shocks can increase young men's employment opportunities or frequency of job offers and increase the asset income (e.g. dividends from stocks) or employment income of their parents. By increasing revenues of oil-producing provinces and aggregate demand for labour, increases in oil prices might induce provincial governments to increase spending on education, lower university tuition fees, modify social assistance parameters, and/or raise minimum wages. All of these factors can potentially affect young men's school enrollment and university attendance.

These issues are addressed as follows. First, controls for young men's unemployment rates and rate of involuntary part-time employment are included in equation (2). The inclusion of these controls rules out the possibility that young men reduce their school enrollment simply

20. When equations (2) and (3) are estimated, standard errors are clustered at the age-education-region level, thereby allowing for serial correlation of an unspecified nature within age-education-region cells.

21. Reference groups vary across sub-samples. When the focus is on young men with no high school diploma (Table 8), high school graduates are the reference group. When the focus is on potential university (college) enrollees (Table 7), young men with a bachelor's degree (college diploma) are the reference group.

because there are more jobs available, rather than because wage offers are higher.[22] Second, increases in parental income triggered by rising oil prices are, if anything, likely to foster young men's school enrollment by (potentially) increasing university attendance. If so, they will bias upwards estimates of β_1, thereby yielding conservative estimates of the degree to which high wages reduce school enrollment and university attendance. A similar argument applies to the omission of government spending on education in equation (2). Third, the study uses augmented versions of equations (2) and (3) that control for the following province-specific variables: (a) log average real tuition fees associated with a bachelor's degree, (b) levels of real income from social assistance potentially available to non-employed single individuals, and (c) log real minimum wages.[23] As a result, the estimates of β_1 reported in this study will not be contaminated by these factors.[24,25] However, increases in parental income and increases in government spending on education will lead to a reduction in the proportion of young men neither enrolled in school nor employed if they lead to a rise in school enrollment among young men who were initially *not* employed. If so, estimates of β_1 will capture the joint influence of increased wages, increased parental income, and increased government spending on the proportion of young men neither enrolled in school nor employed. While this possibility cannot be ruled out, alternative versions of equation (3), augmented with linear trends for oil-producing provinces, are considered. If parental income and government resources spent on education increased faster in the oil-producing provinces than in the other provinces during the observation period and tended to reduce the proportion of young men neither enrolled in school nor employed, estimates of β_1 should drop substantially when moving from equation (3) to alternative versions that include these trends. The study finds no such evidence: estimates of the causal impact of wages on the likelihood of young men being neither enrolled in school nor employed are as large in these alternative specifications as they are in equation (3).[26] This suggests that the main results regarding young men's probability of being neither enrolled in school nor employed are not driven by the omission of parental income or government spending on education.

22. In this study, young men's rates of unemployment and of involuntary part-time work are defined as population-based ratios, i.e., ratios of the number of individuals unemployed or ratios of the number of workers involuntarily employed part-time to the population of young men. Both variables are endogenous with respect to school enrollment: young men enrolled in school are less likely than others to be participating in the labour market and, thus, to be unemployed. However, estimates of the impact of wages will remain consistent as long as the (oil price) instrument used in this study is uncorrelated with the error term after conditioning on observables (including unemployment and involuntary part-time work) (Stock and Watson 2011, p. 467–468). Contrary to the estimated wage impact, the parameter estimates for youth unemployment and involuntary part-time employment will not have a causal interpretation, however.

23. Province-specific/year-specific social assistance incomes are obtained from the report titled *Welfare Incomes 2009*, published by the National Council of Welfare (National Council of Welfare 2009). The calculations from the National Council of Welfare assume that: (*a*) recipients first received welfare benefits on January 1; (*b*) this is the very first time they have ever received welfare benefits; (*c*) recipients reside in the largest city or town in their province or territory; (*d*) there are no penalties for being new to the area; (*e*) recipients live in private rental accommodation and do not share; (*f*) recipients receive the highest level of shelter assistance for tenants, whereby all utility costs are included; (*g*) there are no costs for moving; and (*h*) there are no costs for repairing the rental accommodation.

24. Because these three variables are defined at the province or region level (rather than at the age, education and region level), their inclusion raises issues of multiple levels of clustering and of relatively few clusters at the higher level (region or province) when standard errors are computed. To ensure that the main findings of this study are not affected by such issues, all models have been re-estimated without controls for tuition fees, potential income from social assistance, and minimum wages. Omitting these factors does not alter the main findings of the study.

25. Parental education and average grades in high school are other potential determinants of school enrollment and university attendance omitted from equation (2). However, they are plausibly uncorrelated with movements in world oil prices.

26. The same procedure cannot be used for equation (2) since the instrumental variable used in the study becomes a weak instrument when trends for oil-producing provinces are added. This is expected since the identification strategy used relies partly on cross-provincial variation in wage growth and youth outcomes.

3.2 Instrument relevance

Table 2 shows that the instrument selected is strongly correlated with after-tax real wages. For all samples considered in the study and all percentiles used to impute wages of non-participants, the first-stage F-statistic for OIL_{aert} ranges from 10.0 to 73.0. As expected, increased oil prices are positively correlated with wages. The coefficients for OIL_{aert} are generally close to 2.0. This suggests that a doubling of oil prices from their 2002 level would increase by roughly 10 points the (log) after-tax real wages of young men for whom the probability of working in the oil industry was equal to 5% during the 1997-to-2000 period.

4 Results

Table 3 presents results from equation (2) estimated on the basic sample. Columns 1, 2, 3, and 4 show parameter estimates for β_1 based on imputed wages drawn from the 15^{th}, 25^{th}, 35^{th}, and 45^{th} percentiles of cell-specific after-tax (log) wage distributions of employed young men. The first three rows present results from ordinary least squares (OLS), two-stage least squares (2SLS), and the grouping estimator, Efficient Wald Estimator (EWALD), for school enrollment. The next rows show results regarding the likelihood of young men being employed and the likelihood of their being neither enrolled in school nor employed.

The first observation is that OLS results are very sensitive to the choice of percentiles used for the imputation of wages of non-participants. This is true for each of the outcomes considered. For instance, young men's school enrollment response to wages ranges from -0.20 when imputations are based on the 15^{th} percentile to 0.03 when imputations are based on the 45^{th} percentile. Similarly, the estimated impact of wages on young men's employment rate and likelihood of being neither enrolled in school nor employed drops by a factor of 5 when moving from the 15^{th} percentile to the 45^{th} percentile.

In contrast, 2SLS results cover a much narrower range. School enrollment estimates of β_1 are statistically significant at the 5% level and indicate that a 10-point increase in log after-tax real wages reduces school enrollment by 2.6 to 3.5 percentage points, from a baseline school enrollment rate of 52%. Wage parameter estimates for the probability of being employed and for the probability of being neither enrolled in school nor employed are estimated more precisely: most estimates are statistically significant at the 0.1% level. They suggest that a 10-point increase in log after-tax real wages: (*a*) raises young men's employment rate by 3.5 to 4.7 percentage points[27], and (*b*) reduces the probability of young men being neither enrolled in school nor employed by 1.4 to 1.9 percentage points. Since 59% of young men were employed in 2001 and since 12% of them were neither enrolled in school nor employed that year (Table 3), these estimates imply sizable wage elasticities of labour supply at the extensive margin and of the likelihood of being neither enrolled in school nor employed that average 0.69 and -1.35, respectively.[28]

Like 2SLS results, results from the grouping estimator EWALD suggest that increased real wages raise young men's employment rate and reduce the likelihood of their being neither enrolled in school nor employed. The resulting wage elasticities of labour supply at the

27. In contrast, minimum wage parameter estimates in the employment equation indicate that a 10-point increase in log real minimum wages is associated with a drop in employment rates that range from 0.7 to 1.0 percentage point. Measured in levels or logarithms, income from social assistance potentially available to non-employed single males is uncorrelated with employment rates.
28. Wage elasticities are obtained by dividing the estimated wage impact by the mean of the relevant dependent variable in 2001.

extensive margin and of the likelihood of being neither enrolled in school nor employed are about half those obtained from 2SLS estimates: they average 0.35 and -0.63, respectively. While estimates of β_1 obtained from EWALD indicate that school enrollment drops in response to increased wages, some of these estimates are not statistically significant at conventional levels. Nevertheless, both 2SLS and EWALD suggest that increased real wages have a dual impact. Although they appear to reduce school enrollment• at least temporarily• they bring (back) into the labour market young men who were neither enrolled in school nor employed.

