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**Returns to Skill, Tax Policy, and North American
Migration by Skill Level: Canada and the United
States 1995 - 2001**

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Returns to Skill, Tax Policy, and North American Migration by Skill Level

Canada and the United States 1995-2001

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Abstract

Higher after-tax returns to skill in U.S. states compared to Canadian provinces have raised the issue that higher skilled Canadian workers especially will find migration to the U.S. economically attractive, and especially so after the North American Free Trade Agreement (NAFTA), provisions of which facilitate such cross-country migration through special visas. In this study we develop, estimate, and simulate a nested logit model of migration among 59 Canadian and U.S. sub-national areas using over 70,000 microdata observations on workers across all deciles of the skill distribution obtained from the U.S. and Canadian censuses of 2000/2001. Combining microdata on individual workers with area data, including estimates of after-tax returns by skill decile based on standardized wage distributions and large scale microsimulation tax models for Canadian provinces and U.S. states, we are able to consider the effects of tax policy differences across countries on worker migration. Our ability to identify highly skilled individuals using these data enables us to simulate the effects of changes to taxes (under balanced budget conditions) on the migration propensities of individuals as well as the magnitude of the aggregate migration streams. Simulations suggest that increasing Canadian after-tax returns to skill and implementing fiscal equalization (reducing the average Canadian tax rate to the average U.S. level with offsetting expenditure reductions to maintain budget neutrality) would effectively reduce southward migration and especially so amongst highly skilled workers. The required reductions in tax rates and public expenditures are relatively large however and therefore would be expected to raise other substantial public policy concerns.

JEL Classification: F22, H24, H71, J24, J31

Keywords: International migration, returns to skill, taxes, regional integration

Executive Summary

In the late-1990s, Canadian newspapers were filled with stories about how the country was losing its “best and brightest” citizens to the United States. Lower taxes south of the border, better employment opportunities, and favourable immigration provisions for educated Canadians created the perfect conditions for Canadians to leave their country of birth. And tens of thousands of Canadians did so.

In this study we quantify the effects of these and other factors on migration between Canada and the United States. We do so by developing, estimating, and simulating a nested logit model of migration among 10 Canadian provinces and 49 U.S. areas (the lower 48 states plus the District of Columbia) using over 70,000 microdata observations on workers across all deciles of the skill distribution obtained from the U.S. and Canadian censuses of 2000/2001. Using these data we are able to identify who migrated in the five-year period preceding these census dates, a period which corresponds to the debate about the “brain drain” from Canada to the United States.

We assume that each individual can be characterized by a unique position in the North America-wide skills distribution. We then assign each individual a position in one of ten skills deciles. We also estimate an after-tax return to skill distribution for each of the 59 areas. Total returns to skill are thus based on the individual’s position in the skills as well as the area-specific, after-tax returns to these skills.

After controlling for a number of area-specific and individual-specific factors that have shown to be important determinants of migration, we find that all individuals are attracted to areas with higher after-tax mean returns to skill (i.e., wages), and that higher skilled individuals tend to be attracted to areas with a more unequal returns to skills distribution as they are rewarded more handsomely for their skill endowment. Conversely, lower skilled individuals are attracted to areas with a more equal returns to skill distribution since they are penalized less for their lack of skill.

We perform counterfactual simulations which involve changing the returns to skill distribution in Canada to that which exists in the U.S., as well as decreasing taxes in Canada on average so that they equal the total tax incidence in the U.S., and decreasing expenditures by the same amount in

order to maintain a balanced budget (i.e., fiscal equalization). In both cases, migration from Canada to the U.S. is reduced amongst those at the upper end of the skills distribution, and migration between Canadian provinces is increased. Fiscal equalization has the largest effect on dampening skilled migration.

In sum, higher returns to skills are very attractive to Canadian skilled workers, and this attractiveness increases with skill level. Changing returns to skills in Canada to their values in the U.S. would significantly reduce the southward migration of Canadians. Reducing both taxes and public expenditures in Canada (to maintain a balanced budget), would also reduced skilled migration to the United States, but the required reductions are relatively large however and therefore would be expected to raise other substantial public policy concerns.

Returns to Skill, Tax Policy, and North American Migration by Skill Level Canada and the United States 1995-2001

Background and Motivation

Greater regional integration can raise issues concerning the cross-border migration of labour resources. The migration of high skilled workers from Canada to the United States (U.S.) presents one important example that has attracted significant policy attention. The debate typically is cast in terms of a Canadian brain drain to the U.S. (DeVoretz, 1999; Emery, 1999; Finnie, 2001; Frank and Belair, 1999).¹ The main economic and policy factors underlying the associated migration are relatively higher returns to skilled labour in the U.S., relatively higher tax rates in Canada, and lower costs of migration under the North American Free Trade Agreement (NAFTA). Much of this literature typically uses estimates of the migration of high skilled workers from Canada to the U.S. as a basis for assessing the relative size of the flow and how the size has changed over time. One study by Wagner (2000) measures the responsiveness of Canadian emigration probabilities to variations in after-tax returns to labour between Canada and the U.S. and finds there is some responsiveness but that it is limited.

The contribution of this paper is to analyze the issue using a discrete choice model of migration that encompasses multiple skill levels and geographic locations and that is based on utility maximization and Roy (1951) selection principles (e.g., Borjas, et al., 1992; Hunt and Mueller, 2004). This model is econometrically estimated with over 70,000 microdata observations on workers of various skill levels each of whom can choose among 59 geographic

¹ As discussed in this literature, the emigration of high skilled workers from Canada to the United States is only part of the overall picture of whether Canada experiences a brain drain. A comprehensive analysis of this issue requires identifying and measuring the emigration of all high skilled workers from Canada regardless of their country of destination, and comparing this against the immigration of skilled workers into Canada from all source countries. In addition, it is necessary to make an estimate of the substitutability of skill losses from emigration to skill gains from immigration. In this paper, we focus on the specific Canada-U.S. dimension of the issue which has received a large part of the attention in policy analyses.

areas distributed across the U.S. (lower 48 states and District of Columbia) and Canada (10 provinces). The migration period spans 1996-2001 which has the advantage of post-dating the adoption of NAFTA but pre-dating the events of September 11, 2001.² Each area's after-tax returns to skill are estimated using standardized wage distribution parameters derived from a specific application of Mincerian analysis (Hunt and Mueller, 2002) combined with the effective tax rates in each of these areas prevailing at each decile of the earnings distribution. The rates are computed by relatively large-scale microsimulation tax models specifically calibrated for the Canadian and U.S. areas. The information on after-tax returns is incorporated along with other key labour market and area attributes that have been established in the literature as important migration determinants. Individual characteristics including age, nativity, and ethnicity are also incorporated to proxy various well-known aspects of migration costs, as are interregional distances and the effect of the national border on migration costs.

The model's estimated parameters are consistent with *a priori* expectations and highly statistically significant, and therefore the model is simulated to obtain a sense of how effective Canadian effective tax rate reductions would be in lowering the migration, especially of high skilled workers. The results indicate that dropping average Canadian effective tax rates to average American levels would stem much of the Canada-U.S. migration. However, the required effective tax rate reductions are substantial and may raise other substantial policy issues.

Methodology and Data

Model of Individual Migration

We assume that an individual chooses an area of residence in order to maximize utility over the remainder of their work life. In their current area of residence (origin), utility is assumed

² NAFTA took effect starting January 1, 1994 and includes special North American work visas.

to depend on the after-tax wage, cost of living, other relevant origin area attributes, and the worker's personal characteristics. The worker's utility if he resides in another area depends on these same characteristics extant in this non-origin area plus the costs associated with moving. These costs include fixed costs associated with the act of moving itself such as psychic costs of leaving familiar surroundings, friends, and family (Day, 1992; Hunt and Mueller, 2004; Day and Winer, 2006). They also involve costs associated with the distance of the move and of crossing significant national and cultural boundaries (Hunt and Mueller, 2004; Poot, 2005; Poncet, 2006).

Following Hunt and Mueller (2004) and assuming a fixed retirement age and a constant discount rate, remaining work life indirect utility in non-origin area j for individual i currently residing in origin area o is

$$(1) \quad LV_{ij} = LV[y_i, C_i, w_{ij}, r_j, a_j, e_j, d_{i,o \rightarrow j}, b_{i,o \rightarrow j}, \rho]$$

where

y_i is the individual worker's age

C_i is a vector of characteristics relevant to fixed costs of moving for individual i

w_{ij} is the after-tax wage faced by individual i in area j

r_j is the rent in area j

a_j is a vector of amenity characteristics for area j

e_j is a vector of public expenditure characteristics for area j

$d_{i,o \rightarrow j}$ is the distance between individual i 's origin area (o) and non-origin area j

$b_{i,o \rightarrow j}$ equals unity if i 's move from o to j involves a border crossing, otherwise zero

ρ is a constant discount rate.

Following Borjas et al. (1992), the natural logarithm of individual i 's after-tax wage in area j can be written as

$$(2) \ln[w_{ij}] = \mu_j + \phi_j(v_i - \bar{v})$$

where μ_j is the mean (natural) log after-tax wage in area j , ϕ_j is the after-tax return to skills parameter in area j , v_i is the individual's skill level, and \bar{v} is the mean skill level. Because the individual skill term, v_i , does not include an area index (j), we are assuming that an individual's skills are not dependent on his or her region of residence. In other words, an individual's location in the skills distribution does not depend on their geographic location but only on the individual's human capital characteristics. Therefore, the only reason for an individual's wage to vary by region is due to variations in the wage generating process across areas – i.e., interarea variations in μ_j and ϕ_j in Equation (2).

As developed in Hunt and Mueller (2002, 2004), area-specific μ_j and ϕ_j estimates that are purged of differences in skill mix across areas can be computed with a standardized skill distribution and area-specific wage generation process information. The results, based on standardized after tax wage distributions, are

$$(3) \mu_j = E [\ln(w_{ij})^*]$$

$$(4) \phi_j = \left(\frac{\text{Var}[\ln(w_{ij})^*]}{\sigma^2} \right)^{0.5}$$

where sigma square is the variance of the standardized skill distribution and the asterisk indicates the standardized log after-tax wage distribution.

Substituting (3) and (4) into (2) implies that individual i 's log after-tax wage in area j depends on the mean and variance of the standardized log after-tax wage distribution, the variance of the skill distribution, and the individual's algebraic difference from the mean skill level (i.e., the individual's "skill differential"). So, an individual with a positive skill differential (i.e., an individual with above average skills) will have a higher log after-tax wage in an area

with a higher after-tax return to skills (i.e., a higher value of θ_j) than in an area with a lower after-tax return to skills. In contrast, an individual with below average skills will have a lower log after-tax wage in an area with higher after-tax return to skill. Since individuals with above average skills will receive higher after-tax wages in areas with higher returns to skills, higher skill individuals will receive higher utility in such areas, and *ceteris paribus*, will be more likely to choose such areas for any given cost of migrating.³ On the other hand, individuals with below average skills will receive higher after-tax wages in areas with lower after-tax returns to skill; and conditional on μ_j , such individuals will obtain higher utility in such areas and *ceteris paribus* will be more likely to choose such areas for any given cost of migrating.

Equations (2), (3), and (4) imply that Equation (1) can be rewritten as

$$(5) \quad LV_{ij} = LV[y_i, C_i, \mu_j, \theta_j(v_i - \bar{v}), r_j, a_j, e_j, d_{i,o \rightarrow j}, b_{i,o \rightarrow j}, \rho]$$

where $\theta_j(v_i - \bar{v})$ is the area's return to skills parameter times the individual's skill differential, and all other terms are as previously defined.

