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The Economic Decision of International Migration: Two Empirical Evidences from the United States and Canada

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Abstract: This study investigated whether economic motivations are a key factor in international migration decisions. Applying the selectivity-corrected expected income for migrants and stayers, the difference in expected income for an individual in origin and destination countries was analyzed. This study used data from the U.S. and Canada to empirically test the role of income gaps in migration decisions. The main difficulty in analyzing the role of the gaps lies in collecting both income streams for the same individual, since once an individual migrates to a different country, their potential income in the origin country cannot be observed; and vice versa for stayers. Therefore, directly applying the average income of migrants (conditionally relying on their observed characteristics) to estimate the income of stayers if they had migrated results in a biased estimate of stayers' income. Hence, there is a need to account for selectivity in the migration decision and calculate selectivity-corrected income. The key finding in this study is that the expected income gap is positively associated with, and statistically significant for, international migration decisions for the U.S. and Canada. One of the main reasons may be the easy transfer of labor skills between countries that have similar labor environments and cultural backgrounds.

Keywords: international migration; neoclassical economics; self-selection; expected income difference

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1. Introduction

International migration has increased globally, primarily because the continuing development of many modern systems such as transportation and telecommunications has lowered the cost of migration. Many recent studies have dealt with the diversity of issues associated with the emergence of international migration decisions, and much attention has been paid to the forces changing the structure of the world economy that generate uncertainties in the result of migration (Czaika et al. 2021). Theoretical models explaining international migration have explored the principal causes. Neoclassical economics and the new economics of labor migration (NELM) have dominated empirical applications (Kurekova 2011; Stark and Bloom 1985; Todaro and Smith 2006; McKenzie et al. 2013). Both approaches present similar explanations of the role of differences in expected economic outcomes in the international migration decision.

Despite rigorous theoretical arguments and well-trodden paths for international migration in both models (Borjas 1990; Greenwood and McDowell 1991; Massey et al. 1994; Sanderson and Kentor 2008), few empirical studies have carefully examined the reasons for international migration. In response to the dearth of empirical studies, this study investigated whether expected income gaps play a key role in affecting an individual's decision to migrate between the U.S. and Canada. To achieve the research goal, the present study

(1) combined two sets of individual-level data collected from both the United States (U.S.) and Canada, and (2) showed and compared the analyzed results of 'the U.S. to Canada' (US2CAN) and 'Canada to the U.S.' (CAN2US) migration cases. Even though the North American countries are geographically, culturally, and economically similar, the empirical applications analyzed for both countries are still difficult to find.

This paper proceeds as follows. Section 2 provides a theoretical background on international migration and is connected to Section 3, where empirical limitations in the study of international migration were addressed. Section 4 develops an econometric methodology for estimating the potential income of international migrants and stayers, including the counterfactual cases of the income of "migrants-had-they-stayed" and of "stayers-if-they-had-migrated", respectively. Section 5 describes the data and variables employed in this study. Section 5 presents the estimation results, with particular attention being paid to the effect of expected income gaps stemming from international migration. The paper concludes with a summary and a discussion.

2. Motives for International Migration

The fundamental question in the theory of international migration is what entices individuals to migrate from one country to another. Different migration theories focus on different concepts, objectives, interests, and boundaries, but at the most basic level, all theories are based on an individual's expectation of improved welfare after international migration (Borjas 1990; Massey et al. 1993). Migrants are assumed to move to a destination country that can afford them the highest net gain in income, employment opportunities, personal safety, and social well-being (Castle 2000; Kerr and Kerr 2011).

According to the neoclassical theory of migration, a difference in the present value of an individual's future income between origin and various destination countries encourages migration to the destination country offering the highest present value of income (Borjas 2008; Mansoor and Quillin 2006). Therefore, the migrant flow comes from a pool of individuals who feel attracted to the economic benefits available in a destination country, such as a high level of income, employment, and quality of life (Borjas 1990). According to a microeconomic model of individual choice, if the expected difference in an individual's economic benefit between origin and destination countries is large enough to cover the cost of migration over a timeline, international migration will ensue. International migration can, therefore, be conceptualized as a kind of human capital investment by migrants, since migration involves incurring immediate costs that are more than offset by the increase in the present value of migrants' future incomes (Hass 2008).

Some theories also understand international migration in terms of economic forces operating beyond the individual level. Hass (2008) contends that the neoclassical theory of migration is too focused on the individual, resulting in a narrow theoretical framework that makes it difficult to deal with the complicated realities of international migration. According to the new theory of the economics of the labor market (Stark 1995), international migration depends on household income rather than individual income. The dual labor market theory argues that international migration is generated by the demand for low-level labor in developed countries which can be met by migrants (Constant and Massey 2005). The world systems theory understands international migration as a consequence of economic globalization and the penetration of capital across national boundaries (Castle and Miller 2003; Massey et al. 1993; Sassen 2005). Both dual labor market theory and world systems theory include explanatory variables at the national and/or international levels (Kurekova 2011).

Also, other conditions facilitate international migration (Kandel and Massey 2002). An interpersonal network connects migrants, former migrants, and stayers in origin and destination countries (Massey 1990a, 1990b; Massey et al. 1993). Such interpersonal networks provide information needed for migration and help international migration by reducing the cost of moving and eliminating uncertainties in the migration process (Haug 2008; Prices 2004). Non-economic reasons such as family reunion or a better welfare policy in

the destination country are also important (Chiswick 1999; Kofman 2004; Mincer 1978). In many cases, as anticipated by neoclassical migration theory, it has been found that the welfare of immigrants improves after migration (Enchautegui 1997; Meyer 1998; Gelbach 2000; Massey and Zenteno 2000). Other studies, however, did not find this result (Walker 1994; Levine and Zimmerman 1999; Painter 1999). Part of the reason is that various destination countries in Europe, including Sweden, the Netherlands, Belgium and others, strictly regulate the welfare benefits that are available to immigrants to be integrated into the labor market (Koopmans 2010).

It should be noted that some willing individuals may be unable to migrate due to institutional or systematic limitations stemming from immigration policies (Greenwood 1995). Certain types of workers (e.g., unskilled workers) may not be eligible for entry to destination countries. Also, asymmetric information may hinder migration because potential employers in destination countries may be ignorant of the transferability of immigrants' skills, resulting in fewer job offers (Katz and Stark 1984, 1987; Stark 1995).

3. Empirical Limitations in International Migration

Most migration studies have employed aggregate-level labor market data from destination countries (Greenwood et al. 1997; Greenwood and McDowell 1991). The high-level, aggregate studies generally reach conclusions that are dramatically different from studies based on individual-level data, as Robinson (1950) noted, due to the heterogeneity inherent to individual choice which is excluded from aggregate studies (DaVanzo and Hosek 1981; Bonin et al. 2008). Aggregate studies are often statistically biased and simplistic with inappropriate controls and non-random samples of migrants from one origin country, one destination country, one job site, or one social service agency (Massey et al. 1994). The limitations of aggregate studies make it difficult to test the neoclassical theory of migration.

While incorporating data on individual characteristics makes it possible to empirically test the neoclassical theory of migration (Bauer and Zimmermann 1999), only a few studies have employed individual-level data because such data are scarce or of poor quality to test international migration. Borjas (1987) used individual-level data to analyze migration from Puerto Rico to the U.S., but the study results are difficult to generalize because Puerto Ricans face no quotas or legal impediments migrating to the U.S. There are other major deficiencies in the existing empirical studies that used individual-level data. Most of them focused on geographically limited regions and were based on small samples (Taylor 1986, 1987, 1992; Stark and Taylor 1989; Massey and Espinosa 1997; Sana and Massey 2000; Massey and Zenteno 2000; Basok 2000; Gonzalez and Maloney 2005). Exceptions include Funkhouser (1992) who used individual data collected from the U.S. and El Salvador, and Bauer et al. (2002) who used Portuguese and German data; however, both studies considered migration between markedly different origin and destination countries.