Table 4 assesses whether relatively high real wages induce young males with no high school diploma (Grade 10 or lower; Grade 11, 12, or 13, with no high school diploma) to drop out of school, at least temporarily. As for Table 3, OLS estimates of young men's school enrollment response to wages vary substantially according to the vector of imputed wages used for non-employed individuals. In contrast, 2SLS estimates are fairly stable and range from -0.06 to -0.10. Like EWALD estimates, they are not statistically different from zero. Thus, they provide no support for the hypothesis that lower-skilled young men stop attending school in response to increased wages. Conversely, all three estimators suggest that the employment rate of less-educated young men rises as wages increase. A 10-point increase in log after-tax real wages is associated with a rise of 5.3 to 8.7 percentage points in this probability, when 2SLS estimates are considered.[29] This implies a relatively high wage elasticity of labour supply at the extensive margin that ranges from 1.06 to 1.74. As for Table 3, results from 2SLS indicate that this increase in labour market participation originates• at least partly• from a reduction in the proportion of individuals who are neither enrolled in school nor employed. Hence, the numbers shown in Table 4 indicate that, for young men with no high school diploma, increased wages have no impact on school enrollment, but draw into the labour market those who were neither enrolled in school nor employed.

Given the secular increase in skills requirements (Acemoglu 2002; Autor et al. 2003) and in youth educational attainment observed in the last few decades, it is conceivable that increased wages alter the schooling decisions of individuals "at risk" of attending college or university, rather than those of individuals with relatively low levels of education. If so, the negative school enrollment impact of wages shown in Table 3 would be observed among potential college and university enrollees.[30] Table 5 confirms that this is the case. Results from 2SLS indicate that a 10-point increase in log after-tax real wages reduces school enrollment among this sub-sample by 2.7 to 3.3 percentage points. As for Table 3, all estimators show that following wage increases, the likelihood of young men being employed rises and the likelihood of their being neither enrolled in school nor employed falls. For potential college and university enrollees, 2SLS estimates indicate that a 10-point increase in log after-tax real wages leads to an increase in employment rates that range from 2.2 and 2.7 percentage points.[31] The resulting wage elasticity of labour supply at the extensive margin ranges from 0.36 to 0.44 and thus, is lower than for their counterparts with no high school diploma.

In sum, 2SLS estimates indicate that increased real wages raise labour market participation and reduce the probability of being neither enrolled in school nor employed both for young men with no high school diploma and for their better educated counterparts who are potential college or university enrollees. Contrary to the findings of Black et al. (2005), neither 2SLS estimates nor estimates obtained from a grouping estimator suggest that increased real wages reduce school

29. As for Table 3, increases in real minimum wages are associated with more modest movements in employment rates than increases in real after-tax wages. Minimum wage parameter estimates show that a 10-point increase in log real minimum wages is associated with a drop in employment rates that range from 0.6 to 1.2 percentage point.
30. In this study, potential college and university enrollees exclude individuals with trades' certificates or diplomas, those with no high school diploma (Grade 10 or lower; Grade 11, 12, or 13, with no high school diploma) and those with at least a bachelor's degree.
31. Conversely, 2SLS estimates indicate, for all percentiles, that a 10-point increase in log real minimum wages is associated with a one percentage-point drop in employment rate.

enrollment among less-educated young men. Rather, increased real wages appear to reduce school enrollment only among potential college and university enrollees.

5 Robustness checks

5.1 Model specification

The results shown so far assume that, conditional on observables, young men's outcomes: (*a*) evolve at the same pace in different regions; and (*b*) respond to real wages rather than to relative wages. In Tables 6 to 8, these assumptions are relaxed. First, linear trends for oil-producing provinces are added to equation (3). This allows youth outcomes to change at a different pace in each region because of omitted factors, such as parental income or government spending on education. Second, schooling decisions of young men are modeled as a function, not of real wages but of the wages they currently expect to receive relative to what they would earn were they to increase their educational attainment (Becker 1964). For instance, potential university enrollees may react, not to changes in their expected real wages, but to changes in their expected wages relative to those of bachelor's degree holders. To account for this possibility, the real after-tax wage variable used so far is replaced by a relative-wage variable.

Table 6 shows that adding trends for oil-producing provinces to equation (3) does not reduce substantially the estimated impact of wages on the likelihood of young men being neither enrolled in school nor employed. This is true both for young men with no high school diploma and for potential college and university enrollees. This finding suggests that the EWALD results reported in Tables 3 to 5 regarding young men's likelihood of being neither enrolled in school nor employed are not driven by the omission of region-specific time-varying factors.

Table 7 focuses on the sub-sample of potential college and university enrollees. Full-time university attendance and full-time college attendance are modeled alternatively as a function of real wages and relative wages. Apart from ordinary least squares and 2SLS, two grouping estimators are used: (1) the grouping estimator defined by equation (3) and based on four age groups, and (2) a second grouping estimator based on two age groups (17 to 20; 21 to 24) and thus, on larger sample sizes per grouped observation.[32] Regardless of the estimators used, Table 7 shows very little evidence that increased real or relative wages reduce full-time college attendance. In contrast, results from grouping estimators suggest that increased real or relative wages reduce full-time university attendance. The grouping estimator based on two age groups indicates that a 10-point increase in log after-tax real wages reduces full-time university attendance by 1.5 to 1.7 percentage points, from a baseline full-time university enrollment rate of 22%. The same grouping estimator suggests that a 10-point increase in log relative wages reduces full-time university attendance by 1.0 to 1.3 percentage points. Thus, whether one considers real wages or relative wages, improved wage offers appear to lower full-time university attendance. In contrast, there is no statistically significant evidence that school enrollment rates of young men with no high school diploma fall in response to increased pay rates, whether these are measured in real terms or relative terms (Table 8).[33]

32. For the sub-sample of potential college and university enrollees, average sample size per grouped observation rises from 171.2 to 305.8 when moving from the first grouping estimator to the second grouping estimator.
33. Results are shown only for the Efficient Wald Estimator based on four age groups. A comparison of 2SLS estimates obtained with real wages and relative wages cannot be performed since the instrumental variable used in the study is weakly correlated with relative wages of young men with no high school diploma.

5.2 Selective migration

The results presented so far take no account of selective migration. If young male migrants predominantly consist of individuals who have already completed their schooling, are already employed in their province of origin, and have moved to oil-producing provinces after accepting a better-paid job in these provinces, both university enrollment rates and the likelihood of young men being neither enrolled in school nor employed will fall in the oil-producing provinces relative to the other provinces, even if wages have no causal impact on these outcomes. The same scenario will take place if teenagers from abroad predominantly move to non-oil-producing provinces (e.g., Ontario, Quebec, and British Columbia) and tend to have relatively high full-time university enrollment rates and relatively low employment rates. Thus, selective migration may lead one to overstate the impact of wages on university enrollment, young men's employment, and the likelihood of young men being neither enrolled in school nor employed.

The LAD, an administrative data set well suited for the analysis of selective migration, is used to address this issue. Since 1999, the LAD has contained information on educational deductions for part-time students and full-time students as well as information on tuition fees paid to postsecondary educational institutions. As a result, the LAD allows the estimation of full-time university enrollment rates for the observation period followed in this study.[34] Since it contains a 20% random sample of all Canadian tax filers, the LAD yields very large sample sizes. This allows the estimation of separate models for a basic sample that includes both inter-provincial migrants and stayers and for a sub-sample that focuses exclusively on stayers, those individuals who lived in the same province during the observation period.[35] If the results obtained so far are simply due to selective migration, temporal patterns observed in the basic sample should disappear when focusing on the sub-sample of stayers.

Table 9 assesses whether this is the case. In Panel 1, a binary indicator of full-time university enrollment is regressed on fully interacted age and region indicators, year effects, and a complete set of province–year interactions for Alberta, Saskatchewan, and Newfoundland and Labrador.[36] Two hypotheses are tested: (*a*) whether full-time university enrollment rates fell in these three oil-producing provinces, relative to the other provinces, during the second half of the 2001-to-2008 period (as wage growth accelerated in these three provinces); and (*b*) whether the patterns observed in the basic sample disappear when attention is restricted to the sub-sample of stayers.

