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The Impact of Annual Wages on Interprovincial Mobility, Interprovincial Employment, and Job Vacancies

by Ping Ching Winnie Chan and René Morissette

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^{r} revised
x suppressed to meet the confidentiality requirements of the *Statistics Act*
^{E} use with caution
F too unreliable to be published
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Social Analysis and Modelling Division
Statistics Canada

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Abstract

This study estimates the causal impact of real after-tax annual wages and salaries on the propensity of young men to migrate to Alberta or to accept jobs in that province while maintaining residence in their home province. To do so, it exploits the cross-provincial variation in earnings growth plausibly induced by increases in world oil prices that occurred during the 2000s. Using data that cover the 2001-to-2008 period, the study shows that a 5% increase in real average annual wages in Alberta relative to those in other provinces increased the probability of young unmarried men moving to Alberta by roughly 0.35 percentage points, from a baseline rate of 0.64%. The estimated increase in the migration of young men induced by changes in the regional earnings structure represents 12% to 24% of the job vacancies observed in Alberta during this period. There is also evidence—although sensitive to functional form—that changes in the regional earnings structure increased transitions into interprovincial employment.

Keywords: interprovincial migration, interprovincial employment, job vacancies, wages.

Executive summary

The degree to which workers move across geographic areas in response to emerging employment opportunities or negative labour demand shocks is a key element in the adjustment process of an economy, and its ability to reach a desired allocation of resources.

Yet quantifying the magnitude of the response of workers to movements in the regional earnings and employment structure presents several challenges for researchers. First, migration across regions within a country is often a relatively rare event. As a result, accurate measurements of migration rates require large microdata sets, a condition not often met by conventional household surveys. Second, migrants are unlikely to be a random sample of workers. This raises selectivity issues when assessing the impact of wages on migration using microdata. Third, worker flows from high-unemployment to low-unemployment areas plausibly reduce cross-regional wage disparities, thereby raising issues of reverse causality when assessing the impact of wages on migration using grouped data. The difficulty—as is always the case when attempting to make causal inferences—is to find exogenous variation in the key variable of interest; i.e., wage movements.

This study tackles these challenges and assesses the degree to which movements in the regional earnings structure affected geographic labour mobility in Canada during the 2000s. Using a large administrative dataset, the study quantifies the degree to which changes in the spatial structure of annual wages and salaries led young workers during the 2000s to migrate to Alberta or to accept job offers in that province while maintaining residence in their home province.

The study contributes to the labour mobility literature in two ways.

First, it provides recent estimates of the causal impact of relative after-tax annual wages on interprovincial mobility using the variation in wage growth plausibly induced by increases in world oil prices that occurred during the 2000s.

Second, it highlights the possibility that differential earnings growth across regions may affect not only migration, but also interprovincial employment (the decision of workers to take on employment in a different province while maintaining residency in their home province). Because migration entails considerable costs (e.g., the costs of searching for a new job or home and the costs of relocating) and risk (e.g., uncertainty in employment probability and expected wages), seeking employment opportunities in another region while maintaining residency in the home region can be considered an intermediate step before migrating. Whether movements in the provincial wage structure affect interprovincial employment is a question that, to the knowledge of the authors, has received relatively little attention so far.

The study takes advantage of the fact that oil prices paid to Canadian oil producers more than doubled from 2001 to 2008. Since Canada's oil reserves are concentrated in three Canadian provinces—Alberta, Saskatchewan, and Newfoundland and Labrador—this substantial increase in oil prices likely induced spatial variation in labour demand and wage growth in Canada. Specifically, it likely increased labour demand and wages more in oil-producing provinces than in other provinces. This, in turn, suggests that the interaction of oil price movements and of the share of workers employed in the oil industry at the beginning of the study period is a potentially appropriate instrumental variable for extracting exogenous variation in wage growth across Canadian provinces. The empirical strategy of the paper relies on this instrumental variable.

Focusing on unmarried male paid workers aged 17 to 34, the study finds that even though migration to Alberta and transitions into interprovincial employment in that province were relatively rare events for this group during the 2000s—affecting less than 1% of them on an annual basis—the incidence of these events varied significantly in response to differential changes in wages across provinces.

Using data that cover the 2001-to-2008 period, the study shows that a 5% increase in real average annual wages in Alberta relative to those in other provinces increased the probability of young unmarried men moving to Alberta by roughly 0.35 percentage points, from a baseline rate of 0.64%. The estimated increase in the migration of young men induced by changes in the regional earnings structure represents 12% to 24% of the job vacancies observed in Alberta during this period. There is also evidence—although sensitive to functional form—that changes in the regional earnings structure increased transitions into interprovincial employment. For these two margins of adjustment—migration to Alberta and transitions into interprovincial employment in that province—unmarried men under 25 appear to have displayed stronger responses to wage movements than did their counterparts aged 25 to 34.

1 Introduction

The degree to which increased earnings induce migration that reduces labour shortages in areas with high job vacancy rates is a central question in labour economics. Yet attempts to answer this question present several challenges for empirical researchers. First, migration across regions within a country is often a relatively rare event. As a result, accurate measurements of migration rates require large microdata sets, a condition not often met by conventional household surveys. Second, migrants are unlikely to be a random sample of workers. This raises selectivity issues when assessing the impact of annual wages on migration using microdata. Third, worker flows from high-unemployment to low-unemployment areas plausibly reduce cross-regional earnings disparities, thereby raising issues of reverse causality when assessing the impact of annual wages on migration using grouped data. The difficulty—as is always the case when attempting to make causal inferences—is to find exogenous variation in the key variable of interest; i.e., earnings movements.

This study tackles these challenges and assesses the degree to which movements in the spatial structure of annual wages and salaries affected geographic labour mobility in Canada during the 2000s. Using a large administrative dataset, the study quantifies the degree to which these wage changes contributed to reducing labour shortages during the 2000s in the largest booming province—Alberta—by inducing workers to move to that province or to accept job offers there, while maintaining residence in their home province.

The study contributes to the migration literature in two ways.

First, it provides recent estimates of the causal impact of annual wages and salaries on interprovincial mobility using the variation in earnings growth plausibly induced by substantial increases in world oil prices that occurred during the 2000s.

Second, it highlights the possibility that differential earnings growth across regions may affect not only migration, but also interprovincial employment (the decision of workers to take on employment in a different province while maintaining residency in their home province). Because migration entails considerable costs (e.g., the costs of searching for a new job or home and the costs of relocating) and risk (e.g., uncertainty in employment probability and expected wages), seeking employment opportunities in another region, while maintaining residency in the home region, can be considered an intermediate step before migrating.[1] Whether movements in the regional annual wage structure affect interprovincial employment is a question that, to the knowledge of the authors, has received relatively little attention so far.

The study takes advantage of the fact that oil prices paid to Canadian oil producers more than doubled from 2001 to 2008. Since Canada's oil reserves are concentrated in three Canadian provinces—Alberta, Saskatchewan, and Newfoundland and Labrador—this substantial increase in oil prices likely induced spatial variation in labour demand and earnings growth in Canada. Specifically, it likely increased labour demand and real annual wages more in oil-producing provinces than in other provinces. This in turn suggests that the interaction of oil price movements and of the share of workers employed in the oil industry at the beginning of the study period is a potentially appropriate instrumental variable for extracting exogenous variation in earnings growth across Canadian provinces. The empirical strategy of the paper relies on this instrumental variable.

The upward pressures on annual wages induced by the oil boom increased incentives to migrate to Alberta or to accept job offers in that province while maintaining residency in one's

1. Laporte, Lu and Schellenberg (2013) show that residential mobility and employment mobility in Alberta are interrelated. Of the individuals who were first observed taking on interprovincial employment in 2005 in Alberta, about one in four became Alberta residents during the next five years.

home province, especially for residents of non-oil-producing provinces. The goal of the paper is to assess the magnitude of these responses to earnings movements on two margins of adjustment: migration to Alberta and interprovincial employment in Alberta. The estimated responses are used to assess the degree to which the relatively strong earnings growth in Alberta during the 2000s contributed to filling the job vacancies in that province during that period.

The study focuses on unmarried men under 35. Several reasons motivate this focus. Contrary to young women, some groups of young men were significantly involved in the oil industry at the beginning of the observation period, and the extent to which they were involved varied across provinces. This provides the spatial variation needed to extract exogenous variation in annual wages from the observed earnings growth. Focusing on unmarried young men simplifies the task of identifying which economic incentives likely affect their mobility decisions. By contrast, the migration of couples might result from a complex decision-making process, where economic incentives for each partner and the trade-offs they involve need to be taken into account. Since mobility generally declines with age, young men are a relatively mobile group and, thus, are likely to display mobility rates that vary with time, as the economic incentives they are facing change. As a result, the analysis of their mobility patterns may provide an upper bound for estimates of individuals' mobility responses to wage movements.

The paper proceeds as follows. Section 2 reviews some recent studies. Section 3 describes the methods and data used in the analysis. Section 4 discusses the validity and relevance of the instrumental variable used in the study. Results are shown in Section 5, and Section 6 concludes the paper.

2 Background

Researchers have long been interested in spatial labour mobility. Research on this issue ranges from analyses of rural–urban movements (Harris and Todaro 1970) to structural dynamic modelling aimed at estimating optimal internal migration (Kennan and Walker 2011).[2] Labour mobility is of interest to policy makers, as governments may affect migration flows through tax and expenditure policies (Day 1992).

Migration research generally focuses on the determinants of migration and its consequences. Who migrates, why and when people migrate, and what the consequences of migration are (both for the migrants and for the location of origin and destination) are questions often considered (Greenwood 1997). The central idea of a "behavioural" migration model is that agents compare the costs and benefits of their location options and migrate when the benefits associated with relocation outweigh the costs involved (Lowry 1966). Under a labour market framework, migration may be viewed as part of a labour market search problem (Dahl 2002).

Several studies that examine labour mobility in developed countries employ modified gravity-type models, in which migration is modelled to be directly related to the size of the relevant population of origin and destination, and inversely related to distance (Greenwood 1997).

