

THREE ESSAYS IN IMMIGRANT POST-MIGRATION HUMAN
CAPITAL INVESTMENT AND HETEROGENEITY

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ABSTRACT

Three Essays In Immigrant Post-Human Capital Investment and Heterogeneity

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The following thesis consists of three essays. Each one is a study of the issues of the selection effect of Canadian immigration policy, post-migration human capital investment, and their associated effects on immigrants' labour market performance and economic assimilation. All three papers are explored under the consideration of unobserved heterogeneity. The data are taken from the Longitudinal Survey of Immigrants to Canada (LSIC).

The first essay examines the determinants of post-migration human capital investment, and the effects of this investment on immigrant realized utility and wage income from Canadian labour market. Post-migration human capital investment includes Canadian formal education and a general definition of training. This essay concludes that pre-migration human capital complements post-migration human capital investment. Furthermore, the investment in post-migration human capital lubricates immigrants' transfer from unemployment to employment.

The second study explores the effects of the 'stock' of human capital that immigrants possess, on their occupational choices in the Canadian labour market. The stock of human capital includes both pre-migration human capital, and the part formed through investing in the destination country. This study confirms that immigrants with more stock of pre-migration human capital are inclined to be employed in white-collar occupations, compared to blue-collar occupations or unemployed and searching for jobs. The findings also indicate that once immigrants complete their

first training, they locate at a higher utility level after obtaining employment, either white-, blue-collar occupations or being self-employed.

The third essay employs the existence of asymmetric information and its effect on the Canadian labour market. This study explores three plausible signals that are prevalent on the Canadian labour market; it also studies the influence of these signals on the immigrant economic assimilation in the first years after landing. The signals comprise the relative level of formal education, foreign credential recognition and pre-arranged job before migration. Empirical results from this essay confirm that Canadian immigrants who landed around the period the LSIC was held are heterogeneous. Further more, this heterogeneity leads to a different assimilation path within the first four years after landing.

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I dedicate this thesis to my parents !

仅以此文敬献我的父母!

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Chapter 1

Introduction

The entry of immigrants into the destination country and their assimilation thereafter, attract a lot of attention from labour economists and policy makers. Since the first generation research that was published in the 1970s, the determinants that affect whether an immigrant is able to assimilate successfully, and the speed he or she can integrate into the destination country labour market, is still in discussion. Examples include the relationship between pre-migration human capital and post-migration human capital, and the effects of post-migration human capital investment on immigrant assimilation. The work presented here approaches the following research questions from a variety of dimensions with different methodologies: first, what is the relationship between immigrants' pre-migration human capital and post-migration human capital investment; second, what are the effects of immigrants' stock of human capital on their economic assimilation; and third, what is the influence of immigrants' unobserved heterogeneity on their economic integration?

To address the proposed research questions, this thesis consists of three essays. The three essays that comprise the thesis complement and interact each other in a number of ways. As a whole, this thesis is a series of investigations that explores the dynamics of immigrant post-migration human capital investment, and its associated effects on immigrant labour market outcomes. This includes immigrant labour market states, occupational choices and income from both wage employment and self-employment. Under the consideration of unobserved heterogeneity, the first paper concentrates on immigrant training decisions and their effects on the Canadian labour market. The second paper exploits the determinants, including both pre-migration human capital and the human capital formed through post-migration investment in Canada, that affect immigrant occupational states. Lastly, the third paper explores the effect of this unobserved heterogeneity onto immigrant economic assimilation.

The data used in all the three essays are taken from the Longitudinal Survey of Immigrants to Canada (LSIC). LSIC has been jointly administered by Citizenship

and Immigration Canada (CIC) and Statistics Canada¹. The survey is designed to provide information on how newly landed immigrants establish their economic, social and cultural ties to Canadian society. LSIC, therefore, concentrates on immigrants that have landed from outside of Canada within a six month range, which spans the time from the date of landing to the first interview. The first wave data have been collected in the period between April 2001 and May 2002. Immigrants that were interviewed in the first wave have been followed and interviewed twice, at the end of second and fourth year of landing.

The first essay focuses on the determinants of immigrant post-migration human capital investment, and the effects of this investment on immigrant employment status and labour market income. This has been fulfilled by using a discrete choice sequential decision model. This model combines immigrant labour market states with their labour market income. This framework allows this research to include unobserved heterogeneity into empirical analysis. Training decisions and accumulated stocks of human capital are therefore treated as potentially endogenous. This model assumes immigrants maximize their life time utility with a time additive utility function. Immigrants choose among four mutually exclusive and exhaustive labour market states in each period: unemployed, training and unemployed, training and employed, and employed. The estimation results confirm the importance of pre-migration human capital on immigrant post-migration human capital investment, and also the contribution of this investment to immigrant employment.

The second study explores the effects of immigrants' stock of human capital, including the human capital formed through post-migration investment (discussed in the first essay) on their labour market outcomes. These labour market outcomes includes both immigrants' occupational states, and their incomes from wage employment or self-employment. This essay uses the same methodology that is adopted in

¹The analysis and empirical results of the data represent the author's opinion toward immigration and immigrant issues.

the first study. It assumes that immigrants maximize their lifetime utility through choosing four mutually exclusive and exhaustive occupational states in each period. The occupational states are: unemployed and searching, employed in white-collar occupations, employed in blue-collar occupations, and lastly, self-employment. The empirical results reveal that, besides the contribution of pre-migration human capital, the post-migration human capital investment helps immigrants transfer from unemployment into one of the employment states. Results indicate that the largest marginal effect of post-migration human capital investment is on blue-collar occupations. This essay also confirms that unobserved heterogeneity affects immigrants' choice to pursue relevant labour market employment or to be self-employed.

The third essay employs the unobserved heterogeneity and its effect on the Canadian labour market by using asymmetric information theory. By proposing three plausible signals and testing their predictions on labour market outcomes, this research further confirms the existence of heterogeneity, or productive ability, among immigrants, which has been estimated in the first and the second essay. This essay has also tested immigrants' different assimilation paths in the Canadian labour market, caused by this unobserved heterogeneity. Empirical results reveal that, compared to immigrants with low ability, immigrants with high ability have longer employment duration, receive relatively higher income from the Canadian labour market, and have faster wage growth within the first four years after landing. This essay therefore provides a novel look at the selection results of Canadian immigration policy and the process of immigrant assimilation. Policy implications for the current criteria governing the selection of immigrants are also discussed.

This dissertation consists of three essays that share a similar structure. Each essay starts with an abstract, continues with an introduction of the research questions addressed in the essay and a review of relevant literature, followed by the sections of model setup, data utilized in the essay and empirical results, and ends with a

summary of findings.

Chapter 2

Essay 1: Training Immigrants: Evidence from Canada

ABSTRACT

This paper utilizes data from the Longitudinal Survey of Immigrants to Canada to analyze transitions into the Canadian labour market for newly arrived immigrants. The discrete choice sequential decision model has been selected for the analysis. This paper focuses on the effectiveness of training both in terms of entering and staying in the labour market, and in terms of wage increments. In particular, this paper analyzes the determinants of post-migration human capital investment, and the effect of such investment on immigrants' realized utility and wage income in the Canadian labour market. A discussion about possible policy implications from our results is also provided

Key words: training, sequential decision model, endogeneity, post-migration human capital investment, assimilation of immigrants.

2.1 Introduction

Canada has a long tradition of receiving immigrants. Evidence shows that immigration has accounted for more than half of the country's population increase since the 1930s (Bloom and Gunderson, 1991). Prior to 1967, immigrants generally originated from Britain and other commonwealth countries, such as Western Europe and the U.S. At this time, language, cultural background, and the quality of education were often similar between immigrants and the Canadian-born. Therefore, training immigrants was not a national issue that required public attention.

The rise of the importance of equal rights in the 1960s brought many changes to the Canadian immigration policy. In 1967, a new equal right system was adopted that diminished the selection of immigrants from particular source countries. The new policy allowed for immigrants to come from various countries, instead of a small list of countries chosen by Canadian government. This policy emphasized the role of immigrants' adaptive ability as well as the demand of the Canadian labour market. As a consequence of this immigration policy, substantial changes occurred in the composition of the immigration cohorts that arrived in Canada after 1970. In particular, there was a strong increase in the proportion of immigrants that migrated to Canada from developing countries. This trend was accompanied by a noticeable decrease in the migration of individuals from the traditional source countries. Because of the differences in language, culture, labour market requirements, and the possible disparity of education quality, the change in the composition of the immigrant population has increased the need to provide training for immigrants.

The positive link between immigration, economic development, and prosperity of a destination country has been widely acknowledged. There are numerous studies that have explored how the characteristics of immigrants influence the decision on whether or not to invest in the accumulation of human capital after landing. Data

limitations, however, have limited previous research being largely concentrated on formal education with reduced form models. However, the relationship formed by a reduced form model is not stable because of frequent policy initiatives and interventions (Acemoglu, 2010). This is particularly evident for immigration policies (Boyd and Vickers, 2000; Green and Green 1999). Therefore, it is hard to apply these findings to information concerning newly arrived immigrants, and draw a dynamic picture for the early integration process.

This paper adds to the current knowledge concerning immigrant assimilation and integration by utilizing the Longitudinal Survey of Immigrants to Canada (LSIC), and analyzes labour market characteristics of newly arrived immigrants. It also models the effectiveness of training schemes¹ to integrate newly arrived immigrants into the Canadian labour market. Training effectiveness is, therefore, linked not only to the speed of immigrant's wage adjustment but also to the likelihood that immigrants find relevant and available employment in the Canadian labour market. Accordingly, this paper seeks to address the following questions:

1. What are the determinants of post-migration human capital investment during the first years landed in the destination country?
2. What are the effects of post-migration human capital investment on both the wage level and finding available employment?
3. What are the policy implications for the current criteria in the selection of immigrants?

The paper is organized as follows: Section 2.2 provides a brief review of the existing

¹The definition of training in this paper includes formal education, required for foreign credential recognition, and for career advancement and development. However, because of data limitations, it excludes language training.

literature; Section 2.3 presents the model used for this paper; Section 2.4 describes the survey data, LSIC, utilized in this paper and the associated features of the sample; Section 2.5 presents the empirical results estimated from the model described in Section three; and lastly, Section 2.6 provides a summary of the conclusions and policy implications.

2.2 Literature Review

Research on the economics of immigration has generally concentrated on two areas: the entry effect and the catch-up effect. The entry effect is defined as the wage difference between an immigrant and a native-born with comparable characteristics at the time that the immigrant enters the destination country (Hum and Simpson, 2003). The catch-up effect, or the assimilation effect, reflects the rate at which an immigrant moves up the economic ladder. The result is that the immigrant's social status converges with the average performance of their native-born counterparts (Li, 2000). Generally, findings suggest that the relative efficiency of the 'stock' of human capital possessed by the immigrant, either before or after migration, is important for these two effects.

Human capital is generally measured in terms of a person's education, either duration or credential level, and work experience. The definition, however, creates some ambiguities. For example, Borjas (1985) indicates that there is a tendency for immigrant workers to receive lower wages than their native-born counterparts. Borjas attributes this disparity to an immigrant's lower level of pre-migration human capital. Friedberg (2000), however, argues that the lower immigrant wage rate is due to the inability of immigrants to integrate fully into the local labour market. Friedberg further concludes that the lower immigrant wage is a result of low transferability of

human capital accumulated in the country of origin to the destination-country labour market.

The quantity and quality of transferable human capital is hard to measure directly. It is therefore common in empirical research to divide an immigrant's stock of human capital into two parts: pre- and post-migration human capital. The returns to pre- and post-migration human capital are thereby measured. Empirical findings show that the stock of an immigrant's post-migration human capital is highly rewarded in the destination country; pre-migration education, however, has been undervalued in the destination-country labour market (Friedberg 2000; Zeng and Xie 2004). The latter result is also found to apply to foreign work experience (Miller, 1992).

The relationship between pre-migration human capital and the investment in post-migration human capital has also been found to be ambiguous in previous studies. On the one hand, Borjas (1985) and Khan (1997) find a negative relationship between the two, suggesting that pre-migration human capital is a substitute for post-migration human capital. This implies that a prospective immigrant with a high level of pre-migration human capital has less incentive to acquire additional schooling or training in the destination country. On the other hand, Chiswick and Miller (1994) and Friedberg (2000) find a positive relationship between the two, indicating that pre-migration human capital becomes complementary to the investment of human capital after landing. Under this condition, a prospective immigrant with a higher level of pre-migration human capital will tend to invest in additional schooling or training after migration.

Besides the level of pre-migration human capital, one of the major determinants of post-migration human capital investment is an immigrant's pre-migration occupation. For example, Green (1993) and Miller (1994) conclude that white-collar occupations in the country of origin are positively related with post-migration schooling. Unlike blue-collar occupations (i.e. technicians and workers in the service industry), white-collar

occupations (i.e. professionals and managers) generally require advanced educational credentials and more training in order to meet the requirements of a specific labour market. Therefore, the human capital of immigrants working in white-collar occupations may be less transferable from the country of origin to the destination-country labour market.

Another major factor that determines whether or not an immigrant will invest in the post-migration human capital is the years since immigration (Cohen and Eckstein, 2003). According to human capital theory, investment in post-migration human capital should occur as early as possible, i.e. soon after landing. However, post-migration human capital investment also depends on age, independently from time in the destination country, and consequently, the investment of human capital tends to decline with age.

2.3 A Structural Model of Employment and Training

This paper assumes that individuals maximize expected lifetime utility by choosing the optimal state over a finite horizon T . Lifetime utility is time additive. There are K mutually exclusive and exhaustive states in each period $t \in [0, T]$. Given this, the objective function can be written as

$$Max_{\{d_t^k\}} E\left(\sum_{t=0}^T \beta^t * \left(\sum_{k=1}^K U_t^k * d_t^k\right) | \Omega_t\right) \quad (1)$$

where the control variables d_t^k equal one when option k is chosen in period t and zero otherwise. Therefore $\sum_{k=1}^K d_t^k = 1$ for any t belonging to $[0, T]$. U_t^k denotes the contemporaneous utility of choosing option k in period t , and β is the discount factor, $0 < \beta \leq 1$. The information set, which includes all the relevant state variables at

arrival and all labour market decisions since arrival, at period t is denoted Ω_t .

The maximum expected value achieved in period t , denoted $V_t^k(\Omega_t)$ is given by

$$Max_{\{d_t^k\}} E\left(\sum_{t=0}^T \beta^t * \left(\sum_{k=1}^K U_t^k * d_t^k\right) | \Omega_t\right) = Max_{k \in K} V_t^k(\Omega_t) = V(\Omega_t) \quad (2)$$

Following an approach similar to Cameron and Heckman (2001), this paper approximates the alternative specific value functions using a flexible functional form. Thus, the intertemporal utility of choosing a given state k in period t is assumed to be of the following form

$$V_t^k = X_t' \theta_{kt} + \gamma_{kt} HC_t + \delta_{kt} EX_t + \varphi_k + \varepsilon_t^k \quad (3)$$

for $k = 1, 2, 3$ and 4 , where X are known characteristics of immigrants. HC denotes accumulated human capital (training) in period t since arrival, while EX denotes accumulated work experience in period t , again since arrival in Canada. The parameters γ_{kt} and δ_{kt} capture the structural effects of accumulated training and work experience, respectively, on the utility of choosing option k in period t . The term φ_k is a state specific unobserved heterogeneity term that represents individual difference in preference on training.

