A Job Search Model of Internal Migration

by

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An essay submitted to the Department of Economics
in partial fulfillment of the requirements for
the degree of Master of Arts

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Kingston, Ontario, Canada

May 2010

Abstract

This paper presents a job search model to examine the role of job turnovers and transitions on internal migration decisions. Based on Rendon and Cuecuecha (2010) and Rendon (2006), this model incorporates the possibility of migration into the utility maximization behaviour of individual agents in the labour market. The model explored here is adapted to internal, as opposed to international, migration decisions. One of the consequences of this is that they may choose to migrate to other provinces to take advantage of better labour market conditions. The solution technique to the model, possible extensions, as well as the corresponding Ox code, is presented.

Acknowledgements

I would like to thank Chris Ferrall for his patience and guidance throughout this project. Additionally, I would like acknowledge Gerry Barber, Jennifer Cigana, Margaux MacDonald and Susumu Imai for their help. Furthermore, I would like to thank Rachel Ferreira for her patience. All errors and omissions are solely my responsibility.

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1 Introduction

As shown by Ravenstein's Law's of Migration (1885), researchers have long recognized the importance of migration on growth and regional development. The process of bidirectional movement within a country, or internal migration, is a continuous phenomenon. Economists have principally attributed the process of migration to a response to wage differentials and/or preferences. While these factors certainly play a vital role, only a modest amount of research has been done into the importance of job turnover and transitions to internal migration. In this paper I present a first step in the analysis of the effects of job turnovers and transitions to migration decisions.

Canada has a significant amount of internal migration. For the purpose of this paper, internal migration will be defined as a relatively permanent move from one province to another. Statistics Canada produces detailed information on interprovincial migration between Canadian provinces. In terms of total number of migrants, in 2007 over 370,000 individuals migrated between Canadian provinces - the largest interprovincial movement since 1981. Net provincial migration tends to be volatile in the short run with provinces at times experiencing rapid reversals in net migration. For instance, Ontario experienced a net *outflow* of 19,665 in 1981, but had a net *inflow* of over 42,900 in 1986. Also, Saskatchewan which had experienced a net outflow of over 9,700 people in 2005 had a net inflow over 10,100 migrants.[1]

The main contribution of this paper is to integrate a job search model with a model of internal immigration to investigate the importance of job turnover and transitions on individual migration decisions. At the international level, Rendon and Cuecuecha (2010) were the first to examine the influence of job turnover and transitions to migration decisions. The model of Rendon and Cuecuecha is presented as a method to examine the role of job turnover/transitions on internal migration in Canada. This model incorporates the possibility of migration into the utility maximization behaviour of individual agents. One of the consequences of this is that they may choose to migrate to other provinces to take

[1]For convenience Table 1 in the appendix is a reproduction of Table 5.1 from the Report on Demographic Situation in Canada 2005 and 2006 and gives an overview of recent interprovincial migration.

advantage of better labour market conditions. Borrowing is explicitly incorporated using the framework of Rendon (2006), allowing for agents to borrow to finance migration as part of their decision making process. The estimation of the parameters of the model is beyond the scope of this paper. As such, the estimated parameters derived by Rendon and Cuecuecha are used at this preliminary stage. Using these parameters, as well as assumptions about wage distribution and growth, utility functions, and arrival and layoff rates, the model can be solved by backward induction.

From this initial specification, subsequent steps in this analysis would require the actual parameters of this interprovincial model to be estimated. While these calculations are not performed in this paper, a simulated moments estimation technique (MSM) could be employed to derive values for the necessary parameters. This dynamic structural model would allow several interesting counterfactuals and extensions to be undertaken. For example, it would be possible to apply one province's job arrival rates to another province, to look at the effect of a government subsidy of moving costs to certain provinces, or to examine the effect of both differing unemployment regimes and borrowing constraints.

The paper is organized as follows. The second section reviews migration research with a bias towards Canadian interprovincial migration. The third section presents the model of interprovincial migration based on Rendon (2006) and Rendon and Cuecuecha (2010). The fourth details the step-by-step solution procedure of the model. The fifth section speculates on possible counterfactuals and extensions. Following this, the possible limitations given the definition of internal migration are presented in the sixth section. The seventh section provides concluding remarks, and the Ox program developed to solve the model is included in the appendix.

2 Literature Review

Research on migration can be classified into two general approaches, one focusing on identifying the determinants of migration, and the second on examining the consequences of migration.[2] Research into the determinants of migration examines factors which might

[2] Greenwood(1993)

induce individuals to migrate. Such characteristics include wage differentials, employment opportunities at the destination, and location preferences. Research into the consequences of migration focuses on the effects of migration on the migrants themselves, those who remain, as well as the origin and destination. This section will provide a concise review of papers characteristic of both approaches.[3]

2.1 The Human Capital Approach

Sjaasted (1962) initiated the application of the human capital theory to the process of migration decision making. The human capital approach to migration is based on the theory of investment in physical capital. As Schultz (1961) points out in his classic paper: "The value of the investment (in human capital) can be determined by discounting the additional future earnings it yields just as the value of a physical capital good can be determined by discounting its income stream" (p.8). Thus, as Sjaasted notes, a person's decision to migrate can be viewed as "an investment increasing the productivity of human resources, and investment which has costs and also renders returns" (p.5). This gave economists a general framework to analyze migration. For example, Laber and Chase (1971) use this approach to explain interprovincial migration. With a simple model based on distances and wage differentials and employing census data, they are able to explain a significant portion of net interprovincial and regional Canadian migration.

Researchers have also utilized gravity models in an effort to explain migration. In a gravity model approach, migration is related to the relative size of the origin and destination populations while inversely related to the distance between the two regions. Niedercorn and Bechdolt (1969) derived a version of the gravity model from a utility maximization framework. From this basic framework economists have extended these gravity models to include behavioral and human capital variables (such as wage and unemployment differentials) that are expected to affect migration patterns. Foot and Milne (1984) use an extended gravity model in a multi-regional framework to examine interprovincial migration for 1961-1979. Foot and Milne perform a seemingly unrelated regression technique utilizing real wage rates,

[3] For a more substantial review of literature see Greenwood (1975, 1985, 1993).

unemployment rates, population sizes and distance as variables. The model generates the expected signs on almost all variables for Ontario and western provinces, but produces less conclusive results for eastern provinces.

Courchene (1974) provides an important overview of the effect of migration on incomes in Canada from 1966 to 1968. Using longitudinal tax data, Courchene examines changes in mean income levels for males aged between 15 and 64 by comparing income levels for movers and stayers while controlling for initial income levels. The findings indicate that an "individual's total gross income" is positively affected by interprovincial migration, especially for "have-not" provinces.

While Courchene provided an important starting point for analysis of the consequences of migration on income, it does not include econometric analysis. Finnie (2001) provides a modern econometric analysis on the consequences of migration on earnings. Using data from the Longitudinal Administrative Database (LAD)[4] from 1982 to 1995, Finnie uses a difference model for his analysis, and finds that interprovincial mobility is associated with substantial changes in an individuals' earnings profile over the period examined. Additionally, differing effects by age, sex and provincial origin are also examined. Finnie finds that an individual's income is significantly affected by interprovincial mobility, with the exact change differing by age, sex and province.