2. One of the first contributions to the migration literature can be traced back to Ravenstein's (1885) "The Laws of Migration," which examined the determinants of migration using 1871 and 1881 census data in the United Kingdom. In this early paper, Ravenstein described seven patterns found in the data: (1) most migrants move only a short distance, and then typically to major cities; (2) rapidly growing cities are populated by migrants from nearby rural areas; (3) the process of dispersion is the inverse of the process of absorption; (4) each main current of migration produces a compensating countercurrent; (5) long-distance migrants tend to move to major cities; (6) rural people have a higher propensity to migrate than urban people; and (7) women have a higher propensity to migrate than men. Ravenstein also pointed out that employment and wage opportunities were the major determinants of migration.

Additional variables, such as income, unemployment rate, degree of urbanization, local amenity variables and public expenditures, are included.

In a recent study, Molloy, Smith and Wozniak (2011) document a downward trend in migration rates within the United States from 1980 to 2009. They show that this decline is not related to demographic, socioeconomic or cyclical factors (such as the recent economic downturn). For this reason, they argue that researchers should focus on factors that might have led to the decline since the 1980s, rather than factors specific to recent years.

Kennan and Walker (2011) develop a tractable econometric model of optimal migration. Their results suggest that income plays an important role, as geographic differences in mean wages induce workers to move in search of better earnings when the income in their current location is relatively low.

Several Canadian studies have examined the correlates of labour mobility in recent years. Using administrative data, Finnie (2004) shows that over the 1982-to-1995 period, low income earners and individuals in high-unemployment provinces had relatively high rates of interprovincial mobility in Canada. Bernard, Finnie and St-Jean (2008) provide descriptive evidence that slack local labour markets tend to have high rates of interprovincial mobility. Coulombe (2006) finds that interprovincial mobility is correlated with long-term spatial differences in unemployment rates, labour productivity and the rural–urban differential structure of the provinces. Amirault, de Munnik and Miller (2012) use census data from 1991 to 2006 to model labour mobility across economic regions. They find that, along with language, geographic differences in employment rates and household income help explain migration across economic regions.

While the notion that the mobility rates of individuals change in response to movements in the regional employment and earnings structure is appealing, quantifying the magnitude of this response is difficult for several reasons. First, migrants are likely a selective sample of workers. Second, mobility shifts labour supply from economically depressed areas to dynamic areas and, thus, should reduce cross-regional earnings and employment differences. Both scenarios raise endogeneity issues attributable either to selectivity or to reverse causality. As a result, simple estimates of the correlation between annual wages and mobility cannot identify the causal impact of wages on labour mobility. To do so, exogenous variation in annual wages is required.

The first contribution of this study is to identify such exogenous variation, using an instrumental variable estimator. To the knowledge of the authors, no study has performed this task so far. In addition, this study highlights the possibility that movements in the spatial earnings structure may affect not only migration, but also interprovincial employment (the decision of workers to take on employment in a different province while maintaining residency in their home province). Whether movements in the spatial earnings structure affect interprovincial employment is a question that has received relatively little attention so far. To achieve these goals, the study takes advantage of a large administrative dataset: Statistics Canada's Longitudinal Worker File (LWF).

3 Data and methods

The LWF is a longitudinal administrative dataset that consists of a 10% sample of Canadian workers tracked from 1983 to 2010.[3] Along with the age and sex of workers, the LWF contains information on their annual wages and salaries, province of residence (reported as of December 31 of a given year) and province of employment for the various jobs they hold in a given year.

3. It includes individuals who file a personal income tax form (T1 form) or receive a Statement of Remuneration Paid (T4 slip) from their employer.

The longitudinal data on the province of residence and province of employment of workers are key features of the LWF for the purpose of this study. They allow the computation of interprovincial mobility rates, defined as the percentage of workers who change provinces from one year to the next, and transition rates into interprovincial employment, defined as the percentage of individuals who start a job in a province other than their province of residence in a given year.

The LWF also includes job-level indicators of industry, firm size, union status and layoffs. Participation in postsecondary education is measured using information on tuition credits and education deductions claimed for courses taken at a postsecondary education institution. With this information, changes in school attendance can be controlled. Other information includes employees' coverage by a registered pension plan (RPP) or deferred profit-sharing plan (DPSP), as measured by a positive pension adjustment, and contributions to registered retirement savings plans (RRSPs).

Like several other administrative datasets, the LWF contains no information on the education level, occupation, annual work hours or labour force status of individuals. This precludes an assessment of the degree to which migrants increased their annual work hours when moving to Alberta or making a transition into interprovincial employment in that province. Nevertheless, data from alternative datasets indicate — as will be shown below — that a substantial proportion of individuals in the samples selected in this study experienced unemployment at some point in a given year. Hence, the study includes individuals who are underemployed, as well as those who experienced no unemployment spell in a given year.

The study uses both grouping estimators and estimators applied to microdata to assess the causal impact of annual wages and salaries on migration and interregional employment. Several factors motivate this strategy.

Because interprovincial mobility and transitions into interprovincial employment are rare events, applying ordinary least squares (OLS) to microdata will not necessarily lead to good estimates of the average partial effect of annual wages on these outcomes (Wooldridge 2010; Lewbel, Dong and Yang 2012). Using the two-stage least squares (2SLS) estimator on microdata might lead to similar problems. To address this issue, probit models with continuous endogenous explanatory variables are also estimated, and the resulting average partial effect is computed.

If annual wages have a causal impact on migration and interprovincial employment, then groups of workers who experience the largest changes in relative annual wage offers should display the largest changes in migration rates and transitions into interprovincial employment. The large sample size of the LWF provides a rationale for aggregating microdata into groups — defined across multiple dimensions outlined below — and using grouping estimators. Weighted least squares (from the efficient Wald estimator [EWALD]) are first used. Because the results from EWALD might be biased because of reverse causality, 2SLS are also applied to grouped data.[4]

In sum, the study applies three estimators to microdata (OLS, 2SLS and probit) and two estimators to grouped data (EWALD and 2SLS).

Whether a young male worker i in a given age group a, province p, and firm-size category f moves to Alberta (or accepts a job in Alberta while maintaining residence in his home province) from year t to year $t+1$ is represented by a binary indicator, Y_{iapft}. The individual-level analysis relates this indicator to the young worker's real after-tax annual wages and salaries in year t

4. One concern that arises with grouping estimators is that information potentially useful for identifying the impact of annual wages on mobility might be lost when moving from microdata to grouped data. Because the identification strategy used in this study relies on an instrumental variable that is equal to the interaction of oil prices and group effects (i.e., relies on group-year observations), these concerns are minimized.

relative to those of his counterparts in the same age and firm-size categories in Alberta, RW_{iapft}; to a vector of group fixed effects, θ_{apf}; to a vector of year effects, θ_t; to a set of labour market indicators relative to those in Alberta, X_{apt}; and to a set of control variables, Z_{iapft}. The following equation is used:

$$Y_{iapft} = \theta_{apf} + \theta_t + \beta_1 * RW_{iapft} + Z_{iapft} * \beta_2 + X_{apt} * \beta_3 + \varepsilon_{iapft}, t = 2001, \ldots 2008 \quad (1)$$

where ε_{iapft} is an error term. The key regressor, RW_{iapft}, is equal to the logarithm of real after-tax annual wages of worker i in year t minus the average of the log real after-tax annual wages of his counterparts in age group a and firm-size category f in Alberta in year t.[5]

The vector X_{apt} includes three control variables: (1) the unemployment rate of age group a in province p in year t minus the unemployment rate of age group a in Alberta in year t, (2) the rate of involuntary part-time employment of age group a in province p in year t minus the rate of involuntary part-time employment of age group a in Alberta in year t, and (3) log real minimum wages in province p in year t minus log real minimum wages in Alberta in year t.[6]

The vector Z_{iapft} includes binary indicators for whether worker i (1) claimed tuition credits and education deductions for courses taken at a postsecondary education institution in year t, (2) was permanently laid off in year t, (3) was permanently laid off in year $t-1$, (4) paid union dues in year t, or (5) was covered by an RPP plan or a DPSP plan in year t. In addition, it includes the annual contributions made by worker i in year t to RRSPs. The first three variables allow for the possibility that movements in school attendance and recent job losses might alter the propensity of workers to migrate or make a transition into interprovincial employment.[7] The fourth variable controls for the possibility that unionized workers, because they generally earn higher wages than do observationally equivalent workers (Lemieux 1998), might be less likely to migrate or accept job offers in other regions than their non-unionized counterparts. The fifth variable accounts for the possibility that pension coverage might increase the incentive for employees to stay with their employer and not to migrate. Conversely, if high-ability workers sort into firms that offer generous compensation packages (including pension coverage), this variable may be a proxy for the unobserved abilities of workers. If high-ability workers receive a larger number of job offers than other workers when searching for new employers within or outside their home province, this variable might be positively correlated with the likelihood of migrating. Finally, RRSP contributions control for the propensity to save, which might be correlated with personal attitudes towards risk and mobility.

Because migrants are likely to be a non-random sample of paid workers, RW_{iapft} is plausibly correlated with ε_{iapft}, thereby raising endogeneity issues caused by selectivity. If this is the case,

5. Before being aggregated and converted in relative terms, the annual wages and salaries are defined at the person level; i.e., they are summed across all jobs held by a given individual. The firm-size category refers to the main job held in a given year; i.e., the job in which workers received the highest annual wages and salaries. Real annual wages are computed using province-specific values of the Consumer Price Index (all items). A Canadian tax calculator provided by Milligan (2012) is used to calculate after-tax annual wages and salaries.
6. Data on unemployment and involuntary part-time employment are drawn from the Labour Force Survey.
7. If relative wages are the only channel through which school attendance varies, then Equation (1) is best estimated without controls for school attendance. Conversely, if school attendance varies partly for reasons unrelated to relative wages, then measures of school attendance should be included in Equation (1). As it turns out, estimating Equation (1) without controls for school attendance yields results that are very similar to those presented in this study.

OLS estimates of β_1 will be biased. One solution to this problem is to use an instrumental variable and apply 2SLS.