In order to estimate the model, some restrictions are needed. These restrictions will reflect the necessity to keep the number of parameters at a manageable level. It is also necessary to hold the model to a certain level of coherency. In particular, to reduce the number of parameters, this paper assumes that the vectors of parameters θ_{kt} , γ_{kt} and δ_{kt} remain constant over time. Moreover, individual heterogeneity is parameterized as follows:

$$\varphi_k = \alpha_{1k} + \alpha_{2k} * \mu \quad \forall k \in [1, K] \quad (4)$$

where μ is an individual specific random variable and its distribution is approximated by a discrete distribution with two points of support (μ_1 and μ_2). The type probabilities are estimated using logistic transformation. In order to obtain identification, μ_1 is normalized to equal zero and α_{21} equal one. Finally, this paper assumes that ε_t^k represents a pure stochastic i.i.d. shock observed at the beginning of period t .

Given the above assumptions, the probability of choosing state k in period t , given all available information at that period is

$$Pr(d_t^k = 1|X, d_{t-1}^k, \mu) = \frac{\exp(V_t^k - \varepsilon_t^k)}{\sum_{l=1}^K \exp(V_t^l - \varepsilon_t^l)} \quad (5)$$

The model is estimated using maximum likelihood techniques. The type specific likelihood function is given by

$$L(\cdot|\mu_m) = \prod_{t=0}^T Pr(d_t^k = 1|X, d_{t-1}^k, \mu_m) \quad (6)$$

and the unconditional likelihood function is a weighted average of $L(\cdot|\mu)$:

$$L(\cdot) = \prod_{i=1}^I \left\{ \sum_{m=1}^M \pi_m * L(\cdot|\mu_m) \right\} \quad (7)$$

2.4 Data

2.4.1 The Survey

The data that is utilized in this paper are extracted from the Longitudinal Survey of Immigrants to Canada (LSIC), which is administered jointly by Citizenship and Immigration Canada (CIC) and Statistics Canada. LSIC is designed to provide information pertaining to how newly arrived immigrants establish their economic, social,

and cultural ties to Canadian society during their first years in Canada. The survey therefore excludes the individuals that applied and landed from within Canada. The survey covers a four year survey period, starting from April 1, 2001 and ending on September 30, 2005².

The survey respondents were chosen randomly among immigrants that arrived in Canada between October 1, 2000 and September 30, 2001, 15 years of age or older at the time of landing, and landed from outside of Canada. Those immigrants that were selected for the survey were interviewed within a six-month period from the date of landing to the date of first interview. Interviews were conducted three times within a four-year period after their arrival. Data collection for the first wave began in April 2001 and ended in May 2002. Approximately 12,000 newly landed immigrants were interviewed. It represents approximately 164,200 of the 250,000 individuals admitted to Canada during the period. The survey population cover all Census Metropolitan Areas (CMA) and non-remote Census Agglomerations (CA). The second and third wave of interview were held at the end of the second and fourth year after the date of landing. The second survey included around 9,300 immigrants, while in the third survey the sample dropped to 7,700.

Compared to other commonly used data sources for immigration studies, such as the Canadian Census of Population and other large-scale cross-sectional surveys, LSIC has a comparative advantage. Besides detailed information on age, sex, mother tongue, country of origin, visa type, knowledge of English/French etc., LSIC provides information on the immigrant's formal education, both foreign and Canadian. LSIC also contains detailed information on any additional training, including purpose of attending training (e.g., job search, career development, and personal interest, etc.), and funding resources (e.g., employer-sponsored, government-funded, or self-financed). For these trainees, the survey records the start and end date during

²LSIC User Guide

(WWW.23.statcan.gc.ca/imdb-bmdi/pub/document/4422_d1_t1_v1-eng.pdf).

Table 2.1: **Distribution of Immigrants by labour Market Activity**

Quarter since Landing	Unemployed (%)	Training & Unem (%)	Training & Empl (%)	Employed (%)	Number of Obs
1	51.65	7.23	3.61	37.51	3632
2	27.14	8.65	8.68	55.52	3632
3	22.83	9.73	9.76	57.68	3632
4	22.29	10.95	9.82	56.93	3632
5	20.84	11.56	11.84	55.76	3632
6	18.71	11.88	13.52	55.89	3632
7	17.05	11.53	14.72	56.70	3632
8	14.62	10.29	16.32	58.76	3632
9	12.34	10.13	15.86	61.67	3632
10	13.08	9.44	16.05	61.43	3223
11	13.53	9.25	15.22	62.00	3024
12	13.35	8.87	15.01	62.77	3024
13	13.28	8.37	13.82	64.53	3024
14	12.78	7.75	13.69	65.77	3024
15	11.25	6.95	14.14	67.66	3024
16	9.67	5.74	14.82	69.77	3024

the reference year.

LSIC also contains detailed information on the employment history of the immigrant after landing as well as information on pre-migration occupation³. Lastly and perhaps most importantly, the longitudinal characteristics of LSIC make structural analysis of immigrants post-migration human capital investment possible.

2.4.2 Descriptive Statistics

The sample of this research is restricted to males that are between the ages of 18 and 45 at the time of the first interview. The age restriction is imposed in order to avoid capturing the proportion of the population that attends compulsory schooling (i.e., young adults), as well as the proportion of population that involves retirement

³Occupational categories in LSIC are based on the North American Industry Classification (NAICS 1997), and the Standard Occupation Classification System (SOC 1991).

decisions in each of the four survey years. Individuals that only participated in the first two waves of the survey are retained in our sample, generating an unbalanced panel. In total, there are 3,632 individuals observed for, at most, 16 quarters (See Table 2.1).⁴

Table 2.1 shows the proportion of newly arrived immigrants in four mutually exclusive and exhaustive labour market states: Unemployed, Training and Unemployed, Training and Employed, and Employed. Immigrants were assigned to the states of training if they participated in formal education, training for foreign credential recognition, or for career advancement and development for at least one day in a quarter of a year. An immigrant is assigned to the state of training and employed, if he stays in this state longer than the state of training and unemployed in a quarter of a year. If an immigrant is not assigned to training and worked at least one day during a quarter, that immigrant is assigned to the state of employment. Lastly, if an immigrant is neither trained nor employed, he or she is assigned to the absorbing state, unemployed.

Table 2.1 indicates that during the first quarter after landing, about seven percent of immigrants were in the group of training and unemployed, and some four percent were participating in training and being employed at the same time. About 38 percent of immigrants were in the state of employed in the first quarter after landing, while 52 percent were unemployed. The fraction of immigrants enrolled in training, both employed and unemployed, increases to around 17 percent in the second quarter. The proportion of immigrants in the state of training and unemployed drops to six percent in the sixteenth quarter. This pattern is consistent with human capital theory, which indicates that the investment of human capital happens in the early stage after landing.

The percentage of employed immigrants increases steadily after landing. The

⁴LSIC consists of oversampled refugees thus survey weights have been used in this paper.

Table 2.2: **Descriptive Statistics for Male Immigrants, by Training States**

	Full Sample (St.Dev.)	Non- trainee (St.Dev.)	Training & Unem (St.Dev.)	Training & Empl (St.Dev.)
Number of Observations	3632	1754	1082	796
Age at arrival	32.55 (6.623)	33.42 (6.444)	31.34 (7.109)	32.28 (6.033)
Foreign education	15.65 (2.953)	15.39 (3.171)	15.71 (2.664)	16.15 (2.756)
Number of jobs since landing	2.085 (1.245)	1.967 (1.163)	2.350 (1.417)	2.018 (1.140)
Number of children at arrival	0.506 (0.801)	0.559 (0.836)	0.408 (0.712)	0.520 (0.826)
Average weekly wage of 1st main job	545.0 (492.7)	567.9 (429.8)	454.1 (513.6)	606.9 (565.3)
Source country white- collar occupation (%)	60.5	56.8	61.6	67.2
Married (%)	72.6	77.8	63.6	73.5
Number of trainings since landing	1.321 (0.542)		1.362 (0.554)	1.266 (0.520)

percentage of immigrants that were employed is around 38 percent in the first quarter after landing, and it reaches 70 percent at the end of survey, approximately four years after landing. Finally, the proportion of unemployed immigrants drops from an initial 52 percent to about 10 percent in the last survey period.

Table 2.2 shows the descriptive statistics of male immigrants with and without training. It indicates that 51.7 percent of immigrants participated in training⁵ at least once after landing. Trained immigrants are marginally younger on average than those that did not receive any training. The accumulated pre-migration formal education for immigrants that participated in training is marginally higher: an average of 16.2 years, roughly corresponding to a college degree, for immigrants in the state of training and employed versus an average of 15.4 years for the untrained group.

⁵The percentage of trainees is calculated based on the sum of trainees, with and without employment, divided by the full sample of this research (3632).

Table 2.2 also shows that there is a distinction in terms of the occupation in the country of origin between those that received training and those that did not. The fraction of employed trainees that worked in a white-collar occupation in their country of origin is 67 percent. The corresponding proportion for the untrained group is 57 percent. This observation, together with the average years of pre-migration education, suggests that a positive relationship exists between the acquisition of pre- and post-migration human capital. Furthermore, there are notable wage differences between those with and without training. On average, immigrants earn \$545 per week for their first main job in Canada⁶. The corresponding average wage for the untrained group is \$568 per week. The average weekly wage of the first main job for trainees, with (without) a job at the time of training, is \$607 (\$454) per week. Interestingly, trainees also changed jobs more often than non-trainees.

2.5 Empirical Results

2.5.1 The Effects of Human Capital and the Local Macro Economy Environment on Immigrant Realized Utility

Table 2.3 presents the effects of human capital and the local macro-economy environment on immigrant post-migration human capital investment decisions. The table includes the human capital acquired from the country of origin and the corresponding human capital that was acquired in Canada. Estimates that are associated with the utility acquired from the state of training and unemployed are presented in column one; estimates for the state of training and employed are in column three; and estimates for being employed are in column five. Given the non-linear nature of the model, marginal effects associated with these estimates are presented in columns two,

⁶While many immigrants hold more than one job at a time, the LSIC asks immigrants to report only one occupation as his or her main job for each interview.

four, and six.

Consistent with the existing literature, foreign education has an important influence on immigrant post-migration human capital investment decisions. Compared to being unemployed, immigrants with more foreign education receive more utility from training, no matter whether they are employed or not. However, the effect of foreign education on the state of employment is not significant.

The proficiency in either French or English, Canada's official languages, has a significant effect on the immigrant post-migration human capital investment decisions. Immigrants that speak English or French fluently participate in training or join labour force more so than immigrants that have a poor knowledge of both Canada's official languages. Compared to the state of unemployment, immigrants that speak English or French fluently are more inclined to be in the states of training and employment. The largest marginal effect of language efficiency (0.44) comes from the state of employed.

The occupation that an immigrant held in his country of origin right before migration has a similar effect as foreign education and language proficiency. Compared to immigrants that never worked in their country of origin, immigrants that held a white-collar occupation are inclined to be in the state of training and employed. Furthermore, they also locate at a higher utility level, marginally significant, from being in the state of employed. Immigrants that worked in a blue-collar occupation in their country of origin right before migration, however, are not significantly different from immigrants that never worked⁷.

The accumulation of human capital in Canada also influences immigrants' post-migration human capital investment. The longer an immigrant stays in the state of training and employed, the higher utility level he or she acquires, if he or she keeps staying in this state. The accumulated period of training and employment decreases

⁷For descriptive statistics not shown here, immigrants that never worked before migration are relatively younger, with median at 24 years old, compared to immigrants that worked in blue-collar (white-collar) occupations in the country of origin, with median at 30 (34) years old.

Table 2.3: **The Effects of Human Capital Parameters and the Local Macro Economy Environment on Immigrant Realized Utility**

	Training & Unem (Std.Err.)	M.E.	Training & Empl (Std.Err.)	M.E.	Em- ployed (Std.Err.)	M.E.
Foreign education	0.021 (0.011)	0.0000	0.030 (0.010)	0.0002	0.008 (0.007)	0.0001
Accumulative unemployment	-0.198 (0.011)	-0.0003	-0.234 (0.012)	-0.0002	-0.228 (0.007)	-0.0074
Accumulative training & unemployment	0.195 (0.015)	0.0010	-0.022 (0.017)	-0.0011	0.026 (0.015)	0.0015
Accumulative training & employment	-0.126 (0.025)	-0.0015	0.253 (0.019)	0.0030	-0.008 (0.018)	-0.0020
Accumulative employment	0.010 (0.013)	0.0001	-0.011 (0.009)	-0.0015	0.137 (0.007)	0.0101
Language (dummy)	0.403 (0.069)	0.0006	0.437 (0.065)	0.0026	0.148 (0.042)	0.4426
Source country occupation						
White-collar (dummy)	-0.036 (0.092)	-0.0005	0.171 (0.086)	0.0009	0.107 (0.060)	0.4424
Blue-collar (dummy)	-0.166 (0.092)	-0.0007	-0.037 (0.085)	-0.0005	0.086 (0.059)	0.4434
Never worked	-	-	-	-	-	-
Local macro economy environment						
Provincial unemployment rate	-0.015 (0.023)	-0.0002	-0.113 (0.022)	-0.0003	-0.101 (0.015)	-0.0040

an immigrant's utility level if he or she chooses to be in the state of training and unemployed. However, its effect on the state of training and unemployment is not significant. The state of training and unemployed has similar effects as the state of training and employment—it increase an immigrant's realized utility if he or she stay in this state. Lastly, the marginal effect of accumulated periods of employment positively affects an immigrant's realized utility level, if that immigrant keeps his or her job in the next period.

The accumulation of unemployed periods significantly lowers immigrants' realized utility level in all states other than unemployment. This is due to the fact that accumulative unemployed periods depreciate immigrants' human capital. Another possible reason is that immigrants are frustrated and discouraged, the longer that they stay unemployed.

The local macro-economic environment is also a key determinant in immigrants' states. The marginal effect of a one percent increase of provincial unemployment rates decreases the utility level of an employed immigrant at 0.004.

2.5.2 The Effects of Individual Characteristics, Immigrant Classes, and the Previous Period Training State on Immigrant Realized Utility

Table 2.4 reports the effects of immigrants' individual characteristics, and the previous period state on immigrant post-migration human capital investment decisions. Consistent with the previous literature, older immigrants are less inclined to be in the states of training, either employed or unemployed. The effect of age on employment, however, is not significant. Married immigrants locate at a higher utility level, compared to immigrants that are not married, if employed.