Another branch of research has examined whether migrants or existing residents benefit most from growth in the local job market. Bartik (1993) provides a summary of results.[5]. In general, for the short term, the empirical results from most studies have indicated that new immigrants to an area get between 30% and 50% of all jobs from growth in employment. For the long term, findings show that migrants get an even greater share of new jobs - from 60% to 90%.

2.2 Bidirectional Migration

Simple models based solely on distance and wage/employment differentials are only able to explain one-directional migration. This posed a major problem for the economic

[4]http://www.statcan.gc.ca/start-debut-eng.html

[5]including a Canadian study by Vanderkamp (1988).

theory of migration as a large number of migrants engage in either onward migration, or return migration. This fact became particularly clear with the rise in longitudinal data that allowed researchers to differentiate between one-time migration, onward migration and return migration. For instance, as shown in Bernard et al. (2008), in Canada from 1992 to 2004, about a third of all interprovincial migrants returned back to their home province while a small percentage moved more than once but did not return home. In order to explain return and onward migration, researchers have introduced incomplete information, preference for origin, and other factors into their models.

In Herzog and Schlottman (1983), workers have incomplete information about employment and wages at the destination when making the migration decision. This approach allows workers to update their information after migration and perhaps make corrective return migration. The information effect was shown to be significant for prior migrants considering another move, as well as experienced workers. This finding appears particularly true for blue-collar workers.

Hill (1987) as well as Djajic and Milbourne (1988) include preferences for origin in their explanation of temporary international migration. Hill explains international temporary migration through a life-cycle model of utility maximization. In this model the agent not only cares about the time spent in his home country, but the distribution of that time over his lifetime. The main contribution of Djajic and Milbourne is to develop a general equilibrium model where a population of identical workers maximizes utility of their finite lives. Agents are able to earn a higher wage in an alternative country, but prefer to consume in their home country. In a similar study, Raffelhuschen (1992) uses preference for origin to explain internal migration in a developed country. He utilizes a random utility framework in an overlapping generation model with heterogeneous agents to explain complicated migration patterns in Germany.

Researchers have also looked at the migration decisions of specific groups and how network effects contribute to migration decisions. The majority of these studies focus on international migration,[6] however, Kritz and Nogle (1994) look at the effect of interstate

[6] For example, see Delechat (2001) and Colussi (2006).

networks on internal migration. They find that the concentration of compatriots in the origin state deters interstate but not intrastate migration.

Da Vanzo (1978) examines the effect of being unemployed on migration decisions using the Panel Study of Income Dynamics dataset. She finds that unemployed and others seeking work are more likely to migrate. Furthermore, the findings indicate that these same individuals are more responsive to changes in other variables such as expected earnings increases and origin wage rates. In terms of onward migration, Da Vanzo finds that recent migrants who are unable to find employment are very likely to migrate again. Similarly, Herzog and Schlottmann (1984) use census data to confirm the finding that the unemployed are more likely to migrate.[7]

Government policy can also influence an individual's decision on migration. Enchautegui (1997) examines the effect of differing state welfare payments on a female's decision to migrate fitting a logit model to 1980 census data. Findings indicate that welfare payments significantly affect an individual's decision to engage in interstate migration.[8] Day (1992) investigates the influence of government expenditure on interprovincial migration in Canada by developing a multinomial logit model of migration. By estimating the model using a variety of Statistics Canada data, Day finds that provincial transfer payments, provincial tax rates and unemployment benefits have significant effects on interprovincial migration patterns.

2.3 Structural Models

Recent work has turned to the formation of structural dynamic models of migration. This analysis allows the researcher to explore policy implications and consequences of shocks that are not witnessed in the data. Gallin (2004) argues that researchers have not properly identified parameters in their work because their estimates suffer from omitted variable bias. This is because they have neglected to include the expected future value of living in an area. While Gallin does not investigate an individual's decision to migrate, the results indicate that in general the effect of wage differentials and unemployment rates have been

[7]See Herzog et al. (2003) for a review of literature in this area.
[8]See Moffit (1992) for a review of earlier work.

overstated by past researchers.

Both Tulani (2000) and Dahl (2002) formulate structural dynamic models in order to investigate migration while accounting for self-selection. Tulani develops a rational model of migration in which he accounts for self-selection. After controlling for self-selection, Tulani finds that migrants frequently have negative returns to moving while a few have large returns. This finding supports characterization of the migration process in which migration is seen as a risky endeavor, or a lottery. Alternatively, it could also point to the possibility that agents have poor information about the job prospects at their destination. Dahl (2002) builds on the work of Borjas et al. (1992) by employing a Roy model (See Roy(1951)) to explore returns to education in migration decisions while accounting for the self-selection of migrants. A Roy model in this context allows for different locations to have different returns to skills. In Dahl's model, this allows for differing educational profiles to garner different wages in different locations. Dahl finds that self-selection significantly biases returns to education for migrants.

Kennan and Walker (2008) develop a fully specified econometric model of migration based on wage differentials, climate, moving costs, population sizes and locational preferences. Estimation is done using the National Longitudinal Survey of Youth (NLSY) dataset[9], and the authors find that wage differentials play a significant role in interstate migration decisions. Gemici (2008) extends this model by incorporating joint migration decisions for married couples. The findings indicate that married men and women make job opportunity sacrifices because of their geographical constraints. That is, single agents enjoy an advantage because they are able to utilize their relative geographical freedom.

Rendon and Cuecuecha (2010) use a job search model to examine the importance of job turnover in international migration.[10] In this model agents choose location, consumption and savings to maximize lifetime utility. Data is used from the Mexican Migration Project[11], Mexican and American employment surveys, the *Encuesta Nacional de Empleo Urbano*

[9] http://www.bls.gov/nls/

[10] This is the model which is solved in this paper.

[11] This data set contains information on job-to-job transitions of Mexicans both in Mexico and the United States.

(ENEU)[12] the Current Population Survey and both the Mexican and American census. Only males who are 15 to 45, have never been incarcerated, and are not disabled are used in the the subsequent estimation. To recover the behavioural parameters of the model, the authors utilize a MSM procedure. First introduced by McFadden (1989), this technique chooses the parameters that minimize the distance between the observed data and the values predicted by the model. For their MSM procedure, Rendon and Cuecuecha simulate 50,000 individual career paths and compute moments that are matched to the observed data. The authors then use Powell's method to minimize a weighted measure of distance between the sample and simulated moments.[13] After performing the estimation, it is found that nearly all the parameter estimates are significant at 5%. Through a regime change exercise, it is found that job turnover plays a crucial role in explaining international migration. If Mexico had the arrival rates of the U.S. then migration from Mexico to the U.S. would almost disappear. The authors interpret these results as meaning that the presence of a more dynamic labour market in addition to higher wages attract Mexican migrants to the United States.