This is one of the strategies used in this study. The instrumental variable used is equal to the interaction of oil prices in a given year and of the share of young men employed in the oil industry at the beginning of the observation period.[8] Specifically, the instrumental variable is equal to the product of last year's oil prices and the share of employed young men (in age group a and firm-size category f, and living in province p) who worked in the oil industry between 1998 and 2001, $OIL_{apft} = \left(OIL\_PRICE_{t\text{-}1}\right) * OIL\_SHARE_{apf\_9801}$.[9]

The rationale for this instrument is simple. A given increase in oil prices should boost labour demand and real annual wages to a greater degree in the oil-producing provinces of Alberta, Saskatchewan, and Newfoundland and Labrador than it would in the other provinces. If so, Saskatchewan and Newfoundland and Labrador should see their annual wages relative to those of Alberta evolve more favorably than those of other provinces (e.g., Quebec and Ontario), where relative wages are expected to fall. As a result, the instrumental variable should, all else being equal, be positively correlated with RW_{iapft}. The differential earnings growth across provinces induced by rising oil prices would in turn increase incentives to move to Alberta to a greater degree for young men living in the non-oil-producing provinces than it would for those living in Saskatchewan and Newfoundland and Labrador. The identification strategy of the study relies on this differentiation. Since increases in oil prices may affect youth earnings with a certain lag, the one-year lagged value of oil prices is used when constructing the instrumental variable.

Because OLS and 2SLS do not necessarily provide good estimates of the average partial effect of annual wages on migration and interprovincial employment, probit models with endogenous continuous explanatory variables are also estimated. Specifically, the two-step method of Rivers and Vuong (1988) is used. In this setup, RW_{iapft} is first regressed on the instrumental variable and the control variables. The residuals from this regression are included in a probit model that includes the endogenous regressor (RW_{iapft}), as well as the control variables. The resulting average partial effect of annual wages is then computed.[10]

The vector of group fixed effects, θ_{apf}, ensures full interaction between the age groups, province of residence and firm-size category for young men.[11] As a result, it allows the propensity of workers to migrate or to move into interprovincial employment to vary in an unrestricted way across age groups, provinces and firm-size categories. This yields a flexible specification of workers' responses to changes in the wage structure.

Migration rates or transitions into interprovincial employment may vary by firm size for several reasons. Large firms provide a large internal market in which opportunities for promotion and

8. Morissette, Chan and Lu (2015) adopt a similar instrumental variable strategy to examine the impact of hourly wages on school enrolment and youth labour market participation.
9. 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. Using data from the Labour Force Survey, the fraction of young male workers employed in one of the following four-digit North American Industry Classification System 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).
10. See Wooldridge (2010, 585–589) for details.
11. Nine age groups (17 to 18, 19 to 20, 21 to 22, 23 to 24, 25 to 26, 27 to 28, 29 to 30, 31 to 32, and 33 to 34), nine provinces (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia) and four firm-size categories (fewer than 20 employees, 20 to 99 employees, 100 to 500 employees, and more than 500 employees) are considered. As a result, 324 age–province–firm size cells are considered.

advancement might be greater than in small firms. They also offer better pension coverage than smaller firms (Morissette 1993). Both factors might reduce the incentives for workers to change employers and migrate to another province. In addition, workers with different unobserved abilities—and thus, with different sets of alternative options—might sort themselves into firms of different sizes and might receive different rewards for their unmeasured abilities.[12]

The empirical evidence supports this view. Abowd, Kramarz and Margolis (1999) use administrative data from France and find that worker-specific fixed effects account for three-quarters of firm-size wage differentials. This finding implies that employees in large firms differ from their counterparts in smaller firms on some unmeasured dimensions (such as unobserved problem-solving skills) that are correlated with pay rates. It also suggests that their set of alternative options plausibly differs from that of workers employed in smaller firms. Ferrer and Lluis (2008) use Canadian data from the Survey of Labour and Income Dynamics (SLID) and find that returns to unobserved abilities are higher in medium-sized firms—those that employ between 100 and 499 workers—than in large firms or small firms. Combined with the fact that large firms provide better pension coverage and the possibility that they might offer greater opportunities for advancement, these findings provide a clear rationale for grouping the data by firm size, as well as by age and by province.

When using grouping estimators, the study aggregates microdata by age, province and firm size and estimates the following equation:

$$Y_{apft} = \theta_{apf} + \theta_t + \beta_1 * RW_{apft} + Z_{apft} * \beta_2 + X_{apt} * \beta_3 + \varepsilon_{apft}, t = 2001, \ldots 2008 \quad (2)$$

where the dependent variable and the regressors have been redefined at the group level. Equation (2) is first estimated using weighted least squares (from EWALD), where the weights represent population estimates in a given cell. Since worker flows across provinces may reduce cross-provincial differences in annual wages, reverse causality may plague estimates of β_1 based on EWALD. To overcome this issue, 2SLS are also applied to Equation (2), using the instrumental variable defined above.

The focus of the study is on unmarried male paid workers, aged 17 to 34, who live outside Alberta in year t and are not involved in interprovincial employment during that year.[13] The 2001-to-2008 period during which movements in wages and oil prices were tightly connected is covered.[14]

Two samples are considered. The first sample consists of unmarried male workers whose annual wages and salaries in year t were at least $1,000 (in 2008 dollars). The second sample includes unmarried male workers who received at least $15,000 (in 2008 dollars) in wages and salaries in year t.

The first sample includes individuals at the bottom of the youth skill distribution, as well as those who, for various reasons, have yet to make a complete and definitive school-to-work transition. A significant proportion of individuals in this sample experienced unemployment at some point in a given year. For instance, SLID data indicate that in 2001 and 2002, one-fifth of individuals in

12. The absence of information on the education levels of individuals in the LWF precludes an alternative grouping based on the interaction of age, province and education levels.
13. The last two restrictions allow individuals to be at risk of moving to Alberta or of accepting jobs in that province while maintaining residence in their home province in the next year. Individuals who are not involved in interprovincial employment in year t are employed that year in jobs located in their province of residence (as indicated from the Statement of Remuneration Paid and the personal income tax form).
14. Worker movements to Alberta and transitions into interprovincial employment in Alberta from the 2001-to-2002 period to the 2008-to-2009 period are related to wage movements observed from 2001 to 2008.

this sample were jobless and looked for work in at least one month (Table 1). Roughly 7% were jobless and looked for work in at least six months.

Table 1
Percentage of young men with no job, 2001 to 2008 — Selected years

	Jobless in at least one month of the year			Jobless and looked for work in at least six months
	Total	Looked for work during this period	Did not look for work during this period	
			percent	
First sample				
Men aged 17 to 34				
2001	38.9	19.8	26.4	7.5
2002	34.6	20.4	22.7	6.3
2007	35.5	17.6	25.1	4.7
2008	33.7	17.6	25.0	4.9
Men aged 17 to 24				
2001	49.6	24.3	35.2	9.1
2002	44.2	25.0	31.6	7.9
2007	45.8	21.9	34.3	5.9
2008	42.7	20.9	33.3	5.9
Men aged 25 to 34				
2001	24.1	13.8	14.2	5.4
2002	21.3	14.0	10.3	4.0
2007	21.5	11.7	12.7	3.2
2008	19.9	12.5	12.3	3.5
Second sample				
Men aged 17 to 34				
2001	21.9	10.9	13.7	2.9
2002	17.6	10.9	9.6	2.5
2007	20.3	11.0	12.5	1.6
2008	17.2	9.9	10.7	2.0
Men aged 17 to 24				
2001	29.4	13.9	18.9	3.2
2002	22.7	13.0	14.9	3.1
2007	26.9	13.7	18.8	1.5
2008	22.4	12.2	15.2	2.5
Men aged 25 to 34				
2001	17.6	9.2	10.6	2.7
2002	14.8	9.8	6.6	2.2
2007	16.1	9.3	8.5	1.6
2008	13.8	8.5	7.6	1.7

Notes: The first sample consists of young unmarried men who earned between $1,000 and $500,000 (in 2008 dollars) in year *t,* lived outside Alberta and were not involved in interprovincial employment that year. The second sample consists of young unmarried men who earned between $15,000 and $500,000 (in 2008 dollars) in year *t,* lived outside Alberta and were not involved in interprovincial employment that year. Since some jobless individuals may have looked for work in some months but not in others, the two categories (looked for work and did not look for work) do not sum to the total.

Source: Statistics Canada, authors' calculations based on data from the Survey of Labour and Income Dynamics.

The second sample includes individuals who have a significant attachment to the labour market or a minimal employability level.[15] About 11% of individuals in this sample were jobless and looked for work in at least one month in 2001 and 2002 (Table 1).

Because the two samples likely reflect quite distinct youth populations, they are best analyzed separately. Since the focus of the study is on the mobility decisions of employees, both samples exclude individuals with self-employment income during the reference year. Individuals who earned more than $500,000 (in 2008 dollars) in year t are also excluded.

Two outcomes are considered: (1) moving to Alberta from year t to year $t+1$, and (2) accepting a job in Alberta in year $t+1$ while maintaining residence in the home province that year. For both grouping estimators and estimators applied to microdata, standard errors are clustered at the age group–province level, thereby allowing for unrestricted forms of serial correlation over time within these clusters.

4 Instrument validity and relevance

4.1 Instrument validity

Oil price increases may affect annual wages in two ways. First, they may increase the hourly wages of employees. Second, holding the number of jobs constant, oil price increases may shift the composition of jobs towards those that offer a relatively high number of annual hours, for instance, by increasing the number of permanent jobs or the number of full-year, full-time jobs, and decreasing the number of temporary jobs or the number of full-year, part-time jobs.[16]

Yet oil price increases may affect labour mobility and interprovincial employment not only by inducing changes in the spatial structure of annual wages, but also by altering unemployment rates in various regions. To rule out the possibility that β_1 captures the impact of changes in unemployment or underemployment rather than the impact of annual wages, two control variables are used: (1) age-specific unemployment rates in province p relative to those in Alberta, and (2) age-specific rates of involuntary part-time employment in province p relative to those in Alberta.[17] Real minimum wages¯ which may affect both outcomes¯ are also included as controls to account for the possibility that provincial governments alter minimum wages in response to economic shocks.

15. SLID data indicate that two-thirds of individuals in this sample worked 48 weeks or more during the 2001-to-2008 period, compared with roughly one-half of individuals in the first sample.
16. If permanent jobs pay higher wages than temporary jobs, this compositional effect will tend to raise average hourly wages.
17. Both variables are endogenous with respect to migration and interregional employment. Nevertheless, estimates of the impact of wages will remain consistent as long as the instruments used in this study are uncorrelated with the error term after conditioning on observable factors (including unemployment and involuntary part-time work) (Stock and Watson 2011). Contrary to the estimated wage impact, the parameter estimates for youth unemployment and involuntary part-time employment will not have a causal interpretation, however.