The state occupied by an immigrant in one period has significant influence on his

Table 2.4: **The Effects of Individual Characteristics, Immigrant Classes, and the State in Previous Period on Immigrant Realized Utility**

	Training & Unem (Std.Err.)	Training & Empl (Std.Err.)	Employed (Std.Err.)
Age at arrival	-0.038 (0.006)	-0.037 (0.005)	-0.001 (0.004)
Marriage	-0.060 (0.078)	0.061 (0.070)	0.116 (0.050)
Number of children	0.030 (0.043)	0.016 (0.038)	-0.038 (0.025)
Previous period state (dummy)			
Training & unemployed	3.935 (0.084)	3.825 (0.111)	-0.027 (0.115)
Training & employed	4.281 (0.162)	6.973 (0.111)	3.633 (0.144)
Employed	-0.133 (0.134)	3.383 (0.090)	3.550 (0.049)
Immigrant class (dummy)			
Economic immigrants	0.102 (0.099)	0.054 (0.085)	-0.148 (0.061)
Refugees	-0.053 (0.108)	-0.118 (0.103)	-0.398 (0.069)
Family immigrants	-	-	-

or her utility level in the next period. An immigrant's utility level will be significantly increased if he or she was in the state of training and unemployed in one period and continues training, either employed or unemployed, in the next period. The state of employment in one period significantly increases an immigrant's utility level if he or she is continuing to be employed, with or without training, in the next period. An immigrant is strictly better off if he or she was in the state of training and employed in one period, and in a state other than unemployment in the next period.

Immigrants that are admitted under the refugee and economic class receive less utility from being employed, compared with family reunion immigrants, and the effects are statistically significant. This result is not surprising when considering the respondents of LSIC are immigrants that arrived and landed from outside of Canada. Compared to family reunion immigrants, refugees and economic immigrants lack information concerning Canadian labour market. And, furthermore, refugees have a relative lower human capital transferability. As a result, refugees and economic immigrants are more likely to experience a downward shift of their occupations in the Canadian labour market, compared to the occupation they held right before migrating to Canada. They therefore tend to work in an occupation different to their intended occupation⁸. On the contrary, family class immigrants have connections within Canada and could access much more labour-market information. In particular, family reunion immigrants can be considered to be not completely new to the Canadian labour market, due to the relay of information from family members and friends. This provides them with a significant advantage on the destination-country labour market in the early assimilation period.

⁸Please see the second essay: Occupational Decisions and the Early Assimilation of Immigrants to Canada

Table 2.5: **The Effects of Country of Origin on Immigrant Realized Utility**

Source Country/ Region	Training & Unem (Std.Err.)	Training & Empl (Std.Err.)	Employed (Std.Err.)
Africa	0.388 (0.163)	-0.426 (0.131)	-0.603 (0.095)
China	0.299 (0.167)	-0.839 (0.135)	-0.917 (0.097)
India	-0.161 (0.186)	-0.588 (0.139)	-0.547 (0.100)
Other EU	0.131 (0.169)	-0.572 (0.135)	-0.504 (0.096)
Other Asia	0.243 (0.161)	-0.542 (0.126)	-0.630 (0.091)
Other America	0.310 (0.188)	-0.187 (0.147)	-0.468 (0.109)
US/Western EU	-	-	-

2.5.3 The Effects of Country of Origin and Residential Region in Canada on Immigrant Realized Utility

Table 2.5 presents the effects of immigrant country of origin on their post-migration human capital investment decisions. Compared to immigrants from traditional source countries, such as the U.S., UK, and Western European countries, immigrants from other countries or regions, such as Northern and Eastern Europe, Asia, Africa, and South America, are less inclined to be in the states of employment, whether in training or not. This reflects the difference of human capital transferability and therefore the declined of occupational status for immigrants originally from developing countries.

Table 2.6 reports the effects of the residential region in Canada on immigrant's post-migration human capital investment decisions. There is no significant difference for the state of training and unemployed among immigrants that live in Ontario (the reference group), and immigrants that live in other Canadian provinces. There are

Table 2.6: **The Effects of Residential Region in Canada on Immigrant Realized Utility**

Province	Training & Unem (Std.Err.)	Training & Empl (Std.Err.)	Employed (Std.Err.)
QC	0.034 (0.100)	-0.300 (0.100)	-0.145 (0.067)
ATL	0.048 (0.282)	0.685 (0.271)	0.450 (0.177)
BC	0.040 (0.092)	0.122 (0.083)	0.138 (0.059)
MB	0.315 (0.200)	0.208 (0.170)	0.055 (0.128)
SK	-0.070 (0.291)	-0.574 (0.327)	-0.067 (0.182)
AB	0.031 (0.104)	-0.223 (0.094)	-0.149 (0.066)
ON	-	-	-

some exceptions, such as some states in Alberta, Quebec, and the Atlantic provinces. Immigrants that live in Quebec and Alberta are at a lower utility level if they are employed, whether they participated in training or not. Immigrants that live in one of the four Atlantic Provinces⁹ receive more utility if they are either employed or in the state of training and employed.

2.5.4 The Determinants for Wage

Table 2.7 reports the estimates of the wage equation. The results focus on immigrant's accumulation of pre- and post-migration human capital. Foreign education has a positive effect on immigrants' expected wage. Holding other factors constant, each additional year of foreign education increases an immigrant's expected wage in the Canadian labour market. Proficiency in one of Canadian official languages,

⁹Atlantic provinces include New Brunswick, Newfoundland and Labrador, Nova Scotia, and Prince Edward Island.

Table 2.7: **The Wage Equation**

	Estimates	Std.Err.
Foreign education	0.043	(0.001)
Language	0.200	(0.007)
Accumulative unemployment	-0.029	(0.001)
Accumulative training & unemployment	-0.028	(0.003)
Accumulative training & employment	-0.011	(0.002)
Accumulative employment	0.011	(0.001)

and accumulated Canadian work experience, significantly increases an immigrant's expected wage.

Accumulated periods of training, either employed or unemployed, however, decrease an immigrant's expected wage. This may be indicative of the mismatch between an immigrant's acquisition of human capital in their country of origin, and the occupation they are currently holding in Canada. Unlike a fixed period of training provided by the Israel's government (Cohen and Eckstein, 2003), the duration of training and the number of training sessions a Canadian immigrant participated in are flexible in this paper. This result, therefore, may reflect the fact that the immigrants who utilize training efficiently enter into the state of employment quickly¹⁰. This may also represent the impact of the formal education that immigrants participated after landed in Canada. Since LSIC covers the first four years after landing, immigrants that participate in formal education in Canada are most likely to still be at school and working in a nonprofessional occupation. Their wage therefore, cannot adequately represent the return of human capital that is obtained through Canadian

post-secondary education.

As expected, accumulated unemployment periods depreciate human capital and decrease immigrant expected wage.

2.5.5 The Estimated and Actual Transition Probability

Table 2.8 presents the estimated transition matrix between states. The estimated structural stability rates are much lower than the actual transition matrix (Table 2.9). This is due to the serial correlation of time invariant unobserved heterogeneity, φ , which has been isolated and estimated from the structural model.

The estimated transition probability reveals that the first four years after landing is a volatile period for immigrants. That said, employment is one of the main transition destinations. When an immigrant is unemployed in one period, he or she will stay unemployed with a probability equal to 0.49 in the next period. However, by the next period, an unemployed immigrant is predicted to find employment with a probability equal to 0.41. The structural stability for the states of training, both employed and unemployed, are about 0.57 and 0.51, respectively. The highest structural stability is among immigrants that are employed. If an immigrant is in the state of employment in one period, he or she will stay employed with probability equal to 0.88 in the next period.

2.5.6 Unobserved Heterogeneity

Table 2.10 presents unobserved heterogeneity and its effect on both immigrants' states and labour market income. With an adopted two point system and with μ_1 fixed at zero to represent Type *I* immigrants, there are six percent¹¹ of immigrants

¹⁰The second essay of this thesis (Zhou, 2011) confirms that the first time training is effectively transfer immigrants from being unemployed into the states of employment in the Canadian labour market.

¹¹Calculated based on logistic expression: $\exp(q)/(1+\exp(q))$ with q equal to -2.758.

Table 2.8: **Estimated State Transition Matrix**

		Destination State			Empl
		Unem	Training & Unem	Training & Empl	
Original State	Unemployed	0.491	0.074	0.029	0.406
	Training & Unem	0.116	0.566	0.214	0.104
	Training & Empl	0.019	0.123	0.509	0.349
	Employed	0.057	0.006	0.063	0.875

Table 2.9: **Actual State Transition Matrix**

		Destination State			Empl
		Unem	Training & Unem	Training & Empl	
Original State	Unemployed	0.742	0.055	0.013	0.189
	Training & Unem	0.071	0.781	0.120	0.027
	Training & Empl	0.007	0.055	0.774	0.164
	Employed	0.030	0.003	0.035	0.932

Table 2.10: **The Distribution of Unobserved Heterogeneity: Unobserved Preference for Training and Work**

	Estimates	Std.Err.
μ	-0.030	(0.008)
q	-2.758	(0.007)
Training & unemployed		
Intercept	-1.300	(0.289)
Slope	1.000	(fixed)
Training & employed		
Intercept	-1.678	(0.286)
Slope	-13.55	(6.142)
Employed		
Intercept	0.653	(0.195)
Slope	1.989	(2.089)
Wage equation		
Intercept	-0.769	(0.019)
Slope	-209.9	(57.14)

that belong to Type *II* with the estimated μ_2 equals to -0.03.

This unobserved preference difference generates assorted decisions when immigrants face the four mutually exclusive and exhaustive states. Compared to Type *I* immigrants, Type *II* immigrants are more likely to be in the state of training and employed; they also receive a higher wage in the labour market if employed.

2.6 Summary and conclusions

This paper has examined the determinants of training opportunities for newly arrived immigrants in Canada, as well as the effects of the accumulation of human capital on wages. This has been done by using a discrete choice sequential decision model. This model allows to estimate immigrant post-migration human capital investment decisions jointly with wage outcomes. This framework allows for the inclusion of the correlated unobserved heterogeneity into the econometric analysis. Thus, post-migration human capital investment and accumulated stocks of human capital are treated as potentially endogenous.

The empirical results of this paper are consistent with the previous research that address these issues. Among the estimated determinants, pre-migration human capital, including both education and occupation in the country of origin, plays a key role in determining the post-migration human capital investment among newly arrived immigrants in Canada. For immigrants that participate in training, they usually engage in training quickly after they have landed in Canada. Furthermore, immigrants with a higher proficiency in one of Canadian official languages are more active in training and acquiring ready employment, controlling for all the other factors.

The states of post-migration human capital investment are persistent for the newly arrived immigrants in the sample of LSIC. Accumulated periods of training increases an immigrant's realized utility from the corresponding state. The estimated transition

matrix confirms the presence of a transition from training to employment.

The effects of pre- and post-migration human capital on wages are similar to their effects on realized utility. Foreign education, proficiency in one of the Canadian official languages, and the accumulation of work experience in Canada, increases immigrants' expected wage when they are employed.

This paper reveals that unobserved heterogeneity has significant effects on the training and employment choices of immigrants in the first years after landing. The empirical results have important policy implications concerning immigrant observed heterogeneities. Although the proportion of immigrants that come from traditional countries is consistently decreasing, these immigrants are more integrated to the Canadian economy. In general, they receive more utility from the state of training and employment, compared to immigrants that come from developing countries. They are also more likely to locate employment in the first four years after landing in Canada.

Consistent with previous research, an immigrant's social capital is important in helping immigrants to find ready employment. Compared to economic class immigrants, family class immigrants receive more realized utility from employment. Refugees are, not surprisingly, in the worst situation in the first four years after landing, compared to family class immigrants and immigrants that migrated for economic reasons. However, the long-run effects are worth for further investigation.

The largest marginal effects on immigrant realized utility come from immigrant language ability and white-collar occupations for immigrants that are employed after landing. When an immigrant with higher proficiency in one of the Canadian official languages, or he or she has been employed in a white-collar occupation in the country of origin, he or she is better off in the state of employment, compared to the other labour market states.

This paper also confirms the significant effect of post-migration human capital

investment on immigrants' transition into employment. When an immigrant is in training in one period, he or she is more likely to become employed in the next period. This implies that, along with choosing immigrants that fit the demand of Canadian labour market, investment in immigrant training programs improves immigrants' economic assimilation and therefore their contribution to the Canadian economy.

Finally, younger immigrants are more likely to invest in post-migration human capital and, therefore, are in a much better position to assimilate into the Canadian society economically.

To summarize, while selecting migration applicants that applied from outside of Canada, Canadian immigration policies should emphasize the following characteristics: younger applicants with more years of education, higher proficiency in one of the official Canadian languages, and those that worked in a white-collar occupation in the country of origin. This has been suggested by the empirical analysis that results from the sample data extracted from LSIC, and it is consistent with previous research. Canadian immigration policies should also provide more training opportunities to newly landed immigrants. This will help immigrants transfer from the state of unemployment to becoming employed in the first years after landing. Immigrants, therefore, would be able to contribute more to the development of Canadian economy.

This paper extends the understanding of the behavior of newly landed immigrants in Canada within the first years after landing. Furthermore, it confirms the existence of heterogeneity among immigrants. This paper also provides new evidence for the effects of immigrants' heterogeneity on the participation in training.

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Chapter 3

Essay 2: Occupational Decisions and the Early Assimilation of Immigrants to Canada

ABSTRACT

This paper uses a discrete choice sequential decision model to analyze the occupational decisions of newly arrived immigrants and their labour-market assimilation in the first years after landing in Canada. While most research in the economics of immigration concentrates on the wage gap between immigrants and natives, this wage gap is to a large extent driven by occupational differences. Using data from the Longitudinal Survey of Immigrants to Canada, this paper identifies the determinants of immigrant occupational choices and the effects on their wage increments. Evidence shows that the economic class immigrants has acquired more utility from working in white-collar occupations over others. Occupational outcomes are persistent for every immigrant: the longer an immigrant stays at a low occupational level or is unemployed, the harder it is for that immigrant to move up along the economic and social ladder. The implications of the empirical results for immigrant selection criteria and integration policy are also discussed.

Key Words: occupational mobility, sequential decision model, endogeneity, post-migration human capital investment, assimilation of immigrants

3.1 Introduction

Labour market assimilation is of major importance for overall immigrant social and economic integration. Previous research (Chiswick and Miller 2007, Cohen and Eckstein 2008, Friedberg 2000, Green 1999) indicates that there is a tendency for assimilation to occur rapidly when immigrants' stock of human capital matches an occupation's requirements in the destination-country labour market. This is particularly important for immigrants during the first years after landing, since newly landed immigrants are often not eligible for, or have insufficient information about the destination country's social welfare programs.

Low human capital transferability, lack of language proficiency and little information about the destination-country labour market limit immigrants to find employment. Similar to young native born first entering labour market, newly arrived immigrants appear to practice a job-shopping (Johnson, 1978) behaviour. And they, most often, experience a downward shift of occupational status, compared with the occupation they held just before migration. This is particularly the reality for people that emigrated from a developing country and landed with a limited budget. These immigrants are forced to accept an offer that is different with their intended occupation, in order to balance family budget or to avoid dissaving.

