Fiscal Policy, Returns to Skills, and Canada-US Migration: Evidence from the Late 1990s

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Dans cet article, nous présentons un modèle logit hiérarchique des migrations entre 59 régions du Canada et des États-Unis que nous avons conçu grâce à plus de 70 000 microdonnées portant sur les travailleurs de tous les déciles de la répartition des compétences que comportaient les recensements canadiens et américains de 2000/2001, puis nous faisons des estimations et des simulations. En combinant les données individuelles et et les données régionales, nous pouvons analyser les effets des différences de politiques fiscales des deux pays sur les migrations des travailleurs. Comme nous savons quels sont les travailleurs hautement qualifiés, nous pouvons simuler les effets que des changements en matière d'impôt (en présupposant des budgets équilibrés) auraient autant sur la tendance des individus à migrer que sur l'importance des courants migratoires. Ces simulations suggèrent qu'une augmentation du rendement des compétences après impôt au Canada ainsi que la réduction, au niveau moyen américain, du taux moyen d'imposition canadien (avec compensation des réductions des dépenses pour maintenir la neutralité budgétaire) réduiraient effectivement les migrations vers les États-Unis, particulièrement parmi les travailleurs hautement qualifiés. Toutefois, les réductions des taux d'imposition et des dépenses publiques nécessaires pour produire ce résultat étant relativement élevées, cela soulèverait des questions touchant des politiques publiques importantes dans d'autres domaines.

Mots clés : migration internationale, rendement des compétences, impôt, intégration nord-américaine

In this study we develop, estimate, and simulate a nested logit model of migration among 59 Canadian and US sub-national areas, using over 70,000 microdata observations on workers across all deciles of the skill distribution obtained from the US and Canadian censuses of 2000/2001. Combining microdata on individual workers with area data, we are able to consider the effects on worker migration of tax policy differences across countries. 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 skills and implementing fiscal equalization (reducing the average Canadian tax rate to the average US level with offsetting expenditure reductions to maintain budget neutrality) would effectively reduce southward migration, especially 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.

Keywords: international migration, returns to skills, taxes, regional integration

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Background and Motivation

Greater regional integration can raise issues concerning the cross-border migration of labour resources. As an illustration, the migration of high-skilled workers from Canada to the United States (US) presents one important example that has attracted significant policy attention. The debate typically is cast in terms of a Canadian brain drain to the US (DeVoretz 1999; Emery 1999; Finnie 2001; Frank and Bélair 1999).[1] The main economic and policy factors underlying the associated migration are relatively higher returns to skilled labour in the US, better employment opportunities for professionals in the US, 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 US 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 US and finds there is some responsiveness, but that it is limited.

Most of the literature on the relationship between international migration and taxation addresses the fiscal implication of migration for both the sending and receiving areas.[2] The majority of these studies address the public-expenditure side of inward migration on the receiving area, or the tax implications of the outward migration on the sending area. Relatively few studies reverse this causality and speak to the migration implications of fiscal policy (in general) and the effects of taxes (in particular). Studies that do so include recent works by Liebig and Sousa-Poza (2005, 2006); Liebig, Puhani, and Sousa-Poza (2007); and Egger and Radulescu (2009). The general finding of this work is that interregional differences in taxes have modest effects (if any) on migration, although the migration decisions of the highly skilled tend to be more sensitive to any differences. Recent evidence for Canada (Collins 2008) shows that higher Canadian effective tax rates for Canada compared to the United States may have contributed to the southward migration of recent Canadian post-secondary-education graduates.[3]

The contribution of this paper is to analyze fiscally induced migration between Canada and the US using a discrete choice model that encompasses multiple skill levels and geographic locations and is based on utility maximization and Roy (1951) selection principles (e.g., Borjas et al. 1992; Hunt and Mueller 2004). This model is estimated with over 70,000 microdata observations on workers of various skill levels, each of whom can choose among 59 geographic areas including the lower 48 US states, the District of Columbia, and the ten Canadian provinces. The migration period spans 1995/96–2000/01, which has the advantage of postdating the adoption of NAFTA, but predating the events of 11 September 2001.[4] This is also the period in which concern over the migration of highly skilled Canadians to the US was at its peak.[5]

In addition to this timing advantage, our analysis mitigates the logical error of restricting a worker's choice set for migration to areas in other countries. The restriction is implicit in studies focusing only on migration that crosses national borders. This study integrates both within-country and cross-country migration. For example, highly skilled Canadian workers originating in Ontario can choose to stay in Ontario, migrate to another Canadian province, or migrate to the US.[6] A similar within-country and outside-of-country set of location choices exists logically for US-origin workers. So this study expands the choice set for Canadian (US) workers to logically include both domestic Canadian (US) alternatives as well as US (Canadian) alternatives. This approach mitigates the misspecification of the individual worker's choice set, and it increases the geographical dimension of the sample size with which the effects of migration determinants can be estimated.

The effects of fiscal determinants are estimated using each area's after-tax returns to skills computed with standardized wage distribution parameters that have been 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 generated by relatively large-scale microsimulation tax models specifically calibrated for the Canadian and US 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 are highly statistically significant; therefore the model is simulated to obtain a sense of how useful 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-US migration. However the required effective tax rate reductions are substantial and may raise other substantial policy issues beyond the scope of this migration analysis.