So far, migration between countries with similar economic and cultural circumstances has not been investigated in the North American continent. In this regard, the present study has intellectual merit due to its empirical examinations of bi-directional migration between Canada and the U.S., countries that are close in geographic, economic, and cultural dimensions. This study also provides a model for the study of migration between similar countries elsewhere (e.g., from South Korea to Japan and European Union countries).

4. Research Hypotheses

This study empirically tested the neoclassical theory of migration using data on individuals' economic conditions and examined how individuals' backgrounds and experiences within the origin and destination countries influence their migration decisions. In accordance with the theory, this study assumed that the 'true' gain from migration consists of a positive gap between the income of migrants and stayers and that this gap is a key factor in individual migration decisions.

One problem in the comparison of an individual's future income in the origin and destination countries is that, for a migrant, their future income in the origin country is

not observed. The problem occurs due to so-called self-selectivity, and hence, the uplift in income due to migration should be appropriately evaluated by clarifying the degree of economic development each country has achieved and estimating its influences on human capital and income. Therefore, for this study, data on each origin country is essential to derive a trustworthy test of the neoclassical theory at the individual level.

Using individual data, the present study empirically tested the key proposition of the neoclassical theory of migration: the expected income gain from migration is a key factor in individuals' migration decisions. The empirical analysis begins with a reduced-form probit (RFP) model because this technique is widely applied in migration studies. However, RFP neglects the self-selectivity problem that arises from unobserved differences between migrants and stayers in personal characteristics that influence the migration decision. Failing to account for the impact of such unobserved differences between migrants and stayers can lead to biased estimates. So, in this study, a model is estimated that allows for such unobserved differences in personal characteristics and allows for the estimation of the expected incomes of migrants if they had stayed in their origin country and of stayers if they had migrated to the destination country (Heckman 1979). The nature of the correction process and the amended model are described in detail below.

Assuming individual economic rationality, the basic research hypothesis can be explained by Equation (1) (i.e., that the greater the expected income gap between the origin and destination countries, the greater the probability that an individual will choose to migrate):

$$\frac{\partial M}{\partial G} > 0 \quad (1)$$

where,

M = the probability of migration to a destination country; and
G = the difference in the present value of future incomes in origin and destination countries.

The application of the research hypothesis defined by Equation (1) is most straightforward when at least one of the following three conditions applies: (1) many characteristics, including economic conditions, culture, language, etc., are similar in the origin and destination countries; (2) migration costs are low due to a short travel distance; and (3) the two countries have a 'free of entry visa' agreement. These conditions apply to many empirical studies of either interstate or domestic migration. Yet, they also apply to international migration between the U.S. and Canada. We expect, therefore, that migration decisions from the U.S. to Canada (US2CAN) and from Canada to the U.S. (CAN2US) will prove suitable for an empirical test of the neoclassical theory of migration.

To test the research hypothesis, the RFB model is extended to create a probit model that includes an income gap variable for both types of migration (US2CAN and CAN2US). To take into account the impact of self-selection, the income gap variable for each individual is estimated using optimally estimated coefficients obtained from applying Heckman's selection correction and Maximum Likelihood Estimation (MLE). The following section describes the data used for estimation, the econometric models, and the variables included in the models.

5. Econometric Model, Data and Variables

5.1. Migration Model

The neoclassical theory of migration predicts that an individual's choice of location will be made to maximize the present value of their future lifetime income. In the extreme case of zero moving cost, an individual will choose to migrate when the present value of the future income in the destination country is greater than that in their origin country.

Let ${}^{O}E_i^*$ and ${}^{D}E_i^*$ be the present values of the lifetime income of an individual i in the origin country (O) and destination country (D), respectively. Allowing for a positive moving cost, individual i (=1, …, N) will choose to migrate if their income premium $({}^{D}E_i^* - {}^{O}E_i^*)$ exceeds their migration costs C_i, where migration costs include the material

costs of traveling, the costs of lifestyle maintenance while moving and looking for a new job, the effort required to adapt to the new language and culture, the difficulties experienced in adapting to a new labor market, the psychological costs of severing old ties and forging new ones, and so on. That is, where the net benefit from migration is greater than zero,

$$ {}^{D}E_i^* - {}^{O}E_i^* - C_i > 0 \tag{2}$$

According to the neoclassical theory of migration, an individual i compares the expected costs and benefits of migration to alternative destination countries and chooses to move to the destination country where their discounted, lifetime net benefit is expected to be maximized (Borjas 1990). If an individual's income remains unchanged over an indefinite time (${}^{O}E_i$ or ${}^{D}E_i$, respectively), the individual anticipates obtaining the expected income from the time of entry into the destination country or from the age of entry into the job market in the origin country (t_{Di}^0 or t_{Oi}^0, respectively) until retirement age (that is, ∞);. Therefore, the present value of the expected income in each origin and destination country is presented in Equation (3) (Islam 1985).

$$ {}^{k}E_i^* = \lim_{n_i -> \infty} \int_{t_{Oi}^0}^{n_i} {}^{k}E_i e^{-\omega_i t} dt = \frac{{}^{k}E_i}{\omega_i} \tag{3}$$

where,

${}^{k}E_i^*$ is an individual's expected income in either origin ($k = O$) or destination country ($k = D$);
ω_i is a discount rate factor for an individual i;
n_i is the working horizon (i.e., the time of entry to the destination country or from the age of entry into the job market in the origin country until retirement) for an individual i;
t is the time factor; and
t_{ki}^0 is an individual's entering age to a job market either destination ($k = D$) or origin ($k = O$) country.

Thus, a migrant i will compare the present value of the expected income in the destination country (${}^{D}E_i^*$), with their expected loss of the present value of lifetime income in the origin country (${}^{O}E_i^*$) and the moving cost(C_i).

The behavior of a migrant i, then, is converted to Equation (4).

$$ {}^{D}E_i^* - {}^{O}E_i^* - C_i = {}^{D}E_i^* - {}^{O}E_i^*(1 + P_i) \tag{4}$$

where, $P_i \equiv \frac{C_i}{{}^{O}E_i^*}$ is the ratio of moving costs to the present value of the migrant's expected income in the origin country.

With a log-transformation, Equation (4) can be replaced via the first-order approximation of $\ln(1 + P_i)$ with the following convenient functional form

$$ Y_i \equiv \ln\left(\frac{{}^{D}E_i^*}{{}^{O}E_i^*(1 + P_i)}\right) \tag{5a}$$

$$ \approx \ln {}^{D}E_i - \ln {}^{O}E_i - P_i \tag{5b}$$

where,

Y_i is a decision criterion of an individual migration; and
P_i substitutes $\ln(1 + P_i)$ as a first-order approximation.

Moving costs are assumed to be proportional to income (Robinson and Tomes 1982).