Columns 1, 2, and 3 of Panel 1 confirm that full-time university enrollment rates fell in Alberta and Saskatchewan, relative to the other provinces, from 2004 onwards. Results for the province of Newfoundland and Labrador are ambiguous. Columns 4, 5, and 6 of Panel 1 show that these patterns are qualitatively similar when the focus is on the sub-sample of stayers. Between 55% and 88% of the drop in university enrollment observed from 2004 onwards in Alberta in the basic sample remains when the analysis focuses on stayers. The corresponding numbers for Saskatchewan range from 70% to 89%. The fact that more than half of the relative decline in university enrollment in Alberta and Saskatchewan remains when moving from the basic sample to the sub-sample of stayers does not support the hypothesis that the results shown in previous sections are due solely to selective migration.

The fact that employment rates increased in both samples in all oil-producing provinces, relative to the other provinces, after 2005 provides additional evidence that the changes in young men's outcomes documented in this study are not driven simply by selective migration. A comparison

34. See Section 7, the Appendix, for the construction of full-time university enrollment rates in LAD.
35. The sub-sample of stayers is constructed by removing from the basic sample all person-years observations associated with inter-provincial migrants.
36. Two age groups (17 to 20; 21 to 24) are fully interacted with the eight regions defined above. An alternative specification that simply uses age indicators and region indicators yields similar results.

of columns 1 to 3 with columns 4 to 6 in Panel 2 of Table 9 shows that at least two-thirds of the increases in employment rates in oil-producing provinces (relative to the other provinces) remain when moving from the basic sample to the sub-sample of stayers.

While the LAD allows the estimation of full-time university enrollment rates, it does not allow the computation of school enrollment rates (since, by definition, high schools are not postsecondary institutions and since tuition fees can be claimed only for postsecondary institutions). Hence, it cannot be used to assess the impact of selective migration on the likelihood of young men being neither enrolled in school nor employed.

However, LFS data can shed light on whether the negative relationship between wages and the likelihood of young men being neither enrolled in school nor employed is driven simply by selective migration. If increased real wages have no causal impact on the probability of being neither enrolled in school nor employed, this probability, when measured at the national level (i.e., aggregated across all provinces), should no longer fall once movements in unemployment rates have been taken into account.

Chart 11 examines whether this is the case. The solid line plots the percentage of young men who were neither enrolled in school nor employed during the 1997-to-2008 period relative to (i.e., minus) the corresponding percentage observed in 2004. As Chart 11 shows, the proportion of young men being neither enrolled in school nor employed fell by 1.5 (1.2) percentage points in Canada from 2004 to 2007 (2008). The dotted line shows how much of that drop remains after controlling for labour market tightness, i.e., it plots the residuals obtained from regressing the percentage of young men neither enrolled in school nor employed in Canada on a constant term and the unemployment rate of men aged 25 to 54.[37] When this is done, the likelihood of young men being neither enrolled in school nor employed drops by roughly 1.0 (0.6) percentage point from 2004 to 2007 (2008). Hence, at least one half of the aggregate decline in the percentage of young men who were neither enrolled in school nor employed observed from 2004 to 2007 (2008) remains after one has controlled for labour market tightness. Since wage growth accelerated in the three oil-producing provinces during that period (Chart 4), these results suggest that the observed decline was linked to increased real wages.

In sum, the results shown in Table 9 and in Chart 11 provide no support for the hypothesis that the LFS estimates of the causal impact of wages on young men’s outcomes are driven simply by selective migration.

6 Conclusion

The degree to which improved wage offers induce youth to enter the workforce and to leave school is a key question underlying human capital formation. Despite the importance of this question, the amount of evidence available in this regard has been scarce. This study fills this gap. Using data from the Canadian Labour Force Survey and a large administrative data set, it provides recent estimates of the elasticity of young men’s labour market participation and school enrollment with respect to after-tax wages. The results indicate that, in the labour markets of the 2000s, increased wages had a dual impact: they tended to reduce full-time university enrollment rates but also to bring into the labour market individuals who were neither enrolled in school nor employed. These results hold under a variety of robustness checks and do not appear to be driven by selective migration.

37. Specifically, the value of these residuals in year *t* minus their value in 2004 is plotted. The regression is performed over the 1976-to-2012 period. Similar results are obtained when the regression is estimated over the 1990-to-2012 period.

Do increased wages lead to a net increase in youth human capital? The answer depends on whether reductions in school enrollment are permanent or temporary and on the extent to which the long-term employability of disadvantaged youth increases as they participate in the labour market. Recent evidence suggests that some previous oil booms (e.g., that observed in Canada during the early 1980s) led to a temporary reduction in school enrollment but had no long-term effect on individuals' educational attainment (Emery et al. 2011). Whether a similar scenario has persisted since the end of the 2008-2009 recession and the degree to which increased wages affect the long-term employability of lower-skilled youth are questions for future research.

Table 1
Descriptive statistics, unmarried men aged 17 to 24, 2001 to 2008

	Age group					
	17 to 24		17 to 20		21 to 24	
	All	Employed	All	Employed	All	Employed
	Column 1	Column 2	Column 3	Column 4	Column 5	Column 6
Percent enrolled in school	51.0	36.9	63.6	50.9	35.6	23.8
Percent enrolled in school full-time	46.8	31.8	59.8	46.0	30.9	18.5
Primary or secondary school	17.1	11.5	30.2	23.3	1.0	0.5
College	12.8	10.1	15.4	14.0	9.6	6.4
University	16.9	10.2	14.1	8.7	20.3	11.6
Percent neither enrolled in school nor employed	11.4	…	10.7	…	12.2	…
Average weekly hours	18.3	30.7	13.7	26.2	23.9	34.8
Percent employed	59.6	…	52.3	…	68.5	…
Percent employed full-time	36.3	60.9	23.2	44.4	52.3	76.3
Average hourly wages (2002 dollars)	…	10.89	…	9.19	…	12.47
Percent aged 17 to 20	55.1	48.3	…	…	…	…
Education (percent)						
Grade 10 or lower	9.7	8.0	13.4	11.4	5.1	4.8
Grade 11, 12, or 13, with no high school diploma	17.9	14.9	28.7	25.8	4.5	4.6
High school diploma	27.6	30.7	27.9	32.9	27.2	28.6
Trades certificate or diploma	5.0	6.7	1.9	2.9	8.7	10.3
Some postsecondary	24.8	22.6	23.8	22.8	26.1	22.3
College, CEGEP, and other	11.3	12.8	4.3	4.3	20.0	20.8
Bachelor's degree or above	3.8	4.5	…	…	8.5	8.6
Region (percent)						
Newfoundland and Labrador	1.0	0.7	1.2	0.8	0.7	0.5
Other Atlantic provinces	5.3	4.8	5.7	5.1	4.9	4.6
Quebec	22.3	22.7	22.0	22.8	22.7	22.6
Ontario	41.2	39.5	40.4	37.7	42.1	41.1
Manitoba	3.3	3.7	3.4	4.1	3.0	3.4
Saskatchewan	2.8	3.0	3.0	3.3	2.6	2.7
Alberta	11.4	13.1	11.4	13.3	11.5	12.9
British Columbia	12.8	12.6	12.9	12.9	12.6	12.3
Percent belonging to a household that rents its dwelling	29.8	29.6	23.8	21.7	37.1	37.0
Percent living in a census metropolitan area or a census agglomeration	81.5	81.3	78.9	78.2	84.8	84.3
Sample size (number)	170,632	100,297	100,657	52,651	69,975	47,646

… not applicable
Note: Numbers may not add up to 100.0 as a result of rounding.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September, and October files).