The downward shift of immigrants' occupational statuses in the destination country unavoidably affects their labour market income. This contributes to the entry wage gap between immigrants and their native-born counterparts. Some immigrants are able to complement their source-country human capital by investing on the destination-country human capital, such as formal education or training. They also accumulate the human capital specific to the destination-country labour market through collecting labour market information and working on the market. The accumulated human capital in the destination country helps immigrants find employment

in an occupation that better matches their stock of human capital. These immigrants therefore experience a move up along the career ladder and are able to transfer their occupational mobility into wage mobility.

Even though occupations have an important role in determining immigrant labour market income, previous empirical research has generally ignored occupation. A possible reason is that both occupation and labour market income are correlated with unobserved heterogeneity (Chiswick and Miller, 2007). If this correlation is ignored, estimates will be biased and inconsistent. To deal with this issue, this paper adopts a discrete choice sequential decision model. This model estimates the effects for both occupation and wage, in the presence of both observed and unobserved heterogeneity among immigrants. The categorical occupations also fit naturally with the setup of this model's discrete occupational choices. To my knowledge, there are few researchers that combine both occupation and labour market income into estimation for the analysis of newly landed Canadian immigrants, under the consideration of unobserved heterogeneity.

The empirical results suggest that while pre- and post-migration human capital determine both immigrant occupational states and labour market income, unobserved heterogeneity is also a decisive factor in determining immigrants' early assimilation. Other than working in wage employment such as white- or blue-collar occupations, self-employment is also an important occupation for immigrants. Finally, the residential area where an immigrant lives after landing is crucial to that immigrant's assimilation. The provincial unemployment rate influences both immigrants' occupational decisions and their labour market income.

The rest of the paper is organized as follows: Section 3.2 provides a brief description of the existing literature; Section 3.3 presents the model and special determinants considered in the paper ; Section 3.4 describes the Longitudinal Survey of Immigrants to Canada (LSIC) and certain features of the sample; Section 3.5 presents the em-

pirical results estimated from the models described in Section 3.3; and Section 3.6 provides a summary of the conclusions.

3.2 Literature Review

For some time labour economists have noticed the importance of immigrants' occupation on their assimilation. However, there has been relatively little research on this topic and a generally accepted conclusion has not been reached. Richmond (1967) and Chiswick (1977) are the first to explore this topic and to notice the initially downward shift of occupational status with a recovery thereafter. Green (1999) finds the first few years after landing are crucial to an immigrant's final occupation status. And Cohen and Eckstein (2008) reports that the initial job is an important determinant for immigrants' occupations in the destination-country labour market.

Chiswick, Lee and Miller (2005) propose a U-shaped pattern of immigrant occupational mobility, when comparing the last occupation before migration with the first occupation after landing in the destination country and thereafter. The U-shaped occupational mobility is due to imperfect human capital transferability between countries. Newly landed immigrants can be at a disadvantageous position in the destination-country labour market when competing with their native-born counterparts. Immigrants often lack the human capital that is specific to the destination-country labour market. They lack official language proficiency. And their credentials received from developing countries may not be accepted in the destination labour market. Immigrants therefore are more likely to experience a decline of occupational status initially. They also undergo a recovery afterward as a result of accumulating the human capital specific to the destination-country labour market.

The U-shape pattern is different across immigrants. The depth of the initial down-

ward shift and the improvement thereafter depend on the extent of human capital transferability. It results from the socio-economic similarity between the source and the destination country. When the source country's culture, language, education system and economic structure are similar to the destination country's, it is easier to transfer human capital across boundaries. That is typically the case for people that migrate between developed countries. However, human capital transferability would be much lower when the source and the destination country share little similarity. That is the case of immigrants from developing countries. Therefore, immigrants coming from developed countries have a shallower downward shift of their occupation, due to their highly accepted foreign human capital. However, immigrants emigrated from developing countries experience a deeper downward shift of their occupational status, especially in the first few years after landing.

Immigrants' attributes also influence the depth of the downward shift of occupational status. Economic immigrants have the shallowest decline of occupational status. The reasons are their economic motivation for migration and the selection criteria of the immigration policy at the destination country. The selection criteria mostly depends on immigrant potential human capital, such as age, education, language proficiency, work experience, etc, and immigrant adaptive ability to the country's labour market. Refugees and family reunion immigrants face a steeper decline in their occupational status after landing. Rather than motivated by economic reasons, their migration decisions are more likely due to social unrest, political or family reasons. They therefore possess comparatively less transferable human capital than the economic immigrants. Among them, refugees have the steepest decline of occupational status. Recovery depends on the post-migration human capital investment. Other things equal, immigrants with more foreign education are more likely to experience a steeper recovery.

Chiswick, Lee and Miller (2005) use Australian longitudinal data to analyze immi-

grant occupational mobility. In order to reveal the relationship between immigrant's observable characteristics and the change of their occupations, Chiswick, Lee and Miller (2005) construct a continuous variable, ANU3¹ as the dependent variable to replicate the categorical occupations. The econometric model they use for analysis is Ordinary Least Squares (OLS). Their empirical results support the hypothesis of immigrant's U-shaped occupational mobility.

Green (1999) provides evidence on Canadian immigrants' occupational mobility. He also discusses the economic contribution of immigrants to Canadian economy. Using data from three censuses and a multinomial logistic model, Green (1999) finds that Canadian immigrants are overrepresented in highly skilled occupations and underrepresented in less skilled occupations. Highly skilled occupations include professional occupations and low skilled occupations include sale service, blue collar jobs, etc. Green (1999) notices that the first three years after landing are crucial in determining immigrants' lifetime occupation. Either immigrants quickly move away from low-skilled occupations, or unemployment, to highly skilled occupations, or they will be trapped in these low-skilled occupations with a low wage after this period.

Green (1999) also finds that immigrants are comparatively more adaptable to economic structural change than their native counterparts. He points out that every immigrant cohort experience a massive move away from blue-collar jobs to white-collar occupations in the late 1980s; however, this pattern was not observed for Canadian born over the same period. This cannot be explained by a normal assimilation process.

Finally, Green (1999) identifies some characteristics that are very important in determining immigrants' assimilation. Similar with the conclusion in Chiswick, Lee and Miller (2005), Canadian economic immigrants are more likely to work in highly

¹The method was developed by Jones (1989), which measures relative difference in labour market power, occupation prestige requirements and rewards.

skilled occupations². Even though they also experience an unemployed period or initially work in a low skilled occupation, most of them transfer to a professional occupation. Other immigrant groups are concentrated in low-skilled occupations. As to language effect, although fluency in one of the Canadian official languages influence immigrant occupational mobility, improvement of fluency after landing has nearly no effect. When an immigrant is not fluent in either of the Canadian official languages at the time of landing, he is more likely to work in an occupation that characterizes with job requirement on low skilled labour. This immigrant is also less likely to move to a highly skilled or professional occupation, even if his language skills improved. However, immigrants with a high proficiency in one of the Canadian official languages, either English or French, at the time of landing experience a quick transition among occupations and most end up with work in professional occupations.

In a departure from reduced-form models, Cohen and Eckstein (2008) uses a dynamic model to analyze immigrant labour market decisions. With Israeli longitudinal data for newly landed immigrants, Cohen and Eckstein (2008) assumes that immigrants maximize their life time utility through choosing one of five labour market states in each period. The labour market states are unemployed, training in white-collar occupations, training in blue-collar occupations, work in white-collar occupations, and work in blue-collar occupations. Their empirical results suggest that the imported human capital, including foreign education and potential foreign work experience, has zero return in the Israeli labour market. However, the acquired human capital from the Israeli labour market determines the probability of a job offer and the wage level for immigrants. In particular, participating in white-collar (blue-collar) occupational training has a positive and significant effect on increasing the probability of a job offer in white-collar (blue-collar) occupations. Training also increases immigrant wage level in the corresponding occupation. While accumulated

²Eckstein and Weiss (1998) discuss the immigrant skills and the absorption of the destination-country (Israel) labour market.

Israeli work experience increases the immigrant wage, it decreases the probability of a job offer in both white- and blue-collar occupations. However, Cohen and Eckstein (2008) does not separate local work experience acquired from white- or blue-collar occupations. They simply consider a general Israeli work experience.

Another important conclusion from Cohen and Eckstein (2008) is the persistence of occupational state. Once an immigrant works in a blue collar occupation, it is hard for that immigrant to transfer to a white-collar occupation, let alone those that are currently unemployed.

3.3 A Structural Model of Occupational Decisions

3.3.1 Model Setup

This paper assumes that individuals maximize expected lifetime utility by choosing the optimal state over a finite horizon T . Lifetime utility is time additive, and there are K mutually exclusive and exhaustive states in each period $t \in [0, T]$. Given this, the objective function can be written as

$$Max_{\{d_t^k\}} E\left(\sum_{t=0}^T \beta^t * \left(\sum_{k=1}^K U_t^k * d_t^k\right) | \Omega_t\right) \quad (1)$$

where the control variables d_t^k equal one when option k is chosen in period t and zero otherwise and $\sum_{k=1}^K d_t^k = 1$ for each t belonging to $[0, T]$. U_t^k denotes the contemporaneous utility of choosing option k in period t , and β is the discount factor, $0 < \beta \leq 1$. The information set, at date t , which includes all the relevant state variables at arrival and all labour market decisions since arrival, is denoted Ω_t .

The maximum expected value achieved in period t , denoted $V_t^k(\Omega_t)$ is given by

$$Max_{\{d_j^k\}} E(\sum_{j=0}^T \beta^j * (\sum_{k=1}^K U_j^k * d_j^k) | \Omega_j) = Max_{k \in K} V_t^k(\Omega_t) = V(\Omega_t) \quad (2)$$

Following an approach similar to Cameron and Heckman (2001), this paper approximates the alternative specific value functions using a flexible functional form. Thus, the intertemporal utility of choosing a given state k in period t is assumed to be of the following form

$$V_t^k = X_t' \theta_{kt} + \gamma_{kt} TR + \delta_{kt} EX_t + \varphi_k + \varepsilon_t^k \quad (3)$$

for $k = 1, 2, 3$ and 4 , where X are known characteristics of immigrants. TR denotes whether an immigrant has finished training before period t or not, while EX denotes accumulated work experience in period t since arrival in Canada. The parameters δ_{kt} capture the structural effects of accumulated work experience on the utility of choosing option k in period t . The term φ_k is a state specific unobserved heterogeneity term that represents individual differences in tastes for different occupational decisions.

In order to estimate the model, some restrictions are needed. These restrictions reflect the necessity to keep the number of parameters at a manageable level as well as the necessity to hold the model to a certain level of coherency. In particular, to reduce the number of parameters, this paper assumes that the vectors of parameters θ_{kt} , γ_{kt} and δ_{kt} remain constant over time. Moreover, individual heterogeneity is parameterized as follows:

$$\varphi_k = \alpha_{1k} + \alpha_{2k} * \mu \quad \forall k \in [1, K] \quad (4)$$

where μ is an individual specific random variable and its distribution is approximated

by a discrete distribution with two points of support (μ_1 and μ_2). The type probabilities are estimated using logistic transformation. In order to obtain identification, μ_1 is normalized to equal zero and α_{21} to equal one. Finally, this paper assumes that ε_t^k represents a pure stochastic i.i.d. shock on an individual's utility in period t .

Given the above assumptions, the probability of choosing state k in period t , given all available information at that period is

$$Pr(d_t^k = 1|X, d_{t-1}^k, \mu) = \frac{\exp(V_t^k - \varepsilon_t^k)}{\sum_{l=1}^K \exp(V_t^l - \varepsilon_t^l)} \quad (5)$$

The model is estimated using maximum likelihood techniques. The type specific likelihood function is given by

$$L(\cdot|\mu_m) = \prod_{t=0}^T Pr(d_t^k = 1|X, d_{t-1}^k, \mu_m) \quad (6)$$

and the unconditional likelihood function is a weighted average of $L(\cdot|\mu)$:

$$L(\cdot) = \prod_{i=1}^I \left\{ \sum_{m=1}^M \pi_m * L(\cdot|\mu_m) \right\} \quad (7)$$

3.3.2 The Determinants

This paper adopts a general concept to treat occupational categories as follows: white-collar occupations and blue-collar occupations. This is consistent with previous research that looks at occupation and wage changes (Cohen and Eckstein, 2008), and the collection method of the LSIC. The LSIC adopts a retrospective method in order to collect data over a long time interval. This unavoidably introduces measurement error when people recall their occupations, particularly for immigrants that have fre-

quently changed jobs since landing. The aggregation of occupational categories, i.e. white- and blue-collar occupations, reduce the measurement error problem. It also reduce the computational burden for structural analysis.

This paper also considers self-employment as an occupational choice. Much previous research omits self-employment. This is due to the fact that there may be large measurement error for the number of working hours associated with self-employment, and therefore, it is difficult to separate the return of human capital from the return of physical work and entrepreneurial ability. However, approximate 10% of respondents in LSIC are self-employed at the end of the survey. Excluding them may result in selection bias.

As Green (1999) suggests, immigrants are more flexible or vulnerable to macroeconomic changes. They may quickly respond to changes in the structure of the economy, and fill a newly generated opportunity. Conversely, they may be the first to feel the negative impact when economy growth slows down. Therefore, the quarterly provincial unemployment rate is included in this analysis. Other conventional determinants such as age, foreign education, and other demographic variables, are also included in the analysis.

In the research that has been done on immigrant's occupational changes (Cohen and Eckstein 2008; Chiswick, Lee and Miller, 2005; Toussaint-Comeau, 2006; Grenier and Li, 2010), there is not a standard procedure to classify occupations. This makes the construction of the occupational index relatively arbitrary.

The direct comparison of the occupational categories in the source country and the destination country (Grenier and Li, 2010) relies on a strong assumption: the structure and the requirements of the labour market are the same or have a very close similarity between the source and the destination country. However, this is unlikely, especially when considering the differences between the labour markets in developed and developing countries. Previous research reveals that the return to for-

foreign education is very low (Friedberg, 2000) and the return to foreign work experience is close to zero (Miller, 1992). This implies that the human capital that is acquired through education and work experience is specific to a country. This unavoidably affects an immigrant's occupational outcomes in the destination country. It also lowers the probability that an immigrant find employment in their intended occupation.

Another method that is used in order to capture the occupational differences between the source country and the destination country is to convert discrete occupational categories into a continuous measure (Chiswick, Lee and Miller, 2005; Toussaint-Comeau, 2006). However, there is no generally accepted index for this conversion. Moreover, this method also leads to an high frequency of switching occupations that is not realistic of the overall population.