One problem with this log-transformed model is that the *unchanged* income values ${}^{D}E_i$ and ${}^{O}E_i$, and the cost, P_i, cannot be measured directly at the same time for each individual. This is because ${}^{D}E_i$ is only observed for the individual who migrated to the destination country and ${}^{O}E_i$ is only observed for the individual who stayed in the origin country. To

estimate the unobtainable income information in destination and origin countries, semi-logarithmic forms are introduced to ${}^{D}E_i$ and ${}^{O}E_i$:

$$\ln {}^{D}E_i = {}^{D}X_i {}^{D}\beta + {}^{D}u_i, \qquad {}^{D}u_i \sim N(0, {}^{D}\sigma), \tag{6a}$$

and

$$\ln {}^{O}E_i = {}^{O}X_i {}^{O}\beta + {}^{O}u_i, \qquad {}^{O}u_i \sim N(0, {}^{O}\sigma), \tag{6b}$$

where,
${}^{D}X_i$ (${}^{O}X_i$) = 1 * J vector of J variables that determine the present value of the expected income in the destination (origin) country for an individual i;
${}^{D}\beta$ (${}^{O}\beta$) = J * 1 column vector of coefficients representing the characteristics of the migrants (stayers), allowing the returns along with individual decisions; and
${}^{D}u_i$ (${}^{O}u_i$) = the net effect of all other unobserved variables in X_i, or specific characteristics only useful in the destination (origin) country, having zero mean with σ variance for origin and destination. Note that covariance of σ_{OD} cannot be estimated even if it is assumed to be non-zero because information from only one country case is observed (Greene 1995, p. 638).

Also, if letting δ be the coefficient vector of variables Z_i of individual opportunity costs of migration, P_i is estimated via Equation (7).

$$P_i = Z_i\delta + \varepsilon_i, \qquad \varepsilon_i \sim N(0, \sigma_\varepsilon) \tag{7}$$

where,

Z_i = the vector of variables determining the opportunity costs of migration for individual i, for example, age, marital status, household size, etc.;
δ = the column vector of estimated cost coefficients; and
ε_i = the net costs of all other unobserved variables in Z_i.

Selectivity biases are inherent in Equation (6a,b). All parameters in Equations (6) and (7) may be estimated by the Ordinary Least Squares (OLS) method only if all observations are collected in both origin and destination countries. Yet, there remains the problem of the unobserved individual incomes for migrants in the origin country if they had not migrated and for stayers in the destination country if they had migrated. Therefore, Heckman's (1979) technique is used to modify the semi-logarithmic equations to counter the bias introduced by the missing income information (Nakosteen and Zimmer 1982). Equation (6a) can be re-written as:

$$E(\ln {}^{D}E_i \,|\, {}^{D}X_i, Y_i > 0) = {}^{D}X_i {}^{D}\beta + E({}^{D}u_i \,|\, Y_i > 0) \tag{8a}$$

Note that $E({}^{D}u_i | Y_i > 0)$ is generally non-zero due to the self-selectivity in the migration decision due to the correlation with expected income. Similarly, the subsample regression for stayers can be re-written as:

$$E(\ln {}^{O}E_i \,|\, {}^{O}X_i, Y_i \leq 0) = {}^{O}X_i {}^{O}\beta + E({}^{O}u_i \,|\, Y_i \leq 0) \tag{8b}$$

To incorporate the migration decision into Equation (8a,b), the migration choice equation of (5b) is substituted by Equations (6) and (7), and an RFP model is obtained (Maddala 1983).

$$Y_i = {}^{D}X_i {}^{D}\beta - {}^{O}X_i {}^{O}\beta - Z_i\delta + {}^{D}u_i - {}^{O}u_i - \varepsilon_i \tag{9a}$$

$$\equiv \Omega_i\tau + \varsigma_i \qquad \varsigma_i \sim N(0, \sigma_\varsigma) \tag{9b}$$

where,

the transpose of τ, τ^T = [${}^{D}\beta$, $-{}^{O}\beta$, $-\delta$];
Ω_i = [${}^{D}X_i$, ${}^{O}X_i$,Z_i];
ς_i = ${}^{D}u_i - {}^{O}u_i - \varepsilon_i$; and

σ_ς = Var ($^{D}u_i - {}^{O}u_i - \varepsilon_i$).

Based on these indicators, the correlation ρ_D defined as $\rho(\frac{^{D}u_i}{^{D}\sigma}, \frac{\varsigma_i}{\sigma_\varsigma})$ equals $\frac{^{D}\sigma_\varsigma}{^{D}\sigma\sigma_\varsigma}$. Because σ_ς cannot be estimated due to the omission of stayers, it is used for normalization (Greene 1995). Note $^{D}\sigma_\varsigma$ (= $^{D}\sigma\sigma_\varsigma\rho_D$) is the covariance of $^{D}u_i$ and ε_i, and $E(^{D}u_i \big| \varsigma_i) = {}^{D}\sigma_\varsigma\varsigma_i$ (Maddala 1983, p. 367). Therefore, Equation (8a) is re-written as:

$$E(\ln {}^{D}E_i \big| {}^{D}X_i, Y_i > 0) = {}^{D}X_i{}^{D}\beta + (^{D}\sigma\rho_D)\left[\frac{\phi(\Omega_i\tau)}{\Phi(\Omega_i\tau)}\right] \quad (10a)$$

$$= {}^{D}X_i{}^{D}\beta + (^{D}\sigma\rho_D)^{D}\lambda_i \quad (10b)$$

where,

the Inverse Mill's Ratio (IMR) for the destination country $^{D}\lambda_i = \frac{\phi(\Omega_i\tau)}{\Phi(\Omega_i\tau)}$ (>0);

$\Phi(*)$ is the standard normal cumulative density function; and

$\phi(*)$ is the standard normal probability density function of $\Phi(*)$.

Similarly, Equation (8b) is re-written as:

$$E(\ln {}^{O}E_i \big| {}^{O}X_i, Y_i \leq 0) = {}^{O}X_i{}^{O}\beta + (^{O}\sigma\rho_O)\left[-\frac{\phi(\Omega_i\tau)}{1-\Phi(\Omega_i\tau)}\right] \quad (11a)$$

$$= {}^{O}X_i{}^{O}\beta + (^{O}\sigma\rho_O)^{O}\lambda_i \quad (11b)$$

where,

the correlation $\rho_O = \rho(\frac{^{O}u_i}{^{O}\sigma}, \frac{\varsigma_i}{\sigma_\varsigma}) = \frac{^{O}\sigma_\varsigma}{^{O}\sigma\sigma_\varsigma} = \frac{^{O}\sigma_\varsigma}{^{O}\sigma}$; and

IMR for the origin country, $^{O}\lambda_i = -\frac{\phi(\Omega_i\tau)}{1-\Phi(\Omega_i\tau)}$ (<0).

Therefore, the income equations for migrants and stayers, (6a,b), can be re-written as,

$$\ln {}^{k}E_i = {}^{k}X_i{}^{k}\beta + (^{k}\sigma\rho_k)^{k}\lambda_i + {}^{k}\Gamma_i \quad (12)$$

where: $k = D$ for migrants, otherwise $k = O$.

Here, the mean values of both Γ_is are 0; however, because the observations in each case are omitted due to self-selection, Γ_is have heteroscedasticity. The $^{k}\lambda_i$ in Equation (12) is also unknown. Therefore, the RFP model in Equation (9b) helps estimate $^{k}\lambda_i$. The estimated value ($^{k}\hat{\lambda}_i$), then, can be used to estimate the corresponding parameters of $^{k}\beta$ in Equation (12) using OLS. Starting from the consistent but not fully efficient estimators obtained from the Heckman procedure, the MLE method can be applied to obtain optimally estimated parameters in Equations (9b) and (12). The income coefficients, $^{D}\hat{\beta}$ and $^{O}\hat{\beta}$, and the re-computed coefficients on $^{D}\hat{\lambda}_i$ for migrants and $^{O}\hat{\lambda}_i$ for stayers (and hence, $^{D}\hat{\sigma}$, $\hat{\rho}_D$, $^{O}\hat{\sigma}$, and $\hat{\rho}_O$) are also estimated.