3 Model

3.1 Model Overview

The model presented in this paper is a hybrid model of the job search international migration model introduced by Rendon and Cuecuecha (2010) with borrowing as used in Rendon (2006). In this model, agents choose their level of consumption (c), provincial location (k), and acceptable wage offers (ω) in order to maximize expected utility over their finite lives. In this model utility functions take on a constant relative risk aversion (CRRA) functional form: $U(\cdot) = \frac{c^{1-\gamma}-1}{1-\gamma}$. Individuals begin their working life as unemployed in their home province with initial assets A_0. At the beginning of each period, before engaging in a job search, agents decide whether to relocate (and pay C^k in moving costs) or remain in their current location. For simplicity, it is assumed that there are only two locations:

[12]The ENEU is a data set representing job-to-job transitions of urban Mexicans.
[13]See Judd (1998) for more information on Powell's method.

Ontario ($k = 0$) and every other province ($k = 1$). Agents receive a utility bonus of ψ when located in their home province. If an agent chooses to migrate they enter the new location unemployed. Agents choose their consumption based on their wealth (A_t), location (k), and their employment status (employed or unemployed). Individuals have a discount factor $\beta \in (0, 1)$ and can save and borrow at the same rate (r).

Following Rendon (2006), there is a Hakansson-Miller borrowing limit of B_t. This borrowing limit ensures the that an agent cannot borrow more than they can pay back. The borrowing limit is assumed to be the same across the country. Given that b_k are unemployment benefits, then the lowest income per period is q = $\min[b_k]$ for $k = 0, 1$. The subsequent borrowing limit that satisfies the Inada condition is:

$$B_t = -q\left(\frac{r}{1+r}\right)\left(1 - \frac{1}{(1+r)^{T-t-1}}\right)$$

3.2 Active Life

Individuals begin their active life at $t = 0$ and retire at time period $t = T + 1$. When unemployed, agents are entitled to unemployment benefits b_k. Wage offers are age and location specific and are received at a rate of λ_t^k, where the wages are drawn from the distribution $F^k(\cdot), x \in (\underline{w}, \overline{w}), 0 < \underline{w} < \overline{w} < \infty$. For the purpose of estimation, a truncated lognormal distribution is assumed: $ln(\omega) \sim N(\mu_k, \sigma_k \mid \underline{\omega}, \overline{\omega}); 0 < \underline{\omega} < \overline{\omega} < \infty$ and wages grow according the function: $w_t(\omega, k) = \omega\ exp(\alpha_1^k t + \alpha_2^k t^2)$. Unemployed agents can choose to take a wage offer (if one is offered) or remain unemployed. Employed agents accrue wages w(ω, t), which again, are both age and location specific. Employed agents can: stay employed; quit or be laid off and work for another employer; or quit or be laid off and become unemployed. The employed lose their jobs with probability θ_t^k and receive another wage offer from the same truncated lognormal distribution as described above, with probability π_t^k. For estimation purposes a logistic function is assumed for the age-dependent arrival and layoff rates: $q_t^k = \frac{exp(\alpha_q^{0k} + \alpha_q^k t)}{1 + exp(\alpha_q^{0k} + \alpha_q^k t)}$. Both unemployed and employed agents always have the option to migrate (and pay C^k in costs) and become unemployed in the new location.

An agents active life can be summarized by the following set of equations:

- Expected lifetime utility of being unemployed at age t ($t = 1, ...T$), with assets A_t and at location k:

$$\begin{aligned} V_t^u(A_t, k) &= \max_{A_{t+1} > B_{t+1}} \left\{ U\left(A_t + b_k - \left(\frac{A_{t+1}}{1+r}\right)\right) + (1-k)\psi \right. \\ &+ \left. \beta max[W_{t+1}^u(A_{t+1}, k), W_{t+1}^u(A_{t+1} - C^k, 1-k)] \right\}, \end{aligned}$$

where:

$$W_t^u(A_t, k) = \lambda_t^k \int [V_t^e(A_t, x, k), V_t^u(A_t, k)] dF^k(x) + (1 - \lambda_t^k) V_t^u(A_t, k). \quad (1)$$

Explanation: $U\left(A_t + b_k - \left(\frac{A_{t+1}}{1+r}\right)\right)$ represents an agent's consumption. In this case consumption is current assets and unemployment benefits minus savings for next period. The utility bonus that agents get for being located in their home province is represented by $(1-k)\psi$. The last term, $\beta max[W_{t+1}^u(A_{t+1}, k), W_{t+1}^u(A_{t+1} - c^k, 1-k)]$, is the discounted expected utility for next period.

- Expected lifetime utility of being employed at age $t(t = 1, ..., T)$, with assets A_t and at location k:

$$\begin{aligned} V_t^e &= \max_{A_{t+1} > B_{t+1}} \left\{ U\left(A_t + w_t(\omega, k) - \left(\frac{A_{t+1}}{1+r}\right)\right) + (1-k)\psi \right. \\ &+ \left. \beta max[W_{t+1}^e(A_{t+1}, \omega, k), W_{t+1}^u(A_{t+1} - C^k, 1-k)] \right\}, \end{aligned}$$

where:

$$\begin{aligned} W_t^e(A_t, \omega, k) &= (1 - \theta_t^k) \left(\pi_t^k max \int [V_t^e(A_t, x, k), V_t^u(A_t, k), V_t^u(A_t, k)] dF^k(x) \right. \\ &+ \left. (1 - \pi_t^k) max[V_t^e(A_t, \omega, k) V_t^u(A_t, k)] \right) \\ &+ \theta_t^k \left(\pi_t^k \int [V_t^e(A_t, x, k), V_t^u(A_t, k)] dF^k(x) + (1 - \pi_t^k) V_t^u(A_t, k) \right) \end{aligned}$$

Explanation: As above the first term represents consumption, with the only difference being that agents garner wages $w_t(\omega, k)$ but no unemployment benefits. The second term is the same as for the unemployed agents above. As above, the final term represents the discounted expected utility which is different in this case to represent the differing outcomes possible for employed agents.

Given the framework of the model, there must exist both a reservation wage (ω_t^r) and a retention wage (ω_t^z). The reservation wage is the wage where an agent is indifferent between being employed and unemployed. Therefore $\omega_t^r(A_t, k) = (w \mid V_t^u(A_t, k) = V_t^e(A_t, k, \omega))$. The retention wage is where an employed and unemployed are indifferent between staying in their current location and migrating to a different location. That is for the unemployed $\omega_t^z(A_t, k_t) = (w \mid W_t^u(A_t - C^k, 1-k) = W_t^u(A_t, k))$. For the employed $\omega_t^z(A_t, k_t) = (w \mid W_t^u(A_t - C^k, \omega, 1-k) = W_t^e(A_t, k))$.[14]

3.3 Retirement

At time period T + 1 agents end their active life, retire, and live off their assets until death (period T_f). It is assumed that agents save for their own retirement and consequently do not receive any form of outside income. Agents also do not leave any assets at death (i.e. $A_{T_f} = 0$).

An agents retired life can be summarized by the following equation:

- Present discounted utility value of being retired at age t $(= T+1, ..., T_f)$, with assets A_t and at location k:

$$V_t^r(A_t, k) = \max_{\{A\}_{s=t+1}^{T_f}} \sum_{s=t}^{T_f} \beta^{s-t} \left[U\left(A_s - \frac{A_{s+1}}{1+r}\right) + (1-k)\psi \right]$$

Explanation: Again, the first term in this equation represents consumption. During retirement consumption is current assets minus savings as retired agents receive no form of income. As above, the second term is the home preference bonus.