Econometric Specification

From a stochastic point of view, an individual worker's probability of choosing a particular area (P_{ij}) can be represented by

$$(6) \quad P_{ij} = \text{Prob}[(LV_{ij} + \varepsilon_{ij}) > (LV_{in} + \varepsilon_{in})], \quad j \neq n$$

where ε_{ij} is a stochastic disturbance term for the indirect utility of individual i in area j . We assume that this disturbance follows an extreme value distribution that has a correlation structure across areas that implies two clusters: (1) the origin, and (2) non-origin areas. McFadden (1978, 1981) has shown that this type of random utility process can be modeled as a nested logit. There are two nests: the origin and non-origin areas. The upper level of this nested logit model involves

³ See Roy (1951); Borjas, et al. (1992); and Hunt and Mueller (2004).

the decision to stay in the origin or to migrate to a non-origin area. Conditional on this choice, the lower level involves the choice of area. Because the origin nest has only one area, choosing to stay, at the upper level, implies that the lower level area choice is predetermined to be the origin. On the other hand, if the upper level choice is to migrate (i.e., leave the origin) then the lower level choice is among several areas (58 in this study) and is not degenerate. This particular lower level choice structure implies a partially degenerate nested logit model (Hunt, 2000; Hensher, Rose, and Greene, 2005).

The specific structure of the lower level choice is as follows. For the non-degenerate cluster ($j \neq 0$) conditional on migrating (m):

$$(7a) P_{ij|m} = \frac{\exp(\beta' \mathbf{x}_{ij})}{\sum_{k \in M} \exp(\beta' \mathbf{x}_{ik})}$$

where $\mathbf{x}_{ij} = [\mu_j, \phi_j(v_i - \bar{v}), r_j, \mathbf{a}_j, \mathbf{e}_j, d_{i,o \rightarrow j}, b_{i,o \rightarrow j}]$, β is a parameter vector, and M is the set of non-origin areas.

For the degenerate cluster ($j=0$) conditional on staying (s):

$$(7b) P_{io|s} = \frac{\exp(\beta' \mathbf{x}_{io})}{\sum_{k \in S} \exp(\beta' \mathbf{x}_{ik})} = 1$$

where β is a parameter vector, $\mathbf{x}_{io} = [\mu_o, \phi_o(v_i - \bar{v}), r_o, \mathbf{a}_o, \mathbf{e}_o]$, and S is the set that contains the origin area (s) as its sole element.

The structure of the upper level choice is as follows. For the migrating choice (m):

$$(8) P_{im} = \frac{\exp(\alpha'_m \mathbf{z}_i + \theta_m IV_{im})}{\exp(\alpha'_s \mathbf{z}_i + \theta_s IV_{is}) + \exp(\alpha'_m \mathbf{z}_i + \theta_m IV_{im})}$$

where $\mathbf{z}_i = [C_{io}, y_i]$ as previously defined, and the IV are inclusive value variables that summarize lower level utilities associated with each respective branch (stay, migrate) and bring this information into the upper level choice.⁴

For the stay choice (s):

$$(9) P_{is} = \frac{\exp(\alpha'_s \mathbf{z}_i + \theta_s IV_{is})}{\exp(\alpha'_s \mathbf{z}_i + \theta_s IV_{is}) + \exp(\alpha'_m \mathbf{z}_i + \theta_m IV_{im})}$$

where all terms are as previously defined.

Econometric identification requires a restriction on the alpha parameter vector, and we impose the restriction that $\alpha_m = \mathbf{0}$ implying that the estimates of upper level parameters reported in the next section are normalized on the decision to stay.

Individual Data

Individual data are obtained from the 2000 U.S. Public use Microdata Sample (PUMS) A and the 2001 Canadian Census Individual File. We include only non-institutionalised individuals between the ages of 25 and 64 who worked at least one week in the year prior to the census, were not self-employed, did not attend school either full or part time, and had at least \$1000 U.S. in real wage and salary income in the reference calendar year.⁵ In addition, only Canadian-born and American-born individuals are retained. This is to remove any confounding effects of third-country migrants between and within the two countries.

Due to computing limitations relative to the size of the contextual dataset given 59 areas and the large number of available microdata observations, it is necessary to subsample individual observations. This is accomplished as follows. We retained all recent immigrants to the other

⁴ See McFadden (1978, 1981).

⁵ The reference year for the U.S. is 1999 and for Canada it is 2000. Wage and salary incomes in Canada were deflated by the 1999 annual Canadian inflation rate and then changed into U.S. dollars at the 1999 exchange rate. This gives all earnings in real 1999 U.S. dollars.

country – i.e., those who had immigrated within five years of the census date.⁶ We also retained a subsample of U.S. internal migrants, and a smaller subsample in both countries of those who do not migrate internally or internationally in the five-year period. This subsampling strategy focuses on the groups for which we are most interested in analyzing.⁷

The sampling fractions resulting from the subsampling procedures are inverted and multiplied times the original census weights to obtain revised weights for each observation. These revised weights are applied to the corresponding components of the sample to generate the population represented by the sample. Table 1 shows sample sizes for both males and females. There are 37,573 males in the data, representing almost 47 million males in the two countries. Most of these individuals are stayers, while internal migrants are the second most numerous. The weighted population numbers are proportionately larger for stayers and internal migrants in the United States, and stayers in Canada, since they were subsampled whereas international migrants were not. The total female sample size is 33,329, representing a population of over 44 million. The data follow the well-established pattern in the literature: individuals generally tend to remain where they are (at least within the same province or state), internal migration is not common (less than 10 percent of the individuals are observed to have changed states or provinces), and that international migration is rare (less than one percent in each case).

There are interesting differences in the migration propensities of North Americans. Canadian internal migration rates are approximately half of those in the U.S. Of more relevance

⁶ The data do not allow us to differentiate between those emigrating from their country of birth and those emigrating from third countries. In all cases, we must assume that individuals are emigrating from their country of birth.

⁷ The original U.S. and Canadian census microdata files represent about a five percent and a three percent sample of individuals, respectively. Our subsampling maintains this sampling rate for migrants between the two countries and internal migrants in Canada, and it reduces the rate for internal migrants in the U.S. to 0.25 percent. For stayers in Canada, the subsampling reduces the original sampling rate by a factor of 10; and for stayers in the U.S., the subsampling reduces the original sampling rate by a factor of about 200. We chose to reduce the U.S. observations relatively more by subsampling because there is about an order of magnitude more individuals in the U.S. population than in Canadian population.

to the current study, the share of total migration (internal and between the two countries) represented by international migration between the countries is one about in six for Canadian males and one in seven for Canadian females. The shares for Americans are about one in 225 for U.S. males and one in 1325 for U.S. females. In terms of the weighted estimated population flows in Table 1, there were about 55,000 Canadian males and females who migrated to the U.S. ($32,748 + 21,966 = 54,714$). This represents a migration rate of approximately 0.7 percent using as a base Canadian stayers plus internal and international migrants. The migration rate to Canada by U.S. males and females was approximately 0.005 percent (two orders of magnitude smaller).

Ten years earlier (1986–1991), Canadian migration to the U.S. was about half as much (23,387) and the corresponding rate was about 0.33 percent.⁸ So, both the absolute numbers of Canadians migrating to the U.S., as well as the rate of migration, essentially doubled. Furthermore, the migration rate of highly skilled Canadians to the U.S. more than doubled between these periods. This is consistent with the increased concern about potential brain drain.

For each individual observation in our male and female samples, we have indicator variables for the individual's origin area (1995 or 1996), destination area (2000 or 2001), whether the individual was a stayer (origin equals destination area), a migrant (origin area does not equal destination area), whether the individual has Canadian nativity, and whether the individual's mother tongue is French. In addition, for each individual there is an age variable and variables for the individual's skill level, skill differential from mean skill level in the sample, and skill decile.⁹ Table 2 provides the corresponding variable names used in this study, along with the definitions and sources. Table 3 presents summary statistics.¹⁰

⁸ The 1986–1991 figures are from Hunt and Mueller (2004; Table 1).

⁹ Each individual can be placed in the North American skill distribution and assigned a skill level (index) and a skill decile. Moreover, a skill differential can be computed for each individual based on his or her skill index and the mean index in the population. Individual workers with positive (negative) skill differentials are above (below) the

Area Data

The data on area attributes are obtained from various sources as outlined in Table 2. Attributes for each of the 59 areas include mean after-tax wages (μ), after-tax returns to skill (ϕ), rental price index, employment growth rate, heating and cooling degree days, and public expenditures per capita on health care, education, debt service, and all other categories. All dollar values were deflated to real 1999 U.S. dollars using the corresponding country price deflators, and the Canadian values were converted to U.S. dollars using the 1999 exchange rate. All dollar values are therefore expressed in real 1999 U.S. dollars. Summary statistics are given in Table 3.

To compute the after-tax μ and ϕ variables, tax rate information is required along with standardized wage distribution data for each of the 59 areas. The method used to estimate standardized wage is documented in Hunt and Mueller (2002). A summary is provided in the Appendix. Tax rates are delineated by decile for each area based on the estimates presented in Ettliger, et al. (1996) for U.S. states and the Fraser Institute for Canadian provinces. These tax rates are then used to adjust wages by deciles to an after-tax basis. Table 4 presents selected tax rates used by area and decile.¹¹ The computations for Canadian areas rely on CANTASIM microsimulation model that uses a representative sample of 80,000 Canadian taxpayers incorporated in Statistics Canada's Social Policy Simulation Database and Model.¹² The computations for the U.S. areas are from the Institute on Taxation and Economic Policy's microsimulation tax model that uses a representative sample of 700,000 individual Americans.¹³

population skill average. The methods for developing individual skill data have been presented and implemented previously in the literature. See Hunt and Mueller (2002, 2004) for complete details.

¹⁰ Note that the descriptive statistics for ORIGIN and DEST are identical. This is because for each individual in the sample, ORIGIN and DEST each take the value of unity for only one of the 59 alternative areas for each individual, so the remaining 58 areas have values equal to zero. Thus, the means for these variables are $1/59 = 0.0169$.

¹¹ Although only selected tax rates are used in Table 4 (to economize on space) the full complement of these rates is used in all estimates below and are available upon request.

¹² Personal communication, Niels Veldhuis, Director, Fiscal Studies, The Fraser Institute, Vancouver.

¹³ Documentation is available at <http://www.ctj.org/html/whopay.htm>.

Contextual Data Interactions

As stated above, the distance between an individual's origin area and the various destination areas varies for individuals with different origins. The distance variable reflects this network aspect of distance. Border effects are modeled through interactive contextual data as well. If the individual originates in a Canadian province, then each of the U.S. states constitute a destination that involves crossing the national border. Similarly, for individuals originating in a U.S. state, migrating to a Canadian provincial destination requires crossing the national border. Thus, a border crossing indicator variable is defined for each Canadian-origin individual and set equal to unity for each U.S. state. Likewise, a border crossing indicator variable is defined for each U.S.-origin individual and set equal to unity for each Canadian province. Finally, the variable that captures the effects of variations in after-tax returns on migration propensities also involves an interaction of individual's skill differential and the area's after-tax returns to skill as specified in Equation (5) above. This variable is defined as $\theta_j(v_i - \bar{v})$, or the area's after-tax returns to skills parameter times the individual's skill differential. Again, definitions and sources for these variables are given in Table 2 and summary statistics are reported in Table 3.