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 his or her work life. In the current area of residence (origin), utility is assumed to depend on the after-tax wage, cost of living, other relevant origin-area attributes, as well as the worker's personal characteristics. The worker's utility, if residing 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 1995; 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 (LV_{ij}) currently residing in origin area o is:

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

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

$d_{i,o \to d}$ is the distance between individual i's origin area (o) and non-origin or destination area (d)

$b_{i,o \to d}$ equals unity if i's move from o to d 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) $$1n[w_{ij}] = \mu_j + \varphi_j(v_i - \bar{v})$$

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 geographic location, but only on the individual's human capital characteristics. Therefore, the only reason for an individual's wage to vary by region would be variations in the wage generating process across areas, i.e., inter-area 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 standardized skill distribution and area-specific wage generation process information. The results, based on standardized after-tax wage distributions, are:

(3) $$\mu_j = E[1n(w_{ij})^*]$$

(4) $$\varphi_j = \left(\frac{Var[1n(w_{ij})^*]}{\sigma^2} \right)$$

where σ^2 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 φ_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 skills. 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.[7] On the other hand, individuals with below average skills will receive higher after-tax wages in areas with lower after-tax returns to skills; 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) $$LV_{ij} = LV[y_i, C_i, \mu_j, \varphi_j(v_i - \bar{v}), r_j, a_j, e_j, d_{i,o \to d}, b_{i,o \to d}, \rho]$$

where $\varphi_j(v_i - \bar{v})$ 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:

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

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 with 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 modelled as a nested logit. There are two nests: the origin and non-origin areas. The upper level of this nested logit model involves 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 ($j \neq o$) conditional on migrating (m):

$$P(ij \mid m) = \frac{\exp\left(\beta' x_{ij}\right)}{\sum_{k \varepsilon M} \exp\left(\beta' x_{ik}\right)} \tag{7a}$$

where $x_{ij} = [\mu_j, \varphi_j(v_i - \bar{v}), r_j, a_j, e_j, d_{i,o\rightarrow j}, b_{i,o\rightarrow j},$ β is a parameter vector, and M is the set of non-origin areas.

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

$$P(io \mid s) = \frac{\exp\left(\beta' x_{io}\right)}{\sum_{k \varepsilon s} \exp\left(\beta' x_{ik}\right)} = 1 \tag{7b}$$

where β is a parameter vector, $x_{io} = [\mu_o, \varphi_o(v_i - \bar{v}),$ $r_o, a_o, e_o]$, 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):

$$p_{im} = \frac{\exp(a'_m z_i + \theta_m IVV_{im})}{\exp\left(a'_s z_i + \theta_s IVV_s\right) + \exp\left(a'_m z_i + \theta_m IVV_{im}\right)} \tag{8}$$

where $z_i = [C_{io}, y_i]$ and the *IVV* 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.[8]

For the stay choice (s):

$$p_{is} = \frac{\exp(a'_s z_i + \theta_s IVV_{is})}{\exp\left(a'_s z_i + \theta_s IVV_s\right) + \exp\left(a'_m z_i + \theta_m IVV_{im}\right)} \tag{9}$$

where all terms are as previously defined.

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

The parameters of the partially degenerate nested logit model of migration given in Equations (6)–(9) above are estimated by 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 variable (IVV).

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.[9] 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.[10] 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 (μ) in each area and the area-specific after-tax returns to skills (φ) 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 skills are interacted with the individual's position in North American skills distribution measured by their skill differential ($v_i - \bar{v}$). The variable that captures the returns to skills effect on area choice is therefore $\varphi_j(v_i - \bar{v})$. Because both μ and φ 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.[11] The employment growth rate in an area from 1995 through 2000 (EMPLOYGROW) is expected to raise the attractiveness of an area, whereas more immoderate temperatures, measured by heating and cooling degree days (HEATDD and COOLDD), are expected to lower an area's attraction.[12]

We also specify per capita public expenditures on health care (EXPHEALTH), education (EXPEDUC), debt service (EXPDEBT), and other (EXPOTHER). Variations in the level of and the mix of public expenditure may influence the relative attractiveness of areas.[13] 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 US areas, and zero otherwise (CANORIGIN). For American-origin workers, the corresponding variable is set equal to unity for each Canadian province, and zero otherwise (USORIGIN).[14] The literature on national border effects finds that national borders do exert an additional cost.[15]

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 variable (IVV) that appears at the upper level in each branch: stay and migrate. The IVV 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 IVVs 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).[16] The estimates below 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, simulations are performed with the estimated model in the fourth section of the paper.[17]

In sum, our statistical model treats residential location as a discrete choice among 59 regions across Canada and the United States. A nested logit approach is appropriate because it can encompass the origin area and can allow for the flexibility of treating the unobservable characteristics of the origin area (e.g., local knowledge and relationships) differently from those of non-origin areas. Alternatively, a "flat" (i.e., non-nested) conditional logit structure does not permit this important distinction between origin and non-origin areas to be modelled (i.e., it imposes the Independence of Irrelevant Alternatives (IIA) assumption). As in a "flat" logit model, the nested logit approach permits area characteristics to feed into the decisions on which area to choose (as well as individual characteristics). These characteristics flow into the upper-level choice of staying or migrating through the inclusive value variables (IVV). So, for example, strong utility-increasing features in non-origin areas can overcome the inertia, or cost, of migrating (related to age, language, etc.) and change the upper-level choice from staying to migrating. In these ways, the nested logit approach retains important features of a "flat" conditional logit model and gains the advantage of being able to treat the differences in unobservables between the origin area and the set of non-origin areas (i.e., the two nests in our model).

Individual Data

Individual data are obtained from the 2000 US Public Use Microdata Sample (PUMS) A and the 2001 Canadian Census Individual File. We include only non-institutionalized 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 US in real wage and salary income in the reference calendar year.[18] 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 data set, 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 country, i.e., those who had immigrated within five years of the census date.[19] We also retained all Canadian internal migrants, a subsample of US 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 that we are most interested in analyzing.[20] The resulting sampling fractions 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 as reported in Table 1. There are 37,574 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 total female sample size is 33,326, representing a population of over 44 million.