[14]See Rendon and Cuecuecha (2009) for the proofs of these two propositions.

4 Solution to the Model

The model above contains no closed-form solutions. Following Rendon (2006) and Rendon and Cuecuecha (2010) the state and control variables are discretized in order to construct the value functions and a numerical solution to the model. In this section, the discretized value functions are detailed and the steps used to generate the solution to the model described in a step-by-step format. The appropriate Ox code is also provided in the appendix.

Step I:

The values of the parameters as estimated by Rendon and Cuecuecha (2010) are outlined in Table 2. In my solution, Ontario takes on the parameter values of Mexico, and "other provinces" take on the parameter values of the United States.

Step II:

Next, the state and control variables are discretized (see Table 3), as well as the probability of a wage draw, and growth of wages as a function of age.

Probability of a wage draw $\omega(j)$ in discrete form is:

$$\hat{f}(j,k) = \frac{\Phi\left(\frac{ln(\omega(j)+\Delta_w/2)-\mu^k}{\sigma_w^k}\right) - \Phi\left(\frac{ln(\omega(j)-\Delta_w/2)-\mu^k}{\sigma_w^k}\right)}{\frac{\Phi\left(ln\overline{w}-\mu^k\right)}{\sigma_w^k} - \frac{\Phi\left(ln\underline{w}-\mu^k\right)}{\sigma_w^k}} \tag{2}$$

Growth of wages as a function of age:

$$w(j,k,t) = \omega(j)\, exp(\alpha_t^k t + \alpha_t^k t^2). \tag{3}$$

Step III:

The finite dynamic programming problem can now be solved by backward induction. This process requires maximizing the value function of the last period, then looping backward in time to find the optimal action at each point in time. The discretized value of being retired ($V^r[n_a, k, t]$) in an agent's final period of life can be calculated as:

$$V^r[n_a, k, t] = \max_m \{U(A_s(n_a)) + (1-k)\psi\}. \tag{4}$$

(as $A_{T_f} = 0$)

Next, the discretized value of being retired in previous periods can be calculated. The value function of being retired for period $t = T_f - 1$ to period $t = T + 1$ is:

$$V^r[n_a, k, t] = \max_m \left\{U\left(A_s(n_a) - \frac{A_{s+1}(m)}{1+r}\right) + (1-k)\psi + \beta V^r[n_a, k, t+1]\right\} \tag{5}$$

Step IV:

It is now possible to calculate the value function for a working agent. As outlined above, the value function of an agent in their working life depends on if they are employed or unemployed. Beginning with the first period before retirement ($t = T$) and looping until the first period ($t = 0$), the value function of an agent's active life can be calculated through the following discrete formulas:

Expected value for the unemployed:

$$W^u[n_a, k, t] = \lambda(k, t) \sum_{n_w=0}^{N_w} max[V^e[n_a, n_w, k, t], V^u[n_a, t, k]] f(n_w, k) + (1 - \lambda(k, t))V^u[n_a, k, t]$$

Expected value for the employed:

$$\begin{aligned} W^e[n_a, n_w, k, t] &= (1-\theta(k,t))[\pi(k,t) \sum_{l=1}^{N_w} max[V^e[n_a, n_w, k, t], V^u[n_a, l, k, t], V^u[n_a, k, t]] f(l, k) \\ &+ [1-\pi(k,t)] max[V^e[n_a, n_w, k, t] V^u[n_a, t, k]]] \\ &+ \theta(k,t)[\pi(k,t) \sum_{l=1}^{N_w} max[V^e[l, n_a, k, t], V^u[n_a, k, t]] f(l, k) + (1-\pi(k,t))V^u[n_a, k, t]] \end{aligned}$$

Value function for the previous period of an unemployed agent:

$$V^u[n_a, k, t-1] = \max_m \left\{U\left(A(n_a) + b_k - \left(\frac{A(m)}{1+r}\right)\right) + (1-k)\psi\right.$$

$$+ \quad \beta max[W^u[m,k,t], W^u[h(m,k), 1-k, t]\} ,$$

Value function for the previous period of an employed agent:

$$\begin{aligned} V^e[n_a, n_w, k, t-1] &= \max_n \left\{ U\left(A(n_a) + w(n_w, k, t) - \left(\frac{A(n)}{1+r} \right) \right) + (1-k)\psi \right. \\ &+ \quad \beta max[W^e[n_a, n_w, k, t], W^u[h(n,k), 1-k, t]]\} , \end{aligned}$$

where $h(m,k) = \{h \mid A(h) \geq A(m) - c^k > A(h-1)\}$.

These value functions are maximized by $m = m^*(n_a, k, t)$ and $n = n^*(n_a, n_w, k, t)$. The discretized reservation wage is $j(n_a, t) = \{j \mid V^e[n_a, n_w, k, t] \geq V^u[n_a, k, t] > V^e[n_a, n_w - 1, k, t]\}$. The discretized retention wages are $y(n_a, t) = \{y \mid W^e[n_a, n_w, k, t] \geq W^u[n_a - c^k, 1-k, t]\}$ (for employed agents), and $y(n_a, t) = \{y \mid W^u[n_a, k, t] \geq W^u[n_a - c^k, 1-k, t]\}$ respectively. By completing the above steps, the dynamic programming problem is solved by finding an agent's action at each time period of the model.

5 Results

The Ox code in the appendix allows for properties of the numerical solution of the model to be explored. Figure 1 in the appendix summarizes the reservation wages for workers both in and outside their home province of Ontario.

These results can be compared to similar results produced by Rendon and Cuecuecha (2010). It is clear that the numerical solutions are quite different, with reservation wage considerably lower for workers both in Ontario and in "other provinces". However, qualitatively, the reservation wage for workers in Ontario displays the same upward trend in the solution method presented and Rendon and Cuecuecha. In terms of "other provinces", the reservation wage in my solution is the lowest possible wage offer. However, the exact numerical solution indicates that the value of being employed compared to being unemployed in decreasing in asset level, this is consistent with the results of Rendon and Cuecuecha.

The exact reasons for the differences of the results are unclear. However, one possible reason is the interpretation of certain parameter estimates. Rendon and Cuecuecha report initial levels and growth in layoff rates, arrival rates for the employed, and arrival rates for the unemployed for agents in both their home location and outside. The initial rates are expressed as:

$$q_0^k = \frac{exp(\alpha_q^{0k})}{1 + exp(\alpha_q^{0k})}$$

which implies that the value of α_q^{0k} can be expressed as:

$$ln(q_0^k) - ln(1 - q_0^k)$$

The growth parameter estimation provided is then interpreted as α_q^k. If these parameter estimates were misinterpreted then the corresponding numerical solution would clearly be different than the one provided by Rendon and Cuecuecha. Additionally, as no interest or discount rates are specified within the paper, it is assumed that the same rates as used in Rendon (2006) were used here by the authors.[15]

6 Data Sources

The model as solved above (and the corresponding Ox code in the appendix) assumes parameter values are known. For a complete analysis of the effect of job turnover and transitions on interprovincial migration, the parameters of the model would need to be derived. For this to be accomplished a MSM technique similar to Rendon and Cuecuecha (2010) would have to be employed. For this estimation technique to be used suitable sources of data would need to be found. Specifically, the following data is needed: job-to-job transitions of interprovincial migrants to/from Ontario; annual wage incomes (deflated for costs of living); and unemployment rates, job loss rates, and exits from unemployment.