Here, a further explanation of the self-selectivity parameters ($^{D}\hat{\lambda}_i$ and $^{O}\hat{\lambda}_i$) is needed. Since the coefficient on $^{D}\hat{\lambda}_i$ ($^{O}\hat{\lambda}_i$) is a covariance of invisible errors between the migration decision and migrants' (stayers') income equations, both the significance and direction of the coefficient convey important implications. First, each income equation has heteroscedasticity due to selectivity bias but $^{k}\hat{\lambda}_i$ corrects the bias. Second, if the coefficient on $^{D}\hat{\lambda}_i$ is positive, it indicates $\hat{\rho}_D > 0$ because $^{D}\sigma_\varsigma = {}^{D}\sigma\rho_D$; the invisible characteristics related to the migration decision affect income positively, meaning migrants can earn more, ceteris paribus, in the destination country than they would have earned in their origin country. For stayers, because the coefficient on $^{O}\hat{\lambda}_i$ itself includes the negative direction, as shown in Equation (11b), the migration decision relates positively to stayers' earned income if the direction is negative. Therefore, in ceteris paribus, stayers can earn more in their origin country than they could have earned in a destination country. Table 1 presents the direction of the coefficients on λ_i between the expected income of migrants/stayers and their migration decision.

Table 1. Cross Tab on Expected Incomes and Migration Decisions: Direction of Coefficients on λ_i (=ρ).

	$Y_i = 1$	$Y_i = 0$
$\text{Exp}(\ln {}^{D}E_i) > \text{Exp}(\ln {}^{O}E_i)$	+	+
$\text{Exp}(\ln {}^{D}E_i) < \text{Exp}(\ln {}^{O}E_i)$	−	−

Finally, to directly test the research hypothesis presented in Equation (1), a new probit model that includes an income gap variable was introduced. A new variable G_i (=$\ln {}^{D}\hat{E}_i - \ln {}^{O}\hat{E}_i$) was calculated from the estimated parameters in income Equation (12), substituting the RFP model. The results are presented in the last column of each result table.

5.2. Data and Variables

5.2.1. Data

To test the research hypothesis, individual-level data for this study were drawn from the 1990 U.S. Public Use Micro Samples (PUMS A, 5 percent) and the 1991 Canadian Public Use Micro Files (PUMF, 3 percent) relating to migration between the U.S. and Canada. The details of the procedures for obtaining and preparing the data from each country are presented in Table 2. Briefly, the final data sets were prepared via the following three steps:

Table 2. Data Preparation Procedure.

	U.S. and Canada			
	U.S.	**Observation**	**Canada**	**Observation**
Step A	1990 PUMS A (0.05%) Random Sample (5%) (Stayers) U.S. in Canada (Migrants) Number of Cases Used	124,777 6218 8791 15,009	1991 Ind. PUMF (3%) Random Sample (2%) (Stayers) Canadian in U.S. (Migrants) Number of Cases Used	809,654 16,066 43,159 59,225
Step B	Data Filtering: AGE > 15 Total Income > 0 Household Size > 0 Data prepared for estimating expected Income	11,364	Data Filtering: AGE > 15 Total Income > 0 Household Size > 0 Data prepared for estimating expected Income	47,162
Step C	Combined data 0 < Years of Immigration of American < 15 Valid household type Migrants to Canada Stayers in U.S. Total	11,364 2413 4058 6471	Combined data 0 < Years of Immigration of Canadian < 15 Valid household type Migrants to US Stayers in Canada Total	47,162 5945 11,393 17,338

Migrants	Stayers	Total	Migrants	Stayers	Total	
Mean income	17,976.4	20,617.9	19,632.9	28,686.4	17,072.7	21,054.9
Modified mean income [1]	17,884.6	20,643.1	19,614.5	28,657.5	17,045.4	21,027.1
Expected mean income [2]	16,327.5	17,375.0	16,984.4	22,534.2	16,269.2	18,417.4

Notes: [1]. Modified mean incomes were modified using a Purchasing Power Parity exchange rate and the regional and annual Consumer Price Indices. [2]. The expected mean income is calculated from the coefficients of the modified income regression estimated with square root Box-Cox transformation (that is, $\lambda = 0.5$). Other demographic and socioeconomic independent variables include white or not; living in MSA or not; household or not; number of households; number of laborers in each household; male or female; age dummy variables (16–25, 26–35, 36–45, 46–55, 56–65, 66–75); married or not; widowed, divorced, separated or not; stayers or not; education dummy variables; self-employer or not; existence of additional incomes such as interest or rental income; and owner or not.

Step A included a process for the random sampling of stayers. To reduce the large group effect generally found in the origin data set, the number of stayers was controlled by sampling approximately three times the number of migrants in each country as stayers, and data on migrants were combined for each country.

Step B presents several constraints that filter the data prepared. Constant income values were also estimated here to be consistent with the econometric procedure, instead of using raw income values. To this purpose, the approach developed by Goodman and Kawai (1986) who applied a Box-Cox transformation where the lambda coefficient in the Box-Cox formula is fixed at 0.5 was used. This is a square-root transformation, and is known to provide the optimal estimate for expected income (Goodman 1988; Goodman and Kawai 1986; Watcher and Megbolugbe 1992). The sensitive tests for 0.5 were also consistent with them.

Step C restricts the migration period to a maximum of 15 years to avoid the predetermination of some variables' characteristics, as highlighted in Table 2.

Details not reported in Table 2 but are worth mentioning are as follows. The income of the two countries was modified because the data were in U.S. and Canadian dollars. The Purchasing Power Parity (PPP)[1] exchange rate was used to make the income variables commensurate. Also, to ensure comparability over time, the data were converted to a common year's price level using the domestic Consumer Price Index (CPI) for each country[2].

Individual-level variables featured in migration theories and in previous empirical studies of migration were selected for inclusion in the analysis as predictor variables. A summary of these variables is presented in Table 3. The variables are classified into two categories: income (Inc) and migration (Mig), and the last column in the table specifies into which category each variable falls. For example, the migration category variables include family size (NUMH), entry-age (EAGE), and its squared value (EAGE_SQ). The following paragraphs provide the specific reasons for selecting the independent variables used for migration and income equations.

Table 3. Description of Variables.

	Description	Category [1]
Dependent		
MIG	1 = immigrants, 0 = otherwise	
LNTINC	log of expected incomes of an individual modified by PPP and by year and regional CPIs	
Independent		
Demographic		
AGE	Years in age (> 15)	Inc, Mig
AGE_SQ	(Ag * Ag)/100	Inc, Mig
MALE	1 = male, 0 = otherwise	Inc, Mig
MARY	1 = the married, 0 = otherwise	Inc, Mig
NUMH	household size (before migration for migrants)	Mig
Economic		
YSCH	total years of schooling switched to years from the education attainment category	Mig
YSCH_SQ	(YSCH * YSCH)/100	Mig
SC1	high school =< the level of schooling < BA	Inc
SC2	the level of schooling >= BA	Inc, Mig
SC0	otherwise (Ref.)	
OCC1	managerial, professional, and administrative	Inc, Mig
OCC2	occupations related to sales, services occupations	Inc, Mig
OCC3	primary occupation and simple secondary occupations related to processing, transporting and machining	Inc, Mig
OCC0	otherwise (Ref.)	
EAGE	age − (years since migration), if mig = 1 YSCH + 6, if mig = 0	Mig
EAGE_SQ	(EAGE * EAGE)/100	Mig
G	income gap (= $\ln {}^{D}\hat{E}_i - \ln {}^{O}\hat{E}_i$)	Mig
Regional		
MSA	1 = located in MSA or CMSA, 0 = otherwise	Inc, Mig

Note: [1]. Inc = Income equation, Mig = Immigration Equation.