Econometric Estimates

The parameters of the partially degenerate nested logit model of migration given in Equations (6) – (9) above is estimated with maximum likelihood. In the upper branch, Equations (8) and (9), individuals decide whether to remain in their origin or move to any of the other 58 destinations. The estimates of the upper level parameters are normalized on the stay choice. The stay-migrate decision is based on age, and by several additional cost-related factors including Canadian nativity, French mother tongue, and an individual's location in the skills distribution (separated into deciles). These factors are the components of the vector of individual

characteristics, C_i , specified in Equations (1) and (5) above. The stay-migrate choice also depends on the indirect utility received by residing in the origin or in a non-origin area, as discussed above. This is captured by the inclusive value (IV) variable.

All else equal, we expect age to have a positive effect on remaining in the origin because age tends to raise the psychic costs of moving and lower the number of years over which the benefits from migrating are realized. As discussed above, the migration rates of Canadians are about one-half those of Americans, so a Canadian nativity variable is included and is expected to raise the probability of staying in the origin. French mother tongue is also expected to increase the probability that an individual stays in the origin.¹⁴ Hunt and Mueller (2004) find strong evidence that migration costs vary inversely with skill level. This is captured by the indicator variables for each of the skill deciles.¹⁵ The pattern of estimates on these indicator variables for skill deciles is expected to be decreasing as we move from lower to higher skill deciles.

In the lower branch of the partially degenerate nested logit model, Equations (6) and (7), individuals decide in what area to locate conditional on the choice to stay or migrate at the upper level. The lower level choice is degenerate if the upper level choice is to stay since the origin area is the only area consistent with a choice to stay. Choice of area is based on several area attributes and their interaction with individual characteristics. The after-tax mean wage (MUAT) in each area and the area-specific after-tax returns to skills (PHIAT) are two key area attributes in this study. Because the utility effect of returns to skills depends on an individual's skill level, an area's after-tax returns to skill are interacted with the individual's position in North American skills distribution measured by their skill differential (SD). The variable that captures the returns to skills effect on area choice is therefore PHIATSD ($= \text{PHIAT} * \text{SD}$). Because both MUAT and

¹⁴ This variable captures the apparently higher perceived costs of migration for French Canadians as found in other studies of migration (e.g., Hunt and Mueller, 2004; Finnie, 2005; Day and Winer, 2006).

¹⁵ The first decile is the group omitted to avoid the dummy variable trap.

PHIATSD relate directly to the benefits of an area, each is expected to have a direct relationship with probability of choosing an area.

The variation in the cost of migration with distance migrated is captured with a variable that measures the distance from the origin to the destination (DIST). It is expected to vary inversely with probability of area choice. To proxy both cost of living differences across areas and urban consumption amenity access, an index of rental prices for each area (RENT) is specified. The cost component would impart an inverse relationship with area choice while the amenity component would impart a positive relationship with area choice *ceteris paribus*.¹⁶ The employment growth rate in an area from 1995 through 2000 (EGROW) is expected to raise the attractiveness of an area, whereas more immoderate temperatures, measured by heating and cooling degree days (HDD and CDD), are expected to lower an area's attraction.¹⁷

We also specify per capita public expenditures on health care (XHSPC), education (XEDPC), debt service (XDSPC), and other (XOTHPC). Variations in the level and mix of public expenditure may influence the relative attractiveness of areas.¹⁸ In addition, the availability of these variables in the empirical model permits us to conduct simulations that enforce a balanced budget constraint (see below).

To account for any additional psychic or monetary costs associated with crossing the international border, we add a dummy variable for border effects. For Canadian-origin workers, this variable is set equal to unity for each of the U.S. areas, and zero otherwise (COUD). For

¹⁶ Because area rents are also directly related to consumption amenities present in different areas, it is possible that this positive amenity effect could dominate the negative cost of living effect leading to a direct relationship between RENT and area choice probability (Graves, 1983). Hunt and Mueller (2004) obtain this direct relationship.

¹⁷ The relation of employment opportunities and climate amenities in area choice has a long tradition in the migration literature (see Greenwood, 1975; Graves, 1983; Greenwood and Hunt, 1989; Knapp and Graves, 1989; Hunt, 1993; Hunt and Mueller, 2004).

¹⁸ Helms (1985) finds empirical support for the role of taxes and public expenditure mix in the variation of income growth rates across U.S. states. Although his study does not directly involve migration, his model is based on the influence that taxes and expenditures have on the location of mobile factors of production including labour.

American-origin workers, the corresponding variable is set equal to unity for each Canadian province, and zero otherwise (UOCD).¹⁹ The substantive literature on national border effects finds that national borders do exert an additional cost.²⁰

Finally, the choice of area at the lower level is conditional on the upper level choice to stay or migrate. The upper level choice is also influenced by the maximum indirect utility obtainable in the origin and all other areas. So, area attributes that influence lower level choice also impact upper level choice. This feature is captured by the inclusive value (IV) variable that appears at the upper level in each branch: stay and migrate. The IV brings up the lower level maximum utility from each of the two sets of nests at the lower level. As shown by McFadden (1978, 1981), consistency with utility maximization requires that the parameter estimates on the IV variables be within the [0,1] interval. As Hunt (2000) shows, a partially degenerate nested logit structure must also have the two parameters equal in value if the model is estimated in non-normalized form (as in this study).²¹ The estimates in Table 5 meet these requirements.

As demonstrated by Hunt and Mueller (2004) and Day and Winer (2006), the signs of the estimated coefficients coincide with the direction of effect of the corresponding variable. However, the marginal magnitude of each variable's effect is not equivalent to the magnitude of the estimated coefficient. In order to provide quantitative impacts, in the next section of the paper simulations are performed with the estimated model.²²

¹⁹ COUD is interpreted as "Canadian Origin-U.S. Destination;" and UOCD is interpreted as "U.S. Origin-Canadian Destination."

²⁰ See Helliwell (2005); Hunt and Mueller (2004).

²¹ The non-normalized form is also used in Hunt and Mueller (2004). For technical details on alternative nest logit model forms see Koppelman and Wen (1998); Hunt (2000); and Hensher, Rose and Greene (2005).

²² In addition, the standard marginal effects that can be calculated with the estimated coefficients of our nested logit model do not provide the quantitative information in which we are interested. We want to know the effects of changing after-tax returns on Canadian migration to the 49 U.S. areas as a group. However, the standard marginal effects calculations provide quantitative information on the marginal effects of varying after-tax returns in one specific area (e.g., British Columbia) on migration between that area and one specifically chosen alternative area

Two maximum likelihood estimates are presented in Table 5 for both males and females. Specification A does not distinguish the effects of public expenditures by skill deciles while Specification B allows for variations in effects for deciles 1–5 and 6–10. All parameter estimates carry the expected sign and are highly statistically significant.²³ The IV parameter estimates are in the interval [0,1] as required for consistency of the estimated nested logit model with the principle of utility maximization.²⁴

In all estimates of the upper branch (stay-migrate choice), age is positively related to the probability of remaining in one's origin. Also, the probability of remaining in the origin displays a decreasing pattern as skill decile increases, meaning that individuals with higher (lower) skills are more (less) mobile, *ceteris paribus*. Canadian natives and francophones are have higher probabilities of staying in their observed origins, *ceteris paribus*, and are therefore less mobile.

The lower branch parameter estimates indicate that higher after-tax mean area wages (MUAT) result in increased migration to these areas. Moreover, the higher an area's return to skills, the more (less) likely a higher (lower) skilled individual is to migrate to the area (or to stay in the area if it is his or her origin area). In other words, those with higher than average skills tend to be attracted to areas where these skills are rewarded more highly. Conversely, those with less than average skills will not be attracted to these areas, but to areas where having lower skills is less of a wage disadvantage. These are important results for this study of how returns to skills impact the sorting of workers by skills across areas. As will be discussed in the next section, after-tax returns were lower in Canada than in the U.S. during the latter half of the 1990s. Given

(e.g., Washington). We can obtain quantitative migration effects of policy changes for all Canadian areas through appropriate simulation of the estimated model, and this is the approach that we employ.

²³ As discussed above, the rental index proxies for both the cost of living *and* consumption amenities. A relatively strong amenity effect is consistent with a positive sign on the rental index (Graves, 1983; Hunt and Mueller, 2004).

²⁴ The non-normalized form of the partially degenerate nest logit model is estimated, and as indicated previously, this form of the model requires that the IV parameters in the stay and the migrate branches be equal. This constraint is implicit in the reporting of only one common IV parameter estimate for each specification. See Koppelman and Wen (1998); Hunt (2000); and Hensher, Rose and Greene (2005) for additional technical details.

our empirical results, this situation created economic incentives for higher skilled Canadian workers to migrate to the U.S.²⁵

Distance (DIST) is expected to discourage migration. In all specifications, the estimates confirm this expectation with very high statistical precision. The rental index variable (RENT) is positive and significant and likely reflects the strength of the consumption amenity effect relative to the cost of living effect. Since we are unable in this study to specify all potential consumption amenities, the rental index seems to be picking up some of this effect. Consistent with expectations and a large number of studies in the migration literature, the coefficient on area employment growth rates (EGROW) is estimated to be a positive influence on migration and area choice. Heating and cooling degree days (HDD and CDD) proxy the amenity effects of climate in this study. The negative parameter estimates on these climate variables imply that the more temperatures in an area depart from 65 degrees Fahrenheit the less attractive an area is. This is consistent with expectations and previous work.²⁶

We control for public expenditure mix effects on area choice and migration by specifying four per capita variables: health care expenditures (XHSPC), education expenditures (XEDPC), debt service expenditures (XDSPC), and all other public expenditures (XOTHPC). Some of these are estimated as being attractive for area choice and others are estimated as being negative. In Specification B, variations in the effects are entertained for higher and lower skilled individuals and some differences in attractiveness across these skill groups are revealed.²⁷ Importantly for this study, the results for the after-tax mean wage and returns to skills estimates are robust to the specification of the public expenditure variables across all specifications.

²⁵ It also created incentives for lower-skilled workers to select Canadian provinces as areas in which to reside and work.

²⁶ For example, Hunt and Mueller (2004).

²⁷ Day and Winer (2006) estimate varying effects on internal Canadian provincial migration of public expenditures health, education, and other functions.

Finally, the estimates on the national border effects: Canadian origin-U.S. destination (COUD) and U.S. origin-Canadian destination (UOCD) are both negative, indicating that migrants in either country are much less likely to cross the 49th parallel than to move internally. These results are qualitatively and quantitatively similar to the findings of Hunt and Mueller (2004) on North American migration in particular; and are consistent with the general findings about the deterring effects of national borders on trade and other cross-country interactions.²⁸

In summary, the maximum likelihood estimates of our partially degenerate nested logit model of Canadian-U.S. migration and area choice are correctly signed, highly statistically significant, and consistent with the utility maximizing principle. Conditional on a variety of important individual and area variables that influence the decision to stay or migrate, and the related choice of area, we find that all individuals are attracted to areas with higher after-tax mean wages (i.e., higher values of MUAT). In addition, and very importantly for this study, we also find that higher skilled individuals are differentially attracted to areas with higher after-tax returns to skills (i.e, higher PHIAT and PHIATSD). These results are robust to two alternative specifications of public expenditure mix across Canadian and U.S. areas. The important implication of this finding is that U.S. areas should be more attractive to higher skilled workers than Canadian areas during the latter part of the 1990s because after-tax returns in the U.S. were higher. We now turn to a quantitative analysis based on simulations of our estimated model.

Simulations

We use our estimated Model B to simulate how changes in incentives affect the migration of workers by skill level between Canada and the U.S. There are several steps that we take in developing the simulations. First, we use our estimated model to predict area choices for all

²⁸ For example, see Helliwell (2005).

Canadian-origin and all American-origin workers in our sample. These predictions use the observed variable values in the model and are disaggregated by selected skill deciles and gender. These results form a baseline from which the results from alternative simulations are compared.