Table 1

Weighted Sample Statistics; Number of Sample Observations; and Corresponding Populations by Country, Males, and Females

	Males		Females	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
Weighted sample statistics				
ORIGIN	0.017	0.129	0.017	0.129
DESTINATION	0.017	0.129	0.017	0.129
STAYER	0.905	0.294	0.917	0.276
CANADIAN NATIVITY	0.090	0.286	0.088	0.284
FRENCH MOTHER TONGUE	0.030	0.171	0.030	0.171
DECILE	5.483	2.872	5.501	2.874
Skill decile 1	0.101	0.301	0.102	0.302
Skill decile 2	0.101	0.302	0.098	0.297
Skill decile 3	0.101	0.302	0.101	0.301
Skill decile 4	0.097	0.296	0.099	0.299
Skill decile 5	0.101	0.301	0.098	0.298
Skill decile 6	0.099	0.299	0.099	0.299
Skill decile 7	0.102	0.302	0.104	0.305
Skill decile 8	0.099	0.299	0.100	0.300
Skill decile 9	0.101	0.302	0.098	0.297
Skill decile 10	0.097	0.296	0.101	0.301
AGE	42.076	10.177	42.070	0.995
Skill differential $(v - \bar{v})$	–0.002	0.262	–0.001	0.233
COOLDD	560.193	457.767	560.193	457.767
HEATDD	3129.239	1260.867	3129.239	1260.867
EMPLOYGROWTH	0.119	0.048	0.119	0.048
TAX	41.897	13.713	41.992	13.713
Distance (DIST)	1293.166	811.034	1282.842	4.813
US origin/Canadian destination (USORIGIN)	0.155	0.362	0.155	0.362
Canadian origin/US destination (CANORIGIN)	0.073	0.260	0.071	0.257
Rental index (RENT)	0.963	0.196	0.963	0.196
Public health care expenditures (EXPHEALTH)	1068.807	485.260	1068.807	485.260
Public education expenditures (EXPEDUC)	1012.308	221.851	1012.308	221.851
Public debt service expenditures (EXPDEBT)	224.615	271.466	224.615	271.466
Other public expenditures (EXPOTHER)	1125.159	534.763	1125.159	534.763
Total public expenditures (EXPTOTAL)	3430.889	1017.470	3430.889	1017.470
After-tax wage for mean skills (μ)	6.109	0.241	5.746	0.185
After-tax returns to skill (φ)	0.902	0.237	0.931	0.249
$\varphi (v - \bar{v})$	–0.002	0.244	–0.001	0.225

... continued

TABLE 1
(Continued)

	Males		Females	
	Mean	*Std. Dev.*	*Mean*	*Std. Dev.*
Observations	*Unweighted*	*Weighted*	*Unweighted*	*Weighted*
Canada				
Non-migrants	10,585	3,912,121	9,776	3,620,652
Internal migrants	4,441	164,254	3,473	128,594
Migrants to Canada[a]	51	1,888	67	2,661
Subtotal Canada	15,077	4,078,263	13,316	3,751,907
United States				
Non-migrants	10,215	38,597,750	9,913	36,841,870
Internal migrants	10,829	4,282,786	9,097	3,526,468
Migrants to US[b]	1,453	32,748	1,000	21,966
Subtotal US	22,497	42,913,284	20,010	40,390,304
Total observations	**37,574**	**46,991,547**	**33,326**	**44,142,211**

Notes: Std. Dev. = standard deviation.

[a]Immigrants from US who arrived in Canada within the previous five years (1996–2001).

[b]Immigrants from Canada who arrived in the US within the previous five years (1995–2000).

Source: Authors' calculations.

The data follow the well-established pattern in the literature: individuals 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 international migration is rare (less than 1percent in each case). Canadian internal migration rates are approximately half of those in the US. Of more relevance to the current study, the share of total migration (internal and between the two countries) represented by international migration between the countries is about one in six for Canadian males and one in seven for Canadian females. The shares for Americans are about one in 225 for US males and one in 1,325 for US 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 US (32,748 + 21,966 = 54,714). This represents a migration rate of approximately 7 percent, using as a base Canadian stayers, plus internal and international migrants. The migration rate to Canada by US males and females was approximately 0.005 percent (two orders of magnitude smaller).

For each individual observation in our male and female samples, we have indicator variables for the individual's origin area (1995 or 1996) and destination area (2000 or 2001); also for whether the individual was a stayer (origin equals destination area) or migrant (origin area does not equal destination area), whether the individual had Canadian nativity, and whether the individual's mother tongue was French. In addition, for each individual there is an age variable; there are also variables for the individual's skill level, skill differential from mean skill level in the sample, and skill decile.[21]

Area Data

The data on area attributes are obtained from various sources. Attributes for each of the 59 areas include: mean after-tax wages (μ); after-tax returns to skills (φ); rental price index (RENT); employment growth rate (EMPLOYGROWTH); heating and cooling degree days (HEATDD and COOLDD); and public expenditures per capita on health care (EXPHEALTH), education (EXPEDUC), debt service (EXPDEBT), and all other categories (EXPOTHER).[22] All dollar values were deflated to real 1999 US dollars using the corresponding country price deflators, and the Canadian values were converted to US dollars using the 1999 exchange rate. All dollar values are therefore expressed in real 1999 US dollars.

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 wages is documented in Hunt and Mueller (2002). Tax rates are delineated by decile for each area based on the estimates presented in Ettlinger et al. (1996) for US states and by the Fraser Institute (Veldhuis 2009) for Canadian provinces.[23] These tax rates are then used to adjust wages by deciles to an after-tax basis. 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. The computations for the US areas are from the Institute on Taxation and Economic Policy's microsimulation tax model (Ettlinger et al. 1996) that uses a representative sample of 700,000 individual Americans.

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 modelled through interactive contextual data as well. If the individual originates in a Canadian province, then each of the US states constitutes a destination that involves crossing the national border. Thus, a border-crossing indicator variable is defined for each Canadian-origin individual and set equal to unity for each US state. The same strategy was applied to those originating in the US. Finally, the variable that captures the effects of variations in after-tax returns on migration propensities also involves an interaction of the individual's skill differential and the area's after-tax returns to skills, as specified in Equation (5) above. This variable is defined as $\varphi_j(v_i - \bar{v})$, or the area's after-tax returns to skills parameter times the individual's skill differential. Summary statistics for each of the above variables are reported in Table 1, and Table A2 presents selected tax rates used by area and decile.[24]

Econometric Estimates

Two maximum likelihood estimates are presented in Table 2 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.[25] The IVV parameter estimates are in the interval [0,1], as required for consistency of the estimated nested logit model with the principle of utility maximization.[26]