Provincial differences in housing costs potentially threaten the validity of the instrumental variable used. Arguably, potential migrants compare not only real wage growth between provinces, but also differences in the cost of living between provinces when making migration decisions. Because the real annual wages in Equation (1) are computed using values from the Consumer Price Index (CPI) that account for province-specific changes over time in the cost of living but not for provincial differences in the cost of living at a given point in time, faster real wage growth in Alberta does not imply that the purchasing power of the wages of migrants will increase once they move to Alberta.[18,19] If increases in oil prices lead to sharper growth in housing costs in Alberta than in the non-oil-producing provinces (Table 2), and if housing costs affect migration decisions, then β_1 will reflect both a wage effect and a housing-cost effect. However, because faster real wage growth in Alberta tends to increase migration in that province, while faster growth in housing costs in Alberta plausibly tends to reduce migration in that province, the values of β_1 obtained from Equation (1) (henceforth Model 1) will provide conservative estimates of the impact of wages on migration.

18. The price indices computed by Statistics Canada are either: (a) temporal indices that account for province-specific changes in the cost of living but not for regional differences in the cost of living at a given point in time, or (b) spatial indices that compare the cost of living between cities but do not account for differential changes over time in the cost of living in these cities. For the temporal indices used for the computation of real wages in Equation (1), the Consumer Price Index (CPI) is set to 100.0 in all provinces in a given year (e.g., 2002). For the spatial indices, the CPI is set to 100.0 in a given city every year. No Canadian price index currently captures both provincial differences in the cost of living at a given point in time and differential price movements over time across provinces.
19. To be clear, assume that: (a) annual wages and annual rent in Alberta in 2001 amount to $50,000 and $12,500, respectively, in current dollars; (b) annual wages and annual rent in other provinces in 2001 equal $40,000 and $8,000, respectively; (c) annual wages in Alberta increase to $55,000 in 2008 while rental costs remain unchanged; (d) annual wages and annual rent remain unchanged in other provinces. Under this scenario, moving to Alberta would reduce the purchasing power of one's wages, defined in terms of housing units, (from 5.0 to 4.4, i.e., from $\$40{,}000 / \$8{,}000$ to $\$55{,}000 / \$12{,}500$), even if real wages grew faster in Alberta than in other provinces.

Table 2
Median annual rent, by province, 2001/2002 and 2007/2008

	2001/2002	2007/2008	Change from 2001/2002 to 2007/2008
	current dollars		percent
Median annual rent			
Newfoundland and Labrador	5,880	6,630	12.8
Prince Edward Island	6,240	7,800	25.0
Nova Scotia	6,590	7,500	13.8
New Brunswick	5,940	6,636	11.7
Quebec	5,800	6,900	19.0
Ontario	8,476	9,500	12.1
Manitoba	5,760	7,180	24.7
Saskatchewan	5,796	7,500	29.4
British Columbia	7,800	8,920	14.4
Alberta	7,680	10,560	37.5
		current dollars	
Median annual rent in Alberta minus median annual rent in:			
Newfoundland and Labrador	1,800	3,930	2,130
Prince Edward Island	1,440	2,760	1,320
Nova Scotia	1,090	3,060	1,970
New Brunswick	1,740	3,924	2,184
Quebec	1,880	3,660	1,780
Ontario	-796	1,060	1,856
Manitoba	1,920	3,380	1,460
Saskatchewan	1,884	3,060	1,176
British Columbia	-120	1,640	1,760

Notes: Median annual rent for tenants. The numbers are in current dollars and include expenditures on water, fuel and electricity.
Source: Statistics Canada, authors' calculations based on data from the Survey of Household Spending, 2001, 2002, 2007, and 2008.

To deal explicitly with housing costs, the study considers three additional versions of Equation (1), beyond Model 1.

Model 2 adds to Model 1 a control variable that measures the median annual rent in province p relative to the median annual rent in Alberta.[20] Since changes in housing costs within provinces are already reflected in the CPI (which is the deflator used for RW_{iapft}), Model 2 may control twice for movements in housing costs within provinces.

To avoid this issue, Model 3 includes the median annual rent in province p relative to the median annual rent in Alberta, but replaces RW_{iapft} (the logarithm of individual i's after-tax real annual wages in year t minus the average of log after-tax real annual wages of his counterparts in age group a and firm size category f in Alberta in year t) by NW_{iapft}. This is the logarithm of individual i's after-tax nominal annual wages in year t minus the average of log after-tax nominal annual wages of his counterparts in age group a and firm-size category f in Alberta

20. This control variable equals the logarithm of median annual rent in province p in year t (measured in current dollars) minus the logarithm of median annual rent in Alberta that year. Median annual rent is computed using the Survey of Household Spending from 2001 to 2008.

in year t. The rationale here is to control for province-specific differences in the cost of living and for province-specific changes over time in the cost of living through median rent.

Model 4 achieves the same goal and replaces RW_{iapft} by an alternative wage measure that deflates nominal annual wages in each province by median annual rent (instead of the province-specific values of the CPI). Since the influence of housing costs is captured directly by this alternative wage measure, Model 4 does not include median annual rent as a separate explanatory variable. Three additional versions of Equation (2) are also considered. Whether microdata or grouped data are used, Model 3 is the preferred specification. Contrary to Model 1, it takes explicitly account of provincial differences in the cost of living at a given point in time. Contrary to Model 2, it does not control twice for movements in housing costs within provinces. Contrary to Model 4, it does not restrict the coefficient on median annual rent to be equal, in absolute value, to the coefficient on nominal annual wages.

4.2 Instrument relevance

Tables 4 and 5 show that OIL_{apft}, the instrument selected, is generally strongly correlated with the various wage measures used in the study. This is true for both grouped data and microdata. In Models 1 to 3, the first-stage F-statistic ranges from 9.2 to 19.1 in the first sample (Table 4), and from 33.6 to 52.4 in the second sample (Table 5). Lower values of the first-stage F-statistic are observed in Model 4. Results not shown indicate that, as expected, the instrumental variable is positively correlated with the various wage measures. The coefficients for OIL_{apft} are generally close to 0.02. This suggests that a doubling of oil prices from their 2002 level would lead to 10% faster growth in relative wages in provinces where the probability of working in the oil industry was equal to 5% during the 1998-to-2001 period, compared with non-oil-producing provinces.[21]

5 Results

5.1 Descriptive evidence

From 2001 to 2008, oil prices paid to Canadian producers more than doubled. In 2008, the Industrial Product Price Index for petroleum and coal products was 230.2, up from 106.5 in 2001 (Chart 1).[22] This increase in oil prices led to strong growth in economic activity in the three oil-producing provinces of Alberta, Saskatchewan, and Newfoundland and Labrador.[23] In these three provinces, real annual wages of men under 35 grew faster than they did in other provinces, thereby inducing movements in the spatial wage structure. As a result, relative annual wages – real annual wages and salaries relative to those in Alberta – fell in non-oil-producing provinces from 2001 to 2008 but did not fall in the two other oil-producing provinces (Chart 2).

21. A doubling of oil prices from their 2002 level implies an increase of 100 in the index of oil prices. Multiplying 100 by the product of 0.05 and the coefficient 0.02 yields 0.10, the estimated increase in the degree to which relative wages in oil-producing provinces would increase faster than in non-oil-producing provinces. During the 1998-to-2001 period, the percentage of young unmarried men aged 17 to 34 employed in the oil industry averaged 7.4% in Alberta, 4.6% in Saskatchewan, and 1.8% in Newfoundland and Labrador.
22. 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. The Industrial Product Price Index for petroleum and coal products comes from CANSIM table 329-0065 and equals 100.0 in 2002.
23. Between 1997 and 2008, these three provinces accounted for 97% of the total production of crude oil by the 10 Canadian provinces (CANSIM table 126-0001). Alberta, Saskatchewan, and Newfoundland and Labrador accounted for 68%, 19%, and 10% of this production, respectively.

These movements in the regional earnings structure were associated with increasing rates of migration to Alberta. The percentage of unmarried male paid workers aged 17 to 24 who moved to Alberta rose from 0.55% for the 2001-to-2002 period to 1.20% for the 2005-to-2006 period (Chart 3). The corresponding migration rates for their counterparts aged 25 to 34 increased from 0.45% to 0.95% during that time. Overall, the migration rates of unmarried male paid workers aged 17 to 34 doubled, rising from 0.51% for the 2001-to-2002 period to 1.10% for the 2005-to-2006 period (Table 3-2). Migration rates to Alberta fell subsequently, but remained higher from 2007 to 2008 than they were from 2001 to 2002. Likewise, transitions into interprovincial employment in Alberta from 2007 to 2008 exceeded those observed from 2001 to 2002 (Chart 4). Both outcomes fell further from the 2007-to-2008 period to the 2008-to-2009 period with the onset of the recent economic downturn.

The pace at which migration to Alberta and transitions into interprovincial employment in Alberta rose varied across provinces. From the 2001-to-2002 period to the 2007-to-2008 period, the percentage of individuals moving to Alberta increased for all provinces except Saskatchewan and British Columbia (Table 3-2). These two provinces experienced little change in relative annual wages and salaries (henceforth, relative annual earnings) during that period (Table 3-1). Of all provinces, Ontario experienced the largest decline in relative annual earnings: these fell by 0.16 log points (roughly 16%), dropping from -0.23 in 2001 to -0.39 in 2007. While Ontario tended to exhibit relatively little mobility and interprovincial employment vis-à-vis Alberta, the rate of migration from Ontario to Alberta and of transitions into interprovincial employment from Ontario to Alberta more than doubled during that period. Thus, a simple difference-in-difference interpretation of Table 3-1 and Table 3-2 suggests that young men living in some provinces that experienced relatively large proportionate declines in real annual earnings relative to their counterparts in Alberta experienced greater proportionate increases in migration to Alberta or interprovincial employment in Alberta than other young men.[24,25]

Table 3-1
Relative annual wages by province, 2001 to 2008 — First sample

	2001	2002	2003	2004	2005	2006	2007	2008
				logarithmic value				
Newfoundland and Labrador	-0.70	-0.64	-0.61	-0.67	-0.73	-0.74	-0.64	-0.60
Prince Edward Island	-0.42	-0.41	-0.36	-0.39	-0.48	-0.52	-0.51	-0.52
Nova Scotia	-0.47	-0.41	-0.42	-0.42	-0.50	-0.55	-0.51	-0.51
New Brunswick	-0.47	-0.41	-0.40	-0.41	-0.52	-0.53	-0.51	-0.51
Quebec	-0.33	-0.27	-0.26	-0.29	-0.36	-0.37	-0.36	-0.35
Ontario	-0.23	-0.20	-0.21	-0.24	-0.34	-0.39	-0.39	-0.42
Manitoba	-0.33	-0.28	-0.27	-0.32	-0.38	-0.41	-0.39	-0.39
Saskatchewan	-0.26	-0.21	-0.20	-0.24	-0.29	-0.29	-0.26	-0.23
British Columbia	-0.26	-0.22	-0.21	-0.22	-0.28	-0.30	-0.28	-0.30
All nine provinces	-0.29	-0.25	-0.24	-0.28	-0.35	-0.38	-0.37	-0.38

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t,* lived outside Alberta and were not involved in interprovincial employment that year. Relative annual wages are equal to average log after-tax real annual wages and salaries in a given province minus average log after-tax real annual wages and salaries in Alberta.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

24. This argument refers to the correlation between the logarithm of mobility rates and the logarithm of relative wages. An empirical question—which amounts to the choice of functional form for the outcomes considered in this study—is whether the same argument can be made regarding the correlation between the level of mobility rates and the logarithm of relative wages. This issue is tackled when regression results are presented.
25. The fact that Newfoundland and Labrador displayed an increase in migration rates and in transitions into interprovincial employment from the 2001-to-2002 period to the 2007-to-2008 period despite an improvement in relative annual earnings suggests that other factors, such as changes in employment opportunities, played a role.