Table 2
Results of first-stage regressions (dependent variable is log after-tax real wages)

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
All young men				
Instrumental variable based on oil prices – parameter estimate	2.37 ***	2.16 ***	1.91 ***	1.75 ***
Kleibergen-Paap Wald F statistic	73.0	52.8	42.2	34.8
Young men with no high school diploma				
Instrumental variable based on oil prices – parameter estimate	2.01 ***	1.66 ***	1.42 ***	1.23 **
Kleibergen-Paap Wald F statistic	20.5	15.6	10.7	10.0
Young men – Potential college and university enrollees				
Instrumental variable based on oil prices – parameter estimate	2.74 ***	2.62 ***	2.33 ***	2.22 ***
Kleibergen-Paap Wald F statistic	50.8	36.8	29.4	26.9

*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
Note: The numbers show the coefficient of the instrumental variable based on oil prices in the first-stage regressions of log after-tax real wages. P-values are based on standard errors that are clustered at the fully interacted age, education and region level. Separate regressions are run based on various percentiles used for imputing wages of non-employed men. All regressions also include fully interacted age, education and region indicators, year effects, month indicators, a renter indicator, a census metropolitan area/census agglomeration indicator, the unemployment rate and the rate of involuntary part-time employment defined at the age, education and region level, as well as province-specific log real minimum wages, log average real tuition fees for a bachelor’s degree and levels of social assistance income available to single individuals.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 3
The estimated impact of real wages on young men's outcomes

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates			
Outcome				
Being enrolled in school				
Ordinary least squares	-0.20 ***	-0.12 ***	-0.05	0.03
Two-stage least squares	-0.26 *	-0.28 *	-0.32 *	-0.35 *
Efficient Wald Estimator	-0.10 *	-0.08 †	-0.05	-0.04
Being employed				
Ordinary least squares	0.93 ***	0.69 ***	0.45 ***	0.19 ***
Two-stage least squares	0.35 ***	0.38 ***	0.43 ***	0.47 ***
Efficient Wald Estimator	0.26 ***	0.22 ***	0.20 ***	0.14 ***
Being neither in school nor employed				
Ordinary least squares	-0.31 ***	-0.24 ***	-0.16 ***	-0.06 ***
Two-stage least squares	-0.14 ***	-0.15 ***	-0.17 ***	-0.19 **
Efficient Wald Estimator	-0.08 ***	-0.08 ***	-0.08 ***	-0.06 **
	numbers			
School enrollment rate in 2001	0.52	0.52	0.52	0.52
Employment rate in 2001	0.59	0.59	0.59	0.59
"Neither in school nor employed" rate in 2001	0.12	0.12	0.12	0.12
Sample size (ordinary least squares and two-stage least squares)	170,632	170,632	170,632	170,632
Grouped observations (Efficient Wald Estimator)	1,128	1,128	1,128	1,128
Clusters	164	164	164	164
Average sample size per grouped observation	151.3	151.3	151.3	151.3

*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
* significantly different from reference category (p<0.05)
† significantly different from reference category (p<0.10)

Note: The sample consists of unmarried men aged 17 to 24 with no children. The numbers show the estimated impact of log after-tax real wages on young men's probability of being enrolled in school, being employed, and being neither enrolled in school nor employed. Separate regressions are run based on various percentiles used for imputing wages of non-employed men. All regressions include fully interacted age, education and region indicators, year effects, month indicators, a renter indicator, a census metropolitan area/census agglomeration indicator, the unemployment rate and the rate of involuntary part-time employment defined at the age, education and region level, as well as province-specific log real minimum wages, log average real tuition fees for a bachelor's degree and levels of social assistance income available to single individuals. P-values are based on standard errors clustered at the age, education and region level.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 4

The estimated impact of real wages on the outcomes of young men with no high school diploma

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates			
Outcome				
Being enrolled in school				
Ordinary least squares	-0.09 *	-0.02	0.04	0.11
Two-stage least squares	-0.06	-0.07	-0.08	-0.10
Efficient Wald Estimator	-0.06	0.01	0.02	0.02
Being employed				
Ordinary least squares	1.27 ***	0.94 ***	0.63 ***	0.24 ***
Two-stage least squares	0.53 **	0.64 **	0.75 *	0.87 *
Efficient Wald Estimator	0.26 ***	0.24 **	0.25 *	0.18 †
Being neither in school nor employed				
Ordinary least squares	-0.45 ***	-0.35 ***	-0.24 ***	-0.09 ***
Two-stage least squares	-0.23 *	-0.27 *	-0.32 †	-0.37 †
Efficient Wald Estimator	-0.06	-0.09 †	-0.08	-0.05
	numbers			
School enrollment rate in 2001	0.62	0.62	0.62	0.62
Employment rate in 2001	0.50	0.50	0.50	0.50
"Neither in school nor employed" rate in 2001	0.14	0.14	0.14	0.14
Sample size (ordinary least squares and two-stage least squares)	50,882	50,882	50,882	50,882
Grouped observations (Efficient Wald Estimator)	307	307	307	307
Clusters	48	48	48	48
Average sample size per grouped observation	165.7	165.7	165.7	165.7

*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
* significantly different from reference category (p<0.05)
† significantly different from reference category (p<0.10)

Note: The sample consists of unmarried men aged 17 to 24 with no children who have no high school diploma. The numbers show the estimated impact of log after-tax real wages on young men's probability of being enrolled in school, being employed, and being neither enrolled nor employed. Separate regressions are run based on various percentiles used for imputing wages of non-employed men. All regressions include fully interacted age, education and region indicators, year effects, month indicators, a renter indicator, a census metropolitan area/census agglomeration indicator, the unemployment rate and the rate of involuntary part-time employment defined at the age, education and region level as well as province-specific log real minimum wages, log average real tuition fees for a bachelor's degree and levels of social assistance income available to single individuals. P-values are based on standard errors clustered at the age, education and region level.

Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 5
The estimated impact of real wages on the outcomes of potential college and university enrollees

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates			
Outcome				
Being enrolled in school				
Ordinary least squares	-0.22 ***	-0.15 ***	-0.06 †	0.03
Two-stage least squares	-0.27 *	-0.28 *	-0.31 †	-0.33 †
Efficient Wald Estimator	-0.09	-0.10	-0.06	-0.05
Being employed				
Ordinary least squares	0.94 ***	0.72 ***	0.47 ***	0.20 ***
Two-stage least squares	0.22 *	0.23 *	0.26 *	0.27 *
Efficient Wald Estimator	0.30 ***	0.28 ***	0.24 ***	0.17 ***
Being neither in school nor employed				
Ordinary least squares	-0.28 ***	-0.22 ***	-0.14 ***	-0.06 ***
Two-stage least squares	-0.10 *	-0.10 *	-0.11 *	-0.12 *
Efficient Wald Estimator	-0.09 ***	-0.09 ***	-0.10 ***	0.08 **
	numbers			
School enrollment rate in 2001	0.50	0.50	0.50	0.50
Employment rate in 2001	0.61	0.61	0.61	0.61
"Neither in school nor employed" rate in 2001	0.11	0.11	0.11	0.11
Sample size (ordinary least squares and two-stage least squares)	106,321	106,321	106,321	106,321
Grouped observations (Efficient Wald Estimator)	621	621	621	621
Clusters	84	84	84	84
Average sample size per grouped observation	171.2	171.2	171.2	171.2

*** significantly different from reference category ($p<0.001$)
** significantly different from reference category ($p<0.01$)
* significantly different from reference category ($p<0.05$)
† significantly different from reference category ($p<0.10$)

Note: The sample consists of young men with a high school diploma, individuals with some postsecondary education, individuals with a diploma from a community college or CEGEP, and individuals with a university certificate below a bachelor's degree. The numbers show the estimated impact of log after-tax real wages on young men's probability of being enrolled in university full-time, being employed, and being neither enrolled in school nor employed. Separate regressions are run based on various percentiles used for imputing wages of non-employed men. All regressions include fully interacted age, education and region indicators, year effects, month indicators, a renter indicator, a census metropolitan area/census agglomeration indicator, the unemployment rate and the rate of involuntary part-time employment defined at the age, education and region level, as well as province-specific log real minimum wages, log average real tuition fees for a bachelor's degree and levels of social assistance income available to single individuals. P-values are based on standard errors clustered at the age, education and region level.

Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 6
Being neither enrolled in school nor employed — Robustness checks

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates from the Efficient Wald Estimator			
All young men				
Trends for oil-producing provinces?				
No	-0.08 ***	-0.08 ***	-0.08 ***	-0.06 **
Yes	-0.08 ***	-0.08 ***	-0.08 **	-0.05 *
Young men with no high school diploma				
Trends for oil-producing provinces?				
No	-0.06	-0.09 †	-0.08	-0.05
Yes	-0.05	-0.09	-0.08	-0.04
Young men — Potential college and university enrollees				
Trends for oil-producing provinces?				
No	-0.09 ***	-0.09 ***	-0.10 ***	0.08 **
Yes	-0.09 **	-0.09 **	-0.09 **	-0.07 *

*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
* significantly different from reference category (p<0.05)
† significantly different from reference category (p<0.10)
Note: The numbers show the estimated impact of log after-tax real wages on young men's probability of being neither enrolled in school nor employed. P-values are based on standard errors clustered at the age, education and region level.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 7