The second step computes counterfactual values of key variables such as MUAT and PHIAT. We equalize the average values of these key variables between by setting the Canadian mean value to that of the U.S.'s observed value. These variables are presented in Table 6. For example, the observed U.S. value of MUAT is about 10 percent higher than the Canadian value. Equating these two values implies a counterfactual Canadian value of MUAT that is about 10 percent higher than the observed value of 5.6257 (for males). Likewise, the observed U.S. value of PHIAT is just over twice that for Canada, and so the Canadian value is increased by this magnitude. The data for the variable TAX in Table 6 represent the average tax incidence in the two countries. Since the observed U.S. incidence is about 70 percent of the Canadian incidence, equalization of TAX implies about a 30 percent reduction in TAX for Canada. This equalization of tax incidence is used to reduce public expenditure variable levels in Canada to achieve fiscal equalization in simulations that equate MUAT and PHIAT between the two countries.

The third step in the simulation exercises is to use the counterfactual data to predict the resulting area choices and migration for Canadians and Americans at various skill levels by gender. These counterfactual predictions are compared to the baseline simulations to determine the quantitative effects of the changes in MUAT and PHIAT, and from fiscal equalization (i.e., equalization of U.S. and Canadian MUAT and PHIAT with compensating reductions in Canadian public expenditures). It is these contrasts that provide empirical insights into the effects on Canadian-American migration of changes in Canadian returns to skills and fiscal equalization. All simulations are microdata simulations using the full set of more than 70,000 observations.

Baseline Simulations

Tables 7 and 8 presents the simulation results for Canadian-origin and American-origin individuals, respectively.²⁹ In each we ultimately are interested in the effects of changes (in Canada) on the migration of individuals to the U.S., and differences in these effects in various regions of the skill distribution. First, we must compute a baseline simulation, a necessity since the empirical model's predictions do not perfectly replicate the observed data. The two columns in Table 7 under the heading "Observed" give the weighted numbers of Canadian-origin males and females by migrant type (i.e., stayers, internal migrants, and international migrants) observed in our data. For example, of the 4,109,123 Canadian-origin males, 3,912,121 (95.20%) were stayers – those whose origin in 1996 was the same as their destination in 2001. Internal migrants among this group were 164, 254 (4.00%); and migrants to the U.S. were 32,748 (0.80%).³⁰ Note that individuals at lower skills deciles are less likely to migrate both within Canada and between Canada and the United States. In contrast, Canadian males in the tenth decile are slightly more likely to migrate within Canada compared to the average (4.11% versus 4%) but are almost seven times more likely than the average Canadian resident to have moved to the U.S. (5.45% versus 0.80%). The same pattern holds for Canadian females.

The next two columns to the right in Tables 7 and 8 under the heading "Baseline Simulation" report the results of the baseline simulations which use the observed values of the explanatory variables to predict the number of stayers, internal migrants, and between country migrants. These baseline simulations show that the empirical model has performed rather well. For both males and females, the model tends to overestimate the extent of migration at lower

²⁹ An individual observed in 1995 to be located in a U.S. state is referred to as an American-origin individual; and an individual observed in 1996 to be located in a Canadian province is referred to as a Canadian-origin individual.

³⁰ The sum of observed stayers, internal migrants, and migrants to the U.S. (or, to Canada for U.S.-origin individuals in Table 8) will equal (within rounding error) the corresponding figures in Table 1.

deciles, and underestimate international migration but slightly overestimate internal migration at higher deciles. Despite this, the migration patterns between deciles are essentially preserved in the baseline simulations compared to the patterns in the observed data.

The results for American-origin males and females (Table 8) show that Americans are much more (less) mobile internally (internationally) compared to their Canadian counterparts. And while the baseline simulations in these cases tend to predict the actual number of stayers and internal migrants accurately on average, the model tends to overestimate the numbers going to Canada at lower deciles, while underestimating the number at high deciles.

Alternative Simulations

In this section we are interested in performing counterfactual simulations with the estimated nested logit model. Each is conducted by adjusting specific variable values in Canada to equal the corresponding values observed in the U.S, based on the data in Table 6.

Returns to Skill

As indicated in Table 6, the mean wage level is higher in the United States, and returns to skills are also substantially higher. In terms of our Roy model, this structure of cross-country returns implies that lower-skilled Canadians would have an incentive to stay in Canada whereas the higher skilled would have an incentive to migrate south. Harris and Lemieux (2005) write:

The lower level of inequality in Canada makes the United States particularly attractive to high-income Canadians who typically earn substantially less than their U.S. counterparts. If free trade and economic integration had pushed income inequality in Canada to the U.S. level, we would likely not have seen this systematic migration of highly skilled and high-income Canadians to the United States. (p. 18)

Hunt and Mueller (2004) also find that equalizing PHI across the two countries, but on a before tax basis not an after tax one, confirms these predictions with respect to migration selectivity.

However, they find that the magnitude of the effect is relatively small.

We are able to simulate the effects of these returns to skill factors on an after-tax basis. To do so we raise the value of both MUAT and PHIAT in Canadian provinces by the amount of the mean difference of both variables' values in Canada versus the U.S. In other words, mean values are equalized between the two countries while the relative differences between provinces (and between states) are preserved. This type of equalization might occur, for example, if institutional factors such as employment insurance, minimum wages, labour laws, etc. were changed in Canada, if returns to skills changed in response to shifts in the relative demand or supply of various skills, or if there were changes in the capital stock.

The results of these simulations are presented in Tables 7 and 8 under the headings “MUAT and PHIAT Equalized” and “PHIAT Equalized,” respectively. For both Canadian-origin males and females – and for all skills deciles – migration within Canada increases while migration to the United States *decreases* when MUAT and PHIAT are both equalized. For all Canadian-origin males, the rate of migration to the U.S. drops nearly one-half, to 0.43% from a baseline rate of 0.94%. The rate decreases are progressively larger the higher the skill decile, reflecting the fact that the gains from the equalization of MUAT and PHIAT vary directly with skill level.³¹ For example, for males in the tenth skill decile there is a drop of about two-thirds compared to the baseline. For females in the tenth decile, the drop is larger: about 75 percent.

For U.S.-origin individuals, equalization of these two parameters has the effect of attracting more Americans to Canada, with the results most pronounced at the upper tail of the skill distribution, especially for males.

Increasing only PHIAT in Canada to equal the average value in the United States does little to change either the total number of internal migrants or the number of Canadians migrating

³¹ Recall that it is the interaction of PHIAT and SD that is a regressor in the model (Table 5) and that SD is inter-regionally invariant. As a result, it is changes in PHIAT that will influence destination choice; and raising PHIAT in Canada raises PHIATSD more for workers with higher values of skill differential (SD).

to the U.S. However, there are large differential effects across deciles as expected. When PHIAT is equalized, the after-tax returns to skills in Canada are substantially increased, thus making Canadian areas more attractive for higher skilled workers but less attractive for the lower skilled. The differential pattern of migration responses can be seen in Table 7 under the heading “PHIAT Equalized.” For both genders at the middle of the skills distribution there is little change. For those at the lower tail however, there are sizeable increases in migration to the U.S., whereas there is sizably lower migration to the U.S. for those at the upper tail. These results are consistent with Hunt and Mueller (2004). Moving to the U.S. no longer penalizes individuals at the lower tail of the skills distribution as much, so migration increases. Conversely, those at the upper tail are no longer rewarded as handsomely in the U.S. labour market.

For American males and females, migration to Canada amongst those at the upper tail is enhanced since higher skills will now be rewarded more in Canada. For those in lower deciles, however, migration to Canada is reduced since the lack of skills is now relatively penalized. As expected, the results obtained in this PHIAT equalization simulation are just the opposite for U.S.-origin workers as indicated in Table 8. The reason why an equalization of both PHIAT and MUAT, as in the previous counterfactual simulation, raises the migration of all deciles of American workers to Canada is that the positive effect of raising average after-tax returns to labour in general, by raising MUAT, is enough to more than offset the negative effect for workers in lower skill deciles of an increase in the after-tax returns to skill (PHIAT).

Fiscal Equalization

In spite of the fact that much of the debate about Canada-U.S. migration in the 1990s was framed around higher Canadian income taxes, little evidence has been presented on the magnitude of the effect on the migration decision of Canadians. Davies (2003) has noted that

there exist significant human capital externalities which result in growth, but the income tax system tends to tax investments in human capital at a higher rate than other forms of investment. Collins and Davies (2003) find that the effective tax rate on human capital is higher in Canada than in the United States, especially for higher income earners; and that this could harm Canada in two ways: by reducing the incentive to invest in human capital, and by increasing incentives to migrate to the United States for those who have higher levels of human capital. Collins and Davies (2003; p. 480) also note: “The magnitude of that flow [from Canada to the United States] depends on the elasticity of migration with respect to the tax differential – something outside the scope of this study but deserving of further research.”

Frank and Bélair (1999) study Canadian college graduates who locate in the U.S. and their stated reasons including economic ones. Wagner (2000) attempts to quantify the role that lower taxes in the U.S. compared with Canada play in migration to the U.S. from Canada. He finds that there are tax savings and that these savings do induce migration to the U.S. However, he concludes that the magnitude of the effect is relatively small. We offer some additional insight through a fiscal equalization simulation of our nested logit model of cross-country migration.

To test the quantitative effects of a reduction in taxes in Canada on migration to the U.S., we reduce the average tax rates in Canada to those of the United States. We then use our estimated model to simulate the effects of the equalized average tax burden in Canada to that in the U.S. Based on the information in Table 6, equalization requires reducing the average burden in Canada from 38.8% to 27.6%. This reduction of nearly 30 percent is applied across the board at each of the ten deciles to commensurately reduce the tax rates in each Canadian province. In order to maintain a balanced budget, we also reduce per capita non-debt service expenditures in

each province across the board by the same relative amount. We call this counterfactual simulation “Fiscal Equalization” and the results are presented in Tables 7 and 8.

These changes induce two basic changes to migration incentives: MUAT and PHIAT increase substantially, and per capita non-debt service public expenditures decrease significantly. The first change in migration incentives lowers the migration of workers from Canada to the U.S. as in the previous counterfactual simulations that equalized MUAT and PHIAT jointly. The second change in incentives involves lower per capita spending in Canada. The reduction in non-debt service public expenditures across the board will impact migration as indicated by the signs on the estimated coefficients. Reductions in health care expenditures will lower an area’s attractiveness, but less so for higher skilled workers. Reductions in the other two non-debt service categories will increase an area’s attractiveness; more so for higher skilled workers.³²

The results for Canadian males and females show that *fiscal equalization would dramatically reduce migration to the United States* while increasing inter-provincial migration. Across all skill levels, the migration to the U.S. falls by *an order of magnitude* from the mid-30,000s to the mid-3,000s. In terms of rates, this implies a decline from about 0.9% for all workers, to about 0.09%. Moreover, for both males and females, the relative size of these migration effects increases as we move up the skill distribution.³³ The corresponding results in Table 8 for U.S.-origin workers shows increases in migration rates to Canada for all skill groups.

³² Some authors have found that lower-skilled workers may be more highly attracted than higher skilled workers to areas with more public transfers. This is the “welfare magnet effect” according to Böheim and Mayr (2005). In Table 8, we find that U.S.-origin workers from lower deciles do increase their migration rates to Canada in this fiscal equalization simulation and that the increase is greater than that amount accounted for by the increase in MUAT (compare results from “MUAT and PHIAT Equalization” to “Fiscal Equalization”). This could be reflecting such a welfare magnet effect. Since our public expenditure data do not separate out transfer payments specifically however, we cannot confirm this interpretation.