In all estimates of the upper branch (stay/migrate choice), age is positively related to the probability

TABLE 2
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*
Stay versus migrate choice				
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 NATIVITY	4.9581E–01	2.8522E–03*	4.9388E–01	2.8536E–03*
FRENCH MOTHER TONGUE	7.3378E–01	5.5192E–03*	7.3487E–01	5.5194E–03*
Skill decile 2	–1.7662E–01	2.2372E–03*	–1.7659E–01	2.2372E–03*
Skill decile 3	–2.7435E–01	2.2782E–03*	–2.7431E–01	2.2782E–03*
Skill decile 4	–4.2921E–01	2.2687E–03*	–4.2916E–01	2.2687E–03*
Skill decile 5	–3.1313E–01	2.3631E–03*	–3.1306E–01	2.3631E–03*
Skill decile 6	–3.8809E–01	2.5830E–03*	–3.8781E–01	2.5831E–03*
Skill decile 7	–6.0960E–01	2.3558E–03*	–6.0937E–01	2.3557E–03*
Skill decile 8	–7.0121E–01	2.4013E–03*	–7.0100E–01	2.4011E–03*
Skill decile 9	–9.4335E–01	2.2403E–03*	–9.4315E–01	2.2402E–03*
Skill decile 10	–1.3063E+00	2.4997E–03*	–1.3061E+00	2.4997E–03*
Destination choice				
μ	3.6047E+00	7.9843E–03*	3.6040E+00	7.9857E–03*
$\varphi\,(v - \bar{v})$	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 (EMPLOYGROW)	4.2308E+00	1.4330E–02*	4.2323E+00	1.4332E–02*
Heating degree days (HEATDD)	–2.4662E–04	1.0275E–06*	–2.4574E–04	1.0276E–06*
Cooling degree days (COOLDD)	–2.1684E–04	2.3123E–06*	–2.1630E–04	2.3126E–06*
Public health care expenditures (EXPHEATH)	1.0234E–03	3.4752E–06*	1.0614E–03	4.2158E–06*
Public education expenditures (EXPEDUC)	–6.5804E–04	3.3808E–06*	–5.3446E–04	4.4578E–06*
Public debt service expenditures (EXPDEBT)	–4.7845E–03	1.1355E–05*	–4.3534E–03	1.3765E–05*
Other public expenditures (EXPOTHER)	–7.8544E–04	2.3743E–06*	–9.1909E–04	2.9140E–06*
EXPHEALTH*deciles 6–10			–7.0456E–05	4.8118E–06*
EXPEDUC*deciles 6–10			–2.4808E–04	5.9195E–06*
EXPHEDEBT*deciles 6–10			–9.0473E–04	1.6766E–05*
EXPOTHER*deciles 6–10			2.6631E–04	3.3011E–06*
Canadian origin/US destination (CANORIGIN)	–7.3695E+00	1.0418E–02*	–7.4669E+00	1.0636E–02*
US origin/Canadian destination (USORIGIN)	–2.3573E+00	2.4428E–02*	–2.4639E+00	2.4507E–02*
Inclusive value variable (IVV)				
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	

... continued

Table 2
(Continued)

	Females			
	Model A		*Model B*	
	Coefficient	*Standard Error*	*Coefficient*	*Standard Error*
Stay versus migrate choice				
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 NATIVITY	5.5141E–01	3.2263E–03*	5.4436E–01	3.2206E–03*
FRENCH MOTHER TONGUE	7.6022E–01	6.1268E–03*	7.6377E–01	6.1271E–03*
Skill decile 2	–1.3229E–01	2.5146E–03*	–1.3202E–01	2.5147E–03*
Skill decile 3	–1.6863E–01	2.6747E–03*	–1.6828E–01	2.6748E–03*
Skill decile 4	–3.1822E–01	2.7415E–03*	–3.1819E–01	2.7416E–03*
Skill decile 5	–4.1051E–01	2.7003E–03*	–4.1041E–01	2.7004E–03*
Skill decile 6	–4.6223E–01	2.7623E–03*	–4.6308E–01	2.7624E–03*
Skill decile 7	–4.8186E–01	2.5628E–03*	–4.8260E–01	2.5628E–03*
Skill decile 8	–7.8455E–01	2.3334E–03*	–7.8546E–01	2.3337E–03*
Skill decile 9	–8.2848E–01	2.4791E–03*	–8.2959E–01	2.4795E–03*
Skill decile 10	–8.8356E–01	2.5704E–03*	–8.8461E–01	2.5706E–03*
Destination choice				
μ	3.7880E+00	9.9152E–03*	3.7742E+00	9.9446E–03*
$\varphi\,(v - \bar{v})$	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 (EMPLOYGROW)	4.1734E+00	1.6303E–02*	4.1492E+00	1.6348E–02*
Heating degree days (HEATDD)	–1.5268E–04	1.2296E–06*	–1.5204E–04	1.2314E–06*
Cooling degree days (COOLDD)	1.0420E–04	2.8615E–06*	9.9389E–05	2.8714E–06*
Public health care expenditures (EXPHEATH)	8.9286E–04	3.8608E–06*	5.4223E–04	5.1297E–06*
Public education expenditures (EXPEDUC)	–5.9885E–04	3.8530E–06*	–4.1231E–04	5.4111E–06*
Public debt service expenditures (EXPDEBT)	–4.6574E–03	1.2331E–05*	–4.0822E–03	1.6083E–05*
Other public expenditures (EXPOTHER)	–7.5557E–04	2.6105E–06*	–8.8733E–04	3.4612E–06*
EXPHEALTH*deciles 6–10			5.7443E–04	5.4911E–06*
EXPEDUC*deciles 6–10			–3.4008E–04	6.7059E–06*
EXPDEBT*deciles 6–10			–1.0375E–03	1.8760E–05*
EXPOTHER*deciles 6–10			1.9510E–04	3.7750E–06*
Canadian origin/US destination (CANORIGIN)	–7.2744E+00	1.1749E–02*	–7.3163E+00	1.1991E–02*
US origin/Canadian destination (USORIGIN)	–2.2269E+00	2.1891E–02*	–2.2142E+00	2.1963E–02*
Inclusive value variable (IVV)				
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 percent level. Categorical age variables were also used in place of the continuous variable used here. There were no substantive changes to the results.
Source: Authors' calculations.