Wages, college attendance, and university attendance

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates			
Outcome				
Being enrolled in university full-time				
Ordinary least squares	-0.16 ***	-0.10 ***	-0.04 *	0.03 *
Two-stage least squares	-0.17	-0.18	-0.20	-0.21
Efficient Wald Estimator	-0.13 **	-0.12 *	-0.11 *	-0.07
Efficient Wald Estimator (2 age groups)	-0.17 ***	-0.16 **	-0.15 **	-0.15 **
Efficient Wald Estimator (2 age groups and relative wages)	-0.13 **	-0.12 *	-0.10 *	-0.10 *
Being enrolled in college full-time				
Ordinary least squares	-0.06 **	-0.04 †	-0.02	0.01
Two-stage least squares	-0.15	-0.15	-0.17	-0.18
Efficient Wald Estimator	0.00	-0.01	0.03	0.00
Efficient Wald Estimator (2 age groups)	-0.01	0.01	0.04	0.02
Efficient Wald Estimator (2 age groups and relative wages)	-0.03	0.00	0.04	0.02
	numbers			
Full-time university enrollment rate in 2001	0.22	0.22	0.22	0.22
Full-time college enrollment rate in 2001	0.19	0.19	0.19	0.19

*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
* significantly different from reference category (p<0.05)
† significantly different from reference category (p<0.10)

Note: The sample consists of individuals with a high school diploma, individuals with some postsecondary education, individuals with a diploma from a community college or CEGEP, and individuals with a university certificate below a bachelor's degree. The numbers show the estimated impact of wages on young men's probability of being enrolled in university or college full-time. Separate regressions are run based on various percentiles used for imputing wages of non-employed men. All regressions include fully interacted age, education and region indicators, year effects, month indicators, a renter indicator, a census metropolitan area/census agglomeration indicator, the unemployment rate and the rate of involuntary part-time employment defined at the age, education and region level, as well as province-specific log real minimum wages, log average real tuition fees for a bachelor's degree and levels of social assistance income available to single individuals. P-values are based on standard errors clustered at the age, education and region level.

Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 8

School enrollment of young men with no high school diploma — Robustness checks

	Percentile			
	15th	25th	35th	45th
	Column 1	Column 2	Column 3	Column 4
	parameter estimates from the Efficient Wald Estimator			
Real wages	-0.06	0.01	0.02	0.02
Relative wages	-0.08	-0.02	-0.02	-0.01

Note: The numbers show the estimated impact of wages on the school enrollment rates of young men with no high school diploma. P-values are based on standard errors clustered at the age, education and region level.

Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Table 9
Province–year interaction terms in the three oil-producing provinces — Longitudinal Administrative Databank data

	Sample selected											
	Basic sample						Stayers only					
	Alberta		Saskatchewan		Newfoundland and Labrador		Alberta		Saskatchewan		Newfoundland and Labrador	
	Column 1		Column 2		Column 3		Column 4		Column 5		Column 6	
	parameter estimates											
Panel 1 – Being enrolled in university full-time												
Year 2001	…		…		…		…		…		…	
Year 2002	0.005	*	0.002		-0.002		0.006	**	0.005		0.003	
Year 2003	-0.005	†	-0.017	***	-0.006		-0.002		-0.014	**	0.005	
Year 2004	-0.017	***	-0.037	***	-0.010		-0.015	***	-0.033	***	-0.004	
Year 2005	-0.016	***	-0.043	***	-0.015	*	-0.012	***	-0.037	***	-0.007	
Year 2006	-0.020	***	-0.040	***	0.005		-0.011	***	-0.033	***	0.011	
Year 2007	-0.025	***	-0.044	***	-0.001		-0.015	***	-0.031	***	0.006	
Year 2008	-0.022	***	-0.055	***	-0.015	†	-0.013	***	-0.042	***	-0.010	
Panel 2 – Being employed at some point during the year												
Year 2001	…		…		…		…		…		…	
Year 2002	0.000		0.006		0.013	*	-0.001		0.004		0.010	
Year 2003	0.008	***	0.019	***	0.026	***	0.005	*	0.019	***	0.024	**
Year 2004	0.000		0.012	*	0.025	***	-0.003		0.012	*	0.023	**
Year 2005	0.006	**	0.029	***	0.031	***	0.003		0.031	***	0.029	***
Year 2006	0.014	***	0.030	***	0.044	***	0.010	***	0.035	***	0.049	***
Year 2007	0.012	***	0.035	***	0.062	***	0.008	**	0.041	***	0.067	***
Year 2008	0.016	***	0.040	***	0.070	***	0.012	***	0.045	***	0.078	***

… not applicable
*** significantly different from reference category (p<0.001)
** significantly different from reference category (p<0.01)
* significantly different from reference category (p<0.05)
† significantly different from reference category (p<0.10)
Note: The numbers show the parameter estimates for province–year interaction terms. Regressors also include fully interacted age and region indicators (2 age groups and 8 regions), and year effects. Columns 1, 2, and 3 show these parameter estimates for the basic sample, which includes migrants and stayers. Column 4, 5, and 6 show the corresponding estimates for the sub-sample of stayers. The basic sample and the sub-sample of stayers include 2,004,969 observations and 1,887,889 observations, respectively. In Panel 1, the dependent variable equals 1 when an individual is enrolled in university full-time and equals 0 otherwise. In Panel 2, the dependent variable equals 1 when an individual has T4 earnings in a given year and equals 0 otherwise. P-values are based on standard errors clustered at the individual level. In all cases, the samples include unmarried men aged 17 to 24 in year t who have no children.
Source: Statistics Canada, authors' calculations from Longitudinal Administrative Databank.

7 Appendix: Construction of full-time university enrollment rates using the Longitudinal Administrative Databank (LAD)

While the LAD does not identify full-time university students directly, since 1999, it has included three variables that allow the computation of full-time university enrollment rates: 1) tuition fees for self;[38] 2) educational deduction for full-time students; and 3) educational deduction for part-time students.

The procedure used to construct full-time university enrollment rates is the following.

First, unmarried male tax filers aged 17 to 24 (with no children) who report positive tuition fees and claim an educational deduction for full-time students are selected.

Second, the total amount that students claim as an educational deduction for full-time students is divided by the maximum amount allowed per month for full-time students by the Canada Revenue Agency. This yields an estimate of the number of months an individual has studied full-time during the year. The number of months spent as a part-time student is obtained in a similar way.[39]

Third, a full-time-equivalent estimate of the number of months spent as a student is derived.[40]

Fourth, the amount claimed as tuition fees for self is divided by the estimated number of months obtained in Step 3.[41] This yields an estimate of average tuition fees paid per month.

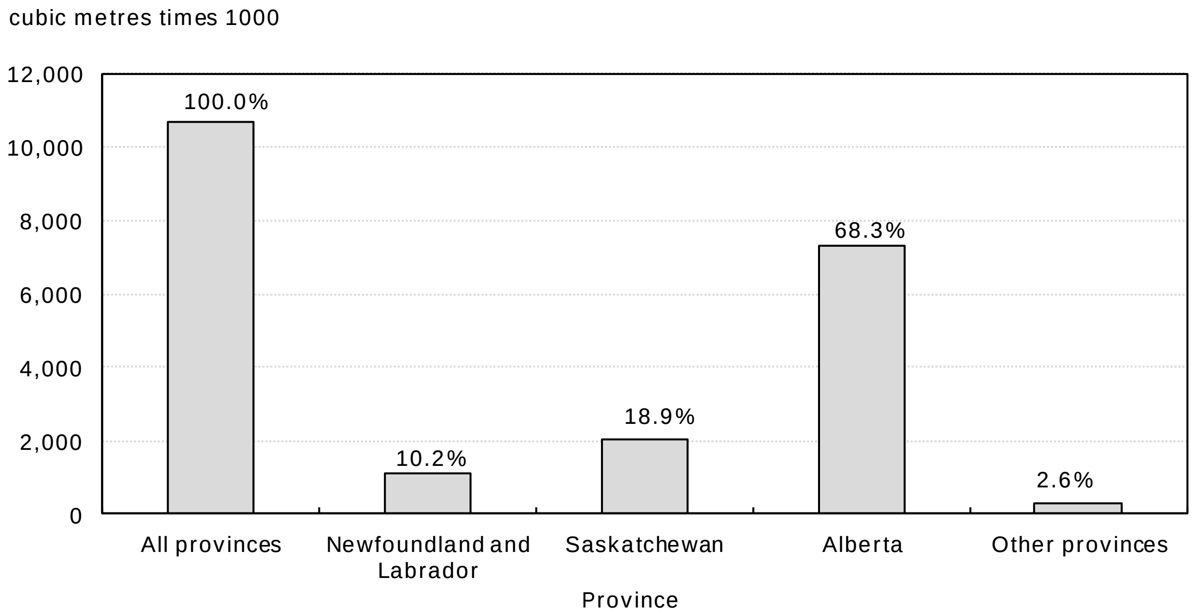
Fifth, estimated average tuition fees paid per month are multiplied by 8 in order to compute a full-time-equivalent tuition amount for eight months within a tax year.