³³ This is consistent with Jackson (2005; p. 304) who noted: “Public opinion research shows that only the very affluent have strongly supported the tax cut agenda, not least because the U.S. model of low taxes and low social service provision would leave them better off.”

Conclusions

We investigate the effect of differentially higher *after-tax returns* to workers in the U.S., especially higher skilled workers, on the propensity of Canadian workers to migrate to the United States during the period 1995–2001. We develop a contextual data set that combines over 70,000 individual U.S. and Canadian worker observations spanning with data on 59 alternative areas in North America: 10 Canadian provinces and the lower-48 U.S. states and the District of Columbia. The individual data provide controls for a variety of important migration cost and return factors and permit the identification of worker skill level. The area data allow us to measure returns to workers overall, as well as differential returns by skill level, between U.S. states and Canadian provinces on an *after-tax* basis. In addition, area data permit us to control for other important determinants of migration including distance, border effects, amenities, employment opportunities and their growth, and the level and mix of public expenditures.

We use these contextual data to obtain maximum likelihood estimates of a partially degenerate nested logit model of Canadian-U.S. migration and area choice. Parameters with *a priori* expectations have estimates that are correctly signed, highly statistically significant, and also consistent with the utility maximizing principle. Conditional on a variety of important individual and area variables that influence the decision to stay or migrate, and the related choice of area, we find that all individuals are attracted to areas with higher after-tax mean wages (i.e., higher values of MUAT). In addition, and very importantly for this study, we also find that higher skilled individuals are differentially attracted to areas with higher after-tax returns to skills (i.e, higher PHIAT and higher PHIATSD). These results are robust to two alternative specifications of public expenditure mix across Canadian and U.S. areas. The important implication of is that U.S. areas should be more attractive to higher skilled workers than

Canadian areas because after-tax returns in the U.S. were higher than in Canada. We now turn to a quantitative analysis of this issue based on simulations of our estimated model.

We use our estimated model to conduct counterfactual simulations that involve the equalization of after-tax returns to labour and to skill between Canada and the U.S. and fiscal equalization. The latter counterfactual requires that Canadian non-debt service public expenditures to be reduced sufficiently to maintain a budget balance in the face of the reduced tax rates required for after-tax returns equalization with the U.S. Both sets of simulations indicate that Canadian migration to the U.S. is reduced and that the reductions are relatively larger for workers in higher skill deciles. Fiscal equalization is predicted to have the largest effects reducing Canadian-U.S. migration to nearly zero for all skill levels.

In the first counterfactual simulation that involves equalizing after-tax returns to labour and to skills, Canadian-origin males and females – across all skills deciles – respond with increased migration rates within Canada while migration to the United States *decreases*. For all Canadian-origin males, the rate of migration to the U.S. drops nearly one-half, to 0.43% from a baseline rate of 0.94%. The rate decreases are progressively larger the higher the skill deciles of the workers. This reflects the fact that the gains from the equalization of returns to skills vary directly with skill level. For example, for males in the tenth skill decile there is a drop of about two-thirds compared to the baseline. For females in the tenth skill decile, the drop is larger: about 75 percent. For U.S.-origin males and females, equalization of these two parameters has the effect of attracting more U.S. workers to Canada. Again, the results are most pronounced for those at the upper tail of the skills distribution for the same reason.

The counterfactual simulation results for Canadian males and females show that *fiscal equalization would dramatically reduce migration to the United States* while increasing inter-

provincial migration. Across all skill levels, the migration to the U.S. falls by *an order of magnitude* from the mid-30,000s to the mid-3,000s over the five-year period 1996-2001. In terms of rates, this implies a decline from about 0.9% for all workers, to about 0.09%. Moreover, for males and for females, the relative size of these migration effects increase as we move up the skills distribution. The corresponding results for U.S.-origin workers show increases in migration rates to Canada for all skill groups.

In summary, our econometric estimates demonstrate very strongly that higher returns to labour and to skills in the U.S. are attractive to Canadian workers and that the attraction increases with skill level. Simulations based on these econometric estimates indicate that equalizing Canadian returns to labour and to skills to those extant in the U.S., during 1995–2001, would substantially reduce Canadian labour force migration to the U.S. and that these reductions get progressively larger in relative terms at higher and higher skill levels. Fiscal equalization which involves equalizing average tax rates and reducing Canadian public expenditures sufficiently to produce a balanced budget, is shown through microdata simulations to nearly eliminate Canadian labour force migration to the U.S. at all skill levels.

Our results show that differentials between the U.S. and Canada in returns to labour and to skills during 1995–2001 increased the flow of workers from Canada to the U.S. and that these migration effects were relatively greater for higher skilled workers. Our simulations indicate that these worker migrations would have been substantially reduced with equalization of returns to labour and to skills across the countries, and the migrations would have been almost eliminated under a policy regime of fiscal equalization. Implementing such a fiscal equalization policy requires substantial relative adjustments to Canadian tax rates and public expenditures and would likely raise other substantial policy concerns.

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Appendix

Methodology for Calculating *MU* and *PHI* Based on Hunt and Mueller (2002)

1. Area Mean Log Wage (μ_j)

In equation (3), μ_j is equal to the expected value of the standardized log wage distribution for area j . We compute an estimate of this expectation for each of the 59 areas by specifying a Mincerian-style log wage equation for individuals that incorporates explanatory variables related both to skill-level factors (such as years of schooling and potential experience) and to non-skill-level factors potentially influencing the wage (such as metropolitan residence status and amenities). This equation is estimated with ordinary least squares (OLS) separately with a sample of microdata observations from each area and for each gender. We then partition the entire sample, irrespective of area, into two subsets: males and females. For each of these subsets, we compute the mean of each of the right-side variables specified in the equation, using the entire sample of males or females across all 59 areas. Using these means in the estimated equation, we compute the predicted log wage for each group in each of the 59 areas. These predicted log wages constitute our estimates of the 59 area-mean log wages for both males and females. By using the entire sample of both males and females across all 59 areas, we are able to control for interarea differences in skills mix that would otherwise affect the area specific estimates of μ_j , thereby achieving an estimate for a standardized distribution of skills.

2. Area Returns to Skills(ϕ_j)

Equation (4) states that an area's ϕ_j value equals the square root of the ratio of the variance of the area's log standardized wage distribution and the variance of the overall standardized skill distribution (σ^2). To get an estimate of the variance of the log wage distribution in each area for the standardized skills distribution, we use the estimated Mincerian-style equations, again introducing the group-specific means computed from the entire sample of males or females, for each of the non-skill-related variables. Summing these terms with the estimated constant parameter yields an area-specific, constant effect on group members' log wages for each area. This constant effect does not play a role in $\text{Var}[\ln(w_{ij})^*]$. We next compute the estimated effect of the skill-related terms on each individual group member's log wage in area j . For these calculations, the entire sample of group members is used, irrespective of area. We refer to this result as the area-specific returns-to-skills effect for each individual. We then compute the variance of these individual area-specific returns-to-skills effects by group. These area specific estimated variances are our estimates of $\text{Var}[\ln(w_{ij})^*]$.

Each area-specific estimate for a gender gives an estimate of the variance of the log wage distribution for the group-specific standardized skills distribution. In order to obtain an estimate of the variance of the standardized skills distribution for each group irrespective of area, we obtain OLS estimates of the skill and nonskill factors specified in our Mincerian-style equation

for all individuals in a group, using the entire male or female sample irrespective of area of residence. In this case, we also specify area-specific fixed effects to capture variation in wages due to area-specific amenity or other unspecified nonskill factors. The estimated parameters on the nonskill factors and fixed effects represent effects that influence the location of area log wage distributions but not their variance. The variance of the standardized skills distribution can be estimated for each group by first introducing the group means of the non-skill-related variables (based on the entire sample) into this estimated version of the Mincerian-style log wage equation, and then computing the result for each group. Because group means are used, the result will not influence the variance. Second, we introduce each individual group member's value for the skill-related variables into the estimated equation and compute the individual-specific result. These individual results provide an estimate of the returns-to-skills effect for each individual in each of the two groups. Finally, an estimate of σ^2 for each gender is provided by computing the variance of the individual returns for each gender. An estimate of the returns-to-skills parameter for each area can now be computed for each group as stated in Equation (4). The estimate of ϕ_j for each area measures the returns-to-skills variance in each of the areas for the standardized skill distribution, relative to the returns-to-skills variance for the standardized skill distribution computed across all areas. If an area's ϕ_j value is greater than (less than) unity, then the area's returns to skills is greater than (less than) the returns-to-skills variance across all areas. Because each term, $\text{Var}[\ln(w_{ij})^*]$, and σ^2 are computed with the same group of individuals, the skill mix is held constant in each term, and therefore the ratio of the terms reflects differences in returns to skill among the 59 areas. As in the computation of μ_j , the use of a fixed group of individuals to compute each area's ϕ_j achieves a standardized measure.

Table 1: Number of Sample Observations and Corresponding Populations by Country and Gender

	Males				Females			
	Unweighted		Weighted		Unweighted		Weighted	
	U.S.	Canada	U.S.	Canada	U.S.	Canada	U.S.	Canada
Nonmigrants	10,215	10,585	38,597,750	3,912,121	9,913	9,776	36,841,870	3,620,652
Internal migrants	10,829	4,441	4,282,786	164,254	9,097	3,473	3,526,468	128,594
Migrants: U.S. to		51		1,888		67		2,661
Migrants: Canada to	1,453		32,748		1,000		21,966	
Country total (individuals)	22,497	15,077	42,913,284	4,078,263	20,010	13,316	40,390,304	3,751,907
Total Observations (N) ^b	37,573		46,991,547		33,329		44,142,211	
Rows of data (Nx59) ^c	2,216,807				1,966,411			

^aImmigrants who arrived within the last five years (1995-2000 for Canada to U.S. and 1996-2001 for U.S. to Canada).

^bTotal number of individual observations (N).

^cEach individual has 59 alternative area choices. Therefore the number of rows in the data set is equal to Nx59.

Table 2: Variable Names, Definitions, and Sources

Variable	Name	Definition	U.S.	Canada
<i>Individual Variables</i>				
Origin area (1995, 1996)	ORIGIN	"= 1 if individual's origin, 0 otherwise	a	b
Destination area (2000, 2001)	DEST	= 1 if individual's destination, 0 otherwise	a	b
Stayer (1995-2000, 1996-2001)	STAYER	= 1 if individual is a stayer, zero otherwise (ORIGIN = DEST)	a	b
Migrant or immigrant (1995-2000, 1996-2001)	MIGRANT	= 1 if individual is a migrant, zero otherwise (ORIGIN ≠ DEST)	a	b
Skill index	\bar{v}	Individual's skill index	c	c
Skill differential = $(\bar{v} - \bar{v})$	SD	Individual's skill differential = (skill index - mean of skill index)	c	c
Nth skill decile	DEC _n	= 1 if individual is in nth skill decile, 0 otherwise (n=1,2,3,...,10)	c	c
Born in Canada	BORNCAN	= 1 if individual's nativity is Canadian, 0 otherwise	a	b
Mother tongue French	MTFRENCH	= 1 if French is the individual's mother tongue, 0 otherwise	a	b
Age (2000, 2001)	AGE	Individual's age in years	a	b
<i>Area Variables</i>				
Log after-tax wage for mean skills	MUAT	Mean of area's standardized log after-tax wage distribution	c	c
After-tax returns to skill	PHIAT	Standard deviation of area's standardized log after-tax wage distribution relative to the standard deviation of the all-area standardized log after-tax wage distribution	c	c
Rental price index	RENT	Area's housing rental price index	d	e
Employment growth rate	EGROW	Area's employment growth rate 1995-2000 in percent	f	g
Heating degree days	HDD	Area's heating degree days in °F	h	i
Cooling degree days		Area's cooling degree days in °F	h	i
Tax Incidence	TAX	Area's total taxation as a % of income, by income decile, 1995	j	k
Public health care expenditures	XHSPC	Public health care expenditures per capita in 1996 (US \$)	n	m
Public education expenditures	XEDPC	Public education expenditures per capita in 1996 (US \$)	n	m
Public debt service expenditures	XDSPC	Public debt service expenditures per capita in 1996 (US \$)	n	m
Other public expenditures	XOTHPC	Total public expenditures per capita less above three items in 1996 (US \$)	n	m
. . . cont.				