5.2.2. Independent Variables

Age is one of the most important factors in the migration decision because it represents the life cycle effect (Long 1988). Neoclassical migration theory suggests that the older an

individual is, the smaller the discounted benefit from migration (Molho 1986; Robinson and Tomes 1982; Islam 1985; Islam and Choudhury 1990; Newbold 1996; Lee and Roseman 1999; Lee et al. 2005). We selected two variables: age (AGE), which positively affects the migration decision and squared age divided by 100 (AGE_SQ), which may negatively affect the migration decision. The latter indicates that the marginal propensity for migration diminishes as the individual's age increases. These age variables are also used in the income model.

In general, males (MALE) are more likely to migrate than females (Stark and Taylor 1991). Also, it should be noted that males, on average, earn a higher income than females (Jones and Kodras 1990; Ha and Lee 2001). However, fewer males migrate when more jobs are available in an origin country relative to a destination country.

Marital status (MARY) is positively correlated with income status, but negatively affects the migration decision. This is because married couples are more likely to be tied-stayers than single individuals (Mincer 1978; Roseman and Lee 1998; Lee and Zhee 2001). As Robinson and Tomes (1982) pointed out, however, if a regression model controls for the family (or household) size, the estimated coefficient may show a partial correlation with the family size; thus, singles may be tied-stayers as family members, especially when cared for by their parents. Because variables in a destination country cannot be predetermined before migration, the effect of marital status in the migration equation was controlled for by restricting the migration period to less than 15 years.

Education and occupation variables represent a prior investment of an individual in their own earning capacity. The likelihood of migration will increase with the individual's education level, since a higher level of education is associated with a higher income in the destination country (Greenwood 1975; Krieg 1993). In addition to boosting economic status, education influences the likelihood of migration through improved information acquisition. It is generally assumed that potential migrants acquire the necessary information on destination countries via media, first-hand personal knowledge and/or their private connections through family, friends, and acquaintances. As an individual achieves a higher level of education, pathways to obtaining information on a destination country will improve.

Individual education and occupation levels are expected to eventually improve the individual socioeconomic status by compensating for the unidentified factors associated with their current income level. As shown in Table 3, the income equation in this study coded individual education as dummy variables (SC1, SC2, and SC0) while the migration equation as linear variables (YSCH and YSCH_SQ). The dummy variables in the income equation are intended to measure the sheepskin effects which are critical to measuring the economic achievements of migrants (Jaeger and Marianne 1996; Myers and Lee 1998). Also, the occupation variable is categorized into four groups (OCC1, OCC2, OCC3, and OCC0). Because individuals who have professional/managerial jobs may have a higher potential to succeed socioeconomically in the destination country than groups who are engaged in non-white collar occupations (Alba and Logan 1992), the outcome of the migration decision may differ according to the individual's occupation.

Whether an individual lives in a metropolitan statistical area (MSA) may also influence the probability of migration between the U.S. and Canada (Lee and Zhee 2001). This is because residents in an MSA are exposed to a greater variety of information on the metropolitan life of other countries than non-MSA residents. Also, an employee hired in an MSA, on average, receives a higher salary than employees in non-MSA areas because the cost of living for MSA residents is generally higher. However, in the migration decision to Canada from the U.S., this variable may exert a negative effect because the overall U.S. job market may be more attractive than the overall Canadian job market.

The likelihood of migration decreases as an individual's family responsibilities increase. Such family responsibilities increase with family size and the presence of aging parents and/or school-aged children (Lee and Roseman 1999). Thus, as shown in many previous studies, family size is a key factor affecting migration decisions (Robinson and Tomes 1982;

Islam and Choudhury 1990; Islam 1985; Newbold 1996; Axelsson and Westerlund 1998). In this study, family size (NUMH) for both stayers and migrants was recalculated with an age restriction by only including individuals aged 15 years or more. Further, when calculating an individual's family size, we excluded children born after migration. This is because family size is already predetermined and new migrants are only selected; hence, it was difficult to include the NUMH variable in the income equation. However, it should be noted that NUMH was used to estimate the expected income model because the migration period was not restricted in the expected income estimation.

Entry-age (EAGE) and its square (EAGE_SQ) variables also serve to determine the cost of migration. International migration decreases as the entering age into a destination country increases. Silva (1997) showed that age variables exert a greater impact on international migration than many other migrant characteristics. However, because the migration period is restricted to 15 years, entry-age may not be fully regarded in the labor market of the destination country and may be unrelated to an individual's income.

6. Results

The US2CAN and CAN2US regression results are presented in Tables 3 and 4, respectively. Each table contains four regression equations estimated using the following approaches: RFP model, OLS income models with self-selectivity of migrants and stayers (OLS-S), migration choice and income models re-estimated efficiently by MLE on the basis of the OLS estimators (MLE model), and a new migration choice model with a new variable representing the income gap (Gap model). Simulation results to show the effect of the expected income difference (i.e., the gap) on the probability of international migration were calculated at different education levels, as presented in Figure 1.

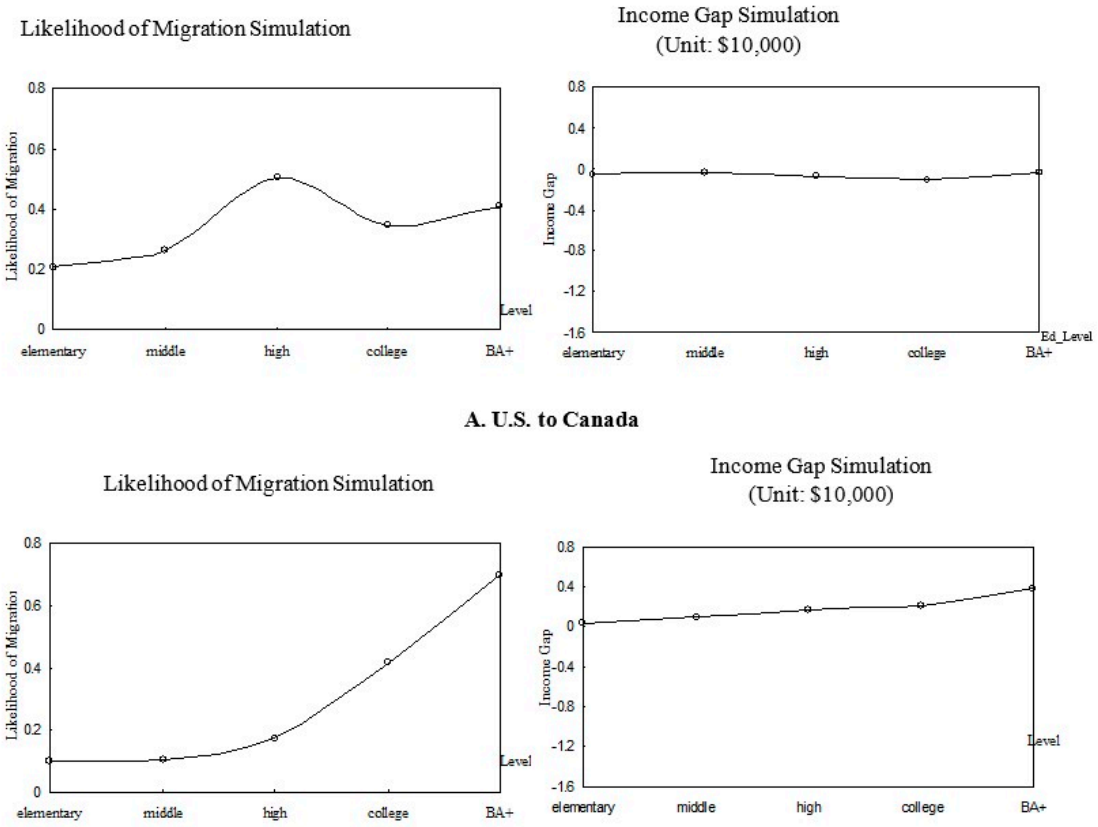

Figure 1. Simulation Results of Migration Propensity. Note: Ed_Level means the education level that individuals achieved.