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 both 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 (μ) 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 will migrate to the area (or 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 US during the latter half of the 1990s. Given our empirical results, this situation created economic incentives for higher-skilled Canadian workers to migrate to the US.[27]

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.[28] Consistent with expectations and a large number of studies in the migration literature, the coefficient on area employment growth rates (EMPLOYGROW) is estimated to be a positive influence on migration and area choice. Heating and cooling degree days (HEATDD and COOLDD) 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 the area is. This is consistent with expectations and previous work.[29]

We control for public-expenditure-mix effects on area choice and migration by specifying four per capita variables: health care expenditures (EXPHEALTH), education expenditures (EXPEDUC), debt service expenditures (EXPDEBT), and all other public expenditures (EXPOTHER). Some of these are estimated as being attractive for area choice, while 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.[30] 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.

Finally, the estimates on the national border effects: Canadian origin-US destination (CANORIGIN) and US origin-Canadian destination (USORIGIN) 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 general findings about the deterring effects of national borders on trade and other cross-country interactions.[31]

In summary, the maximum likelihood estimates of our partially degenerate nested logit model of Canadian-US 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 on 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 μ). 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 $(v_i - \bar{v})$ and φ). These results are robust to two alternative specifications of public expenditure mix across Canadian and US areas. The important implication of this finding is that US areas should have been more attractive to higher-skilled workers than Canadian areas during the latter part of the 1990s because after-tax returns in the US 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 US. We take several steps in developing the simulations. First, we use our estimated model to predict area choices for all 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 to which the results from alternative simulations are compared.

Our second step computes counterfactual values of key variables such as μ and φ. We equalize the average values of these key variables between, by setting the Canadian mean value to that of the US observed value. These variables are presented in Table 3. For example, the observed US value of μ is about 10 percent higher than the Canadian value. Equating these two values implies a counterfactual Canadian value of μ that is about 10 percent higher than the observed value of 5.6257 (for males). Likewise, the observed US value of φ 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 3 represent the average tax incidence in the two countries. Since the observed US 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 μ and φ between the two countries.

Our 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

Table 3
Average Values of μ, φ, and TAX for US and Canadian Areas

	Males			*Females*		
	US	*Canada*	*US/Canada*	*US*	*Canada*	*US/Canada*
μ	6.2072	5.6257	1.1034	5.8162	5.4045	1.0762
φ	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.

the changes in μ and φ, and from fiscal equalization (i.e., equalization of US and Canadian μ and φ 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 4 and 5 present the simulation results for Canadian-origin and American-origin individuals, respectively.[32] We ultimately are interested in the effects of changes (in Canada) on the migration of individuals to the US, 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 4 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 percent) 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 percent); and migrants to the US were 32,748 (0.80 percent).[33] 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 percent versus 4.00 percent), but are almost seven times more likely than the average Canadian resident to have moved to the US (5.45 percent versus 0.80 percent). The same pattern holds for Canadian females.

The next two columns to the right in Tables 4 and 5 under the heading "Baseline Simulation" report the results of the baseline simulations that use the observed values of the explanatory variables to predict the number of stayers, internal migrants, and between-country migrants. A casual comparison of these baseline simulations with the actual observed numbers shows that the empirical model appears to have performed rather well, in the sense that the migration patterns between deciles are essentially preserved in the baseline simulations.[34] This holds for both males and females and for both American and Canadian migrants.

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 US based on the data in Table 3.

Returns to Skills

As indicated in Table 3, 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 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 US counterparts. If free trade and economic integration had pushed income inequality in Canada to the US level, we would likely not have seen this systematic migration of highly skilled and high-income Canadians to the United States. (2005, 18)

Hunt and Mueller (2004) also find that equalizing φ 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.

TABLE 4

Migration and Destination Choice of Canadian-Origin Males and Females by Skill Level (1996–2001): Observed, Baseline Simulation, and Alternative Simulations

	Males									
					Alternative Simulations					
	Observed		*Baseline Simulation*		*μ and φ Equalized*		*φ Equalized*		*Fiscal Equalization*	
Categories	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*	*Number*	*%*
Total	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	95.2	3,900,198	94.9	3,900,534	94.9	3,900,201	94.9	3,900,582	94.9
Migrate in Canada	164,254	4.0	170,355	4.1	190,924	4.6	170,410	4.1	205,034	5.0
Migrate to US	32,748	0.8	38,568	0.9	17,677	0.4	38,512	0.9	3,486	0.1
Decile 1	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 Canada	15,556	3.5	17,233	3.9	18,260	4.1	16,301	3.7	19,735	4.5
Migrate to US	194	0.0	2,902	0.7	1,860	0.4	3,850	0.9	376	0.1
Deciles 2 and 3	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 Canada	38,016	4.8	36,206	4.6	39,427	5.0	35,215	4.5	42,446	5.4
Migrate to US	1,335	0.2	7,061	0.9	3,791	0.5	8,069	1.0	755	0.1
Deciles 4–7	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 Canada	66,583	3.9	66,944	4.0	74,983	4.4	66,935	4.0	80,507	4.8
Migrate to US	6,017	0.4	15,085	0.9	6,920	0.4	15,094	0.9	1,364	0.1
Deciles 8 and 9	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 Canada	35,144	3.6	39,707	4.1	45,845	4.7	40,922	4.2	49,076	5.0
Migrate to US	13,326	1.4	10,273	1.1	4,037	0.4	9,037	0.9	786	0.1
Decile 10	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 Canada	8,955	4.1	10,265	4.7	12,409	5.7	11,038	5.1	13,268	6.1
Migrate to US	11,876	5.4	3,247	1.5	1,069	0.5	2,461	1.1	206	0.1