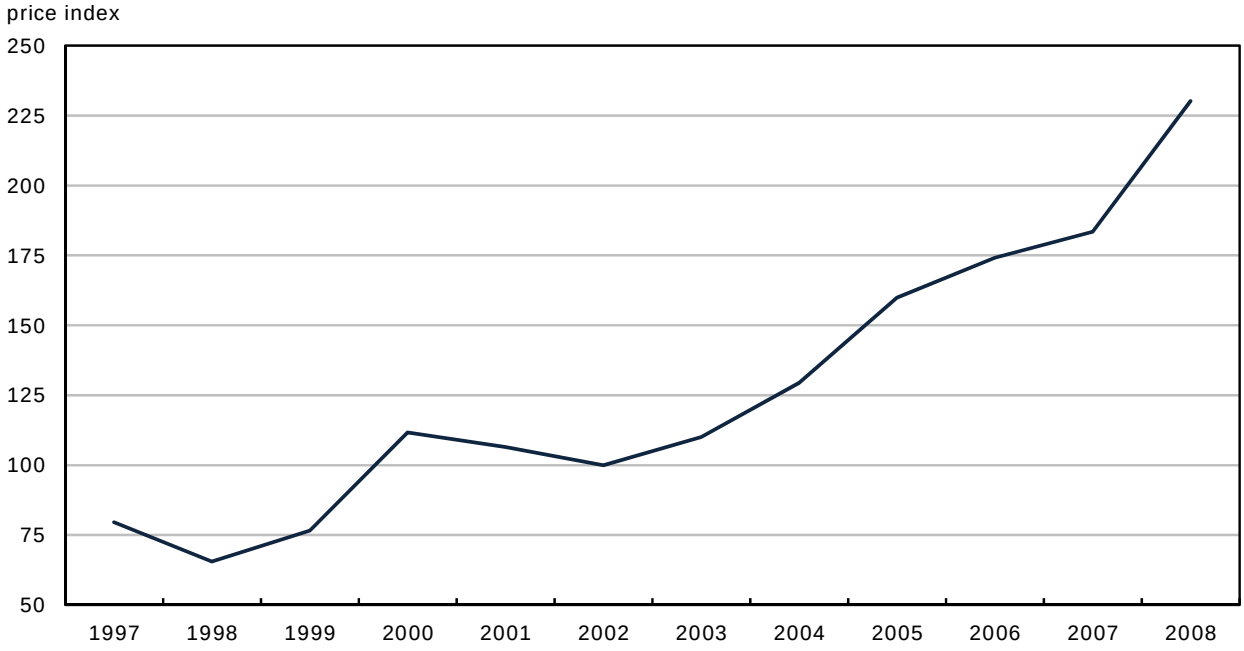
Table 3-2
Inter-provincial mobility, and interprovincial employment — First sample

	2001 to 2002	2002 to 2003	2003 to 2004	2004 to 2005	2005 to 2006	2006 to 2007	2007 to 2008	2008 to 2009
				percent				
Individuals moving to Alberta								
Newfoundland and Labrador	1.22	2.26	2.67	4.85	5.42	2.51	2.24	1.05
Prince Edward Island	1.21	0.78	1.86	3.84	3.63	2.08	2.36	0.30
Nova Scotia	1.02	1.53	1.32	2.21	3.64	2.01	1.78	0.57
New Brunswick	0.64	0.74	0.91	1.64	2.75	1.27	1.53	0.38
Quebec	0.08	0.04	0.06	0.09	0.28	0.20	0.21	0.07
Ontario	0.23	0.25	0.26	0.38	0.78	0.68	0.60	0.30
Manitoba	0.82	0.80	1.05	1.80	1.99	1.18	1.20	0.50
Saskatchewan	2.88	2.82	2.84	3.62	3.56	1.81	1.29	0.98
British Columbia	1.50	1.32	1.08	1.39	1.56	0.97	0.79	0.73
All nine provinces	0.51	0.51	0.52	0.77	1.10	0.72	0.65	0.34
Individuals getting a job in Alberta								
Newfoundland and Labrador	1.40	1.36	1.89	2.81	4.27	4.30	4.38	1.33
Prince Edward Island	1.48	1.43	1.59	1.99	4.68	3.85	3.54	1.21
Nova Scotia	0.72	0.86	0.93	1.49	2.63	2.36	2.20	1.06
New Brunswick	0.57	0.35	0.61	1.10	1.97	1.83	2.07	0.49
Quebec	0.22	0.17	0.21	0.26	0.39	0.38	0.36	0.13
Ontario	0.22	0.24	0.23	0.26	0.60	0.52	0.56	0.23
Manitoba	0.80	0.75	1.00	1.20	1.58	1.59	1.02	0.54
Saskatchewan	3.01	4.00	4.06	5.33	5.90	4.52	3.91	2.14
British Columbia	1.48	1.37	1.28	1.69	1.73	1.41	1.57	1.01
All nine provinces	0.54	0.55	0.58	0.75	1.06	0.92	0.92	0.44

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Getting a job in Alberta means starting a job in Alberta while maintaining residence in one's home province.

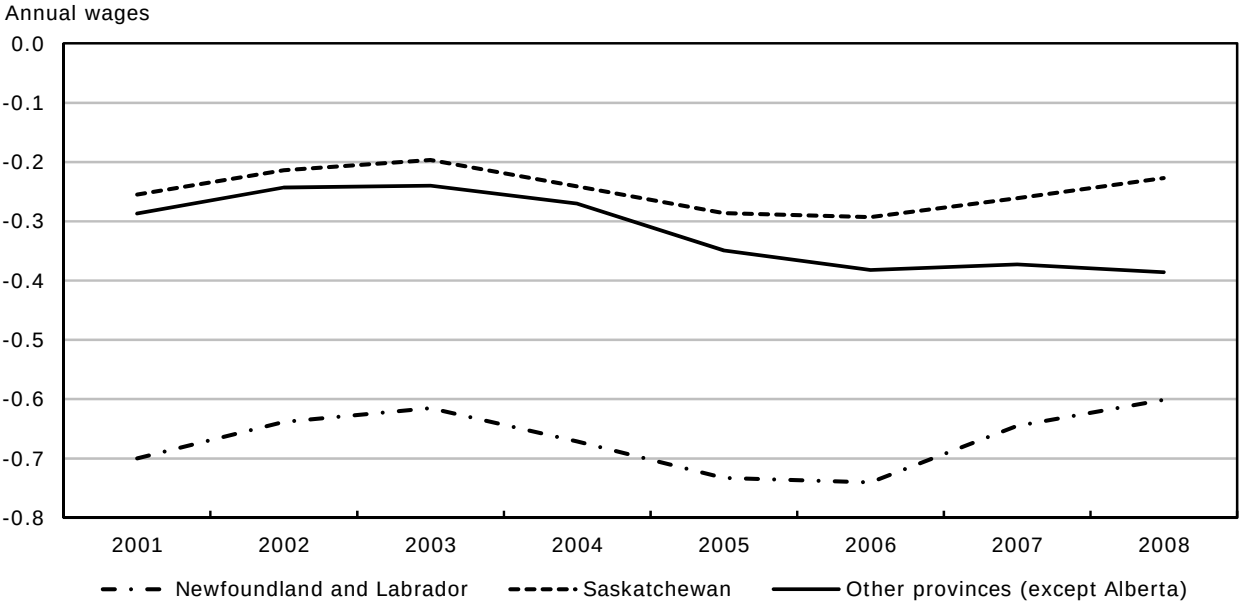
Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Chart 1
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.