Finally, a binary indicator for being a full-time university student will be set to 1 if this full-time-equivalent tuition amount for eight months is between 0.8 times and 2 times the provincial tuition fee averages; it will be set to 0 otherwise.[42,43]

38. Students can claim tuition fees paid to an educational institution of postsecondary level in order to get a non-refundable tax credit.
39. In other words, the total amount that students claim as an educational deduction for part-time students is divided by the amount allowed per month for part-time students by the Canada Revenue Agency.
40. The number of month(s) of part-time education is weighted by a factor of 0.6. Thus, the total number of months = month(s) of full-time education + 0.6 times the number of month(s) of part-time education.
41. Since the tuition fees claimed include any amount that an individual incurred during the tax year (from enrollment in any eligible course that can be taken full-time or part-time within the tax year), they are converted into a full-time-equivalent tuition amount. This allows a comparison of the full-time-equivalent tuition amount with average tuition fees paid by full-time Canadian undergraduate students.
42. The upper bound of 2 times is set in order to exclude students from private schools with higher tuition payments than those paid by students attending publicly-funded universities. Comparing the counts of full-time university students obtained in this way from the LAD with those provided by the Tourism and Centre for Education Statistics Division of Statistics Canada reveals that the LAD estimates capture about 80% of total university enrollment at the national level.
43. The weighted average tuition fees for full-time Canadian undergraduate students are compiled by the Tourism and Centre for Education Statistics Division of Statistics Canada. Since the original amounts are captured on an academic-year basis, two-year averages are used to compare to the calendar-year amount derived from the LAD. For example, the tuition fees of 2001 is the average of 2000/2001 and 2001/2002.

Chart 1

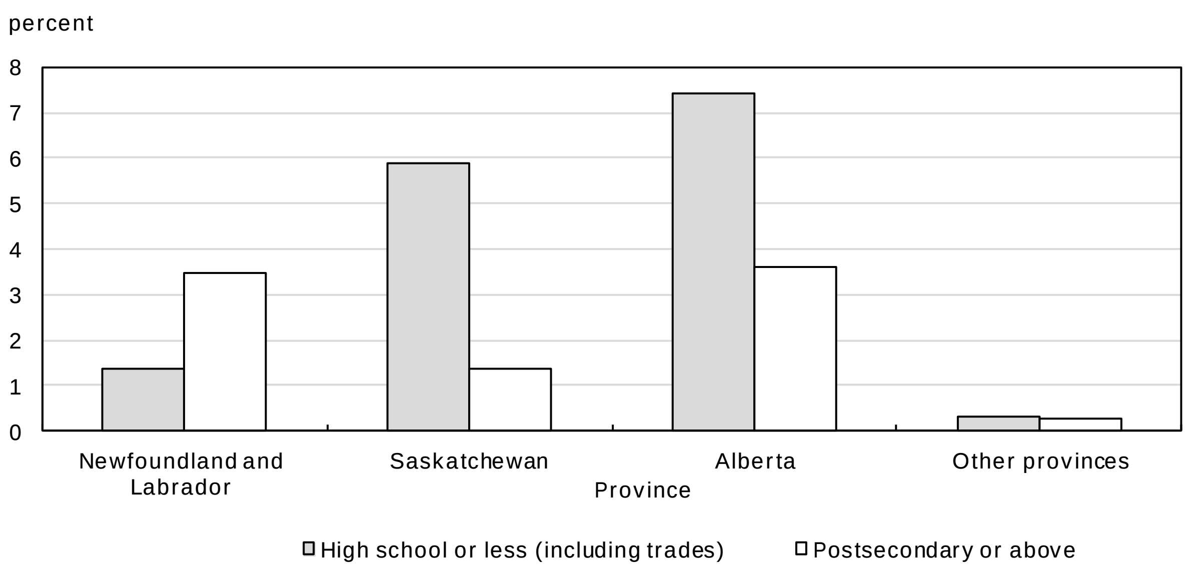
Total production of crude oil (cubic metres times 1000) by province, average of 1997 to 2008



Source: Statistics Canada, CANSIM table 126-0001.

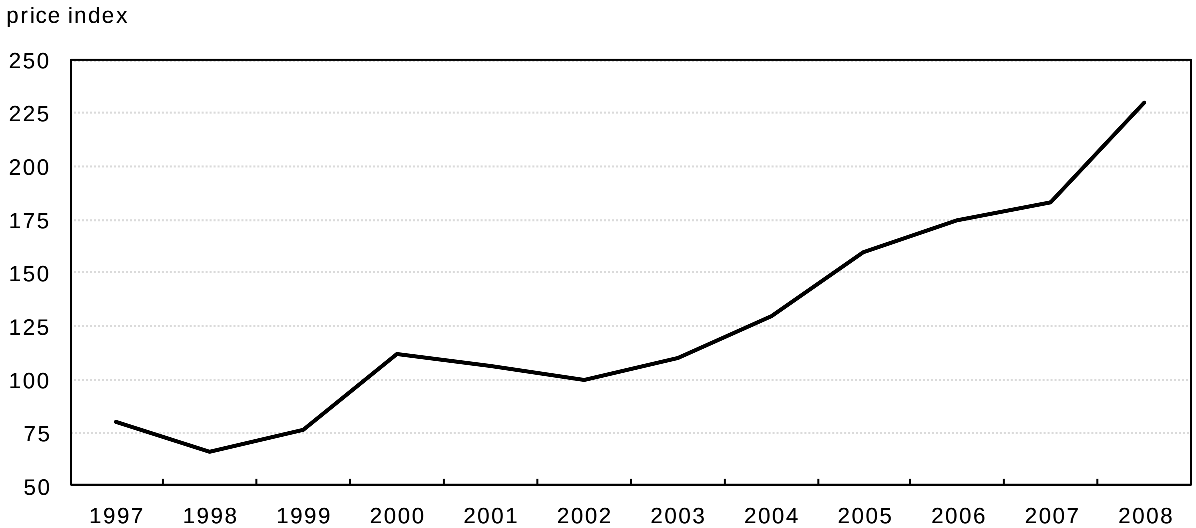
Chart 2

Percentage of unmarried men aged 17 to 24 employed in the oil industry, average of 1997 to 2000



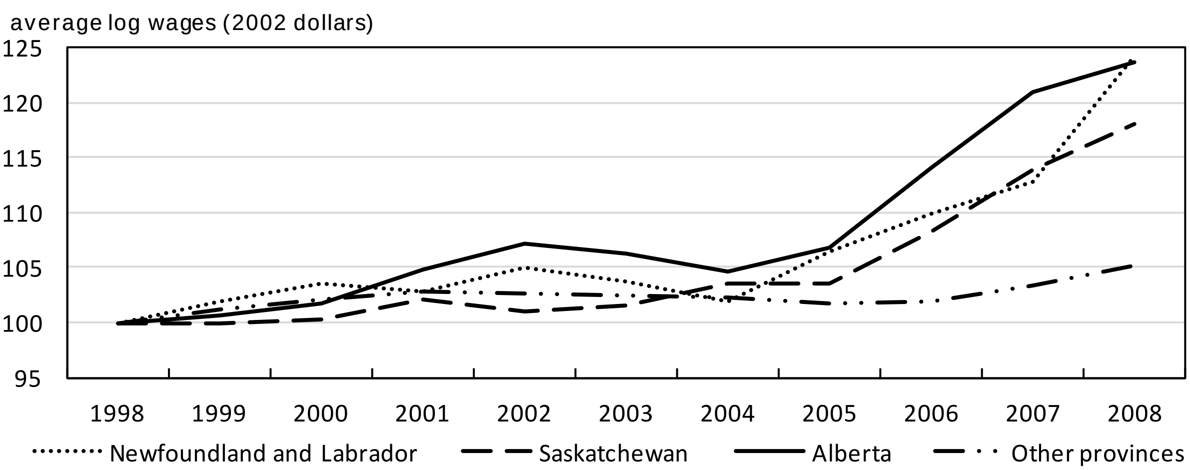
Note: Unmarried male paid workers aged 17 to 24 with no children.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 3
Industrial product price index for petroleum and coal products, 1997 to 2008 (2002 = 100)



Note: The industrial product price index for petroleum and coal products is predominantly for petroleum products.
Source: Statistics Canada, CANSIM table 329-0065.