Females										
					Alternative Simulations					
	Observed		Baseline Simulation		μ and φ Equalized		φ Equalized		Fiscal Equalization	
Categories	Number	%	Number	%	Number	%	Number	%	Number	%
Total	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 Canada	128,594	3.4	136,263	3.6	150,819	4.0	137,899	3.7	157,765	4.2
Migrate to US	21,966	0.6	25,338	0.7	10,466	0.3	23,661	0.6	3,491	0.1
Decile 1	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 Canada	13,857	2.6	13,496	2.5	13,860	2.6	12,644	2.4	14,483	2.7
Migrate to US	283	0.1	1,347	0.3	988	0.2	2,230	0.4	369	0.1
Deciles 2 and 3	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 Canada	14,631	2.8	15,973	3.1	16,886	3.2	15,386	2.9	17,679	3.4
Migrate to US	888	0.2	2,145	0.4	1,219	0.2	2,752	0.5	428	0.1
Deciles 4–7	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 Canada	53,640	3.5	57,476	3.8	62,571	4.1	57,264	3.8	65,405	4.3
Migrate to US	5,541	0.4	9,487	0.6	4,287	0.3	9,707	0.6	1,440	0.1
Deciles 8 and 9	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 Canada	39,632	4.1	41,932	4.3	48,123	5.0	44,054	4.5	50,350	5.2
Migrate to US	9,050	0.9	9,632	1.0	3,294	0.3	7,449	0.8	1,051	0.1
Decile 10	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 Canada	7,254	3.3	7,384	3.3	9,378	4.2	8,551	3.9	9,848	4.4
Migrate to US	6,204	2.8	2,726	1.2	678	0.3	1,523	0.7	203	0.1

Notes: Column totals 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.

Source: Authors' calculations.

TABLE 5
Migration and Destination Choice of US-Origin Males and Females by Skill Level (1995–2000): Observed, Baseline Simulation, and Alternative Simulations

	Males									
					Alternative Simulations					
	Observed		Baseline Simulation		μ and φ Equalized		φ Equalized		Fiscal Equalization	
Categories	Number	%	Number	%	Number	%	Number	%	Number	%
Total	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 US	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 Canada	1,888	0.00	1,835	0.00	4,698	0.01	1,846	0.00	24,392	0.06
Decile 1	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 US	412,671	9.58	408,115	9.48	407,979	9.47	408,184	9.48	406,562	9.44
Migrate to Canada	37	0.00	219	0.01	357	0.01	150	0.00	1,822	0.04
Deciles 2 and 3	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 US	892,010	10.21	887,715	10.16	887,267	10.16	887,785	10.16	883,650	10.12
Migrate to Canada	37	0.00	430	0.00	883	0.01	359	0.00	4,560	0.05
Deciles 4–7	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 US	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 Canada	370	0.00	655	0.00	1,652	0.01	653	0.00	8,573	0.05
Deciles 8 and 9	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 US	957,323	11.33	956,007	11.32	955,223	11.31	955,931	11.32	950,368	11.25
Migrate to Canada	630	0.01	369	0.00	1,163	0.01	446	0.01	6,066	0.06
Decile 10	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 US	476,253	10.95	484,196	11.13	483,721	11.12	484,120	11.13	481,042	11.06
Migrate to Canada	814	0.02	162	0.00	643	0.01	239	0.01	3,371	0.08

	Females									
					Alternative Simulations					
	Observed		Baseline Simulation		μ and φ Equalized		φ Equalized		Fiscal Equalization	
Categories	Number	%	Number	%	Number	%	Number	%	Number	%
Total	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 US	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 Canada	2,661	0.01	2,397	0.01	2,284	0.01	2,392	0.01	18,287	0.05
Decile 1	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 US	316,993	8.02	316,066	8.00	316,083	8.00	316,253	8.00	315,334	7.98
Migrate to Canada	148	0.00	381	0.01	363	0.01	190	0.00	1,283	0.03
Deciles 2 and 3	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 US	651,414	7.90	648,413	7.86	648,438	7.86	648,558	7.86	646,107	7.83
Migrate to Canada	148	0.00	554	0.01	527	0.01	405	0.00	2,907	0.04
Deciles 4–7	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 Canada	552	0.00	840	0.01	801	0.00	791	0.00	5,934	0.04
Deciles 8 and 9	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 Canada	1,073	0.01	481	0.01	450	0.01	688	0.01	5,477	0.07
Decile 10	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 Canada	740	0.02	142	0.00	135	0.00	318	0.01	2,686	0.06

Notes: Column totals 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.

Source: Authors' calculations.

We are able to simulate the effects of these returns-to-skills factors on an after-tax basis. To do so we raise the value of both μ and φ in Canadian provinces by the amount of the mean difference of both variables' values in Canada versus the US 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 4 and 5 under the headings "μ and φ Equalized" and "φ 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 μ and φ are both equalized. For all Canadian-origin males, the rate of migration to the US drops nearly one-half, to 43 percent from a baseline rate of 94 percent. The rate decreases are progressively larger, the higher the skill decile, reflecting the fact that the gains from the equalization of μ and φ vary directly with skill level.[35] 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 US-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 φ 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 to the US. However, there are large differential effects across deciles, as expected. When φ 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 4 under the heading "φ 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 US, whereas there is sizably lower migration to the US for those at the upper tail. These results are consistent with Hunt and Mueller (2004). Moving to the US 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 US 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 φ equalization simulation are just the opposite for US-origin workers, as indicated in Table 5. The reason why an equalization of both φ and μ, 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 μ, 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 (φ).

Fiscal Equalization

Although much of the debate about Canada-US 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 that 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) and Collins (2008) 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, 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 US and their stated reasons, including economic ones. Wagner (2000) attempts to quantify the role that lower taxes in the US, compared with Canada, play in migration to the US from Canada. He finds that there are tax savings and that these savings do induce migration to the US. However, he concludes that the magnitude of the effect is relatively small.[36] 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 US, 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 equalizing the average tax burden in Canada to equal that in the US. Based on the information in Table 3, equalization requires reducing the average burden in Canada from 38.8 percent to 27.6 percent. 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 4 and 5.