3.4 Data

3.4.1 The Survey

The data that is utilized in this paper are extracted from the Longitudinal Survey of Immigrants to Canada (LSIC), which is administered jointly by Citizenship and Immigration Canada (CIC) and Statistics Canada. LSIC is designed to provide information pertaining to how newly landed immigrants establish their economic, social, and cultural ties to Canadian society during their first years in Canada. The survey therefore excludes the individuals that applied and landed from within Canada. It covers a four year survey period, starting from April 1, 2001 and ending on September 30, 2005³.

The survey respondents were chosen randomly among immigrants that arrived

³LSIC User Guide

(WWW.23.statcan.gc.ca/imdb-bmdi/pub/document/4422_d1_t1_v1-eng.pdf).

in Canada between October 1, 2000 and September 30, 2001, 15 years of age or older at the time of landing, and landed from outside of Canada. Those immigrants that were chosen for the survey were interviewed within a six-month period from the date of landing to interview. Interviews were conducted three times within a four-year period after their arrival. Data collection for the first wave began in April 2001 and ended in May 2002. Approximately 12,000 newly landed immigrants were interviewed. It represents approximately 164,200 of the 250,000 individuals admitted to Canada during the period. The survey population cover all Census Metropolitan Areas (CMA) and non-remote Census Agglomerations (CA). The second and third wave of interview were held at the end of the second and fourth year after the date of landing. The second survey included around 9,300 immigrants, while in the third survey the sample dropped to 7,700.

Compared to other commonly used data sources for immigration studies, such as the Canadian Census of Population and other large-scale cross-sectional surveys, LSIC has a comparative advantage. Besides detailed information on age, sex, mother tongue, country of origin, visa type, knowledge of English/French etc., LSIC provides information on the immigrant's formal education, both foreign and Canadian, and a wide range of training.

LSIC also contains detailed information on the employment history of the immigrant after landing as well as information on pre-migration occupation. Occupational information includes both industry unit groups, based on North American Industry Classification (NAICS 1997), and occupation unit groups, based on Standard Occupation Classification System (SOC 1991). The North American Industry Classification System (NAICS) is an industry classification system developed by the statistical agencies of Canada, Mexico and the United States. It contains four digits to represent a hierarchical structure of a production oriented industry classification system. NAICS divides the economy into 20 sectors at the highest level; it further distin-

Table 3.1: **Distribution of Immigrants by Occupational States**

Quarter since Landing	Unem and Searching (%)	White-Collar (%)	Blue-Collar (%)	Self-Employed (%)	Number of Obs
1	58.18	13.66	26.54	1.63	3555
2	34.69	19.49	43.28	2.54	3555
3	31.40	21.45	43.85	3.30	3555
4	32.10	22.55	41.42	3.93	3555
5	31.24	23.45	41.18	4.12	3555
6	29.39	24.30	41.86	4.45	3555
7	27.35	25.02	42.82	4.80	3555
8	23.61	26.27	44.73	5.39	3555
9	21.12	26.98	45.76	6.13	3555
10	21.58	27.57	44.34	6.51	3170
11	21.93	28.66	42.71	6.70	2979
12	21.36	29.14	42.27	7.23	2979
13	20.78	29.51	42.05	7.66	2979
14	19.65	30.06	42.00	8.29	2979
15	17.29	31.00	42.95	8.76	2979
16	14.47	32.06	44.23	9.25	2979

guishes the different economic activities in which businesses are engaged at lower levels. Lastly and perhaps most importantly, the longitudinal characteristics of LSIC make structural model to analyze a series of changes for occupational decisions in the destination-country labour market.

3.4.2 Descriptive Statistics

This research extracts a sub-sample from the LSIC that includes only male immigrants between the ages of 18 and 45 at the time of the first interview. The age restriction is imposed in order to avoid capturing the proportion of the population that attends compulsory schooling (i.e., young adults), as well as the proportion of population that is in the process of making retirement decisions in each of the four survey years.

Individuals that only participated in the first two waves of the survey are retained in the sample, which generates an unbalanced panel. With a focus on labour market assimilation, immigrants that are not active in labour market are dropped from the sample. In total, there are 3,555 individuals observed for approximately 16 quarters (See Table 3.1) ⁴.

Table 3.1 shows the proportion of newly arrived immigrants in four mutually exclusive and exhaustive labour market states: Unemployed and Searching, Employed in White-collar Occupations, Employed in Blue-collar Occupations, and Self-Employed. Table 3.1 shows that during the first quarter after landing, 58 percent of immigrants were unemployed. Among the employed immigrants, the majority worked in blue-collar occupations, around 27 percent. Furthermore, some 14 percent worked in white-collar occupations and about two percent were self-employed.

The percentage of immigrants that are employed in blue-collar occupations increases to some 43 percent in the second quarter after landed in Canada, with small fluctuations around this number thereafter. The number of unemployed immigrants decreases steadily after the second quarter. Moreover, it drops to approximately 14 percent in the 16th quarter, four years after landing in Canada. Corresponding to the drop in the number of unemployed immigrants, the number of immigrants that are employed in white-collar occupations, or being self-employed, is steadily increasing. At the end of survey period, around 32 percent of immigrants work in white-collar occupations and nine percent are self-employed. However, compared to approximately 56 percent of immigrants that worked in a white-collar occupation in their country of origin (See Table 3.2), the fraction of immigrants that are working in white-collar occupations after moving to Canada is still comparatively low.

As Table 3.2 indicates, the average age for immigrants that work in white-collar occupations in Canada is not apparently different from the full sample. However,

⁴The LSIC oversampled refugees, therefore survey weights are used in this paper.

Table 3.2: **Descriptive Statistics for Male Immigrants, by Occupational States**

	Full Sample (St.Dev.)	White- Collar Occ (St.Dev.)	Blue- Collar Occ (St.Dev.)	Self-Empl (St.Dev.)
Number of observations	3555	1275	1962	170
Age at arrival	32.41 (6.905)	33.16 (5.759)	31.66 (7.347)	35.77 (6.648)
Foreign education	15.39 (3.191)	17.05 (2.803)	14.50 (3.022)	15.26 (2.947)
Number of jobs since landing	2.266 (1.291)	2.183 (1.204)	2.403 (1.342)	1.250 (0.494)
Time between landing and first job (month)	7.116 (9.334)	6.085 (8.513)	6.804 (8.717)	8.157 (9.599)
Number of children at arrival	0.527 (0.827)	0.525 (0.797)	0.485 (0.793)	0.939 (1.099)
Marriage (%)	71.6	76.4	68.0	82.8
Source country white-collar occupation (%)	55.5	79.8	41.5	64.4
Average weekly wage of 1st main job (\$)	532.0 (498.5)	750.4 (646.3)	412.3 (342.4)	609.5 (419.0)

immigrants that work in white-collar occupations acquired more formal education before migrating to Canada (17.1 years), is higher than that of immigrants who work in blue-collar occupations (14.5 years), or that are self-employed (15.3 years). Immigrants that are employed in white-collar occupations take approximately six months to find their first main job after landing in Canada, which is shorter than immigrants that work in blue-collar occupations (roughly seven months), and immigrants that are self-employed (eight months). Self-employed immigrants however, are older, more likely to be married, have more children, and wait longer to find their first main job. This may indicate that, compared to the rest immigrants, it is much more difficult for immigrants that are self-employed to find employment in the Canadian labour market.

Table 3.2 shows that immigrants are distinctive to each other in terms of occupations. The fraction of immigrants that were employed in white-collar occupations in their country of origin is 56 percent in total. Approximately 80 percent of immigrants who worked in white-collar occupations in their country of origin work in white-collar occupations in Canada. The corresponding proportion of immigrants that work in blue-collar occupations in Canada is about 42 percent. Interestingly, approximately 64 percent of self-employed immigrants were employed in white-collar occupations in their country of origin.

There are notable wage differences among immigrants that work in different occupations. The average weekly wage of immigrants' first main job after arriving in Canada is \$750 for immigrants that work in white-collar occupations in Canada. This is higher than the average wage calculated for the full sample, \$532 per week, and is also higher than the average weekly wage among immigrants in blue-collar occupations and those that are self-employed. The average weekly wage for immigrants in blue-collar occupations is \$412 per week, while the average weekly wage among immigrants that are self-employed is \$610 per week. The average weekly wage of

immigrants, combined with the level of foreign education, implies that a positive relationship may exist between the acquisition human capital before arriving in Canada and post-migration occupational states.

3.5 Empirical Results

3.5.1 The Effects of Human Capital and Local Macro Economic Environment on Immigrant Realized Utility from Each Occupation

Table 3.3 presents the effects of human capital on immigrant occupational states. It includes the human capital that is acquired in the country of origin and the human capital that is obtained in Canada. Due to the non-linearity of the model, it is difficult to interpret these estimates. Marginal effects are therefore calculated and are added next to the original estimates.

Consistent with existing literature, the acquisition of foreign education has an important effect on the occupational states of landed immigrants in Canada. More foreign education helps immigrants move up the career ladder in Canada. Educated immigrants receive more utility from working in a white-collar occupation in Canada.

However, an additional year of foreign education decreases immigrants' realized utility when he or she works in a blue-collar occupation or is self-employed in Canada. Considering the average length of education is 15 years, equivalent to approximately college level, and more than 50 percent immigrants hold a white-collar occupation before migrating to Canada in the full sample (42 percent for immigrants working in blue-collar occupations and 64 percent for self-employed immigrants), working in a blue-collar occupation in the destination country unavoidably decreases an immi-

Table 3.3: **The Effects of Human Capital Parameters and Local Macro Economic Environment on Immigrant Realized Utility**

	White- Collar (Std.Err.)	M.E.	Blue- Collar (Std.Err.)	M.E.	Self- Empl (Std.Err.)	M.E.
Foreign education	0.091 (0.012)	0.0004	-0.019 (0.007)	-0.0003	-0.038 (0.015)	-0.0001
Accumulative unemployment	-0.218 (0.011)	-0.0006	-0.187 (0.006)	-0.0025	-0.074 (0.016)	-0.0000
Accumulative white-collar occupation	0.196 (0.014)	0.0008	-0.050 (0.017)	-0.0007	0.080 (0.025)	0.0000
Accumulative blue-collar occupation	-0.042 (0.014)	-0.0002	0.117 (0.007)	0.0018	0.103 (0.015)	0.0000
Accumulative self-employment	-0.086 (0.061)	-0.0003	-0.029 (0.039)	-0.0006	0.449 (0.031)	0.0004
Language (dummy)	0.533 (0.084)	0.0013	-0.028 (0.040)	-0.0004	-0.109 (0.116)	-0.0001
Complete 1st training (dummy)	0.336 (0.081)	0.0000	0.287 (0.045)	0.0067	0.016 (0.128)	0.0001
Source country occupation (dummy)						
White-collar	0.572 (0.112)	0.0015	-0.033 (0.058)	-0.0005	0.221 (0.173)	0.0001
Blue-collar	0.010 (0.117)	0.0000	0.151 (0.055)	0.0020	0.113 (0.176)	0.0000
Never worked	-	-	-	-	-	-
Local macro economic environment						
Provincial unemployment rate	-0.084 (0.027)	-0.0003	-0.116 (0.015)	-0.0016	-0.008 (0.040)	-0.0000

grant's realized utility.

Proficiency in one of Canadian official languages has positive effect on an immigrant's occupational status. Compared to working in blue-collar occupations or being self-employed, immigrants that speak fluently one of the Canadian official languages, English or French, receive more utility from working in white-collar occupations. Besides requiring more formal education and professional training, white-collar occupations demand higher language proficiency than blue-collar occupations and self-employment. Proficiency in English or French also helps immigrants transfer their acquired foreign human capital to the specific human capital that can be utilized in the Canadian labour market.

The occupation that an immigrant held right before they migrated to Canada has a similar effect as foreign education and language proficiency. Compared to the reference group, immigrants that never worked in their country of origin, immigrants that held a white-collar occupation right before migrating to Canada are at a higher utility level, if they are employed in white-collar occupations in Canada. However, these immigrants are no different with the reference group when they work in blue-collar occupations, or they are self-employed after landing in Canada. The contribution to utility in working in blue-collar occupations or being self-employed is not significant.

Immigrants that held a blue-collar job in their country of origin receive more utility from working in blue-collar occupations after landed in Canada, compared to immigrants that never worked in their country of origin. However, the difference is insignificant if they are employed in white-collar occupations or being self-employed, compared to the reference group.

The acquired Canadian human capital also influences immigrants' occupational states. Although immigrants that participate in training after landing usually pursue training more than one time, the first training period is effective in influencing immigrants' occupational states. Compared with the reference state, unemployed

and searching for jobs, trained immigrants receive more utility from working in one of the three employment states. Among them, training contributes the most utility to immigrants that work in blue-collar occupations. The contribution of training to utility is not significant for immigrants that are self-employed. This reveals that self-employment is the last resort for those immigrants that fail to secure a wage employment, a result consistent with the small number of self-employed immigrants in the dataset extracted from the LSIC.

The effect of acquired Canadian work experience on utility is specific to occupations. The marginal effect of accumulating white-collar work experience positively affects an immigrant's realized utility if that immigrant keeps working in white-collar occupations. However, it has a negative effect on an immigrant's utility if he or she is employed in a blue-collar occupation. The marginal effect of accumulating white-collar work experience on immigrants' realized utility level is close to zero when they are self-employed.

The accumulation of blue-collar work experience has similar effects on immigrants' realized utility as the accumulated Canadian white-collar work experience. The accumulated blue-collar work experience increases an immigrant's realized utility when he or she works in a blue-collar occupation. It decreases that immigrant's realized utility when he or she switches to a white-collar occupation.

Although the results are insignificant, an immigrant's accumulated periods of self-employment decreases his or her utility if he or she works in a white-collar occupation or a blue-collar occupation. Accumulated periods of self-employment only has a positive effect on an immigrant's realized utility if that immigrant is keeping to be self-employed. This confirms that self-employment is the last resort of employment for immigrants that decide to continue to stay in Canada, at least in the first four years after landing.

The above results imply that occupational states play a major part in determining

immigrants' occupational choices—the longer an immigrant is employed in a specific occupation, the harder it is for that immigrant to switch to another occupation, or climb up the career ladder. Lastly, the accumulation of periods of unemployment decreases an immigrant's realized utility in every occupational states. This reflects the result of depreciated human capital.

The local macro-economic environment is also a key factor in the decision of an immigrant's occupational state. When the provincial unemployment rate is high, it decreases the realized utility for all immigrants that are employed. Among them, immigrants that work in blue-collar occupations are affected the most. However, the marginal effect of the provincial unemployment rate for immigrants that are self-employed is not significant.

3.5.2 The Effects of Individual Characteristics, Immigrant Classes, and the Occupational State of the Previous Period on Immigrant Realized Utility from Each Occupation

Table 3.4 reports the effects of individual characteristics, immigration classes, and the labour market states in the previous period. The estimates reveal that with an additional year of age, an immigrant's utility significantly decreases from working in a white-collar occupation. Elder immigrants, however, are inclined to work in a blue-collar occupation, or to be self-employed. This may reflect that the older an immigrant becomes, the harder it is to transfer foreign human capital and to be utilized in the Canadian labour market. Marital status also has an impact; married immigrants prefer to work in a white-collar occupation, or to be self-employed. An additional dependent child has no significant effect on immigrant occupational states.