Table 4. The Result of International Migration: 'the U.S. to Canada'.

	Reduced-form Probit (RFP)			OLS with Selectivity (OLS-S)						MLE									Probit with Income Difference (Gap)		
				Migrants			Stayers			Migration			Migrants			Stayers					
Dep. Var.	Y_i			$\ln^D E_i$			$\ln^O E_i$			Y_i			$\ln^D E_i$			$\ln^O E_i$			Y_i		
Var.	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**
Con.	8.6122	***	0.9855	6.2550	***	0.0512	6.3953	***	0.0481	7.7277	***	0.9488	6.2578	***	0.0471	6.5658	***	0.0352	10.9115	***	1.1196
AGE	0.4598	***	0.0475	0.0944	***	0.0024	0.0889	***	0.0020	0.4948	***	0.0630	0.0943	***	0.0023	0.0847	***	0.0016	0.3816	***	0.0500
AGE_SQ	−0.8307	***	0.0789	−0.0834	***	0.0025	−0.0778	***	0.0020	−0.8666	***	0.1097	−0.0833	***	0.0023	−0.0754	***	0.0017	−0.7712	***	0.0794
MALE	−0.5178	***	0.0666	0.6323	***	0.0135	0.6700	***	0.0119	−0.4002	***	0.0671	0.6328	***	0.0159	0.6478	***	0.0118	−0.4109	***	0.0707
YSCH	1.9088	***	0.1072							1.9347	***	0.0742							2.0118	***	0.1112
YSCH_SQ	−7.0990	***	0.4024							−7.1486	***	0.2958							−7.5971	***	0.4235
SC1				0.3725	***	0.0188	0.3850	***	0.0127				0.3729	***	0.0157	0.3958	***	0.0110			
SC2				0.8766	***	0.0228	0.8253	***	0.0182				0.8770	***	0.0244	0.8518	***	0.0193			
OCC1	−0.4401	***	0.1549	0.1017	***	0.0255	0.1473	***	0.0207	−0.3197	**	0.1347	0.1023	***	0.0237	0.1353	***	0.0181	−0.1412		0.1677
OCC2	−1.0760	***	0.1692	0.0560		0.0370	0.1110	***	0.0220	−0.9503	***	0.1431	0.0575		0.0390	0.0683	***	0.0176	−0.9506	***	0.1705
OCC3	−0.2534	*	0.1534	0.0302		0.0256	0.1093	***	0.0214	−0.1295		0.1335	0.0299		0.0222	0.1044	***	0.0187	0.4470	**	0.2174
MARY	0.2503	***	0.0730	0.0779	***	0.0149	0.0521	***	0.0120	0.4392	***	0.0368	0.0805	***	0.0157	0.0723	***	0.0117	0.1655	**	0.0756
MSA	−0.0992		0.0676	0.2615	***	0.0141	0.2038	***	0.0110	−0.1058		0.1181	0.2618	***	0.0140	0.2002	***	0.0102	−0.6541	***	0.1406
NUMH	−0.0217		0.0343							−0.0937	**	0.0307							−0.0192		0.0345
EAGE	−2.9100	***	0.1471							−2.8995	***	0.0732							−2.9088	***	0.1480
EAGE_SQ	7.6130	***	0.3754							7.5340	***	0.0687							7.5993	***	0.3772
λ				0.0727	***	0.0129	−0.3666	***	0.0392												
G																			8.8730	**	1.9656
σ													0.3224	***	0.0040	0.3023	***	0.0033			
ρ													0.1996	***	0.0405	−0.4175	***	0.0483			
χ^2	6490.2	***																	6510.7	***	
−2LogL	2057.7			1351.5			1589.7						5082.65						2037.2		
N	6471			2413			4058												6471		
adj. R^2	0.7592			0.8139			0.8034												0.7617		

Notes: 1. ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$. 2. The adjusted R^2s in probit equations indicate the pseudo R^2s calculated from the McFadden's approach.

6.1. The U.S. to Canada

When comparing the RFP model to the Gap model, the χ^2 (chi-squared) or negative twice the difference in the log-likelihood ($-2LL$) statistics can be used to assess the model fit between the models. It needs to be noted that the $-2LL$ information in the MLE model is much greater than that of RFP because the MLE model includes three models. Therefore, comparing the χ^2 statistics for RFP and the Gap model is proper. The Gap model was better estimated than the former because when adding only income gap to RFP, the ${\chi^2}_{(1)}$ of the Gap model is higher than the critical value at the one percent significance level (that is, ${\chi^2}_{(1)} = 6510.7 - 6490.2 > 6.635$) for US2CAN. Consistently, the pseudo R^2 in the Gap model was higher than the adjusted R^2 of RFP.

Also, the coefficients in the two income equations with self-selectivity variables (${}^D\hat{\lambda}_i$ and ${}^O\hat{\lambda}_i$) estimated using OLS provide information on the selection bias, and the associated estimated parameters (${}^D\hat{\beta}$ and ${}^O\hat{\beta}$). In the MLE model, all variables are significant at the one percent level except OCC2 and OCC3 in the income model for migrants, which is consistent with the results of previous studies.

Based on the MLE and the Gap model results, the age variables (AGE and AGE_SQ) are significant at the one percent significance level. Because the former is positive and the latter is negative, the probability of migration increases as age increases but at a decreasing rate. This result is consistent with the neoclassical theory of migration. The coefficient on the MALE variable was negative, which implies that a male is unlikely to migrate to Canada, perhaps because the U.S. provides superior job opportunities. The two coefficients on schooling (YSCH and YSCH_SQ) were significant at the one percent level: YSCH was positively and YSCH_SQ negatively associated with the probability of migration. This indicates that more educated individuals are more likely to migrate, but that the positive impact of education on the probability of migration decreases as the level of education increases.

In the RFP model, all three occupational category dummy variables are significantly and negatively associated with the migration decision, indicating Americans are not willing to migrate to Canada. However, the estimated coefficient on OCC1 changed to be non-significant, and that of OCC3 (i.e., primary or simple secondary transportation, machining, or processing jobs) is positively significant in the Gap model. This indicates that individuals who are employed in OCC3 in the U.S. may be more likely to migrate to Canada, perhaps because they expect to earn more in Canada. Interestingly, however, working in service sectors (OCC2) was negatively associated with migration decisions. This may be because service jobs are more locally dependent and because individuals in the sector are often in a more tightly knit human network such as through family ties or relationships with other workers who may be an important source of job opportunities in the service sector. Regarding OCC1, the result implies that the migration decision of an individual who has a relatively high-status job would depend on various factors such as the expected income gap in the job markets and other social benefits both in the U.S. and Canada. However, as also indicated by the OCC1 coefficient estimated in the MLE and Gap models, relatively high-status employees (OCC1) in the U.S. are reluctant to migrate to Canada because individuals in the OCC1 sector may expect to earn more by staying in the U.S. Also, the coefficient on NUMH, which was not significantly related to migration in the RFP model, is significant in the MLE estimation, implying that the probability of migration decreases as the household size gets larger.