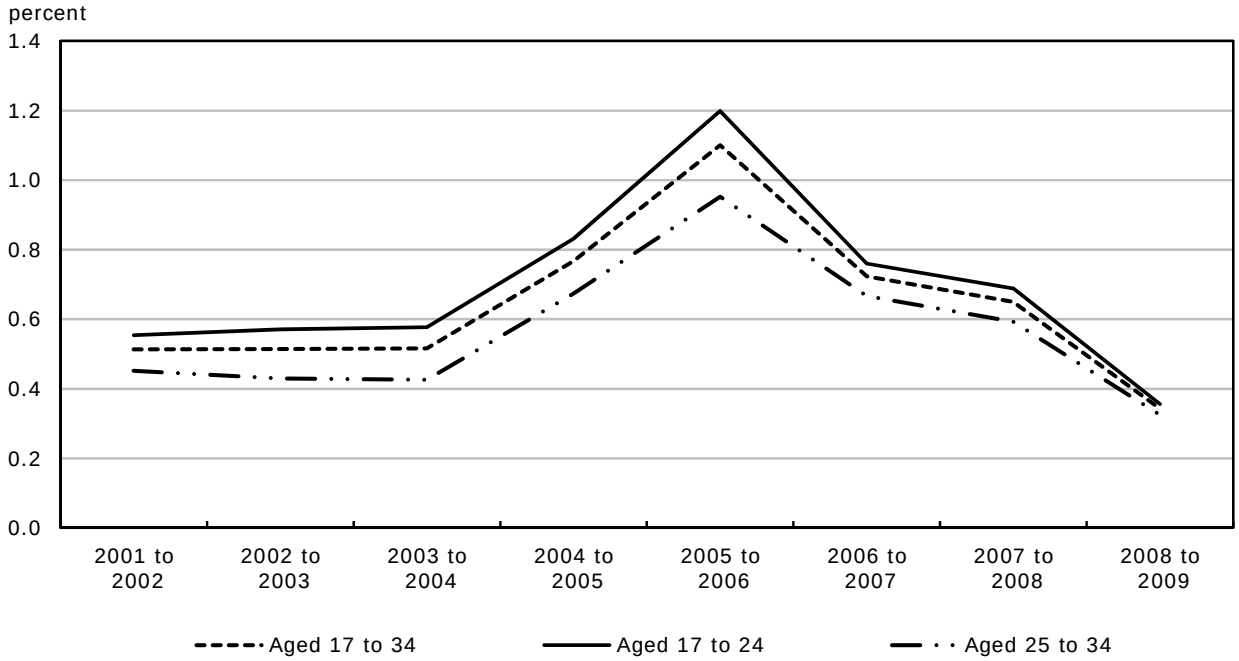
Chart 2
Relative annual wages, 2001 to 2008



Note: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Relative annual wages are equal to average log after-tax real annual wages and salaries of workers and age group *a* and firm size *f*, and who live in province *p* minus the corresponding value in Alberta.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

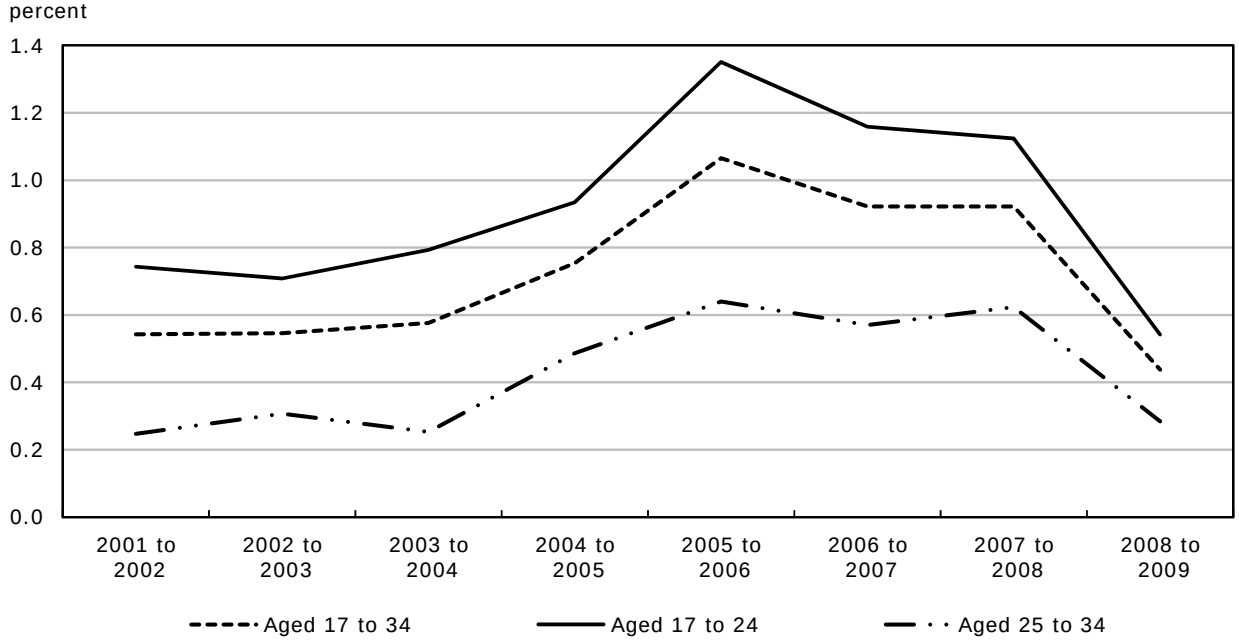
Chart 3
Percentage of young men moving to Alberta, by age



Note: The sample consists of unmarried male paid workers who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta, and were not involved in interprovincial employment that year.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Chart 4
Percentage of young men getting a job in Alberta, by age



Notes: The sample consists of unmarried male paid workers who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta, and were not involved in interprovincial employment that year. Getting a job in Alberta means starting a job in Alberta while maintaining residence in one's home province.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

5.2 Regression results

Table 4 shows regression results for the first sample; i.e., young men who earn at least $1,000 during the reference year. Regardless of the models considered, OLS estimates of β_1 are essentially equal to zero, thereby suggesting that workers do not respond to changes in the spatial earnings structure. Applying the 2SLS estimator to microdata leads to the rejection of this conclusion. For instance, Models 1 to 3 indicate that β_1 varies between -0.18 and -0.22. In other words, a 10% decline in annual wages relative to those paid in Alberta increases the probability of migrating to Alberta by between 1.8 percentage points (0.018) and 2.2 percentage points (0.022), from a baseline rate of 0.64%. 2SLS estimates based on grouped data are of similar magnitude and are about 20 times higher, in absolute value, than EWALD estimates.[26] As with Models 1 to 3, 2SLS estimates from Model 4 suggest that interprovincial mobility rises in response to widening cross-regional wage differences. However, these estimates are based on weaker first-stage regressions than those underlying Models 1 to 3 and, therefore, must be interpreted with caution.

Whether applied to microdata or grouped data, 2SLS estimates also generally indicate that a greater proportion of young men become interprovincial employees as cross-regional wage differences increase. Models 1 to 3 suggest that a 10% decline in wages relative to those paid in Alberta increases the probability of accepting a job in Alberta while maintaining residence in one's home province by between 0.70 percentage points (0.007) and 1.0 percentage point (0.010), from a baseline rate of 0.72%.[27]

Table 5 shows results for the second sample; i.e., young men who earn at least $15,000 during the reference year. For this sample, Models 1 to 3 yield 2SLS estimates of β_1 very similar to those obtained from the first sample, both in terms of migration and transitions into interprovincial employment.

The results presented so far are based on linear models and, thus, do not necessarily provide appropriate estimates of the average partial effect of annual wages on the binary outcomes considered. Table 6 deals with this issue and provides estimates of average partial effects of annual wages that are obtained after implementing the two-step method of Rivers and Vuong (1988). In the first sample, Models 1 to 3 indicate that a 10% decline in annual wages relative to those paid in Alberta increases the probability of migrating to Alberta by 0.7 percentage points to 0.8 percentage points. The corresponding increases in the likelihood of migrating vary between 0.7 percentage points and 0.9 percentage points in the second sample. Hence, for both samples, the average partial effects resulting from probit models with endogenous regressors are less than half those obtained from the linear models of Tables 4 and 5. This conclusion holds when average partial effects of annual wages on the likelihood of making a transition into interprovincial employment, as obtained from Table 6, are compared with those of Tables 4 and 5.

26. Appendix Tables 1 and 2 display detailed 2SLS results from Models 1 and 3. As expected, results from microdata and grouped data indicate that young men who attend a postsecondary education institution were less likely to migrate to Alberta than others. This is also the case for young men who were laid off in year t or year $t-1$. By contrast, young men who had a registered pension plan or a deferred profit-sharing plan (as indicated by a positive pension adjustment) or who had relatively high RRSP contributions were more likely to migrate to Alberta than others. All else being equal, the likelihood of young men moving to Alberta fell after 2005 relative to 2001, as indicated by the negative coefficients for the 2006, 2007 and 2008 binary indicators.
27. Appendix Tables 3 and 4 show separate results, based on the first sample, for men aged 17 to 24 and men aged 25 to 34. Although the responses of men aged 25 to 34 are often not statistically different, at conventional levels (5%), from those of their counterparts younger than 25, a comparison of these two tables generally suggests that unmarried men younger than 25 tend to respond to wage movements to a greater extent than do unmarried men aged 25 to 34. This finding is consistent with one of the most universal mobility relationships between age and migration, as noted by Greenwood (1997)—that the propensity to migrate often peaks during the early twenties.

Tables 4 to 6 relate changes in migration rates to proportionate changes in relative annual wages. An important question is whether the findings from these tables hold when proportionate changes in migration rates are related to proportionate changes in relative wages. Table 7 answers this question for the first sample. It assesses whether the grouped data results of Table 4 hold when the dependent variable is modelled in logarithms, rather than in levels. Models 1 to 3 indicate that using logarithms yields somewhat lower wage elasticities, in absolute value, of the likelihood of migrating to Alberta.[28] For instance, these wage elasticities equal -31.3 when using logarithms in Model 3, compared with -33.1 when using levels. Table 7 also shows that the wage parameters for the likelihood of making a transition into interprovincial employment are, in Models 1 to 3, no longer statistically significant when the dependent variable is modelled in logarithms. Hence, results on the likelihood of moving to Alberta are robust to functional form issues, while results on the likelihood of making a transition into interprovincial employment are sensitive to functional form issues. This conclusion holds for the second sample (Table 8).

28. When using logarithms, wage elasticities are equal to the wage parameter. When using levels, wage elasticities are obtained by dividing the wage parameter by the mean of the dependent variable.