As for immigrant classes, refugees have the poorest outcomes within the first four years after landing in Canada, when compared to economic and family class immigrants. Economic class immigrants are at a disadvantaged in blue-collar occupations when compared to family class immigrants. This may reflect the effect of family connections, and thus the availability and the utilization of labour market information in the Canadian labour market. However, economic class immigrants locate at a higher utility level when they are employed in white-collar occupations. Economic immigrants are statistically indifferent compared to family class immigrants when looking at self-employment.

Economic immigrants that migrate with high economic motivation, and under the selection of Canadian immigration policy, are able to transfer their foreign human capital to local human capital more easily. Compared to refugees and family immigrants, they receive more utility from working in white-collar occupations, controlling for all other factors. This implies that economic immigrants are the most able to assimilate into the Canadian economy during the first four years after landing.

3.5.3 The Effects of Country of Origin and Residential Region in Canada on Immigrant Realized Utility from Each Occupation

Table 3.5 reports the effects of immigrants' country of origin on their occupational states. Immigrants that come to Canada from regions, such as Northern and Eastern European, Africa, Asia, and South America, do not assimilate as well in the Canadian labour market for all three occupations, compared to immigrants that come from the U.S., UK and Western Europe. This result is consistent with previous research that looks at occupational status and how it is affected by the transferability of human

Table 3.4: **The Effects of Individual Characteristics, Immigrant Classes, and Occupational State in Previous Period on Immigrant Realized Utility**

	White-Collar (Std.Err.)	Blue-Collar (Std.Err.)	Self-Empl (Std.Err.)
Age at arrival	-0.023 (0.006)	0.011 (0.004)	0.023 (0.009)
Marriage	0.264 (0.085)	0.026 (0.048)	0.432 (0.144)
Number of kids	-0.045 (0.045)	-0.047 (0.025)	-0.026 (0.057)
Immigrant class			
Economic immigrants	0.361 (0.112)	-0.321 (0.056)	-0.100 (0.153)
Refugee	-0.612 (0.159)	-0.316 (0.064)	-1.191 (0.215)
Family Immigrants	-	-	-
Previous period state (dummy)			
White-collar occupation	4.888 (0.097)	0.343 (0.159)	0.896 (0.250)
Blue-collar occupation	0.260 (0.124)	3.514 (0.045)	0.456 (0.157)
Self-employed	1.597 (0.391)	1.241 (0.294)	6.090 (0.208)

Table 3.5: **The Effects of Country of Origin on Immigrant Realized Utility**

Source Country/ Region	White-Collar (Std.Err.)	Blue-Collar (Std.Err.)	Self-Empl (Std.Err.)
Africa	-1.052 (0.140)	-0.339 (0.103)	-1.616 (0.224)
China	-1.167 (0.137)	-0.594 (0.106)	-2.257 (0.212)
India	-0.761 (0.147)	-0.173 (0.109)	-1.428 (0.223)
Other EU	-0.692 (0.141)	-0.295 (0.105)	-1.248 (0.210)
Other Asia	-0.940 (0.132)	-0.359 (0.100)	-1.459 (0.187)
Other America	-0.647 (0.157)	-0.247 (0.115)	-2.011 (0.297)
US/Western EU	-	-	-

capital across countries (Chiswick, Lee and Miller, 2005).

Table 3.6 presents the effects of a residential region on immigrants' occupational states. Using Ontario as the reference group, there is no obvious occupational difference among immigrants that live in other provinces in Canada⁵. This is indicated by insignificant estimates. Exceptions are some occupations located in Quebec, Alberta, British Columbia and Atlantic Canada. Compared with immigrants that live in Ontario, Quebec immigrants receive less utility from working in white-collar occupations or being self-employed. Interestingly, immigrants move to Alberta are less inclined to work in blue-collar occupations. Immigrants that live in BC or one of the provinces in Atlantic Canada⁶. however, receive more utility from working in blue-collar occupations. This may reflect structural differences in economic performance across provinces.

⁵The residential region does not include the northern area of Canada, due to few observations.

⁶Atlantic Canada includes New Brunswick, Newfoundland, Nova Scotia and Prince Edward Island.

Table 3.6: **The Effects of Residential Region in Canada on Immigrant Realized Utility**

Province	White-Collar (Std.Err.)	Blue-Collar (Std.Err.)	Self-Employed (Std.Err.)
QC	-0.237 (0.118)	-0.056 (0.067)	-0.466 (0.199)
ATL	0.185 (0.346)	0.423 (0.173)	0.097 (0.469)
BC	0.005 (0.100)	0.134 (0.057)	0.102 (0.152)
MB	0.041 (0.219)	-0.083 (0.114)	0.039 (0.357)
SK	0.365 (0.332)	-0.181 (0.182)	-0.821 (0.617)
AB	-0.140 (0.111)	-0.234 (0.064)	0.087 (0.170)
ON	-	-	-

3.5.4 The Determinants for Wage

Table 3.7 presents the determinants of immigrants' expected wages, which primarily concentrates on the effect of human capital. Foreign education has a positive effect on immigrants' expected wage. Controlling for other factors, each additional year of foreign education increases the expected wage by about 3.5 percent. Proficiency in one of the Canadian official languages also increases an immigrant's expected labour market income.

The accumulation of Canadian work experience also impacts immigrants' expected wage. The accumulation of work experience in white-collar occupations increases an immigrants labour market income. However, the accumulation of periods of self-employment has no significantly effect on immigrants' labour market income. The effect of accumulation of work experience in blue-collar occupations is also not significantly on immigrants' labour market income. Finally, the accumulation of periods of unemployment depreciates an immigrant's human capital, and therefore has a nega-

Table 3.7: **The Wage Equation**

	Estimates	Std.Err.
Foreign education	0.035	0.001
Language	0.117	0.006
Accumulative unemployment	-0.028	0.001
Accumulative white-collar occupation	0.044	0.001
Accumulative blue-collar occupation	-0.001	0.001
Accumulative self-employment	0.000	0.001

tive effect on immigrants' labour market income.

3.5.5 The Estimated and Actual Transition Probability

Table 3.8 reports the estimated occupational transition matrix. The estimated structural stability rates are much lower than the actual transition matrix (Table 3.9). This is due to the serial correlation of time invariant unobserved heterogeneity, φ , that has been isolated and estimated from the structural model.

The estimated transition probability reveals that occupational states have an impact on whether or not an immigrant will transfer between occupations. It is unlikely for an immigrant to transfer from a blue-collar occupation, or from self-employment, to a white-collar occupation. According to the results, if an immigrant is employed in a white-collar occupation during one period, he or she will stay in white-collar occupations with a probability equal to 0.80 in the next period. The structural stability for an immigrant to stay in blue-collar occupations is 0.84 and the corresponding probability for self-employment is 0.70. However, when an immigrant is self-employed in one period, there is only a probability of 0.09 for that immigrant to switch to a white-collar occupation in the next period. The lowest transitional probability to

Table 3.8: **Estimated State Transition Matrix**

		Destination State			
		Unemployed	White-Collar	Blue-Collar	Self-Empl
Origin State	Unemployed	0.564	0.141	0.259	0.036
	White-Collar	0.116	0.799	0.067	0.018
	Blue-Collar	0.100	0.043	0.844	0.013
	Self-Employed	0.088	0.089	0.120	0.703

Table 3.9: **Actual State Transition Matrix**

		Destination State			
		Unemployed	White-Collar	Blue-Collar	Self-Empl
Origin State	Unemployed	0.793	0.054	0.137	0.017
	White-Collar	0.018	0.974	0.006	0.002
	Blue-Collar	0.054	0.007	0.935	0.004
	Self-Employed	0.012	0.006	0.010	0.973

white-collar occupations is from a blue-collar occupation, at merely 0.04. These results reveal that it is difficult for an immigrant to climb up the career ladder once he or she has been employed in a blue-collar occupation, or self-employment.

The second highest transitional probability to white-collar occupations, other than itself, is from unemployment. This is consistent with the finding of Eckstein and Weiss (1998). The probability of being employed in white-collar occupations during this period is equal to 0.14, if an immigrant is unemployed in the previous period. For blue-collar occupations, this probability equal to 0.26. Blue-collar occupations are also major destination occupations for immigrants who were self-employed in the previous period. The probability of an employed immigrant in a white-collar occupation in one period, being unemployed in the next period, is approximately equal to 0.12.

Table 3.10: **The Distribution of Unobserved Ability: Unobserved Preference for Occupational Choice**

Utility Equation	Estimates	Std.Err.
μ	-0.022	0.002
q	-3.906	0.128
White-collar occupation		
Intercept	-2.198	0.314
Slope	1.000	Fixed
Blue-collar occupation		
Intercept	-2.274	0.187
Slope	-117.0	7.711
Self-employed		
Intercept	-29.02	0.461
Slope	-1194	89.39
Wage equation		
Intercept	-0.302	0.027
Slope	-266.8	19.93

3.5.6 Unobserved Heterogeneity

Table 3.10 presents unobserved heterogeneity and its effect on both occupational choices and their associated labour market income. With an adopted two point system, and with μ_1 fixed at zero to represent type *I* immigrants, the majority of immigrants in the Canadian labour market belong to type *I*. Conversely, 2 percent of immigrants⁷ belong to of type *II* with a μ_2 estimated at -0.022. Compared with type *II* immigrants, type *I* immigrants are inclined to work in white-collar occupations, while type *II* immigrants receive more utility from working in blue-collar occupations or by being self-employed. The estimated unobserved heterogeneity among immigrants positively affects immigrants' expected labour market income, while holding other factors constant.

The existence of unobserved heterogeneity among immigrants reveals the diversity of immigrants and its effect on their assimilation paths. Some immigrants face more

⁷Calculated based on logistic expression: $\exp(q)/(1+\exp(q))$ with q equal to -3.906.

Table 3.11: **The Difference between Actual and Predicted Occupational States, by Quarter since Landing**

Quarter since landing	Unem and Searching	White-Collar	Blue-Collar	Self-Employed
1	0.052	0.028	0.026	0.002
2	0.089	0.022	0.070	0.002
3	0.009	0.016	0.007	0.000
4	0.015	0.015	0.030	0.000
5	0.005	0.015	0.016	0.004
6	0.003	0.018	0.012	0.003
7	0.009	0.020	0.008	0.003
8	0.027	0.028	0.007	0.000
9	0.025	0.026	0.000	0.002
10	0.001	0.024	0.025	0.000
11	0.007	0.024	0.031	0.000
12	0.002	0.028	0.025	0.001
13	0.002	0.029	0.026	0.001
14	0.006	0.031	0.025	0.000
15	0.024	0.037	0.012	0.002
16	0.037	0.042	0.004	0.002

difficulty than the others in finding employment in white-collar occupations when entering the Canadian labour market, controlling for observable characteristics.

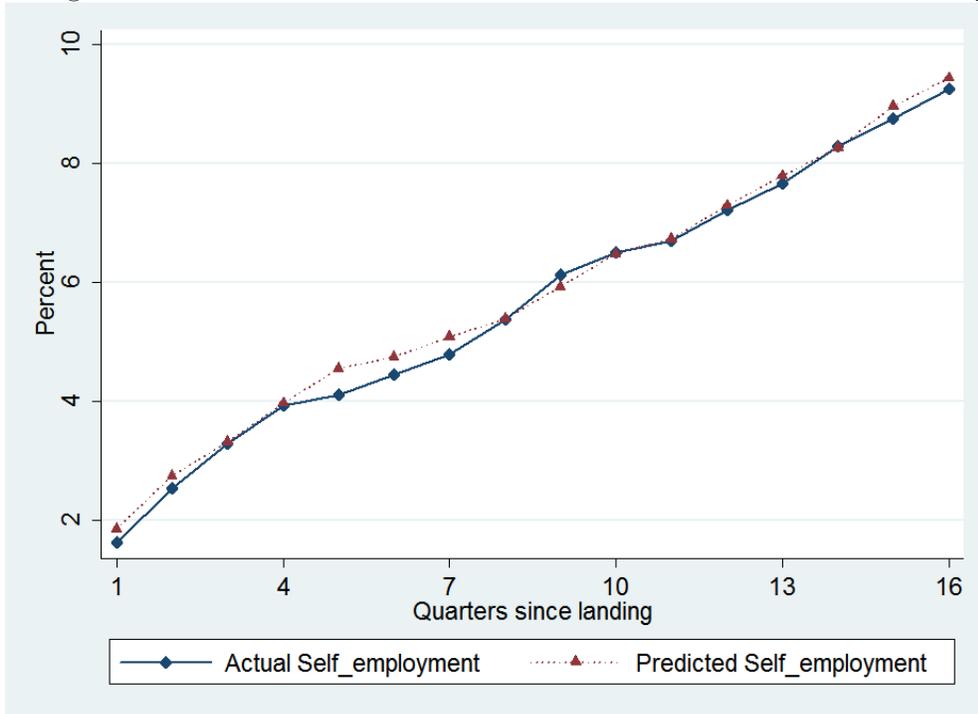
3.5.7 Model Fit

Table 3.11 shows the absolute value between the actual distribution of labour market activity and the ones predicted by the model. The model perfectly predicted the immigrants that choose self-employment as their occupation. The difference of the distribution between the predicted and the actual self-employed immigrants in the first sixteen quarters (four years after landing) is less than half percentage points⁸.

Figure 3.2 shows the distribution of actual and predicted immigrants that work in

⁸Please also see Figure 3.1.

Figure 3.1: The Actual and Predicted Distribution of Self-employment



white- and blue-collar occupations. The model under-predicts immigrants that work in white-collar occupations, and in general, the model over-predicts immigrants that work in blue-collar occupations. However, if immigrants that work in white-collar occupations or blue-collar occupations are combined into one large group, wage employment, the difference between the actual and the predicted distribution becomes very small (Please see Figure 3.3).