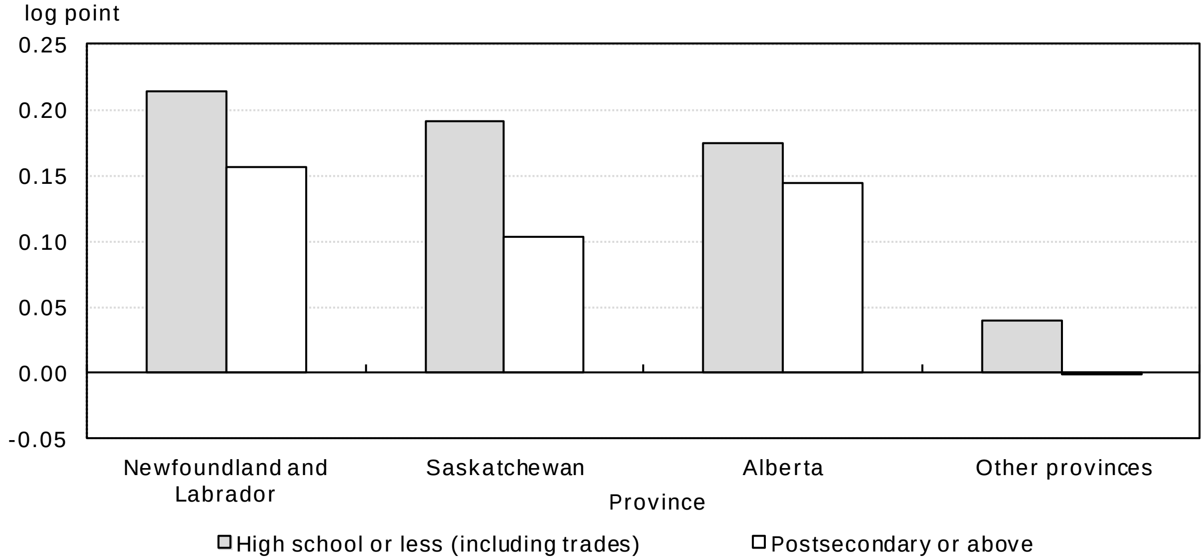
Chart 4
Average log real wages of unmarried men aged 17 to 24, by province, 1998 to 2008 (1998 = 100)



Note: Unmarried male paid workers aged 17 to 24 with no children. Averages of year *t* and year *t-1*.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 5

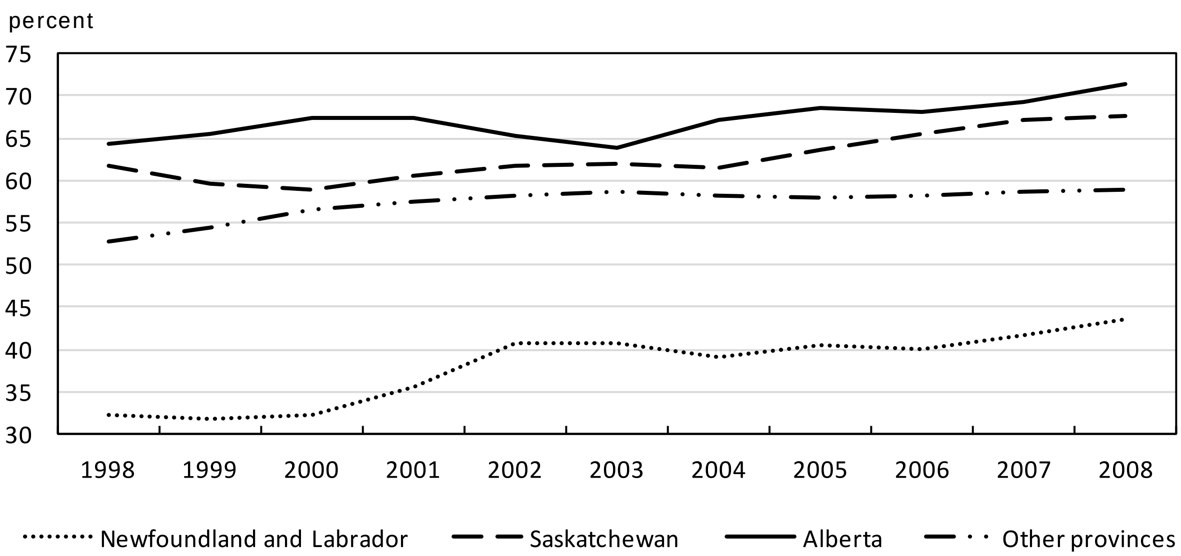
Real wage growth (log points) from 2001/2002 to 2007/2008, by province and education level



Note: Growth in average log wages (2002 dollars) of unmarried male paid workers aged 17 to 24 with no children.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

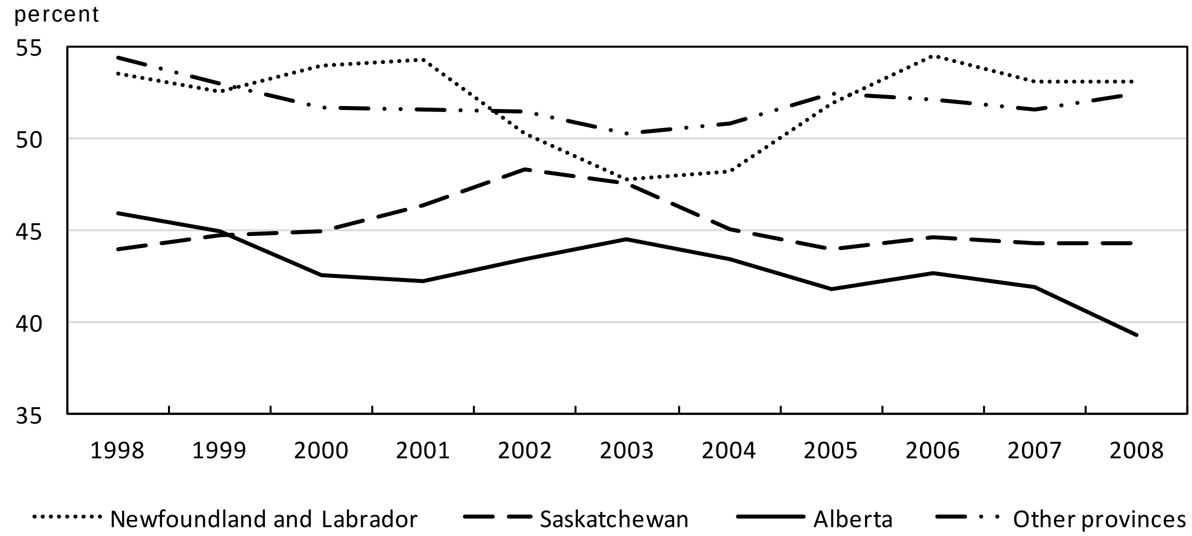
Chart 6

Employment rate of unmarried men aged 17 to 24, 1998 to 2008



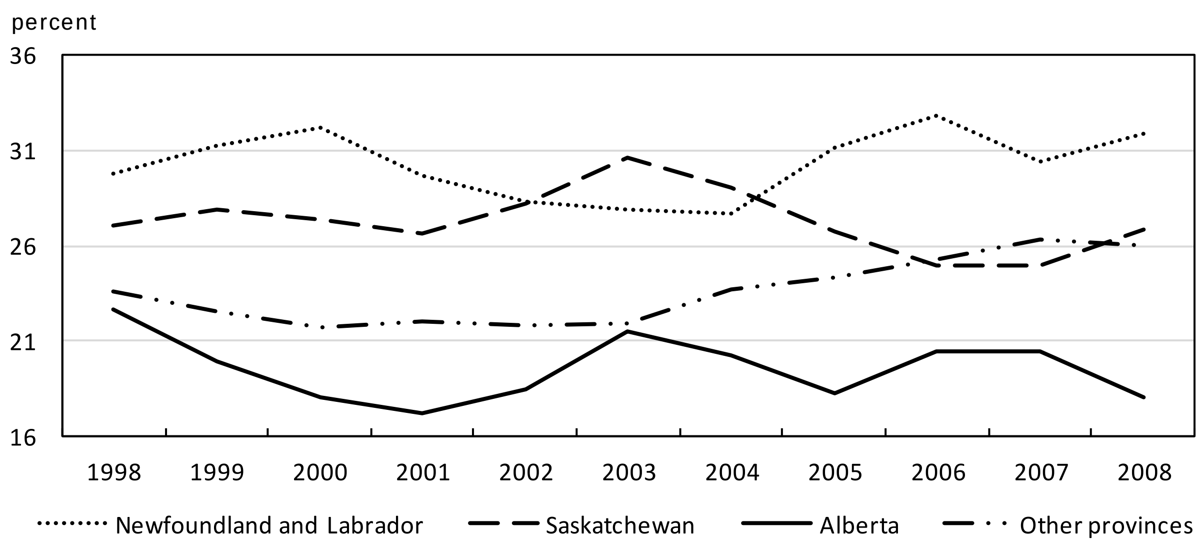
Note: Unmarried men aged 17 to 24 with no children. Averages of year *t* and year *t-1*.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 7
Percentage of unmarried men aged 17 to 24 enrolled in school, 1998 to 2008