Table 2: Variable Names, Definitions, and Sources, continued

Variable	Name	Definition	U.S.	Canada
<i>Individual x Area Variables</i>				
PHIAT x SD	PHIATSD	PHIAT * SD	c, j	c, k
Distance from origin to each area	DIST	Distance (in miles) from capital city of individual's origin to capital of each destination (= 0 for origin to origin)	l	l
Canadian origin, U.S. destination dummy	COUD	= 1 for U.S. areas if individual's origin is in Canada, 0 otherwise	c	c
U.S. origin, Canadian destination dummy	UOCD	= 1 for Canadian areas if individual's origin is in U.S., 0 otherwise	c	c

Notes:

- a. 2000 U.S. Census of Population, PUMS Sample A (5%).
- b. 2001 Canadian Census of Population.
- c. Computed by authors following the methodology of Hunt and Mueller (2002).
- d. 2000 U.S. Census of Population, Social and Economic Characteristics, and 1990 U.S. Census of Housing, General Housing Characteristics.
- e. Social and Economic Characteristics of Individuals, Families and Households, 2001 Census, Catalogue No. 97F0021XCB2001000.
- f. U.S. Bureau of Labor Statistics, Regional and State Employment and Unemployment (various issues).
- g. Statistics Canada, CANSIM Table 281-0025.
- h. National Oceanographic and Atmospheric Administration, Climatography in the U.S., Number 81 (January 1992).
- i. Environment Canada, Canadian Climate Normals or Averages, 1971-2000.
Michael P. Ettlinger, John F. O'Hare, Robert S. McIntyre, Julie King, Neil Miransky and Elizabeth A. Fray. *Who Pays?: A Distributional Analysis of the Tax Systems of All 50 States (Citizens for Tax Justice, 1996). Based on Institute for Taxation and Economic Policy's (ITEP)*
- j. *microsimulation tax model.*
- k. Personal communication, Niels Veldhuis, Director of Fiscal Studies, Fraser Institute, Vancouver, British Columbia, Canada. Based on CANTASIM microsimulation tax model.
- l. Rand McNally Standard Highway Guide (1987).
- m. CANSIM Tables 176-0049, 385-0002, 1996 Canadian Census of Population.
- n. U.S. Bureau of the Census, State and Local Government Finances, by state (1995-96).

Table 3: Sample Statistics, Males and Females

	Males (N = 37,573)				Females (N = 33,329)			
	Mean	Std. Dev.	Minimum	Maximum	Mean	Std. Dev.	Minimum	Maximum
ORIGIN	0.017	0.129	0.00	1.00	0.017	0.129	0.00	1.00
DEST	0.017	0.129	0.00	1.00	0.017	0.129	0.00	1.00
STAYER	0.905	0.294	0.00	1.00	0.917	0.276	0.00	1.00
CAN	0.090	0.286	0.00	1.00	0.088	0.284	0.00	1.00
MTFRENCH	0.030	0.171	0.00	1.00	0.030	0.171	0.00	1.00
DECILE	5.483	2.872	1.00	10.00	5.501	2.874	1.00	10.00
First skill decile	0.101	0.301	0.00	1.00	0.102	0.302	0.00	1.00
Second skill decile	0.101	0.302	0.00	1.00	0.098	0.297	0.00	1.00
Third skill decile	0.101	0.302	0.00	1.00	0.101	0.301	0.00	1.00
Fourth skill decile	0.097	0.296	0.00	1.00	0.099	0.299	0.00	1.00
Fifth skill decile	0.101	0.301	0.00	1.00	0.098	0.298	0.00	1.00
Sixth skill decile	0.099	0.299	0.00	1.00	0.099	0.299	0.00	1.00
Seventh skill decile	0.102	0.302	0.00	1.00	0.104	0.305	0.00	1.00
Eighth skill decile	0.099	0.299	0.00	1.00	0.100	0.300	0.00	1.00
Ninth skill decile	0.101	0.302	0.00	1.00	0.098	0.297	0.00	1.00
Tenth skill decile	0.097	0.296	0.00	1.00	0.101	0.301	0.00	1.00
AGE	42.076	10.177	25.00	64.00	42.070	0.995	25.00	64.00
SD	-0.002	0.262	-1.33	0.91	-0.001	0.233	-1.40	0.85
CDD	560.193	457.767	8.90	2327.00	560.193	457.767	8.90	2327.00
HDD	3129.239	1260.867	581.00	5777.50	3129.239	1260.867	581.00	5777.50
EGROW	0.119	0.048	0.02	0.29	0.119	0.048	0.18	0.29
TAX	41.897	13.713	4.10	69.40	41.992	13.713	4.10	69.40
DIST	1293.166	811.034	0.00	4525.00	1282.842	4.813	0.00	4525.00
UOCD	0.155	0.362	0.00	1.00	0.155	0.362	0.00	1.00
COUD	0.073	0.260	0.00	1.00	0.071	0.257	0.00	1.00
RENT	0.963	0.196	0.65	1.56	0.963	0.196	0.65	1.56
XSHPC	1068.807	485.260	444.09	2802.35	1068.807	485.260	444.09	2802.35
XEDPC	1012.308	221.851	474.16	1489.33	1012.308	221.851	474.16	1489.33
XDSPC	224.615	271.466	27.92	1018.43	224.615	271.466	27.92	1018.43
XOTHPC	1125.159	534.763	486.80	4138.88	1125.159	534.763	486.80	4138.88
XTOTPC	3430.889	1017.470	2298.05	8656.88	3430.889	1017.470	2298.05	8656.88
MUAT	6.109	0.241	5.51	6.51	5.746	0.185	5.30	6.22
PHIAT	0.902	0.237	0.31	1.18	0.931	0.249	0.38	1.47
PHIATSD	-0.002	0.244	-1.57	1.08	-0.001	0.225	-2.07	1.25

Table 4: Selected Total Tax Rate by Decile and Area

Area	Decile									
	1st	2nd	3rd	4th	5th	6th	7th	8th	9th	10th
United States										
Arizona	17.6	17.6	22.9	22.9	25.8	25.8	28.2	28.2	32.3	35.5
California	18.3	18.3	22.4	22.4	25.8	25.8	28.6	28.6	33.6	37.2
Colorado	16.2	16.2	22.4	22.4	25.7	25.7	28.2	28.2	32.4	35.4
Connecticut	17.6	17.6	22.9	22.9	26.8	26.8	29.3	29.3	33.6	35.9
District of Columbia	16.8	16.8	23.4	23.4	26.8	26.8	29.6	29.6	33.8	36.2
Florida	20.3	20.3	23.2	23.2	24.9	24.9	26.9	26.9	31.1	33.9
Illinois	19.8	19.8	23.7	23.7	26.7	26.7	28.8	28.8	33.1	35.5
Kansas	17.2	17.2	23.1	23.1	26.6	26.6	29.3	29.3	33.6	36.4
Kentucky	16.7	16.7	23.9	23.9	27.5	27.5	30.4	30.4	34.5	37.2
Maine	17.9	17.9	23.1	23.1	27.2	27.2	39.6	39.6	35.2	38.0
Massachusetts	17.7	17.7	23.6	23.6	26.9	26.9	29.2	29.2	33.8	36.8
Michigan	19.5	19.5	24.8	24.8	27.5	27.5	29.6	29.6	33.6	36.3
Minnesota	17.2	17.2	24.3	24.3	27.7	27.7	30.2	30.2	34.5	37.8
Missouri	17.8	17.8	23.6	23.6	26.9	26.9	29.3	29.3	33.5	36.3
Nebraska	17.1	17.1	23.5	23.5	27.0	27.0	29.6	29.6	34.1	37.0
Nevada	15.2	15.2	19.0	19.0	22.0	22.0	24.6	24.6	29.2	32.3
New Hampshire	15.3	15.3	20.1	20.1	23.0	23.0	26.1	26.1	30.5	33.6
New Jersey	21.9	21.9	23.4	23.4	26.4	26.4	28.9	28.9	33.8	36.8
New Mexico	21.3	21.3	26.0	26.0	28.3	28.3	30.5	30.5	34.7	37.3
New York	22.4	22.4	27.3	27.3	30.8	30.8	33.1	33.1	37.2	39.6
North Carolina	15.9	15.9	23.1	23.1	26.4	26.4	29.2	29.2	33.5	36.5
Ohio	17.9	17.9	23.4	23.4	26.9	26.9	29.6	29.6	33.9	37.0
Oregon	17.1	17.1	22.5	22.5	26.5	26.5	29.7	29.7	34.3	37.4
Pennsylvania	19.5	19.5	24.1	24.1	27.1	27.1	29.4	29.4	33.5	36.0
Texas	20.1	20.1	23.8	23.8	25.8	25.8	27.8	27.8	31.9	34.7
Utah	18.3	18.3	24.6	24.6	27.9	27.9	30.3	30.3	34.2	36.8
Vermont	15.7	15.7	21.9	21.9	26.9	26.9	28.9	28.9	33.8	36.8
Virginia	15.9	15.9	22.2	22.2	25.6	25.6	28.1	28.1	32.6	35.7
Washington	23.3	23.3	25.6	25.6	27.7	27.7	29.4	29.4	33.0	35.2
Wisconsin	19.9	19.9	25.5	25.5	29.3	29.3	31.6	31.6	35.6	37.9
Alberta	21.0	14.0	28.5	35.2	40.2	42.0	42.8	45.5	47.3	58.5
British Columbia	11.7	17.0	23.5	32.4	40.8	45.8	48.5	48.3	49.8	59.5
Newfoundland	4.1	4.9	11.3	18.4	31.5	36.2	39.9	47.5	50.7	57.2
Ontario	14.9	21.0	30.1	37.3	41.3	44.8	45.1	47.6	48.9	60.7
Quebec	17.0	19.7	29.0	32.4	41.9	47.4	47.7	49.7	52.8	63.1

Notes: Federal Taxes are total effective tax rates. The 9th decile is "backed out" and is based on the Congressional Budget Office (1995) report for the U.S. State Taxes are after federal offset deduction and include sales and excise taxes, property taxes, and state income taxes. Canadian taxes are average tax bill on cash income for 1995 and include provincial and federal.