Table 4
Impact of wages on mobility and interprovincial employment — First sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072
Estimate of β_1 (wage parameter)								
Microdata								
Ordinary least squares (OLS)	0.000	0.000 *	0.000	0.000 †	0.000	0.000 †	0.000	0.000 †
Two-stage least squares (2SLS)	-0.183 ***	-0.081 *	-0.217 **	-0.083 *	-0.184 ***	-0.070 *	-0.336 *	-0.149 †
Grouped data								
Weighted least squares (EWALD)	-0.010 ***	-0.003	-0.007 **	0.000	-0.008 **	0.000	-0.002	0.004
Two-stage least squares (2SLS)	-0.215 ***	-0.098 *	-0.256 **	-0.100 †	-0.212 ***	-0.083 *	-0.433 †	-0.198
Number of clusters	81	81	81	81	81	81	81	81
Number of observations								
Microdata	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071
Grouped data	2,591	2,591	2,591	2,591	2,591	2,591	2,591	2,591
Kleibergen-Paap Wald F-statistic (2SLS)								
Microdata	19.1	19.1	12.9	12.9	17.8	17.8	6.2	6.2
Grouped data	14.9	14.9	9.2	9.2	13.2	13.2	3.3	3.3

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Table 5
Impact of wages on mobility and interprovincial employment — Second sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049
Estimate of β_1 (wage parameter)								
Microdata								
Ordinary least squares (OLS)	0.000	0.001 †	0.000	0.001 †	-0.001	0.001 †	0.000	0.001 †
Two-stage least squares (2SLS)	-0.239 ***	-0.079 **	-0.249 ***	-0.077 *	-0.207 ***	-0.064 *	-0.507 *	-0.169 †
Grouped data								
Weighted least squares (EWALD)	-0.014 **	-0.003	-0.008 †	0.000	-0.010 *	0.000	0.008 †	0.008 *
Two-stage least squares (2SLS)	-0.228 ***	-0.078 *	-0.238 ***	-0.075 *	-0.198 ***	-0.063 *	-0.514 *	-0.176
Number of clusters	81	81	81	81	81	81	81	81
Number of observations								
Microdata	563,133	563,133	563,133	563,133	563,133	563,133	563,133	563,133
Grouped data	2,530	2,530	2,530	2,530	2,530	2,530	2,530	2,530
Kleibergen-Paap Wald F-statistic (2SLS)								
Microdata	48.3	48.3	38.4	38.4	52.4	52.4	8.2	8.2
Grouped data	42.7	42.7	33.6	33.6	45.6	45.6	6.7	6.7

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $15,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Table 6
Results from probit models with endogenous relative annual wages

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
First sample								
Mean of dependent variable	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072
Relative annual wages								
Probit coefficient	-4.285 ***	-1.965 ***	-4.855 ***	-1.578 **	-4.112 ***	-1.338 **	-7.863 ***	-3.613 ***
Average partial effect	-0.072	-0.036	-0.082	-0.029	-0.069	-0.024	-0.132	-0.066
Number of clusters	81	81	81	81	81	81	81	81
Number of observations	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071	1,140,071
Second sample								
Mean of dependent variable	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049
Relative annual wages								
Probit coefficient	-5.787 ***	-2.875 ***	-5.673 ***	-2.413 ***	-4.720 ***	-2.004 ***	-12.290 ***	-6.078 ***
Average partial effect	-0.092	-0.037	-0.090	-0.031	-0.074	-0.026	-0.195	-0.089
Number of clusters	81	81	81	81	81	81	81	81
Number of observations	563,133	563,133	563,133	563,133	563,133	563,133	563,133	563,133

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

Notes: The first sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year.The second sample consists of unmarried male paid workers aged 17 to 34 who earned between $15,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. For both samples, Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Table 7
Impact of wages on mobility and interprovincial employment, grouped data estimates with different functional forms — First sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072	0.0064	0.0072
Estimate of β_1 (wage parameter)								
Level–log								
Weighted least squares (EWALD)	-0.010 ***	-0.003	-0.007 **	0.0	-0.008 **	0.0	-0.002	0.004
Two-stage least squares (2SLS)	-0.215 ***	-0.098 *	-0.256 **	-0.100 †	-0.212 ***	-0.083 *	-0.433 †	-0.198
Log–log								
Weighted least squares (EWALD)	-0.943	0.921	-1.160	1.263	-1.276	1.333	-1.448	1.687
Two-stage least squares (2SLS)	-26.8 **	-3.0	-37.8 *	-0.9	-31.3 **	-0.7	-54.0 †	-6.1
Wage elasticities (2SLS)								
Level–log	-33.6	-13.6	-40.0	-13.9	-33.1	-11.5	-67.7	-27.5
Log–log	-26.8	-3.0	-37.8	-0.9	-31.3	-0.7	-54.0	-6.1
Number of clusters	81	81	81	81	81	81	81	81
Number of observations	2,591	2,591	2,591	2,591	2,591	2,591	2,591	2,591
Kleibergen-Paap Wald F-statistic (2SLS)	14.9	14.9	9.2	9.2	13.2	13.2	3.3	3.3

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Table 8
Impact of wages on mobility and interprovincial employment, grouped data estimates with different functional forms — Second sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049	0.0058	0.0049
Estimate of β_1 (wage parameter)								
Level–log								
Weighted least squares (EWALD)	-0.014 **	-0.003	-0.008 †	0.000	-0.010 *	0.000	0.008 †	0.008 *
Two-stage least squares (2SLS)	-0.228 ***	-0.078 *	-0.238 ***	-0.075 *	-0.198 ***	-0.063 *	-0.514 *	-0.176
Log–log								
Weighted least squares (EWALD)	-5.840 †	0.788	-5.126	1.055	-5.028	1.229	-1.855	1.457
Two-stage least squares (2SLS)	-31.3 ***	-8.7	-32.7 **	-9.2	-27.2 **	-7.6	-70.4 *	-19.5
Wage elasticities (2SLS)								
Level–log	-39.3	-15.9	-41.0	-15.3	-34.1	-12.9	-88.6	-35.9
Log–log	-31.3	-8.7	-32.7	-9.2	-27.2	-7.6	-70.4	-19.5
Number of clusters	81	81	81	81	81	81	81	81
Number of observations	2,530	2,530	2,530	2,530	2,530	2,530	2,530	2,530
Kleibergen-Paap Wald F-statistic (2SLS)	42.7	42.7	33.6	33.6	45.6	45.6	6.7	6.7

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 17 to 34 who earned between $15,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

5.3 Implications for job vacancies

The degree to which worker movements to Alberta reduced job vacancies during the 2001-to-2008 period depends on the increase in aggregate annual work hours that resulted from these movements. If all young men who moved to Alberta worked full-time on a full-year basis in their home province prior to migrating and did not increase their work hours afterwards, and if their departure from their home province created a job vacancy that remained unfilled, then migration to Alberta would reduce job vacancies in that province while increasing vacancies elsewhere, leaving unchanged the total number of vacant positions in Canada. Conversely, if migrants left jobs that were subsequently filled by unemployed individuals in their home province, then migration to Alberta would reduce the aggregate number of job vacancies in Canada by an amount equal to the number of migrants. Thus, the increase in the expected number of migrants associated with a given increase in Alberta's relative annual wages provides an upper bound for the degree to which changes in the regional wage structure reduced job vacancies in Canada during the observation period.

From 2001 to 2005, real average annual wages and salaries earned by unmarried men (of a given age and employed in a given firm-size category and a given province) relative to those of their counterparts in Alberta fell by about 6%, from -0.29 in 2001 to -0.35 in 2005 (Table 3-1). Multiplying the average partial effect obtained from probit Model 3 using the first sample (-0.069, see Table 6) the preferred specification by -0.06 yields a predicted increase in migration rate of 0.4 percentage points.[29,30] Multiplying this increase (0.004) by 10 times the average sample size (1,425,089=10*(1,140,071/8)) yields the predicted increase in the number of young male migrants; i.e., 5,900. Since private-sector locations operating in Alberta had between 37,000 and 48,000 job vacancies from 2001 to 2005 (Table 9), the estimated increase in the number of young male migrants represents between 12% and 16% of the number of job vacancies observed in Alberta during the 2001-to-2005 period.

This conclusion is strengthened by computing the estimated increase in the number of young male migrants that results from a decline of 9% (rather than 6%) in relative annual wages, which is the decline observed from 2001 to 2006 (Table 3-1). In that case, the estimated increase in the number of young male migrants represents between 18% and 24% of the number of job vacancies observed in Alberta during the 2001-to-2005 period. Regardless of the scenario considered, these numbers suggest that increased annual wages paid in Alberta induced flows of young male workers that represent a significant proportion of the job vacancies observed in that province.

29. Since the percentage of young unmarried men moving to Alberta rose by 0.6 percentage points from the 2001-to-2002 period to the 2005-to-2006 period (Table 3), this estimated increase in migration amounts to two-thirds of the increase observed during that period.
30. Alternatively, if annual wages and salaries earned by unmarried men relative to those of their counterparts in Alberta fell by 5%, the probability of young unmarried men moving to Alberta would rise by roughly 0.35 percentage points.

Table 9
Number of job vacancies in Alberta, 2001 to 2014

Year and data source	Job vacancies
	number
2001 Workplace and Employee Survey	37,256
2003 Workplace and Employee Survey	32,631
2005 Workplace and Employee Survey	48,143
2011 Business Payrolls Survey	43,880
2012 Business Payrolls Survey	60,100
2013 Business Payrolls Survey	48,508
2014 Business Payrolls Survey	48,283

Notes: Job vacancies in businesses operating in all industries except farming, fishing, hunting, and public administration. No data on job vacancies are available for the years 2006 to 2010.
Source: Statistics Canada, authors' calculations based on data from the Workplace and Employee Survey and CANSIM table 284-0001.

6 Concluding remarks

Quantifying the degree to which the geographic mobility of workers responds to spatial movements in annual wages is a difficult task that requires both the use of large datasets and the identification of exogenous variation in cross-regional wage movements. This article tackles these challenges by using mobility information from a large administrative dataset and identifying the exogenous variation in cross-regional earnings movements plausibly induced by substantial increases in oil prices observed during the 2000s.

The empirical strategy of the study takes advantage of the fact that the oil boom of the 2000s generated a natural experiment in which annual earnings grew much faster in the three oil-producing provinces of Canada than in the other provinces. These spatial movements in the earnings structure increased the incentives for individuals to move to the biggest oil-producing province, Alberta, or to accept job offers in that province while maintaining residence in their home province.

The main finding of the study is that even though migration to Alberta and transitions into interprovincial employment in that province were relatively rare events for young unmarried male paid workers during the 2000s—affecting less than 1% of them on an annual basis—the likelihood of these events occurring varied significantly in response to spatial movements in the earnings structure. The results of this study indicate that faster growth in real annual wages and salaries in Alberta, compared with other provinces, substantially increased migration to Alberta. The resulting worker inflows represented a significant fraction of the job vacancies observed in that province during the 2000s. There is also evidence that changes in the regional wage structure fostered transitions into interprovincial employment in Alberta. Whether the magnitude of these responses is optimal, and to what degree these responses were constrained by barriers to mobility, are questions left for further research.