[15] see Ox Code in the appendix for values of all the above parameters.

A source that could potentially provide a large portion of the needed data is the Longitudinal Administrative Dataset (LAD). Covering over 96% of the population, the LAD is a 20% sample of the T1 Family File (T1FF), which is based on Canada Revenue tax filers and their families. The LAD provides a dynamic data set that provides yearly data on individual and family income, taxes and social characteristics (including provincial location). In the present model, this data set would provide valuable information on interprovincial migration - including onward and return migration - as well as the changes in earnings experienced by these provincial migrants.[16] The amount of unemployment benefits received is also included for each individual in the data set. Given the size of the data set it might also be possible to perform separate estimations for differing groups (such as language and sex) as performed by Finnie (2001).

7 Extensions and Counterfactuals

The model presented in this paper lends itself to a number of interesting counterfactuals and extensions. Once the model is estimated, the effect of Ontario having the "other provinces" job turnover rates, as well as the impact of changing moving costs provide interesting insights into causes of interprovincial migration. This can be done simply by applying the job arrival parameter of one province (λ^k, α^k_λ, π^k, α^k_π) to another. The same process can be done to layoff rates. The cost of migration (C_k) can also be adjusted to see varying effects caused by lower (or higher) migration costs.

Beyond these counterfactuals, several simple extensions such as employment insurance and borrowing constraints can also be examined. Such extensions would make the model more applicable to an internal migration setting.

7.1 Employment Insurance

Given that Day (1992) and Enchautegui (1997) find that unemployment benefits (UI) and welfare payments affect internal migration patterns it seems natural to incorporate

[16]Table 4 in the appendix provides an overview of the mean effect of interprovincial migration on earnings as seen in Bernard et al. (2008).

differing provincial standards in the model. In Canada, in order to receive benefits, an individual must have been employed for a minimum number of weeks in the previous year. The exact number of weeks required varies by region, and also depends on an individual's previous employment record and UI benefits received. The amount of benefits received depends on the individual's previous wage with a maximum and minimum amount of benefits set. UI could be included in the model in a similar method to Ferrall (1994). Ferrall presents a job search model examining how differing unemployment insurance designs affect work transitions for new graduates in the US and Canada. In Ferrall's model, the value of each job offer includes the value of associated UI benefits. Under this extension, agents have several states under which they can be searching for employment. That is, agents can be searching for employment when UI benefits have been exhausted (or not been qualified for), or, alternatively agents can be searching while receiving UI benefits. Through this approach, the impact of differing UI regimes across Canada on interprovincial migration can be examined.

7.2 Borrowing Constraints

Borrowing is excluded in Rendon and Cuecuecha (2010) as it is argued that agents cannot guarantee repayment. However, in an internal migration model, it seems natural to incorporate borrowing. Within the framework of Rendon and Cuecuecha, and following Rendon (2006), it is also possible to examine the effect of imposing borrowing constraints on migration decisions. Given the above Hakansson-Miller borrowing limit, a further constraint could be applied to borrowing by adding tightness to the credit market. The constrained borrowing limit (B_h^t) could then be expressed as $B_h^t = sB^t$ ($s \in (0,1)$). For instance, if borrowing was constrained an agent might not be able to afford to pay the moving costs while young, and thus might need to wait longer before migrating to a location with better labour market conditions.

8 Limitations

For the purpose of this paper internal migration is defined as the movement from one province to another. Using this level of spatial aggregation creates several problems given the varying sizes and complexities of the individual provinces. This definition obviously underestimates the actual prevalence of internal migration in Canada and would be particularly problematic for large provinces such as Ontario and Quebec since it excludes intra-provincial migration. For example, an individual moving from Ottawa to Montreal would be treated as a migrant whereas an individual moving from Hull to Montreal would not. Additionally, this level of spatial aggregation uses a single cost to estimate migrations that vary from less than 100 kilometers to over 1000 kilometers. For example, a move from Thunder Bay to Montreal would be estimated as having same cost as a move from Ottawa to Montreal. The assumption of a single unemployment rate across an entire province is fairly strong as unemployment rates vary within a province. This is likely to be particularly problematic for larger provinces such as Ontario rather than smaller provinces such as Prince Edward Island.

Given that Canada is a bilingual nation, the structure of the model poses a problem with respect to the home preference (ψ) for certain individuals. French, english and bilingual speakers from Quebec and New Brunswick are likely to have differing values for their home preference. This would likely be caused by differing employability of different languages. For instance, a strictly french speaker may have higher home preference for Quebec (or New Brunswick) than a bilingual speaker. This is because the job opportunities in Ontario for an unilingual french individual are likely lower than an english or bilingual individual.

The model also imposes the assumption that all individuals engage in speculative migration. That is, all migrants enter the new labour market as unemployed. This seems to be a strong assumption as it is very likely that a significant portion of internal migrants have firm job offers before migrating. A potential resolution is to allow individuals to search in other locations, but to have a lower arrival rate of job offers in the potential destination location.

Despite the limitations imposed by the definition of internal migration and the structure of the model, this analysis is still a useful base in which to begin analysis of the importance of job turnover and transitions. Subsequent analysis and estimation could build on this by employing a definition of migration based on census areas[17] or looking solely at major metropolitan areas.

9 Conclusion

This paper presents a job search model to examine the influence of job turnovers and transitions on internal migration decisions. Based on Rendon and Cuecuecha (2010) and Rendon (2006), in this model individuals seek to maximize their lifetime utility by choosing their location (either Ontario or “other provinces” in the simple version outlined) and consumption levels.

Several extensions, such as borrowing constraints and differing unemployment insurance regimes are also presented. These simple extensions would make the model more applicable to examining internal migration. The solution technique to the basic model, as well as the corresponding Ox code, is presented.

The results of Rendon and Cuecuecha (2010) are not exactly reproduced in this paper. However, the results display the same characteristics. The reservation wage is rising in asset levels in Ontario, and falling in asset levels in “other provinces”. In subsequent analysis, the solution technique presented, in conjunction with an appropriate data source (for example, the T1FF data outlined above), can be used to estimate the parameters of the model.

With the parameter values derived, it is possible to examine how differing labour markets affect migration between Ontario and ”other provinces”. Additionally, counterfactuals provide insight into how differing migration costs and arrival rates would affect migration decisions while natural extensions to the model would indicate how unemployment insurance and borrowing constraints affect internal migration in Canada.

[17]Census areas are used in Gemici’s (2008) analysis of joint migration decisions.