3.6 Summary and Conclusions

This paper has examined the determinants of occupational states for newly arrived immigrants to Canada, as well as the effects of human capital accumulation on wages. This has been done by using a discrete choice sequential decision model where occupational states are modeled jointly with wage outcomes. This framework allows for the inclusion of correlated unobserved heterogeneity into analysis, and estimated together

Figure 3.2: The Actual and Predicted Distribution of White- and Blue-collar Occupations

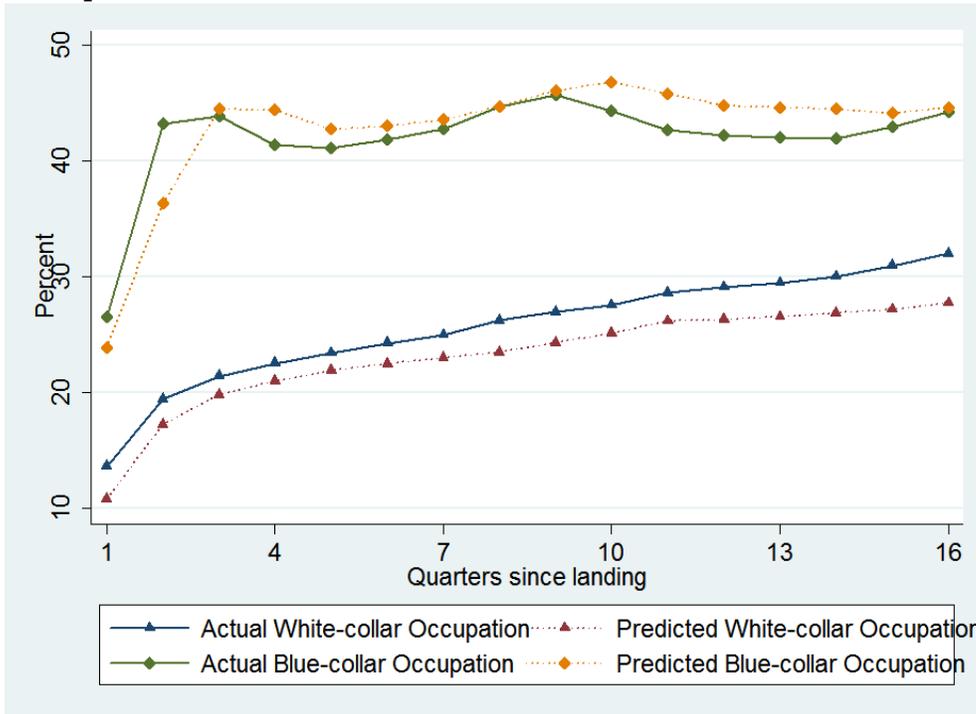
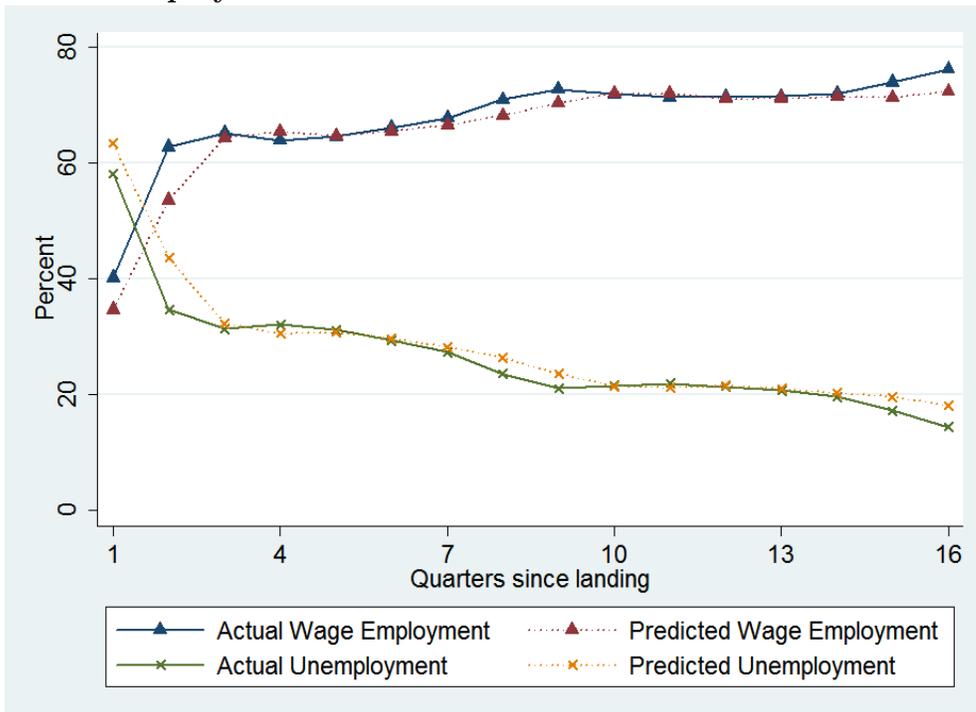


Figure 3.3: The Actual and Predicted Distribution of Wage Employment and Unemployment



with other socio-economic characteristics. Thus, occupational decisions, accumulated stocks of human capital and wage are treated as potentially endogenous.

The empirical results of this paper are consistent with previous research that examines similar outcomes. Pre-migration human capital, including foreign education attainment and the occupation held in the country of origin right before migrating to Canada, plays a key role in determining immigrants' occupational states after landing. Specifically, immigrants with higher pre-migration human capital tend to work in white-collar occupations. Immigrants with a high proficiency in one of Canadian official languages also tend to work in white-collar occupations, while controlling all the other factors.

The accumulation of Canadian work experience and labour market information also plays a key role in determining immigrants' occupations. Once immigrants have completed their first training period, they have a higher utility level if they are employed in one of the three occupational states, compared to the absorbing state—unemployment and searching. The largest marginal effect from completing training is for immigrants that work in blue-collar occupations. The accumulation of occupational work experience in Canada has a positive effect on immigrants' realized utility level, if they are employed in the same occupation across survey periods. The estimated transition matrix confirms that immigrants in occupational states are likely to stay in them, which indicates that immigrants have limited occupational mobility.

The effects of pre- and post-migration human capital accumulation on immigrant wages are similar to their effects on realized utility. The acquisition of foreign education and language proficiency increases immigrant's wages. Moreover, the accumulation of white-collar work experience in Canada also increases immigrants' labour market income.

Finally, this paper confirms the existence of heterogeneity among immigrants. This paper also provides new evidence for the effects of immigrants' heterogeneity on

their occupational states and wage level. The majority of immigrants prefer to work in white-collar occupations, rather than to work in blue-collar occupations, or to be self-employed.

This paper enlightens our understanding of newly arrived immigrants' occupational decisions in the transition period. It suggests that self-employment is an important substitute for wage employment. Also, this paper indicates that the local economic environment has a significant impact on immigrants' occupational decisions. All in all, finding employment soon after landing or being self-employed is very important in helping immigrants assimilate into Canadian society.

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Chapter 4

Essay 3: Asymmetric Information and the Immigrant Wage Gap

ABSTRACT

This paper uses asymmetric information theory to explain the immigrant wage gap. Employers have imperfect information concerning immigrants' productive ability when immigrants first enter the labour market of the destination country. This is particularly evident among immigrants that arrive from developing countries. Evidence suggests that employers acquire more precise information about a worker's ability, the more time the immigrant spends in the labour market. Two questions emerge: first, are there sub-groups of immigrants with different levels of productive ability? and second, can high ability immigrants signal themselves to be rewarded with a high initial wage, and hence yield a smaller entry wage gap and faster wage growth thereafter? As a departure from the symmetric information analysis, this paper provides a novel look at both the entry and catch-up effect on immigrants.

Keywords: productive ability, asymmetric information, sub-immigrant groups, wage gap

4.1 Introduction

Along with an aging society and a worldwide economy, attracting high quality immigrants has become a trend among developed countries. Among these, Canada, Australia, and the United States are major destination countries which attract two-thirds of legal immigrants around the world.

The quality of immigrants is not only an economic issue but also a social issue. Immigrants with a large stock of human capital and productive ability have a complementary effect on creating low level jobs. They also contribute directly to the economy of the destination country, by increasing tax income, introducing advanced skills and novel ideas, and so on. Immigrants with low productivity, however, influence social attitudes and other connected issues towards the whole immigrant population, thus influencing social stability. Although economists recognize the importance of immigration to the economic development of the destination country, social recognition for this conclusion is far from reached (Card, Dustmann and Preston, 2010). Immigrant social welfare dependence and competition in the low-level labour market attract a good deal of social comment. This can lead to social tension, particularly when economic development slows down.

Unlike American immigration policies, which concentrates on family reunion, Canadian immigration policies emphasize the applicant's potential human capital¹ and the demand for particular skills in the Canadian labour market, both in the short- or long-run. Only people that work in designated occupations are permitted for migration to Canada. Borjas (1990) notes that Canada has drawn better immigrants than the U.S. Since the adverse selection of U.S. immigrants (Borjas, 1987) may certainly happen, it is interesting to ask the following question: what immigrant

¹25 points are allocated to foreign education, 21 to foreign work experience and 16 for language proficiency; there is another 10 points for Canadian education and work experience. In total, there are 72 points assigned to applicant's potential human capital. For a total of 100 with 67 being the passing score, the rest 28 points are allocated to other aspects, such as whether the applicant has relatives in Canada or not, etc.

quality has the Canadian immigration policy selected, particularly in recent years?

This paper extends the work of Gibbons and Katz (1991) and Kahn (2009) on the employer learning model to immigrant selection issues. Using data from the Longitudinal Survey of Immigrants to Canada (LSIC), this paper identifies whether asymmetric information is prevalent in the Canadian labour market. This paper also bridges the gap between asymmetric information theory and empirical analysis on the topic of immigrant selection and integration. It also offers quantitative evidence that is consistent with the predictions derived directly from the asymmetric information model on immigrant selection, and relating, to the case of Canada². That is, Canadian immigration policy may lead to the migration of both high and low productive ability immigrants to the country at the same time. This paper identifies the effectiveness of a few signals that reveal the ability differences among immigrants in the Canadian labour market. It also confirms the effectiveness of these signals on immigrant labour market performance and assimilation results. This paper therefore, provides not only a novel look on the general topic of immigrants, but also contributes to the corresponding implications on Canadian immigrant selection and relevant assimilation policies.

The rest of the paper is organized as follows: Section 4.2 provides a brief review of the existing literature; Section 4.3 presents the model and its background. Section 4.4 describes the special features of the LSIC, and the descriptive statistics; Section 4.5 presents the empirical estimates of the model, and the interpretations. A summary of the conclusions are provided in Section 4.6.

²Using a structural model, Caponi (2011) provides evidence on the selection effect of Mexican immigrants to the U.S.

4.2 Literature Review

There is a long history of debate on the selection of immigrants, but the question has never been settled. In his 1978 paper, Chiswick concludes that self-selected, highly motivated immigrants take ten to fifteen years to catch up with their native counterparts in terms of wages. Since then, the type of immigrants selected by immigration policies has been a major concern to labour economists and policy makers. Using data from various countries and sources, there are numerous papers published on this topic, see for example Borjas, 1987 and 1991; Chiswick, 1978 and 1999; Cobb-Clark, 1993; Baker and Benjamin, 1994; Bratsberg, 1995; Butcher and DiNardo, 2002; Green and Worswick 2004.

Models based on standard human capital theory assume that observable characteristics, such as education, work experience, etc, determine immigrant economic performance in the destination country's labour market. However, some research findings indicate that some characteristics, such as productive ability, that are only partially observable or completely unobservable, also impact immigrants' labour market outcomes. Therefore, other plausible explanations may exist if this is along with the reality among migration issues, particularly for immigrants coming from developing countries.

While the traditional immigrant source countries are among developed countries, such as the U.S., Britain, and Western European countries, immigrants from developing countries are relatively new in developed countries immigration history. Early on, immigration from developing countries was often constrained by restricted quotas and discriminating immigration laws. Most of these laws were only abolished in the early 1960s. Canada, for instance, relaxed its immigration policy and opened up for immigration from developing countries in 1967. Since then, Canadian immigration policy has put a particular emphasis on immigrant potential human capital and the demand of Canadian labour market. The U.S. abandoned its discriminating regional

migration policy in 1965, and Australia changed it in 1966.

The change of immigration policy in Canada, and other countries, has led to a change of immigrant composition. While 87 percent of immigrants to Canada in the 1950's were from traditional immigration countries, approximately 50 percent were from these countries in 1967-1973, the period following the establishment of the new immigration policy (Parai, 1975). Over the past century, this number has continued to drop. As of year 2000, only eight percent of immigrants who landed in Canada are originally from traditional source countries, according to the dataset extracted from LSIC and used in this paper.

Developed countries share similar characteristics, including a long mutual migration history, similar cultures and labour market structure, and known education systems. This makes immigrants' productive ability well known in the destination country labour market. Compared with immigrants from traditional immigration countries, immigrants from developing countries are in a disadvantageous position. Besides the difference in culture, education system, and a less developed labour market, early developing-country immigrants concentrate on low-level hard labour jobs. This separates them from the main stream of society and continues to hinder the recognition of successive immigrants.

Researchers have begun to study this issue based on the assumption of asymmetric information. The general assumption is that immigrant productive ability is unobservable in either the source or the destination country labour market. When studying the migration decisions of foreign students in the U.S., Kwok and Leland (1982) assume that U.S. employers are able to fully observe students' productive ability. This is largely due to the knowledge of the education system and a long hiring history. They therefore are willing to pay a wage corresponding to the real ability level of foreign students. However, the source country employers, on the contrary, cannot observe individual productive ability. They therefore only pay a wage corre-

sponding to the mean of the known ability distribution for the students that studied abroad. Kwok and Leland conclude that the high ability foreign students will stay in the U.S. and earn a higher wage, compared to the students that go back to their country of origin after graduation. This prediction implies that foreign students that studied and stayed in the U.S. are the ones at the upper tail of all foreign students. However, Katz and Stark (1984) points out, by using the Kwok and Leland' model, the lower tail selection will happen if the source country employers are able to observe such students ability, instead of employers in the destination country.

Based on asymmetric information theory, Katz (1986) further addresses this topic by developing a theoretical model. He considered three ability levels among the source country population: high, medium and low. Katz assumes that there is a linear relationship between ability and wages³ and that the return to ability is higher in the destination country. He further assumes that there is a positive moving cost of migration and that employers in the destination country are unable to observe immigrant ability directly, although they are able to observe the ability distribution. Thus, before a signal reveals an immigrant's actual ability level, employers are only willing to pay an average wage, corresponding to the mean of the known immigrant ability distribution. Corresponding to the cost of signaling, three possible situations would happen.

First, for a moderate signaling cost, the high ability individuals in the source country will migrate. They will choose to signal their ability levels when the benefits of migration overweight the costs. Consequently, the low ability individuals still migrate, but they prefer not to signal themselves, because of the associated cost and benefit from signaling. Therefore, migration of individuals with both high and low ability levels takes place at this situation. Second, when the signaling cost is too high, the individuals with high ability are not able to benefit from differentiating themselves

³Katz and Stark (1987) extended this linear model into a nonlinear relationship between wage and ability.

from the other immigrants. Facing a low average wage in the destination country, together with direct and indirect migration costs, such as transportation cost, forgone income, etc, they will not migrate at this situation. Only individuals that have low productive ability can benefit from migration without signaling. In this situation, the lower tail selection happens. And lastly, while there exists a signal with zero cost, the ability distribution of immigrants in the destination country should be the same as that of the country of origin. In other words, immigrants should be a mixture of high, medium and low ability people. And the wage levels in the destination country should correspond to their respective ability levels.

Caponi (2011) provides evidence on the selection of Mexican immigrants to the U.S. Using a structurally estimated intergenerational self-selection model of migration and education, Caponi concludes that Mexican immigrants to the U.S. are positively self-selected with respect to their ability levels.