7 Appendix tables

Appendix Table 1
Two-stage least squares (2SLS) estimates from Model 1 — First sample

	Microdata		Grouped data	
	Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
	estimate			
Mean of dependent variable	0.0064	0.0072	0.0064	0.0072
Relative annual earnings	-0.183 ***	-0.081 **	-0.215 ***	-0.098 *
Attending a postsecondary institution in year *t*	-0.046 ***	-0.019 *	-0.059 *	-0.002
Laid off in year *t*	-0.021 *	-0.005	-0.090 *	-0.047 †
Laid off in year *t*-1	-0.014 **	-0.001	-0.042 †	-0.010
Paying union dues in year *t*	0.010 **	0.005 **	0.001	-0.001
Having a positive pension adjustment in year *t*	0.076 ***	0.033 *	0.132 ***	0.062 *
RRSP contributions in year *t* ($'000)	0.013 ***	0.006 *	0.017 **	0.009 *
Relative unemployment rates	0.000	0.000	0.000	0.000
Relative rates of involuntary part-time employment	-0.001 †	-0.001 *	-0.001 *	-0.001 *
Relative minimum wages	-0.035 †	-0.001	-0.038 †	-0.002
Year effects				
2002	0.010 ***	0.004 *	0.012 ***	0.005 *
2003	0.012 ***	0.005 *	0.013 ***	0.005 †
2004	0.010 ***	0.004 *	0.010 ***	0.004 *
2005	-0.003	0.001	-0.005	-0.001
2006	-0.014 ***	-0.003	-0.019 ***	-0.005
2007	-0.014 ***	-0.003	-0.018 ***	-0.005
2008	-0.020 ***	-0.008 **	-0.024 ***	-0.010
	value			
Kleibergen-Paap Wald F-statistic (2SLS)	19.1	19.1	14.9	14.9
	number			
Clusters	81	81	81	81
Groups	…	…	324	324
Observations	1,140,071	1,140,071	2,591	2,591

… not applicable

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of young unmarried men who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Relative unemployment rates are equal to the unemployment rate of unmarried men aged 17 to 34 in a given age group (17 to 18, 19 to 20, 21 to 22, 23 to 24, 25 to 26, 27 to 28, 29 to 30, 31 to 32, and 33 to 34) and a given province in year *t* minus the corresponding value in Alberta. Relative rates of involuntary part-time employment equal the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and a given province in year *t* minus the corresponding value in Alberta. Relative minimum wages equal the logarithm of real minimum wages in a given province in year *t* minus the corresponding value in Alberta. RRSP stands for registered retirement savings plan.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Appendix Table 2
Two-stage least squares (2SLS) estimates from Model 3 — First sample

	Microdata		Grouped data	
	Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
	estimate			
Mean of dependent variable	0.0064	0.0072	0.0064	0.0072
Relative annual earnings	-0.184 ***	-0.070 *	-0.212 ***	-0.083 *
Relative annual rent	0.045	-0.003	0.046	-0.004
Attending a postsecondary institution in year *t*	-0.047 ***	-0.016 *	-0.057 *	-0.016
Laid off in year *t*	-0.022 *	-0.003	-0.082 *	-0.040 †
Laid off in year *t*-1	-0.014 *	0.000	-0.042 †	-0.007
Paying union dues in year *t*	0.010 **	0.004 *	-0.003	-0.003
Having a positive pension adjustment in year *t*	0.076 ***	0.028 *	0.118 **	0.053 *
RRSP contributions in year *t* ($'000)	0.013 ***	0.005 *	0.017 *	0.008 †
Relative unemployment rates	0.000	0.000	0.000	0.000
Relative rates of involuntary part-time employment	-0.001 †	-0.001 *	-0.001 †	-0.001 *
Relative minimum wages	-0.033	0.006	-0.034	0.006
Year effects				
2002	0.007 ***	0.003 *	0.008 ***	0.003 †
2003	0.008 *	0.002	0.008 *	0.002
2004	0.003 *	0.002 †	0.003	0.001
2005	-0.007 †	0.000	-0.010 *	-0.002
2006	-0.022 ***	-0.005	-0.027 **	-0.008
2007	-0.021 ***	-0.007 *	-0.026 ***	-0.011 *
2008	-0.027 ***	-0.013 ***	-0.032 ***	-0.016 **
	value			
Kleibergen-Paap Wald F-statistic (2SLS)	17.8	17.8	13.2	13.2
	number			
Clusters	81	81	81	81
Groups	…	…	324	324
Observations	1,140,071	1,140,071	2,591	2,591

… not applicable

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of young unmarried men who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Relative unemployment rates are equal to the unemployment rate of unmarried men aged 17 to 34 in a given age group (17 to 18, 19 to 20, 21 to 22, 23 to 24, 25 to 26, 27 to 28, 29 to 30, 31 to 32, and 33 to 34) and a given province in year *t* minus the corresponding value in Alberta. Relative rates of involuntary part-time employment equal the rate of involuntary part-time employment of unmarried men aged 17 to 34 in a given age group and a given province in year *t* minus the corresponding value in Alberta. Relative minimum wages equal the logarithm of real minimum wages in a given province in year *t* minus the corresponding value in Alberta. Relative annual rent equals the logarithm of median annual rent (in current dollars) in a given province in year *t* minus the corresponding value in Alberta. When using microdata, relative annual earnings equal the logarithm of nominal after-tax annual wages and salaries of worker *i* in age group *a*, firm size *f* and province *p* in year *t* minus the corresponding average value in Alberta. When using grouped data, relative annual earnings equal the average of log after-tax annual wages and salaries (in current dollars) of workers in age group *a*, firm size *f* and province *p* in year *t* minus the corresponding value in Alberta. RRSP stands for registered retirement savings plan.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Appendix Table 3
Impact of wages on mobility and interprovincial employment, unmarried men aged 17 to 24 — First sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0069	0.0092	0.0069	0.0092	0.0069	0.0092	0.0069	0.0092
Estimate of β_1 (wage parameter)								
Microdata								
Ordinary least squares (OLS)	0.001 **	0.000	0.001 **	0.000	0.001 **	0.000	0.001 **	0.000
Two-stage least squares (2SLS)	-0.217 ***	-0.127 **	-0.291 **	-0.149 *	-0.240 **	-0.123 **	-0.441 *	-0.258 †
Grouped data								
Weighted least squares (EWALD)	-0.018 ***	-0.009 †	-0.015 ***	-0.004	-0.016 ***	-0.005	-0.009 *	0.002
Two-stage least squares (2SLS)	-0.277 ***	-0.169 **	-0.365 *	-0.197 *	-0.289 **	-0.156 *	-0.611	-0.374
Number of clusters	36	36	36	36	36	36	36	36
Number of observations								
Microdata	679,888	679,888	679,888	679,888	679,888	679,888	679,888	679,888
Grouped data	1,152	1,152	1,152	1,152	1,152	1,152	1,152	1,152
Kleibergen-Paap Wald F-statistic (2SLS)								
Micro data	12.9	12.9	7.3	7.3	10.5	10.5	4.0	4.0
Grouped data	9.1	9.1	4.9	4.9	7.5	7.5	1.9	1.9

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 17 to 24 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 17 to 24 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 24 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 17 to 24 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 17 to 24 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 17 to 24 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

Appendix Table 4
Impact of wages on mobility and interprovincial employment, unmarried men aged 25 to 34 — First sample

	Model 1		Model 2		Model 3		Model 4	
	Outcome		Outcome		Outcome		Outcome	
	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta	Moving to Alberta	Getting a job in Alberta
Mean of dependent variable	0.0056	0.0043	0.0056	0.0043	0.0056	0.0043	0.0056	0.0043
Estimate of β_1 (wage parameter)								
Microdata								
Ordinary least squares (OLS)	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***	-0.001 ***
Two-stage least squares (2SLS)	-0.135 **	-0.004	-0.140 *	0.008	-0.120 *	0.007	-0.215	-0.006
Grouped data								
Weighted least squares (EWALD)	-0.003	0.000	-0.001	0.001	-0.001	0.002	0.003	0.004 †
Two-stage least squares (2SLS)	-0.141 *	-0.006	-0.147 *	0.010	-0.125 *	0.008	-0.253	-0.011
Number of clusters	45	45	45	45	45	45	45	45
Number of observations								
Microdata	460,183	460,183	460,183	460,183	460,183	460,183	460,183	460,183
Grouped data	1,439	1,439	1,439	1,439	1,439	1,439	1,439	1,439
Kleibergen-Paap Wald F-statistic (2SLS)								
Microdata	10.7	10.7	8.4	8.4	11.5	11.5	4.2	4.2
Grouped data	8.7	8.7	6.1	6.1	8.6	8.6	2.5	2.5

* significantly different from reference category (p<0.05)

** significantly different from reference category (p<0.01)

*** significantly different from reference category (p<0.001)

† significantly different from reference category (p<0.10)

Notes: The sample consists of unmarried male paid workers aged 25 to 34 who earned between $1,000 and $500,000 (in 2008 dollars) in year *t*, lived outside Alberta and were not involved in interprovincial employment that year. Model 1 includes real after-tax annual wages and salaries of unmarried male paid workers aged 25 to 34 relative to those of their counterparts (in given age and firm size categories) in Alberta. It includes no controls for housing costs. Model 2 adds median annual rent in a given province relative to that in Alberta as a control variable. Model 3 includes nominal after-tax annual wages and salaries of unmarried male paid workers aged 25 to 34 relative to those of their counterparts (in given age and firm-size categories) in Alberta. It also includes median annual rent in a given province relative to that in Alberta as a control variable. Model 4 deflates nominal after-tax annual wages and salaries of unmarried male paid workers aged 25 to 34 in a given province by median annual rent in that province. It does not include median annual rent in a given province relative to Alberta as a separate control variable. All models include control variables for the following: (a) attendance at postsecondary education institutions in year *t*, (b) being laid off in year *t*, (c) being laid off in year *t*-1, (d) being unionized in year *t*, (e) being covered by a registered pension plan or a deferred profit-sharing plan in year *t*, (f) annual contributions to registered retirement savings plans in year *t*, (g) the unemployment rate of unmarried men aged 25 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, (h) the rate of involuntary part-time employment of unmarried men aged 25 to 34 in a given age group and province in year *t* minus the corresponding value in Alberta, and (i) real minimum wages in a given province in year *t* relative to those in Alberta. Getting a job in Alberta means starting a new job in Alberta while maintaining residence in one's home province. P-values are based on standard errors clustered at the age group–province level.

Source: Statistics Canada, authors' calculations based on data from the Longitudinal Worker File.

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