Table 5: Maximum Likelihood Estimates of Partially Degenerate Nested Logit Model of Migration and Destination Choice, Males and Females

	Males			
	Model A		Model B	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>Stay versus migrate choice</i>				
Constant	1.2058E-01	3.0758E-03 *	1.2291E-01	3.0757E-03 *
Age	6.5990E-02	6.5358E-05 *	6.5989E-02	6.5357E-05 *
Canadian-born	4.9581E-01	2.8522E-03 *	4.9388E-01	2.8536E-03 *
Mother tongue French	7.3378E-01	5.5192E-03 *	7.3487E-01	5.5194E-03 *
Second skill decile	-1.7662E-01	2.2372E-03 *	-1.7659E-01	2.2372E-03 *
Third skill decile	-2.7435E-01	2.2782E-03 *	-2.7431E-01	2.2782E-03 *
Fourth skill decile	-4.2921E-01	2.2687E-03 *	-4.2916E-01	2.2687E-03 *
Fifth skill decile	-3.1313E-01	2.3631E-03 *	-3.1306E-01	2.3631E-03 *
Sixth skill decile	-3.8809E-01	2.5830E-03 *	-3.8781E-01	2.5831E-03 *
Seventh skill decile	-6.0960E-01	2.3558E-03 *	-6.0937E-01	2.3557E-03 *
Eighth skill decile	-7.0121E-01	2.4013E-03 *	-7.0100E-01	2.4011E-03 *
Ninth skill decile	-9.4335E-01	2.2403E-03 *	-9.4315E-01	2.2402E-03 *
Tenth skill decile	-1.3063E+00	2.4997E-03 *	-1.3061E+00	2.4997E-03 *
<i>Destination choice</i>				
MUAT	3.6047E+00	7.9843E-03 *	3.6040E+00	7.9857E-03 *
PHIATSD	1.3935E+00	1.3350E-02 *	1.1177E+00	1.3786E-02 *
Distance (DIST)	-8.6672E-04	7.7727E-07 *	-8.6709E-04	7.7767E-07 *
Rental index (RENT)	9.2563E-01	3.9196E-03 *	9.2767E-01	3.9207E-03 *
Employment growth rate (EGROW)	4.2308E+00	1.4330E-02 *	4.2323E+00	1.4332E-02 *
Heating degree days (HDD)	-2.4662E-04	1.0275E-06 *	-2.4574E-04	1.0276E-06 *
Cooling degree days (CDD)	-2.1684E-04	2.3123E-06 *	-2.1630E-04	2.3126E-06 *
Public health care expenditures (XHSPC)	1.0234E-03	3.4752E-06 *	1.0614E-03	4.2158E-06 *
Public education expenditures (XEDPC)	-6.5804E-04	3.3808E-06 *	-5.3446E-04	4.4578E-06 *
Public debt service expenditures (XDSPC)	-4.7845E-03	1.1355E-05 *	-4.3534E-03	1.3765E-05 *
Other public expenditures (XOTHPC)	-7.8544E-04	2.3743E-06 *	-9.1909E-04	2.9140E-06 *
XHSPC*DEC6-10			-7.0456E-05	4.8118E-06 *
XEDPC*DEC6-10			-2.4808E-04	5.9195E-06 *
XDSPC*DEC6-10			-9.0473E-04	1.6766E-05 *
XOTHPC*DEC6-10			2.6631E-04	3.3011E-06 *
Canadian origin/U.S. destination (COUD)	-7.3695E+00	1.0418E-02 *	-7.4669E+00	1.0636E-02 *
U.S. origin/Canadian destination (UOCD)	-2.3573E+00	2.4428E-02 *	-2.4639E+00	2.4507E-02 *
<i>Inclusive value</i>				
Migrate	1.5204E-02	5.8227E-04 *	1.6082E-02	5.8386E-04 *
Number of observations	2,216,807		2,216,807	
Number of iterations	49		53	

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Table 5: Maximum Likelihood Estimates of Partially Degenerate Nested Logit Model of Migration and Destination Choice, Males and Females, continued

	Females			
	Model A		Model B	
	Coefficient	Standard Error	Coefficient	Standard Error
<i>Stay versus migrate choice</i>				
Constant	5.1559E-01	3.3321E-03 *	5.2524E-01	3.3343E-03
Age	5.8943E-02	6.7161E-05 *	5.8938E-02	6.7160E-05 *
Canadian-born	5.5141E-01	3.2263E-03 *	5.4436E-01	3.2206E-03
Mother tongue French	7.6022E-01	6.1268E-03 *	7.6377E-01	6.1271E-03 *
Second skill decile	-1.3229E-01	2.5146E-03 *	-1.3202E-01	2.5147E-03 *
Third skill decile	-1.6863E-01	2.6747E-03 *	-1.6828E-01	2.6748E-03 *
Fourth skill decile	-3.1822E-01	2.7415E-03 *	-3.1819E-01	2.7416E-03 *
Fifth skill decile	-4.1051E-01	2.7003E-03 *	-4.1041E-01	2.7004E-03 *
Sixth skill decile	-4.6223E-01	2.7623E-03 *	-4.6308E-01	2.7624E-03 *
Seventh skill decile	-4.8186E-01	2.5628E-03 *	-4.8260E-01	2.5628E-03 *
Eighth skill decile	-7.8455E-01	2.3334E-03 *	-7.8546E-01	2.3337E-03 *
Ninth skill decile	-8.2848E-01	2.4791E-03 *	-8.2959E-01	2.4795E-03 *
Tenth skill decile	-8.8356E-01	2.5704E-03 *	-8.8461E-01	2.5706E-03 *
<i>Destination choice</i>				
MUAT	3.7880E+00	9.9152E-03 *	3.7742E+00	9.9446E-03
PHIATSD	3.1055E+00	1.7721E-02 *	2.7809E+00	1.7969E-02 *
Distance (DIST)	-9.0255E-04	8.7678E-07 *	-9.0155E-04	8.7777E-07 *
Rental index (RENT)	9.6130E-01	4.2690E-03 *	9.6853E-01	4.2732E-03 *
Employment growth rate (EGROW)	4.1734E+00	1.6303E-02 *	4.1492E+00	1.6348E-02 *
Heating degree days (HDD)	-1.5268E-04	1.2296E-06 *	-1.5204E-04	1.2314E-06 *
Cooling degree days (CDD)	1.0420E-04	2.8615E-06 *	9.9389E-05	2.8714E-06 *
Public health care expenditures (XHSPC)	8.9286E-04	3.8608E-06 *	5.4223E-04	5.1297E-06 *
Public education expenditures (XEDPC)	-5.9885E-04	3.8530E-06 *	-4.1231E-04	5.4111E-06 *
Public debt service expenditures (XDSPC)	-4.6574E-03	1.2331E-05 *	-4.0822E-03	1.6083E-05 *
Other public expenditures (XOTHPC)	-7.5557E-04	2.6105E-06 *	-8.8733E-04	3.4612E-06 *
XHSPC*DEC6-10			5.7443E-04	5.4911E-06 *
XEDPC*DEC6-10			-3.4008E-04	6.7059E-06 *
XDSPC*DEC6-10			-1.0375E-03	1.8760E-05 *
XOTHPC*DEC6-10			1.9510E-04	3.7750E-06 *
Canadian origin/U.S. destination (COUD)	-7.2744E+00	1.1749E-02 *	-7.3163E+00	1.1991E-02 *
U.S. origin/Canadian destination (UOCD)	-2.2269E+00	2.1891E-02 *	-2.2142E+00	2.1963E-02 *
<i>Inclusive value</i>				
Migrate	2.2171E-02	6.2203E-04 *	2.5410E-02	6.1945E-04 *
Number of observations	1,966,411		1,966,411	
Number of iterations	46		52	

Notes: * denotes statistical significance at the 1 per cent level. Categorical age variables were also used in place

Table 6: Average Values of MUAT, PHIAT and TAX for U.S. and Canadian Areas

	Males			Females		
	U.S.	Canada	U.S./Canada	U.S.	Canada	U.S./Canada
MUAT	6.2072	5.6257	1.1034	5.8162	5.4045	1.0762
PHIAT	0.9867	0.4861	2.0296	1.0255	0.4681	2.1908
TAX	27.6059	38.8013	0.7115	27.6059	38.8013	0.7115

Source: Authors' calculations.

**Table 7: Migration and Destination Choice of Canadian-Origin Males and Females By Skill Level (1996-2001):
Observed, Baseline Simulation, and Alternative Simulations**

Categories	Males									
	Observed		Baseline Simulation		Alternative Simulations					
	Number	%	Number	%	AUAT & PHIAT Equalize		PHIAT Equalized		Fiscal Equalization	
	Number	%	Number	%	Number	%	Number	%	Number	%
<i>Total</i>	4,109,123	100.0%	4,109,122	100.0%	4,109,135	100.0%	4,109,123	100.0%	4,109,102	100.0%
Stay in origin	3,912,121	95.20%	3,900,198	94.9%	3,900,534	94.9%	3,900,201	94.9%	3,900,582	94.9%
Migrate in Canac	164,254	4.0%	170,355	4.1%	190,924	4.6%	170,410	4.1%	205,034	5.0%
Migrate to U.S.	32,748	0.8%	38,568	0.9%	17,677	0.4%	38,512	0.9%	3,486	0.1%
<i>Decile 1</i>	441,425	100.0%	441,424	100.0%	441,425	100.0%	441,424	100.0%	441,424	100.0%
Stay in origin	425,675	96.4%	421,289	95.4%	421,305	95.4%	421,273	95.4%	421,312	95.4%
Migrate in Canac	15,556	3.5%	17,233	3.9%	18,260	4.1%	16,301	3.7%	19,735	4.5%
Migrate to U.S.	194	0.0%	2,902	0.7%	1,860	0.4%	3,850	0.9%	376	0.1%
<i>Deciles 2 & 3</i>	787,584	100.0%	787,582	100.0%	787,584	100.0%	787,584	100.0%	787,584	100.0%
Stay in origin	748,233	95.0%	744,316	94.5%	744,366	94.5%	744,300	94.5%	744,384	94.5%
Migrate in Canac	38,016	4.8%	36,206	4.6%	39,427	5.0%	35,215	4.5%	42,446	5.4%
Migrate to U.S.	1,335	0.2%	7,061	0.9%	3,791	0.5%	8,069	1.0%	755	0.1%
<i>Deciles 4 - 7</i>	1,689,015	100.0%	1,689,008	100.0%	1,689,010	100.0%	1,689,009	100.0%	1,689,014	100.0%
Stay in origin	1,616,415	95.7%	1,606,978	95.1%	1,607,106	95.2%	1,606,980	95.1%	1,607,143	95.2%
Migrate in Canac	66,583	3.9%	66,944	4.0%	74,983	4.4%	66,935	4.0%	80,507	4.8%
Migrate to U.S.	6,017	0.4%	15,085	0.9%	6,920	0.4%	15,094	0.9%	1,364	0.1%
<i>Deciles 8 & 9</i>	973,186	100.0%	973,186	100.0%	973,184	100.0%	973,185	100.0%	973,188	100.0%
Stay in origin	924,716	95.0%	923,206	94.9%	923,302	94.9%	923,226	94.9%	923,326	94.9%
Migrate in Canac	35,144	3.6%	39,707	4.1%	45,845	4.7%	40,922	4.2%	49,076	5.0%
Migrate to U.S.	13,326	1.4%	10,273	1.1%	4,037	0.4%	9,037	0.9%	786	0.1%
<i>Decile 10</i>	217,913	100.0%	217,913	100.0%	217,913	100.0%	217,913	100.0%	217,913	100.0%
Stay in origin	197,082	90.4%	204,401	93.8%	204,435	93.8%	204,414	93.8%	204,439	93.8%
Migrate in Canac	8,955	4.1%	10,265	4.7%	12,409	5.7%	11,038	5.1%	13,268	6.1%
Migrate to U.S.	11,876	5.4%	3,247	1.5%	1,069	0.5%	2,461	1.1%	206	0.1%

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**Table 7: Migration and Destination Choice of Canadian-Origin Males and Females By Skill Level (1996-2001):
Observed, Baseline Simulation, and Alternative Simulations, continued**