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10 Appendix

10.1 A1 - Ox Code

```
include oxstd.h

include oxfloat.h

include maximize.h

import solvenle

include oxdraw.h

include oxprob.h

enum(nw,na,k,nt,Nstatevars); //defines t=0,na=1,nw=2; indices into state vector

enum(Nw = 51, Na = 251, Nt= 75, K = 2,

Nstates1 = Nw*Na*K, //contemporaneous state space

Nstates = Nt*Nstates1,

T = 52, // Retirement Age

Tf = Nt

);

const decl

ind1 = 1;Nw;Nw*Na;0,

lbar = 50,0.0,16.0, 0.0,

ubar = 20000.0,150000.0,75.0,1,

alpha1 = 0.0852, 0.0930,

alpha2 = -.0019, -0.0021,

mu = 6.9001, 8.1762, //mean base log wages

sigma = 0.8662, 0.8107,

psi = 1452.53, //home preference

gamma = 0.559, //risk aversion
```

```
gcomp = 1-gamma,
beta = 0.98, //beta from Rendon 2006 = .98
r = 0.015, //interest rate Rendon 2006 =.015
b = <14.73, 133.02>, //unemployment transfers
c =<882.32, 27.16>, //travel costs
lambda = <-.26762, 1.5708>, //base in arrival
alphalambda = <0.2104, 0.0039>, //growth in arrival
theta = <1.1836, -.4997>, //base in arrival
alphatheta = <-0.2137, -0.0609>, //growth in arrival
pi = <-1.343, .8151>, //base in arrival
alphapi = <0.0012, 0.0034>; //growth in arrival
decl
ind, // indices into value vector for given state
V,
Vuf,
Vef,
vwage,
vasset,
delta,
nxtst1,
aprime,
Wuactm,
Wuactm1,
fhat (const expwage, const mystate) // A function for the density of wages
(
decl fhat1, myw, mylbar, myubar,i, numerator1, numerator2, numerator, denominator1,
```

```
denominator2, denominator;
    fhat1 = zeros(Nw, 1);
    for(i = 0; i <= Nw-1; ++i)
    (
    myw = vwage[expwage[i][nw]];
    mylbar = log(lbar[nw]);
    myubar = log(ubar[nw]);
    denominator1 = (myubar - mu[mystate[k]])/(sigma[mystate[k]]);
    denominator2 = (mylbar - mu[mystate[k]])/(sigma[mystate[k]]);
    denominator = probn(denominator1) - probn(denominator2);
    if(i == 0)
    (
    numerator1 = (log(myw + delta/2) - mu[mystate[k]])/(sigma[mystate[k]]);
    numerator2 = (log(myw) - mu[mystate[k]])/(sigma[mystate[k]]);
    numerator = probn(numerator1) - probn(numerator2);
    fhat1[i] = numerator/denominator;
    )
    else if(i == Nw-1)
    (
    numerator1 = (log(myw) - mu[mystate[k]])/(sigma[mystate[k]]);
    numerator2 = (log(myw - delta/2) - mu[mystate[k]])/(sigma[mystate[k]]);
    numerator = probn(numerator1) - probn(numerator2);
    fhat1[i] = numerator/denominator;
    )
    else
    ( numerator1 = (log(myw + delta/2) - mu[mystate[k]])/(sigma[mystate[k]]);
```

numerator2 = (log(myw - delta/2) - mu[mystate[k]])/(sigma[mystate[k]]);

numerator = probn(numerator1) - probn(numerator2);

fhat1[i] = numerator/denominator;

)

)

return fhat1';

)

wage (const mystate) // A function for the growth in wages

(

return vwage[mystate[nw]]*(exp((mystate[nt]*(alpha1[mystate[k]]) + alpha2[mystate[k]]*(mystate[nt])2̂

)

lambda1 (const mystate) // A function for the arrival rate for the unemployed

(

return (exp(lambda[mystate[k]] + mystate[nt]*alphalambda[mystate[k]]))/(1 + exp(lambda[mystate[k]] + mystate[nt]*alphalambda[mystate[k]]));

)

pi1 (const mystate) // A function for the arrival rate for the employed

(

return (exp(pi[mystate[k]] + mystate[nt]*alphapi[mystate[k]]))/(1 + exp(pi[mystate[k]] + mystate[nt]*alphapi[mystate[k]]));

)

theta1 (const mystate)// A function for the layoff rate

(

return (exp(theta[mystate[k]] + mystate[nt]*alphatheta[mystate[k]]))/(1 + exp(theta[mystate[k]] + mystate[nt]*alphatheta[mystate[k]]));

)

bellman () (decl today, tomorrow, ms, m1, nind, nind1, nind2, ewind, Util, Util1, ewind1, i, Vestay, Vemove,

Vustay, Vumove,Wu,Wu1, Wut1, We1, Wet1, We, Weact, Weact1, Weact2, mystate = zeros(1,Nstatevars), nxtst, nxtst1,nind3, nind4, expwage, Vret, expwage1, Ve, Vu, Veact, Vuact, Vuact1, Wuact, Wuact1, Veactstay, Vustay1, Vumove1, Veactmove, Vuact1t, Vuactstay, Vuact1move, Vuact1stay, Vretmove, Vuactmove, aprime1, aprime2, aprime3, location,location1,location2, location3, retention, Vret1, Vret2, Vret3, Wut, Wet, Vut, Vet;

Vuf = zeros(Nstates+Nstates1, 1); //Creating the needed matrices

Vef = zeros(Nstates+Nstates1, 1);

Wu1 = zeros(Nstates+Nstates1, 1);

Wut1 = zeros(Nstates+Nstates1, 1);

We1 = zeros(Nstates+Nstates1, 1);

Wet1 = zeros(Nstates+Nstates1, 1);

aprime = zeros(Nstates+Nstates1,1);

Vu = zeros(Nstates1,2);

Vut = zeros(Nstates1,2);

Ve = zeros(Nstates1,2);

Vet = zeros(Nstates1,2);

Wu = zeros(Nstates1,2);

Wut = zeros(Nstates1,2);

We = zeros(Nstates1,2);

Wet = zeros(Nstates1,2);

aprime1 = zeros(2,1);

aprime2 = zeros(2,1);

aprime3 = zeros(2,1);

retention = zeros(Nstates+Nstates1,1);

today = FALSE; tomorrow = TRUE;

for(mystate[nt]=Tf-1;mystate[nt]>=0;–mystate[nt]) (

tomorrow = today; today = !today; //swap today and tomorrow

for(mystate[k]=K-1; mystate[k]>=0; –mystate[k])

(

for(mystate[na]=Na-1; mystate[na]>=0;–mystate[na])

(

for(mystate[nw]=Nw-1; mystate[nw]>=0;–mystate[nw])

(

nxtst = reshape(mystate,mystate[na]+1,Nstatevars);

nxtst[][na] = range(0,mystate[na])';

++nxtst[][nt];

ms = mystate*ind;

m1 = mystate*ind1;

nind = nxtst*ind1;

nind2 = nxtst*ind;

nxtst1 = nxtst;

nxtst1[][k] = 1 - mystate[k]; //person switches location

nind1 = nxtst1*ind1;

if (mystate[nt]>T) (//retirement

Vuact1 = (((vasset[mystate[na]] - vasset[nxtst[][na]]/(1+r)).ĝcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*Vef[nind2]'; //because retirement location does not change

Vuf[ms] = maxc(Vuact1');

Vef[ms] = maxc(Vuact1');

)

else if (mystate[nt]==T) (//first year of retirement (need to allow agents to move their last active period)