These changes induce two basic changes to migration incentives: μ and φ 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 US, as in the previous counterfactual simulations that equalized μ and φ 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.[37]

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, migration to the US 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 9 percent for all workers to about 0.09 percent. Moreover, for both males and females, the relative size of these migration effects increases as we move up the skill distribution.[38] The corresponding results in Table 5 for US-origin workers show increases in migration rates to Canada for all skill groups.

Conclusions

We investigate the effect of differentially higher *after-tax returns* to workers in the US, especially higher-skilled workers, on the propensity of Canadian workers to migrate to the United States during the period 1995–2001. Individual data provide controls for a variety of important person-specific 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 US 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 obtain maximum likelihood estimates of a partially degenerate, nested logit model of Canadian-US 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 μ). 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 $(v_i - \bar{v})$ and higher φ). These results are robust to two alternative specifications of public expenditure mix across Canadian and US areas. The important implication of this is that US areas should have been more attractive to higher-skilled workers than Canadian areas because after-tax returns in the US were higher than in Canada.

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 US and fiscal equalization. The latter counterfactual requires that Canadian non-debt service public expenditures be reduced sufficiently to maintain a budget balance in the face of the reduced tax rates required for after-tax returns equalization with the US Both sets of simulations indicate that Canadian migration to the US 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-US 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 US drops nearly one-half, to 0.43 percent from a baseline rate of 0.94 percent. 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 US-origin males and females, equalization of these two parameters has the effect of attracting more US 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 US 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 0.90 percent for all workers to about 0.09 percent. Moreover, for males and for females, the relative size of these migration effects increases as we move up the skills distribution. The corresponding results for US-origin workers show increases in migration rates to Canada for all skill groups.

In summary, our results show that differentials between the US and Canada in returns to labour and to skills during 1995–2001 increased the flow of workers from Canada to the US 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 that the migrations would have been almost eliminated under a policy regime of fiscal equalization. However, implementing such a fiscal equalization policy would require substantial relative adjustments to Canadian tax rates and public expenditures and would likely raise other substantial policy concerns beyond the scope of this migration analysis.

Appendix

Table A1
Variable Names, Definitions, and Sources

Variable	Name	Definition	US	Canada
Individual variables				
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	v	Individual's skill index	c	c
Skill differential	$v - \bar{v}$	Individual's skill differential = (skill index - mean of skill index)	c	c
Skill decile n	DECn	= 1 if individual is in nth skill decile, 0 otherwise (n=1,2,3,…,10)	c	c
Canadian nativity	BORNCAN	= 1 if individual born in Canada, 0 otherwise	a	b
French mother tongue	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
Area variables				
Log after-tax wage for mean skills	μ	Mean of area's standardized log after-tax wage distribution	c	c
After-tax returns to skill	φ	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	EMPLOYGROW	Area's employment growth rate 1995–2000 in percent	f	g
Heating degree days	HEATDD	Area's heating degree days in °F	h	i
Cooling degree days	COOLDD	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	EXPHEATH	Public health care expenditures per capita in 1996 (US $)	n	m
Public education expenditures	EXPEDUC	Public education expenditures per capita in 1996 (US $)	n	m
Public debt service expenditures	EXPDEBT	Public debt service expenditures per capita in 1996 (US $)	n	m
Other public expenditures	EXPOTHER	Total public expenditures per capita less above three items in 1996 (US $)	n	m

... continued

TABLE A1
(Continued)

Variable	Name	Definition	US	Canada
Individual x Area variables				
Area advantage (disadvantage) to those with above (below) average skills	$\varphi(\nu - \bar{\nu})$	Relative area returns to skill distribution x individual's skill differential	c, j	c, k
Distance from origin to each area	DISTANCE	Distance (in miles) from capital city of individual's origin to capital of each destination (= 0 for origin to origin)	l	l
Canadian origin, US destination dummy	CANORIGIN	= 1 for US areas if individual's origin is in Canada, 0 otherwise	c	c
US origin, Canadian destination dummy	USORIGIN	= 1 for Canadian areas if individual's origin is in US, 0 otherwise	c	c

Notes:
a. 2000 US Census of Population, PUMS Sample A (5 percent).
b. 2001 Canadian Census of Population.
c. Computed by authors following the methodology of Hunt and Mueller (2002).
d. 2000 US Census of Population, Social and Economic Characteristics, and 1990 US Census of Housing, General Housing Characteristics.
e. Social and Economic Characteristics of Individuals, Families and Households, 2001 Census, Catalogue No. 97F0021XCB2001000.
f. US Bureau of Labor Statistics, Regional and State Employment and Unemploymnet (various issues).
g. Statistics Canada, CANSIM Table 281-0025.
h. National Oceanographic and Atmospheric Administration, Climatography in the US, Number 81 (January 1992).
i. Environment Canada, Canadian Climate Normals or Averages, 1971–2000.
j. Ettlinger, et al. (1996). *Based on Institute for Taxation and Economic Policy's (ITEP) 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. US Bureau of the Census, State and Local Government Finances, by state (1995–96).

Source: Authors' calculations.or as noted above.

Table A2
Selected Total Tax Rate by Decile and Area

	Decile									
Area	*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
Canada										
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 US. State taxes are after federal offset deduction and include: sales and excise taxes, property taxes, state income taxes, social security taxes, and unemployment insurance taxes. Canadian taxes are the average tax bill on cash income for 1995 and include all provincial and federal taxes.

Source: See Table A1.

Notes

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[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 estimate the substitutability of skill losses from emigration to skill gains from immigration, whether or not emigration is permanent, and the productivity of individuals who do return to their countries of origin. In this paper, we focus on the specific Canada-US dimension of the issue, which received a large part of the attention in policy analyses of the late-1990s (the period covered by our data).

[2] See Hanson (2008) for a review.