Note: Unmarried men aged 17 to 24 with no children. Averages of year *t* and year *t-1*.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

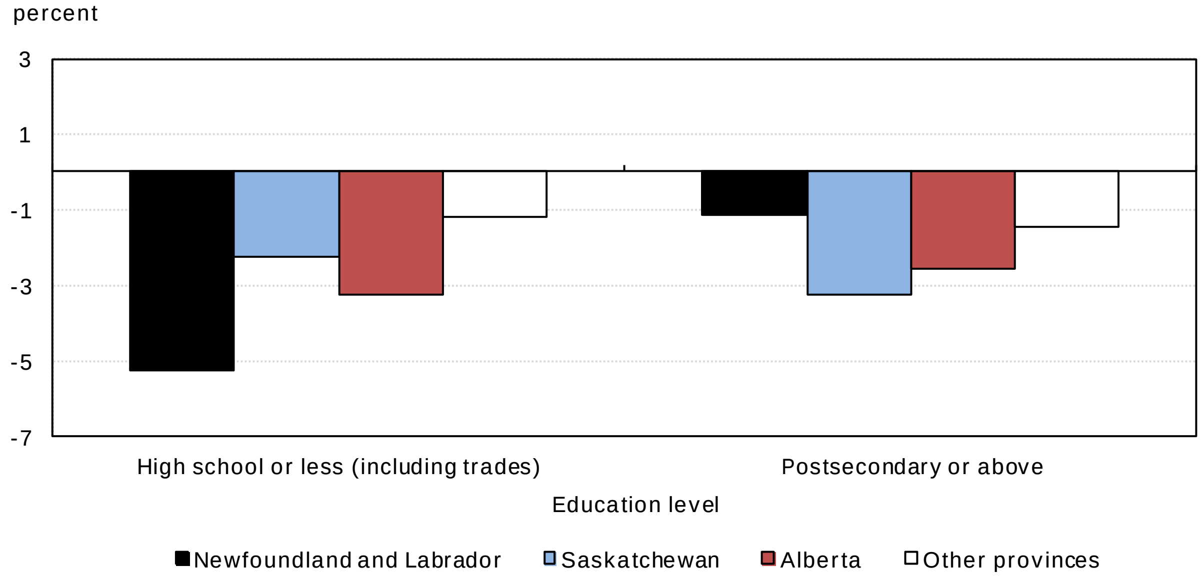
Chart 8
Percentage of unmarried men aged 17 to 24 enrolled in university full-time, 1998 to 2008



Note: Unmarried men aged 17 to 24 with no children. Individuals with trades' certificates, no high school diploma and those with at least a bachelor's degree are excluded. Averages of year *t* and year *t -1*.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 9

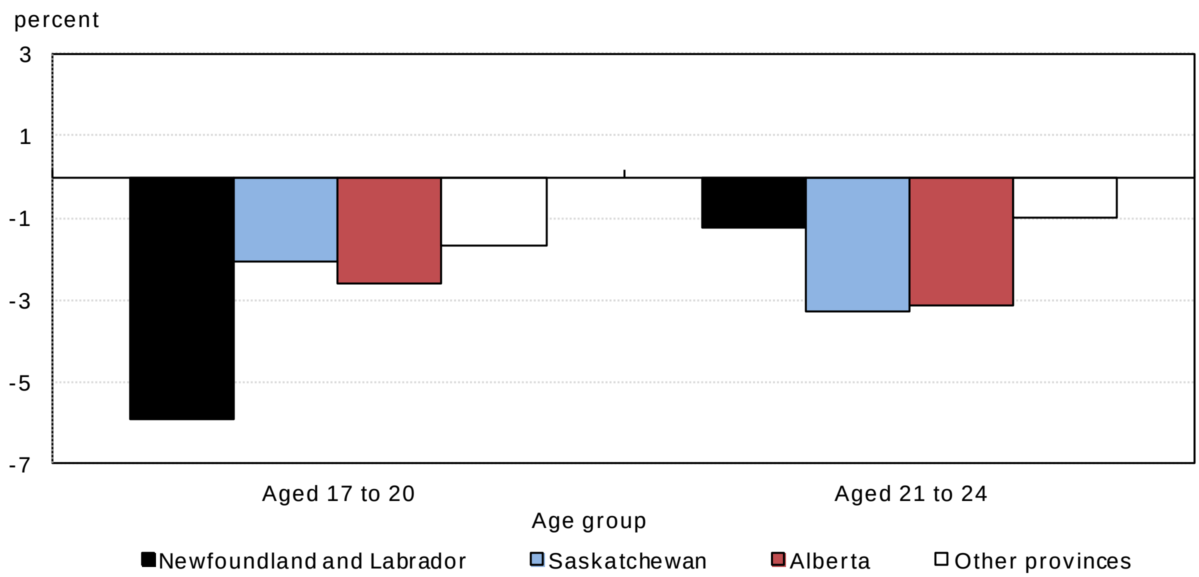
Changes in the percentage of young men neither enrolled in school nor employed, by province and education level, 2001/2002 to 2007/2008



Note: Unmarried men aged 17 to 24 with no children.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 10

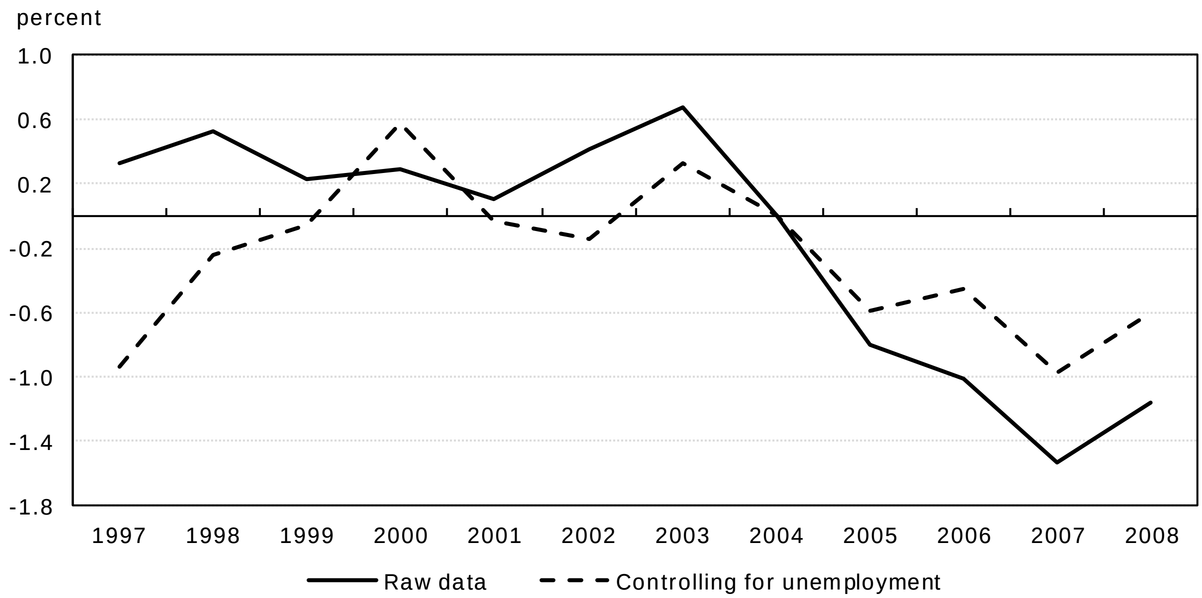
Changes in the percentage of young men neither enrolled in school nor employed, by province and age, 2001/2002 to 2007/2008



Note: Unmarried men aged 17 to 24 with no children.
Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

Chart 11

Percentage of young men neither enrolled in school nor employed relative to that observed in 2004



Source: Statistics Canada, authors' calculations from Labour Force Survey (February, March, September and October files).

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