Vuact1move = (((vasset[mystate[na]] - c[1-mystate[k]] - vasset[nxtst[][na]]/(1+r)).ĝcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*Vef[nind2]'; //Value function if someone moved to this location

Vuact1stay = (((vasset[mystate[na]] - vasset[nxtst[][na]]/(1+r)).ĝcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*Vef[nind2]'; //Value function if someone was already in this location

Util1 = zeros(mystate[na]+1, 1);

for(i = 0; i<= mystate[na]; ++i) //a loop to ensure that the person can afford to move

(

Util1[i] = vasset[mystate[na]] - (vasset[nxtst[i][na]]/(1+r));

if(Util1[i] >= c[1-mystate[k]])(

Vuact1move[i] = Vuact1move[i];)

else(

Vuact1move[i] = -1000000000000; //if person move a large negative utility is associated with this value

))

Vuf[ms] = maxc(Vuact1stay'); //Value function if someone moved to this location

Vef[ms] = maxc(Vuact1stay');

Wu[m1][today] = Vuf[ms]; //the expected value of remaining in this location when employed or unemployed

We[m1][today] = Vef[ms];

Wut[m1][today] = maxc(Vuact1move'); //the expected value of moving to this location when employed or unemployed Wet[m1][today] = maxc(Vuact1move');

)

else //active age

(

```
//Unemployed

Util = vasset[mystate[na]] - (vasset[nxtst[][na]]./(1+r));

Vustay = (((Util + b[mystate[k]]) .^gcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*(maxc((Wu[nind][tomorrow] Wut[nind1][tomorrow])'));

Vuactstay = maxc(Vustay');

Vu[m1][today] = Vuactstay;

Vumove = (((Util + b[mystate[k]] - c[1-mystate[k]]).^gcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*(maxc((Wu[nind][tomorrow] Wut[nind1][tomorrow])'));

Util1 = zeros(mystate[na]+1, 1);

for(i = 0; i<= mystate[na]; ++i) //Again, making sure the agent can afford to move

(

Util1[i] = vasset[mystate[na]] - (vasset[nxtst[i][na]]/(1+r));

if(Util1[i] >= c[1-mystate[k]])

Vumove[i] = Vumove[i];

)

else(

Vumove[i] = -1000000000000;

) )

Vuactmove = maxc(Vumove');

Vut[m1][today] = Vuactmove;

Vuf[ms] = Vu[m1][today];

//Employed

Vestay = (((Util + wage(mystate)).^gcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*(maxc((We[nind][tomorrow] Wut[nind1][tomorrow])'));

Vemove = (((Util + wage(mystate) - c[1-mystate[k]]).^gcomp)-1)/(gcomp)

+ (1 - mystate[k])*psi + beta*(maxc((We[nind][tomorrow] Wut[nind1][tomorrow])'));
```

```
//To get Retention Wage
location = We[nind][tomorrow];
location1 = Wut[nind1][tomorrow];
location2 = (maxc((We[nind][tomorrow] Wut[nind1][tomorrow])'))';
location3 = location2[maxcindex(Vestay')];
retention = location1[maxcindex(Vestay')];
Util1 = zeros(mystate[na]+1, 1);
for(i = 0; i<= mystate[na]; ++i) //Again, making sure the agent can afford to move
(
if(Util1[i] >= c[1-mystate[k]])
Vemove[i] = Vemove[i];
)
else(
Vemove[i] = -1000000000000;
) )
Veactstay = maxc(Vestay');
Veactmove = maxc(Vemove');
Vet[m1][today] = Veactmove; //value of traveling to this location and being employed
Ve[m1][today] = Veactstay; //value of being employed given you are at this location
Vef[ms] = Ve[m1][today];
if(mystate[nt] == 9)
//prints out the value of being employed and unemplyed at age 23.
(
println(Vef[ms] Vuf[ms] vwage[mystate[nw]] vasset[mystate[na]] mystate[k]); )) )))
//This calculates the expected wage in active life
if (mystate[nt] < T)(
```

```
for(mystate[k]=K-1; mystate[k]>=0; –mystate[k])
(
for(mystate[na]=Na-1; mystate[na]>=0;–mystate[na])
(
for(mystate[nw]=Nw-1; mystate[nw]>=0;–mystate[nw])
(
m1 = mystate*ind1;
expwage = reshape(mystate, Nw, Nstatevars);
expwage[][nw] = range(0,Nw-1)';
ewind = expwage*ind1;
//expected value if unemplyed agent remains in this location
Wuact = maxc((Vu[ewind][today] Ve[ewind][today])');
Wuact1 = Wuact*(fhat(expwage, mystate)');
Wu[m1][today] = lambda1(mystate)*(Wuact1) + (1-lambda1(mystate))*Vu[m1][today];
//expected value if unemployed agent travels to this location
Wuactm = maxc((Vut[ewind][today] Vet[ewind][today])');
Wuactm1 = Wuactm*(fhat(expwage, mystate)');
Wut[m1][today] = lambda1(mystate)*(Wuactm1) + (1-lambda1(mystate))*Vut[m1][today];
expwage1 = reshape(mystate, Nw, Nstatevars);
expwage1[][nw] = range(0,Nw-1)';
for(i=0; i<=Nw-1; ++i))
if(expwage1[i][nw] < mystate[nw]) //loop through and if the current wage is higher
) // than the offer you keep the old
expwage1[i][nw] = mystate[nw];
) )
//expected value if agent is employed
```

```
ewind1 = expwage1*ind1;
Weact = maxc((Ve[ewind1][today] Vu[ewind1][today])');
Weact1 = Weact*(fhat(expwage, mystate)');
We[m1][today] = (1-theta1(mystate))*(pi1(mystate))*Weact1 + (1-theta1(mystate))*(1-
pi1(mystate)) *maxc((Vu[m1][today] Ve[m1][today])')
+ theta1(mystate)*pi1(mystate)*Wuact1 + theta1(mystate)*(1-pi1(mystate))*Vu[m1][today];
)) )) ))
main()
(
ind = ind1;
ind[nt] = Nstates1;
vwage = lbar[nw] +range(0,Nw-1)*(ubar[nw]-lbar[nw])/(Nw-1);
vasset = lbar[na] +range(0,Na-1)*(ubar[na]-lbar[na])/(Na-1);
delta = (ubar[nw] - lbar[nw])/(Nw-1);
bellman(); )
```