[3] Interestingly, higher Canadian tax rates may themselves have resulted from changes in US immigration policy. Davies and Winer (2011) argue that the Canada-US border was open until US policy changes in the 1960s effectively closed it to free migration. This allowed the Canadian labour market to become uncoupled from that of the US, decreasing the elasticity of labour supply in Canada. This allowed relatively higher public sector growth and tax increases in Canada. Opening the border again in the post-FTA and post-NAFTA era resulted in increased migration of Canadians to the United States. In essence, closing the border reduced the necessity for the Canadian government to impose fiscal discipline on itself vis-à-vis the government of the United States.

[4] NAFTA took effect starting 1 January 1994 and, like its predecessor the Canada-US Free Trade Agreement, includes special North American work visas that greatly ease the movement of highly skilled individuals between the two countries

[5] Recent work (Dion and Vézina 2010) shows that the number of Canadians migrating to the United States decreased between 2000 and 2006, almost certainly the result of the strong Canadian economy over this period.

[6] Workers can also migrate elsewhere in the world. This study adds detail on the domestic alternatives, which in conjunction with the US alternatives, encompass the overwhelming majority of migration choices for Canadians.

[7] See Roy (1951); Borjas et al. (1992); and Hunt and Mueller (2004).

[8] See McFadden (1978, 1981).

[9] 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).

[10] The first decile is the group omitted to avoid the dummy variable trap.

[11] 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.

[12] 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).

[13] Helms (1985) finds empirical support for the role of taxes and public expenditure mix in the variation of income growth rates across US 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.

[14] CANORIGIN is interpreted as "Canadian Origin-US Destination;" and USORIGIN is interpreted as "US Origin-Canadian Destination."

[15] See Helliwell (2005), and Hunt and Mueller (2004).

[16] 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).

[17] 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 US areas as a group. However, the standard marginal effects calculations provide quantitative information about 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 (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.

[18] The reference year for the US is 1999 and for Canada, 2000. Wage and salary incomes in Canada were deflated by the 1999 annual Canadian inflation rate and then changed into US dollars at the 1999 exchange rate. This gives all earnings in real 1999 US dollars.

[19] 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.

[20] The original US and Canadian census microdata files represent about a 5 percent and a 3 percent sample of individuals, respectively. Our subsampling maintains this sampling rate for migrants between the two countries and internal migrants in Canada and reduces the rate for internal migrants in the US to 0.25 percent. For stayers in Canada, the subsampling reduces the original sampling rate by a factor of ten; and for stayers in the US, the subsampling reduces the original sampling rate by a factor of about 200. We chose to reduce the US observations relatively more by subsampling because there is about one order of magnitude more individuals in the US population than in Canadian population.

[21] 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 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.

[22] Definitions and sources for all variables used in this study are given in Appendix Table A1.

[23] Niels Veldhuis is Director, Fiscal Studies, The Fraser Institute, Vancouver.

[24] Although only selected tax rates are used in Table A2 (to economize on space), the full complement of these rates is used in all estimates below and is available upon request.

[25] 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).

[26] 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 IVV parameters in the stay and the migrate branches be equal. This constraint is implicit in the reporting of only one common IVV parameter estimate for each specification. See Koppelman and Wen (1998), Hunt (2000), and Hensher, Rose, and Greene (2005) for additional technical details.

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

[28] Because the focus of this study is not on rent as a factor in area choice, we utilize rent to help account for omitted larger scale amenity factors that are not included elsewhere (e.g., the public expenditures variables). Still, insofar as public expenditures and amenities are positively correlated and may not be fully captured in our public expenditure variables, these amenities may be captured by higher rent values. Thus these results, as well as the simulations below, should be treated with some caution.

[29] For example, Hunt and Mueller (2004).

[30] Day and Winer (2006) estimate the varying effects on internal Canadian provincial migration of public expenditures for health, education, and other functions.

[31] For example, see Helliwell (2005).

[32] An individual observed in 1995 to be located in a US 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.

[33] The sum of observed stayers, internal migrants, and migrants to the US (or, to Canada for US-origin individuals in Table 5) will equal (within rounding error) the corresponding figures in Table 1.

[34] In discrete choice models with observations distinguished by quantiles, and in which some quantiles experience relatively rare events, parametric estimators such as those we employ can produce relatively larger errors in the tails of the distribution (Kordas 2006). This may explain the relatively good baseline simulation performance of our models overall and in the middle, and also the eighth and ninth deciles relative to the first and tenth deciles, for example. In our baseline simulations, the highest decile migration flows are understated relative to many other deciles and relative to the total flows across all deciles. This should be kept in mind when assessing our results and when interpreting the border effects parameter estimates, which may be overstating the role of the border in cross-country migration flows (although other estimates in the model are also likely to be playing a role).

[35] Recall that it is the interaction of φ and $(v_i - \bar{v})$ that is a regressor in the model (Table 2) and that the skill differential $(v_i - \bar{v})$ is inter-regionally invariant. As a result, it is changes in φ that will influence destination choice; and raising φ in Canada raises $\varphi\ (v_i - \bar{v})$ more for workers with higher values of $(v_i - \bar{v})$.

[36] Other recent evidence suggests that higher returns to university education, as well as relative shortages for highly skilled workers in the US labour market, were compelling factors in attracting university-educated Canadians south of the border in the 1990s and early 2000s. Zafira and Walters (2008) find that the 2000 cohort of university graduates who did migrate south and who were interviewed in 2002 were heavily concentrated in only a few knowledge-economy fields (e.g., engineering and computer science). While their relative numbers were not large, they were among the best and brightest as measured by scholarships while in university, and they did command higher salaries than their colleagues who remained in Canada. Bonikowska, Hou, and Picot (2011) find that the university wage premium for new immigrants was similar in both the United States and Canada in 1980, but by 2005 was considerably higher in the United States.

[37] 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 5, we find that US-origin workers from lower deciles do increase their migration rates to Canada in this fiscal equalization simulation and that the increase is greater than the amount accounted for by the increase in μ (compare results from "μ and φ 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.

[38] This is consistent with Jackson (2005, 304) who noted: "Public opinion research shows that only the very affluent have strongly supported the tax-cut agenda, not least because the US model of low taxes and low social-service provision would leave them better off."

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