Turning to consideration of the MARY variable, a single individual in the U.S. would be less likely to move to Canada because s/he has a more attractive alternative in domestic migration within the U.S. This may reflect family ties or even preferable weather conditions within the U.S. The coefficient on MSA in the Gap model is significant but not in RFP, suggesting that Americans living in urban areas are reluctant to migrate to Canada. Consistently, entry-age and its square term (divided by 100) were significantly correlated with the migration decision, showing negative and positive directions, respectively. The findings from the entry-age variables imply that the experiences of individuals in the U.S. induce

less inclination to migrate to Canada, while the marginal propensity increases slightly as entry-age increases.

Testing the hypothesis suggested in Section 2 by adding the expected income gap variable, G_i, to the RFP model yields some interesting results: First, the G_i coefficient affects the migration decision positively and significantly, supporting the research hypothesis suggested in Equation (1). Second, the magnitude of the other socioeconomic variables decreased in the Gap model compared to the RFP model, indicating that the variable G_i may be encroaching upon the effects of the other variables in the equation.

Table 6 presents a summary of the selection biases estimated in the income equations for migrants and stayers ($^{D}\hat{\lambda}_i$ and $^{O}\hat{\lambda}_i$). The positive and significant coefficients for the US2CAN migrants indicate that the migrants would earn more in Canada than they would have earned if they had stayed in the U.S. For stayers, the negative coefficient on $^{O}\hat{\lambda}_i$ indicates that the stayers would have earned more in the U.S. than they would have earned in Canada had they migrated. These results indicate that the decisions made by both migrants and stayers were economically rational.

6.2. Canada to the U.S.

Canada is, in many ways, similar to the U.S., but the U.S. job market is generally perceived to be more competitive, and the environmental (e.g., weather) conditions in the U.S. are superior to those in Canada. The results are shown in Table 5.

In the migration equation using MLE, the absolute values of the coefficients for all variables are slightly greater than those in the RFP equation. The Gap model presents some interesting differences in coefficient values; for example, the coefficient on MALE is positive at the one percent significance level in the Gap equation. This indicates that males would be more likely to migrate to the U.S. than females when controlling for the expected income gap. Consistent with US2CAN, the expected income gap (*G*) in CAN2US has a positive coefficient; however, its effect is smaller than that of US2CAN, demonstrating that Canadians are less sensitive to the income gap than Americans in the migration decision.

The CAN2US case results yield some interesting points. The coefficients on AG, AG_SQ, YSCH, and YSCH_SQ are all significant at the one percent significance level, suggesting that the marginal propensity to migrate diminishes as age and years of schooling increase. These findings are consistent with the human capital model of migration and with the results in the RFP model found in US2CAN. Also, the coefficient on marital status (MARY) was significantly positive, consistent with US2CAN. The entry-age variables were also consistent with US2CAN, but less affected by the change of entry-age, suggesting Canadian workers' migration decisions are less age-dependent.

The coefficient on household size (NUMH) is negative at the one percent significance level, confirming that family size increases reduce individual mobility, as suggested by neoclassical migration theory. Further, individuals residing in MSAs may be more likely to move to the U.S. because of their broad exposure to information on the U.S., which is perceived as an economically and environmentally more attractive place than Canada. This result helps explain why the coefficient on the MSA variable in US2CAN was negative. In contrast to US2CAN, all OCC variables were positive, indicating that competitive individuals in Canada who are able to acquire better jobs in the U.S. are more likely to migrate.

Table 5. The Empirical Results for International Migration: 'Canada to the U.S.'.

	Reduced-form Probit (RFP)			OLS with Selectivity (OLS-S)						MLE									Probit with Income Difference (Gap)		
				Migrants			Stayers			Migration			Migrants			Stayers					
Dep. Var.	Y_i			$\ln^D E_i$			$\ln^O E_i$			Y_i			$\ln^D E_i$			$\ln^O E_i$			Y_i		
Var.	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**	**coeff.**		**S.E.**
Con.	6.9520	***	0.4806	6.1953	***	0.0391	5.1714	***	0.0372	5.2708	***	0.4801	6.2077	***	0.0341	5.4143	***	0.0287	3.9161	***	0.7814
AGE	0.2906	***	0.0240	0.1152	***	0.0019	0.1356	***	0.0016	0.3914	***	0.0299	0.1150	***	0.0017	0.1272	***	0.0014	0.3434	***	0.0264
AGE_SQ	−0.6130	***	0.0403	−0.1137	***	0.0022	−0.1206	***	0.0017	−0.7617	***	0.0531	−0.1136	***	0.0019	−0.1143	***	0.0015	−0.6339	***	0.0407
MALE	−0.0442		0.0343	0.6721	***	0.0096	0.7812	***	0.0086	0.0341		0.0371	0.6717	***	0.0114	0.7756	***	0.0100	0.3003	***	0.0775
YSCH	0.6546	***	0.0374							0.7069	***	0.0145							0.7128	***	0.0394
YSCH_SQ	−2.0288	***	0.1383							−2.2179	***	0.0726							−2.2023	***	0.1434
SC1				0.3309	***	0.0134	0.4007	***	0.0097				0.3305	***	0.0120	0.4107	***	0.0096			
SC2				0.8447	***	0.0152	0.8322	***	0.0154				0.8442	***	0.0165	0.8987	***	0.0187			
OCC1	0.8429	***	0.1220	−0.0021		0.0236	0.1154	***	0.0162	0.9146	***	0.1015	−0.0032		0.0205	0.1326	***	0.0158	1.3119	***	0.1544
OCC2	1.1873	***	0.1250	−0.0601	**	0.0243	0.0456	**	0.0197	1.2662	***	0.1048	−0.0622	***	0.0203	0.0830	***	0.0208	1.6985	***	0.1623
OCC3	0.3528	***	0.1218	0.0065		0.0258	0.1034	***	0.0155	0.4310	***	0.1006	0.0075		0.0219	0.0785	***	0.0134	0.6048	***	0.1317
MARY	−0.1223	***	0.0404	0.1445	***	0.0106	0.0430	***	0.0097	0.6037	***	0.0407	0.1438	***	0.0117	0.0676	***	0.0103	0.2616	***	0.0656
MSA	−1.7786	***	0.0385	0.2828	***	0.0122	0.2423	***	0.0089	0.3019	***	0.0380	0.2811	***	0.0108	0.2604	***	0.0087	0.2065	***	0.0412
NUMH	−0.1223	***	0.0179							−0.1713	***	0.0178							−0.1230	***	0.0180
EAGE	−1.7786	***	0.0512							−1.7960	***	0.0343							−1.7875	***	0.0516
EAGE_SQ	4.6702	***	0.1290							4.6871	***	0.0964							4.6931	***	0.1300
λ				−0.0100		0.0095	−0.4596	***	0.0198												
G																			3.3834	***	0.6831
σ													0.3486	***	0.0015	0.4345	***	0.0028			
ρ													−0.0561	**	0.0230	−0.4083	***	0.0244			
χ^2	15,148.6	***																	15,173.0	***	
−2LogL	7144.8			4427.9			12,565.6						24,318.2						7120.1		
N	17,337			5945			11,392												17,337		
adj. R^2	0.6795			0.7984			0.7455												0.6806		

Notes: 1. ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$. 2. The adjusted R^2s for the probit equations were calculated using McFadden's method.