10.2 A2 - Figures

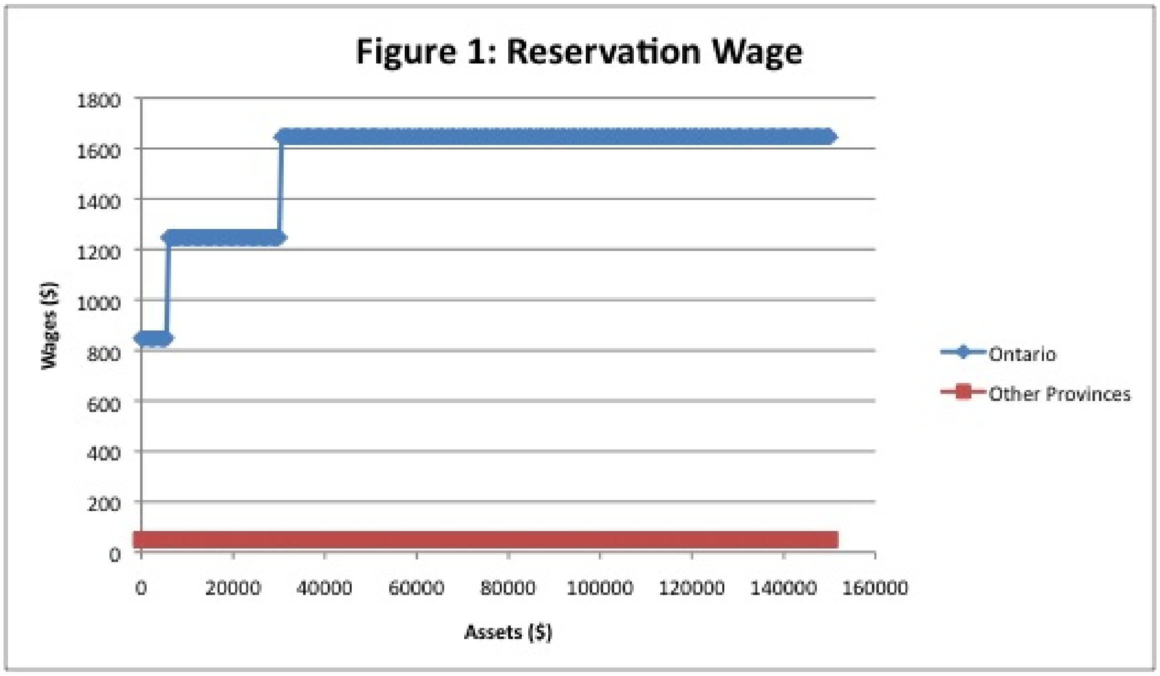

Figure 1: Reservation Wages: Ontario and"Other Provinces"

10.3 A3 - Tables

Table 1: Net Interprovincial Migration 1981 - 2007

	Province of Destination										
	NL	PEI	NS	NB	Que.	Ont.	MB	Sask.	AB	BC	Total Number of Migrants
Year											
1981	-6237	-783	-2465	-4766	-22549	-19665	-3621	-520	40243	21565	380041
1986	-4682	-493	-739	-2897	-3020	42916	-3039	-7020	-20293	910	302352
1991	-1084	-415	1039	-79	-13047	-9978	-7581	-9499	5511	34572	315659
1996	-7945	401	-1064	-910	-15358	-1706	-3738	-1871	15069	17798	284484
1997	-8522	-241	-2074	-1812	-17559	6823	-6717	-2669	32459	1980	291580
1998	-7971	-15	-1571	-2935	-14512	11466	-3097	-1786	40125	-17521	298164
1999	-3916	212	947	-638	-11712	18424	-2387	-7146	19692	-12413	276489
2000	-4884	-62	-1393	-1748	-11233	23292	-4188	-8301	24397	-14783	290505
2001	-3914	268	-1946	-1914	-6388	10622	-5025	-8600	24614	-7278	280408
2002	-3187	65	-256	-164	-4228	5065	-2733	-7431	17883	-5216	281873
2003	-1103	224	142	-1277	218	-5074	-3162	-4590	10254	4055	255565
2004	-2651	-259	-1594	-867	-3297	-8222	-3153	-6027	19348	7551	269727
2005	-4497	-237	-3679	-2708	-6834	-14500	-9298	-9737	44968	7434	292172
2006	-3964	-591	-3060	-3574	-12915	-32318	-7658	-2856	58166	10221	358516
2007	-694	-237	-546	1100	-14444	-17762	-1390	10174	10625	13385	370763

Source: Report on Demographic Situation in Canada 2005 and 2006 (preliminary data for 2007)

Table 2: Parameter Estimates in Rendon and Cuecuecha (2010)

Parameters	Mexico	United States
Unemployment Transfers (b)	14.73	133.02
	(2)	(22)
Arrival Rate Unemployed: Base (λ_0)	0.4339	0.8279
	(0.0232)	(0.0523)
Arrival Rate Unemployed: Growth (α_λ)	0.2104	0.0039
	(0.0195)	(0.0002)
Arrival Rate Employed: Base (π_0)	0.2070	0.6932
	(0.0313)	(0.0472)
Arrival Rate Employed: Growth (α_π)	0.0012	0.0034
	(0.0016)	(0.0002)
Layoff Rate: Base (Θ_0)	0.7656	0.3776
	(0.0354)	(0.0682)
Layoff Rate: Growth (α_Θ)	-0.2137	-0.0609
	(0.0040)	(0.0001)
Mean of Base Logwages (μ)	6.9001	8.1762
	(0.7016)	(0.9353)
Linear Growth of Logwages (α_1)	0.0852	0.0930
	(0.0042)	(0.0025)
Quadratic Growth Logwages (α_2)	-0.0019	-0.0021
	(0.0037)	(0.0041)
St. Deviation of Logwages (σ)	0.8662	0.8107
	(0.3371)	(0.0442)
Cost of Migration (c)	882.32	27.16
	(43.81)	(87.45)
Attachment to Origin (C_ψ)	1452.53	
	(46.7482)	
Coefficient of Risk Aversion (γ)	0.5590	
	(0.0372)	

Standard Errors in Parenthesis
Source: Rendon and Cuecuecha (2010)

Table 3: Discretized State and Control Variables

	Assets	Wages
Discretized Variable	$A(n_a)$	$\omega(n_\omega)$
Gridpoints	$n_a = 0, ..., N_a$	$n_w = 0, ..., N_\omega$
Number of Gridpoints	$N_a = 251$	$N_\omega = 51$
Lower Bound	$\underline{A}$	$\underline{\omega}$
Upper Bound	$\overline{A}$	$\overline{\omega}$
Gridsize	$\Delta_A = \frac{(\overline{A}-\underline{A})}{(N_a-1)}$	$\Delta_\omega = \frac{(\overline{\omega}-\underline{\omega})}{(N_\omega-1)}$

Table 4: Mean Earnings in Year Before and After Interprovincial Migration for Men age 20 to 54 (in 2004 $CDN)

	Year 1		Year 3		Percent Change	
	Non-migrant	Migrant	Non-migrant	Migrant	Non-migrant	Migrant
All Provinces	39300	40400	42300	46500	7.6	15.1
Newfoundland and Labrador	27000	20700	28500	36400	5.6	75.8
Prince Edward Island	27600	26400	29000	32500	5.1	23.1
Nova Scotia	32400	34400	34000	43000	4.9	25.0
New Brunswick	30700	33300	32300	41400	5.2	24.3
Quebec	34800	37600	37100	46400	6.6	23.4
Ontario	43500	47700	47300	51600	8.7	8.2
Manitoba	33700	36400	35900	43100	6.5	18.4
Saskatchewan	34500	34600	36700	43500	6.4	25.7
Alberta	45700	46400	50200	49400	9.8	6.5
British Columbia	39800	38700	42000	44500	5.5	15.0

Source: Interprovincial Mobility and Earnings 2008