Females										
Categories	Observed		Baseline Simulation		Alternative Simulations					
	Number	%	Number	%	UAT & PHIAT Equalize		PHIAT Equalized		Fiscal Equalization	
					Number	%	Number	%	Number	%
<i>Total</i>	3,771,212	100.0%	3,771,790	100.0%	3,771,170	100.0%	3,771,177	100.0%	3,771,188	100.0%
Stay in origin	3,620,652	96.0%	3,609,589	95.7%	3,609,886	95.7%	3,609,617	95.7%	3,609,932	95.7%
Migrate in Canac	128,594	3.4%	136,263	3.6%	150,819	4.0%	137,899	3.7%	157,765	4.2%
Migrate to U.S.	21,966	0.6%	25,338	0.7%	10,466	0.3%	23,661	0.6%	3,491	0.1%
<i>Decile 1</i>	535,683	100.0%	535,684	100.0%	535,684	100.0%	535,684	100.0%	535,684	100.0%
Stay in origin	521,543	97.4%	520,840	97.2%	520,837	97.2%	520,810	97.2%	520,832	97.2%
Migrate in Canac	13,857	2.6%	13,496	2.5%	13,860	2.6%	12,644	2.4%	14,483	2.7%
Migrate to U.S.	283	0.1%	1,347	0.3%	988	0.2%	2,230	0.4%	369	0.1%
<i>Deciles 2 & 3</i>	523,685	100.0%	523,686	100.0%	523,686	100.0%	523,684	100.0%	523,684	100.0%
Stay in origin	508,166	97.0%	505,567	96.5%	505,580	96.5%	505,546	96.5%	505,578	96.5%
Migrate in Canac	14,631	2.8%	15,973	3.1%	16,886	3.2%	15,386	2.9%	17,679	3.4%
Migrate to U.S.	888	0.2%	2,145	0.4%	1,219	0.2%	2,752	0.5%	428	0.1%
<i>Deciles 4 - 7</i>	1,521,036	100.0%	1,521,038	100.0%	1,521,038	100.0%	1,521,036	100.0%	1,521,036	100.0%
Stay in origin	1,461,855	96.1%	1,454,075	95.6%	1,454,180	95.6%	1,454,065	95.6%	1,454,190	95.6%
Migrate in Canac	53,640	3.5%	57,476	3.8%	62,571	4.1%	57,264	3.8%	65,405	4.3%
Migrate to U.S.	5,541	0.4%	9,487	0.6%	4,287	0.3%	9,707	0.6%	1,440	0.1%
<i>Deciles 8 & 9</i>	969,254	100.0%	969,256	100.0%	969,253	100.0%	969,251	100.0%	969,253	100.0%
Stay in origin	920,572	95.0%	917,692	94.7%	917,836	94.7%	917,748	94.7%	917,852	94.7%
Migrate in Canac	39,632	4.1%	41,932	4.3%	48,123	5.0%	44,054	4.5%	50,350	5.2%
Migrate to U.S.	9,050	0.9%	9,632	1.0%	3,294	0.3%	7,449	0.8%	1,051	0.1%
<i>Decile 10</i>	221,554	100.0%	221,554	100.0%	221,554	100.0%	221,554	100.0%	221,554	100.0%
Stay in origin	208,096	93.9%	211,444	95.4%	211,498	95.5%	211,480	95.5%	211,503	95.5%
Migrate in Canac	7,254	3.3%	7,384	3.3%	9,378	4.2%	8,551	3.9%	9,848	4.4%
Migrate to U.S.	6,204	2.8%	2,726	1.2%	678	0.3%	1,523	0.7%	203	0.1%

Notes: Column total may not add due to rounding error. The model simulations assign probabilities to each of the 59 areas for each individual and these are multiplied by individual weights. The program loops over individuals and sums the probability weight products for each area. This weighting results in small differences in sample sizes between simulations.

**Table 8: Migration and Destination Choice of US-Origin Males and Females By Skill Level (1995-2000):
Observed, Baseline Simulation, and Alternative Simulations**

Categories	Males									
	Observed		Baseline Simulation		Alternative Simulations					
	Number	%	Number	%	UAT & PHIAT Equalize		PHIAT Equalized		Fiscal Equalization	
	Number	%	Number	%	Number	%	Number	%	Number	%
<i>Total</i>	42,882,424	100.00%	42,882,292	100.00%	42,882,276	100.00%	42,882,304	100.00%	42,882,276	100.00%
Stay in origin	38,597,750	90.01%	38,610,752	90.04%	38,610,712	90.04%	38,610,752	90.04%	38,610,424	90.04%
Migrate in U.S.	4,282,786	9.99%	4,269,706	9.96%	4,266,866	9.95%	4,269,706	9.96%	4,247,459	9.90%
Migrate to Canac	1,888	0.00%	1,835	0.00%	4,698	0.01%	1,846	0.00%	24,392	0.06%
<i>Decile 1</i>	4,305,958	100.00%	4,305,959	100.00%	4,305,959	100.00%	4,305,959	100.00%	4,305,961	100.00%
Stay in origin	3,893,250	90.42%	3,897,624	90.52%	3,897,623	90.52%	3,897,626	90.52%	3,897,576	90.52%
Migrate in U.S.	412,671	9.58%	408,115	9.48%	407,979	9.47%	408,184	9.48%	406,562	9.44%
Migrate to Canac	37	0.00%	219	0.01%	357	0.01%	150	0.00%	1,822	0.04%
<i>Deciles 2 & 3</i>	8,734,867	100.00%	8,734,848	100.00%	8,734,850	100.00%	8,734,848	100.00%	8,734,863	100.00%
Stay in origin	7,842,820	89.79%	7,846,703	89.83%	7,846,700	89.83%	7,846,704	89.83%	7,846,654	89.83%
Migrate in U.S.	892,010	10.21%	887,715	10.16%	887,267	10.16%	887,785	10.16%	883,650	10.12%
Migrate to Canac	37	0.00%	430	0.00%	883	0.01%	359	0.00%	4,560	0.05%
<i>Deciles 4 - 7</i>	17,044,838	100.00%	17,044,828	100.00%	17,044,832	100.00%	17,044,830	100.00%	17,044,836	100.00%
Stay in origin	15,499,940	90.94%	15,510,513	91.00%	15,510,501	91.00%	15,510,513	91.00%	15,510,418	91.00%
Migrate in U.S.	1,544,528	9.06%	1,533,661	9.00%	1,532,679	8.99%	1,533,664	9.00%	1,525,846	8.95%
Migrate to Canac	370	0.00%	655	0.00%	1,652	0.01%	653	0.00%	8,573	0.05%
<i>Deciles 8 & 9</i>	8,446,034	100.00%	8,446,030	100.00%	8,446,033	100.00%	8,446,029	100.00%	8,446,032	100.00%
Stay in origin	7,488,081	88.66%	7,489,654	88.68%	7,489,648	88.68%	7,489,652	88.68%	7,489,598	88.68%
Migrate in U.S.	957,323	11.33%	956,007	11.32%	955,223	11.31%	955,931	11.32%	950,368	11.25%
Migrate to Canac	630	0.01%	369	0.00%	1,163	0.01%	446	0.01%	6,066	0.06%
<i>Decile 10</i>	4,350,727	100.00%	4,350,728	100.00%	4,350,729	100.00%	4,350,728	100.00%	4,350,728	100.00%
Stay in origin	3,873,660	89.03%	3,866,370	88.87%	3,866,365	88.87%	3,866,369	88.87%	3,866,315	88.87%
Migrate in U.S.	476,253	10.95%	484,196	11.13%	483,721	11.12%	484,120	11.13%	481,042	11.06%
Migrate to Canac	814	0.02%	162	0.00%	643	0.01%	239	0.01%	3,371	0.08%

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**Table 8: Migration and Destination Choice of US-Origin Males and Females By Skill Level (1995-2000):
Observed, Baseline Simulation, and Alternative Simulations, continued**

Categories	Females									
	Observed		Baseline Simulation		Alternative Simulations					
	Number	%	Number	%	UAT & PHIAT Equalize		PHIAT Equalized		Fiscal Equalization	
	Number	%	Number	%	Number	%	Number	%	Number	%
<i>Total</i>	40,370,999	100.00%	40,371,036	100.00%	40,371,036	100.00%	40,371,028	100.00%	40,371,020	100.00%
Stay in origin	36,841,870	91.26%	36,852,880	91.29%	36,852,884	91.29%	36,852,888	91.29%	36,852,392	91.28%
Migrate in U.S.	3,526,468	8.74%	3,515,760	8.71%	3,515,868	8.71%	3,515,748	8.71%	3,500,343	8.67%
Migrate to Canac	2,661	0.01%	2,397	0.01%	2,284	0.01%	2,392	0.01%	18,287	0.05%
<i>Decile 1</i>	3,952,801	100.00%	3,952,802	100.00%	3,952,802	100.00%	3,952,802	100.00%	3,952,797	100.00%
Stay in origin	3,635,660	91.98%	3,636,356	91.99%	3,636,356	91.99%	3,636,360	91.99%	3,636,180	91.99%
Migrate in U.S.	316,993	8.02%	316,066	8.00%	316,083	8.00%	316,253	8.00%	315,334	7.98%
Migrate to Canac	148	0.00%	381	0.01%	363	0.01%	190	0.00%	1,283	0.03%
<i>Deciles 2 & 3</i>	8,250,522	100.00%	8,250,520	100.00%	8,250,519	100.00%	8,250,518	100.00%	8,250,524	100.00%
Stay in origin	7,598,960	92.10%	7,601,553	92.13%	7,601,554	92.13%	7,601,556	92.13%	7,601,510	92.13%
Migrate in U.S.	651,414	7.90%	648,413	7.86%	648,438	7.86%	648,558	7.86%	646,107	7.83%
Migrate to Canac	148	0.00%	554	0.01%	527	0.01%	405	0.00%	2,907	0.04%
<i>Deciles 4 - 7</i>	16,174,273	100.00%	16,174,242	100.00%	16,174,242	100.00%	16,174,243	100.00%	16,174,247	100.00%
Stay in origin	15,000,140	92.74%	15,007,861	92.79%	15,007,862	92.79%	15,007,863	92.79%	15,007,766	92.79%
Migrate in U.S.	1,173,581	7.26%	1,165,541	7.21%	1,165,579	7.21%	1,165,589	7.21%	1,160,547	7.18%
Migrate to Canac	552	0.00%	840	0.01%	801	0.00%	791	0.00%	5,934	0.04%
<i>Deciles 8 & 9</i>	7,764,632	100.00%	7,764,624	100.00%	7,764,625	100.00%	7,764,626	100.00%	7,764,620	100.00%
Stay in origin	6,784,610	87.38%	6,787,896	87.42%	6,787,896	87.42%	6,787,893	87.42%	6,787,796	87.42%
Migrate in U.S.	978,949	12.61%	976,248	12.57%	976,270	12.57%	976,046	12.57%	971,348	12.51%
Migrate to Canac	1,073	0.01%	481	0.01%	450	0.01%	688	0.01%	5,477	0.07%
<i>Decile 10</i>	4,228,771	100.00%	4,228,769	100.00%	4,228,770	100.00%	4,228,769	100.00%	4,228,768	100.00%
Stay in origin	3,822,500	90.39%	3,819,155	90.31%	3,819,155	90.31%	3,819,151	90.31%	3,819,085	90.31%
Migrate in U.S.	405,531	9.59%	409,473	9.68%	409,479	9.68%	409,300	9.68%	406,997	9.62%
Migrate to Canac	740	0.02%	142	0.00%	135	0.00%	318	0.01%	2,686	0.06%

Notes: Column total may not add due to rounding error. The model simulations assign probabilities to each of the 59 areas for each individual and these are multiplied by individual weights. The program loops over individuals and sums the probability weight products for each area. This weighting results in small differences in sample sizes between simulations.