In the OLS income equations, the coefficients on all independent variables for migrants were significant at the one percent level, except the occupation dummy variables. The results for the stayers were also consistent with those in US2CAN. Interestingly, the effect of job type on income in CAN2US differed from that in US2CAN. Although Canadian migrants are competitive in their home country, they may not necessarily be competitive in the U.S. job market. Generally, the U.S. job market is much more competitive, and Canadian migrants may have limited access to the U.S. job market. This possible explanation is consistent with asymmetric information theory. Further, despite its lack of statistical significance, the negative coefficient on ${}^{D}\hat{\lambda}_i$ provides an additional indication of asymmetric access to the job market. As suggested in Table 6, Canadian migrants would earn less, ceteris paribus, in the U.S. than they would have earned in their own country had they not migrated. The significant correlation, $\hat{\rho}_D$, in the income equation of migrants in MLE also supports that there may be a disparity in the income of Canadian migrants. Also, the negative coefficient on ${}^{O}\hat{\lambda}_i$ indicates, ceteris paribus, that the stayers would earn more in Canada than the potential income they would have earned in the U.S. if they had migrated. This result is reasonable because the individual capabilities that Canadian residents hold would be better revealed in the smaller but more familiar Canadian job market rather than in the larger, more competitive U.S. job market.

Table 6. The Direction of the Estimated Coefficients on λ_i $(= \rho)$ from the Maximum Likelihood Estimation (MLE).

US->Canada	Y_i **= 1**	Y_i **= 0**
$\text{Exp}(\ln {}^{D}E_i) > \text{Exp}(\ln {}^{O}E_i)$	+ ***	
$\text{Exp}(\ln {}^{D}E_i) < \text{Exp}(\ln {}^{O}E_i)$		− ***
Canada->US	$Y_i = 1$	$Y_i = 0$
$\text{Exp}(\ln {}^{D}E_i) > \text{Exp}(\ln {}^{O}E_i)$		
$\text{Exp}(\ln {}^{D}E_i) < \text{Exp}(\ln {}^{O}E_i)$	−	− ***

Note: ***, $p < 0.01$; **, $p < 0.05$; *, $p < 0.10$.

6.3. Simulation

To show the results from another perspective, a new set of migration propensity, education and income variables were estimated based on the regression results in Tables 4 and 5 and used in simulations. In general, education is positively associated with migration propensity and income (Lee and Roseman 1997, 1999; Lee and Zhee 2001). Migration propensity generally increases as education level increases because more educated people often have better access to information on the U.S. Education will also increase the income gap.

The simulation results in Figure 1, for both the US2CAN and CAN2US cases, illustrate the positive impact of education on both migration likelihood and income status, with both generally rising with an individual's education level. In sum, more educated people are more likely to migrate because they expect a higher rate of return in the destination country, and since the U.S. has a more attractive labor market, more highly educated people from Canada are more likely to migrate to the U.S.

7. Conclusions and Limitations

International migration decisions are made in uncertain contexts because information about the destination countries is incomplete and the abilities that an individual holds may not be fully transferable to a destination country (Czaika et al. 2021). Also, in conducting studies of international migration, finding and processing data for both countries is a challenge.

The present study empirically modeled the international migration decisions using individual-level data from the U.S. and Canada and tested the predictions of the neoclassical theory of migration, which conceptualizes international migration as a way to maximize an

individual's lifetime income. To properly and empirically address our research hypotheses, we prepared a dataset drawn from both the U.S. and Canada. While the present study experienced some limitations due to limited data accessibility, it nonetheless enabled us to estimate an 'opportunity income' that individuals might have made if their migration decision had been different; that is, the income of migrants-had-they-stayed and stayers-had-they-migrated.

The key findings of this study are as follows: the expected income gap is positively associated with the likelihood of migration at a statistically significant level for both the U.S. to Canada and Canada to U.S. migration cases. The results indicate that the ease of transferring labor skills from an origin country to a destination country can be one of the major reasons for migration decisions, even in the case of international migration. These results support the hypothesis that international migration is motivated by a desire to achieve a higher lifetime income through migration.

Even so, further research is required. First, this study focused on individual-level international migration, but migration is often a family affair (Mann et al. 1988; Cromartie and Stack 1989; Johnson and Roseman 1990; Lee and Roseman 1997; Roseman and Lee 1998; Lee and Zhee 2001). However, the assessment of family migration decisions is more complicated because it involves a collection of individuals, including school children or multiple workers who might have been unemployed after migration. Nevertheless, the study of whole family migration decisions merits further work.

Also, this study uses data that are more than 30 years old (i.e., the 1990 U.S. PUMS and 1991 Canadian PUMF) due to the difficulty in collecting more recent data. While the findings are still adequate to test the neoclassical theory of migration, another study using more recent data could be used to compare with findings from this study so as to see if its findings still apply.

Third, it would be valuable to better understand how non-economic factors affect the international migration decision, especially focusing on international migration from a 'developing' country to a 'developed' country. Cases that encompass different cultures, languages, and economic development status are needed to understand if the expected income gap is as important a decision factor as it was in the present study.

Finally, a multi-dimensional analysis of the migration decision should be undertaken (Czaika et al. 2021). While migration theories stress the expected economic benefit as the main migration determinant, there are a host of non-economic factors, such as network theory, asymmetric information, family reunion, advanced welfare system, and systematic inherent exclusion, that may also influence the decision. However, there is a dearth of studies incorporating such non-economic factors. The limitations stemming from the difficulty in obtaining raw data to cover diverse factors influencing international migration between countries can be complemented by qualitative techniques. Interviews and case studies can explain unidentified individual characteristics beyond the factors identified with the currently available data and quantitative analysis influencing migration (Martin 2003). An anthropological perspective from the past can also shed light on patterns of international migration beyond merely presenting circumstances about international migration (Horevitz 2009).

The migration decision is a complex one, and the incorporation of the diverse contexts and motivations of migrants and stayers is required to reveal the multifaceted nature of migratory behavior.

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Notes

[1] The Purchasing Power Parity (PPP) exchange rate is calculated by determining the amount of national currency required to purchase a given basket of goods and services in each of two countries and then taking the ratio of the two amounts. The PPP exchange rate has the advantage over the market exchange rate (i.e., the rate of exchange between two currencies in currency markets) that it reflects the amount of goods and services that an individual can purchase with a given amount of money in each country. When incomes expressed in national currencies are compared using a PPP exchange rate, a better measure of relative living standards is obtained (Paul and Francette 2002). For the historical data of the PPPs, see https://www.oecd.org/en/data/indicators/purchasing-power-parities-ppp.html?oecdcontrol-00b22b2429-var3=2003 (accessed on 1 March 2003).

[2] The U.S. is divided into four regions (North Central, Southern, Northeastern, and Western regions); Canada into ten regions (see http://www.bls.gov/cpi/ (accessed on 1 June 2024) for the U.S. regional CPI; and https://www150.statcan.gc.ca/n1/pub/62-001-x/2010001/t080-eng.htm (accessed on 1 June 2024) for the Canadian regional CPI). The author recalculated the weighted regional CPIs, based on the average national CPIs of the two countries.

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