4.3 The Model

For the purposes of this paper, the theoretical model and identification strategy for wage analysis follows the work of Gibbons and Katz (1991). The variance analysis follows the work of Kahn (2009). This paper, however, extends their theoretical predictions to the empirical identification of immigrants' signaling decisions and their labour market results. This paper also proposes new implications for the existence of asymmetric information among immigrants, and tests these implications through the analysis of employment duration and permanent wage difference.

4.3.1 Model Setup

Facing a suppressed wage after arriving in the destination country, the high ability immigrants, if they exist, will decide whether or not to distinguish themselves from the others and be rewarded with a higher return in the destination country labour market.

When a signal takes time, employers in the destination country will not be able to detect the ability difference among immigrants before the signal is effective. Based on the known ability distribution among immigrants, employers are only willing to pay a wage corresponding to the mean of the known immigrant ability distribution. Thus the wage difference between high and low ability immigrants is not observable at this stage. However, after an immigrant's ability has been revealed by an effective signal, this immigrant will be paid a wage that corresponds to his or her actual ability level, whereas immigrants that choose not signaling their ability level will still receive an average wage. Thus, there exists a wage difference between the signal and non-signal immigrant groups at this point. The following equation is used to identify the signal effect⁴.

$$\ln w_t = X'\beta + I\alpha + \varepsilon_t \quad (1)$$

where X are observable characteristics and I is the index for the signal group. The estimate, $\hat{\alpha}$, will capture the effect of the signal on wages for the group of immigrants with revealed ability, compared to the group of immigrants that do not signal their ability levels. It will be positive and significant when an effective signal successfully reveal the high ability group. However, it will be insignificant before such signals become effective, or if there is no ability difference among immigrants.

Corresponding to the wage changes before and after an effective signal, the vari-

⁴For details of the methodology and identification strategy, please see Gibbons and Katz (1991).

ance of immigrant income, which corresponds to immigrants' ability levels, should also be different. The wage distribution and its variance are suppressed when immigrants are paid an average wage, based on the known immigrant ability distribution. However, while there is an effective signal that is able to reveal the group's actual ability level, the wage paid to these immigrants will represent their ability difference and follow its distribution. Thus, immigrants that choose to signal their actual ability levels would experience a larger change of income variance following their wage change, compared with the suppressed case of the non-signal group. Identifying the change of wage variance takes a two-step procedure⁵.

$$\ln w_t - \ln w_{t-1} = X' \beta_1 + I \alpha_1 + \xi_t \quad (2)$$

$$\xi_t^2 = X' \beta_2 + I \alpha_2 + e_t \quad (3)$$

The first stage involves regressing the difference of the natural log wages right before and after an effective signal on observable characteristics and the group index, I . In the second stage, the square of the ξ_t , which is the residual obtained from the first stage regression, will be used as the dependent variable, and it is regressed on the same independent variables. If the signal is able to reveal the signaling behavior of immigrants that have high ability, the estimate $\hat{\alpha}_2$ will be positive and significant.

When there are different ability levels among immigrants, there will be a permanent difference between high and low ability immigrants. Performance in the destination country's labour market will depend on an immigrant's ability to adapt to this new environment. Immigrants that have high ability will be more efficient at acquiring and utilizing labour market information than immigrants with low ability. This ensures that immigrants with high ability are able to acquire relevant employ-

⁵For detail of this methodology and identification strategy, please check Kahn (2009).

ment much more easier than those immigrants with low ability. Furthermore, the high ability immigrants are more likely to keep employed status longer than the rest immigrants. Therefore, immigrants with high ability have a longer employment duration and, together with the effective signals, a higher permanent wage than those immigrants whose ability locate at low levels. These two hypotheses are tested by equation (4) :

$$y = X'\beta + I\alpha + \eta \quad (4)$$

where y is the duration of employment in the period of first four years after landing for the employment duration analysis, and y equals the average wage in the survey period of LSIC with natural log transformation for the permanent wage difference analysis.

4.4 Data

4.4.1 The Survey

The data that is utilized in this paper are extracted from the Longitudinal Survey of Immigrants to Canada (LSIC), which is administered jointly by Citizenship and Immigration Canada (CIC) and Statistics Canada. LSIC is designed to provide information pertaining to how newly arrived immigrants establish their economic, social, and cultural ties to Canadian society during their first years in Canada. The survey therefore excludes the individuals that applied and landed from within Canada. It covers a four year survey period, starting from April 1, 2001 and ending on September 30, 2005⁶.

⁶LSIC User Guide.

The survey sample was chosen randomly among immigrants that arrived in Canada between October 1, 2000 and September 30, 2001, 15 years of age or older at the time of landing, and landed from outside of Canada. Those immigrants that were chosen for the survey were interviewed within a six-month period from the date of landing to interview. Interviews were conducted three times within a four-year period after their arrival. Data collection for the first wave began in April 2001 and ended in May 2002. Approximately 12,000 newly landed immigrants were interviewed. It represents approximately 164,200 of the 250,000 individuals admitted to Canada during the period. The survey population cover all Census Metropolitan Areas (CMA) and non-remote Census Agglomerations (CA). The second and third wave of interview were held at the end of the second and fourth year after the date of landing. The second survey included around 9,300 immigrants, while in the third survey the sample dropped to 7,700.

Compared to other commonly used data sources for immigration studies, such as the Canadian Census of Population and other large-scale cross-sectional surveys, LSIC has a comparative advantage. Besides detailed information on age, sex, mother tongue, country of origin, visa type, knowledge of English/French etc., LSIC provides information on the immigrant's formal education, both foreign and Canadian.

LSIC also contains detailed information on the employment history of the immigrant after landing as well as information on pre-migration occupation. Occupational information includes both industry unit groups, based on North American Industry Classification (NAICS 1997), and occupation unit groups, based on Standard Occupation Classification System (SOC 1991). Lastly and perhaps most importantly, the longitudinal characteristics of LSIC make it possible to identify the existence of asymmetric information and signals.

4.4.2 Descriptive Statistics

This research extracts a sub-sample from the LSIC, which includes both male and female immigrants between the ages of 18 and 55 at the time of the first interview. The age restriction is imposed in order to avoid compulsory schooling for young adults and the consideration involving retirement decisions. The analysis concentrates only on immigrants from developing countries. Immigrants from developing countries make up the majority of the immigrant population in Canada. They also face more obstacles to assimilate into Canadian society. Our sample only includes immigrants that worked before migration and participated in all three survey interviews. This generates a balanced panel. In total, there are 4896 individuals observed in the four-year survey period.⁷

As Table 4.1 indicates, about 46 percent⁸ of immigrants participated at least once in some form of training⁹, including formal education. Trained immigrants are on average younger than those that did not receive any training. The average accumulated pre-migration formal education for trainees is marginally higher than that of non-trainees, 15.7 years versus 14.8 years.

Table 4.1 also shows that there is a distinction in terms of occupation between those that received training and those that did not. The proportion of trainees that were employed in white-collar occupations in the country of origin is 73 percent. The corresponding proportion for non-trained immigrants is 65 percent. This suggests that, together with average pre-migration education, there is a positive relationship between the acquisition of human capital before and after migration. Furthermore, there is no notable wage difference between immigrants who invested in

⁷LSIC survey weights have been used in all empirical analysis in this paper.

⁸Calculated based on the total number of immigrants, 4896, divided by the number of immigrants that ever participated in training after landing, 2242.

⁹Training includes all individuals that acquire a degree, diploma or certificate at completion, and it adopts a broad concept that includes formal education, training due to career development, and foreign credential recognition.

Table 4.1: **Descriptive Statistics for Male and Female Immigrants**

	Full Sample (St.Dev.)	Trainee (St.Dev.)	Non- Trainee (St.Dev.)	Arranged Job (St.Dev.)	No-Arr job (St.Dev.)	Higher Edu Level (St.Dev.)	Lower Edu Level (St.Dev.)	Creden- tial Recog (St.Dev.)	Creden- tial Non-recog (St.Dev.)
Number of Obs	4896	2242	2654	262	4634	417	1218	1906	2084
Age at arrival	33.10 (7.99)	31.72 (7.57)	34.30 (8.15)	33.73 (7.13)	33.06 (8.04)	26.54 (7.00)	32.80 (6.95)	33.34 (6.83)	33.83 (7.36)
Education before migration (years)	15.23 (3.18)	15.73 (2.82)	14.79 (3.39)	16.80 (4.08)	15.14 (3.09)	14.49 (3.67)	16.22 (2.49)	16.56 (2.62)	15.49 (2.36)
Number of jobs since landing	1.656 (0.67)	1.721 (0.68)	1.599 (0.65)	1.510 (0.62)	1.665 (0.67)	1.684 (0.69)	1.722 (0.68)	1.681 (0.680)	1.628 (0.653)
Time betw landing & 1st job (month)	9.100 (11.16)	10.18 (11.91)	8.161 (10.36)	1.612 (4.189)	9.537 (11.28)	12.23 (13.54)	10.48 (12.18)	8.447 (10.73)	9.397 (11.31)
Average wage of 1st main Job (\$)	13.22 (8.88)	12.89 (7.64)	13.51 (9.79)	23.67 (16.28)	12.45 (7.51)	13.64 (8.72)	12.15 (6.77)	15.14 (9.77)	12.64 (8.65)
Male (%)	53.80	54.91	73.25	75.56	52.54	51.93	53.75	61.13	49.64
Source country white-coll occ (%)	68.94	73.25	65.05	72.51	68.70	68.60	73.71	77.87	70.59
Married (%)	79.04	72.38	84.85	75.47	79.25	47.60	77.75	78.85	85.41
Skilled worker (%)	68.87	75.74	62.87	79.51	68.25	63.26	80.54	83.67	71.30
Visible minority (%)	85.70	84.07	87.13	78.25	86.14	87.08	83.13	82.70	86.18

post-migration human capital and those who did not. The average wage of the first main job¹⁰ in Canada for those that received training is \$12.9 per hour¹¹, which is almost the same as that of immigrants who did not participate in any training (\$13.5).

Immigrants with and without a pre-arranged job before migration are similar in terms of age and pre-migration education. The proportion of immigrants that worked in white-collar occupations in the country of origin are also similar. However, the average wage of the first main job after landing is very different: \$24 per hour for immigrants with a pre-arranged job and only \$12 per hour for immigrants without a pre-arranged job. There is a similar pattern between immigrants that have their foreign credentials recognized, either by Canadian employers, government, or Canadian institutions, and those without recognized foreign credentials.

Another interesting point in the descriptive statistics to notice is, among immigrants with an arranged job before migration, 78 percent are visible minorities. The percentage of minority immigrants increases to 86 percent for those without an arranged job. The corresponding percentage of visible minority immigrants with their foreign credentials recognized (not recognized) is 83 percent (86 percent).

Table 4.2 shows the level of Canadian formal education after landing, by immigrant class. Compared to non-skilled worker immigrants, there are more percentage of skilled worker immigrants that pursue Canadian education at a level of Master or PhD degree, and less percentage at high school or lower education levels. There are very close percentage of skilled and non-skilled worker immigrants that pursue education at Bachelor or college level. However, skilled worker immigrants on average have longer years of pre-migration education (16.2) than the non-skilled worker immigrants (13.1). And about 75 percent of individuals that repeat their Canadian education at the

¹⁰Immigrants reports any job they held in the period of interview. However, they have to identify only one as the the main job for the period.

¹¹Hourly wage is calculated based on reported weekly wage divided by weekly working hours.

Table 4.2: **Canadian Education after landing, by Immigrant Class and Education Category**

	All Immigrants (St.Dev.)	Skilled Worker Immi (St.Dev.)	Non-skilled Worker Immi (St.Dev.)
Average of pre-migration education	15.23 (3.18)	16.17 (2.57)	13.14 (3.40)
Education Category (%)			
Master/PhD	15.72	19.45	3.72
Bachelor	24.20	23.94	24.95
College/Diploma	53.43	53.72	52.52
High school and lower	6.64	2.87	18.81

same level as the education level at their country of origin, or even pursue Canadian education at a lower level, are skilled worker immigrants¹².

The above descriptive statistics reveals the first evidence that, other than traditional human capital characteristics, unobserved characteristics may have an important role in determining immigrant labour market performance. This will be explored from econometric modeling in the following section.

4.5 Empirical Results

Before testing the existence of effective signals, we must first determine what could work as a signal to reveal an immigrant's actual ability level. As signalling model points out, the mechanism to work as a signal must satisfy two conditions: first, while immigrants with high ability can be rewarded by their signaling decision, immigrants that have low ability cannot, due to high direct or indirect costs; and second, the signal must be clear and effective to the labour market. This implies that no one is able to pretend to be in the other group when the signal cost is low.

¹²Please see Table 4.1

Evidence from previous research reveals that more educated immigrants are apt to invest in human capital, i.e., training or formal education, in the destination country, and furthermore, they also benefit from a high return to this investment in the local labour market (Friedberg, 2000; Chiswick, 1999). This may result from the fact that, via a long hiring history, local employers may be able to observe and reward the ability of domestic graduates through the known education system. Could this post-migration human capital investment work as a signal for newly arrived immigrants to Canada?

4.5.1 Canadian Training and Formal Education as Signal

As Table 4.1 shows, 46 percent of immigrants choose to participate in training or formal education after landing. Thus if training, including formal education, in the destination country can work as a signal, the hypothesis $\hat{\alpha} = 0$ in equation (3) must not be rejected before training starts. Furthermore, it should be rejected after training is effectively revealing an immigrant's actual ability. If both are true, this implies that an ability difference exists between those that invest in acquiring human capital in the destination country and those that do not, after controlling for traditional observable human capital variables, such as foreign and domestic education, work experience, occupation, etc.

With a natural log transmission of hourly wage as the dependent variable, the estimates for testing this hypothesis are shown in first two columns of Table 4.3. The first column shows the estimates for immigrants that had a job before training, compared with immigrants that have not participated in training at all in the four-year survey period. As we can see, while trainees receive a wage lower than the non-trainees before training starts (5.5%), the difference is not significant after training (Please see Table 4.3, column 2).

Table 4.3: **Signal Effect of Canadian Training and Formal Education**

	Before Training	After Training	Before Training
	Estimates (Std.Err)	Estimates (Std.Err)	Estimates (Std.Err)
Constant	2.053 ^a (0.050)	2.256 ^a (0.051)	2.080 ^a (0.078)
Signal	-0.055 ^a (0.017)	-0.057 (0.059)	-0.058 ^a (0.020)
Age	-0.001 (0.001)	-0.005 ^a (0.001)	-0.001 (0.002)
Sex	0.122 ^a (0.017)	0.152 ^a (0.016)	0.132 ^a (0.021)
Canadian work exp	0.255 ^a (0.051)	0.071 ^a (0.007)	0.279 ^a (0.061)
Visible minority (yes=1)	-0.128 ^a (0.024)	-0.122 ^a (0.022)	-0.137 ^a (0.027)
Canadian job type (white occupation=1)	0.526 ^a (0.025)	0.374 ^a (0.021)	0.535 ^a (0.026)
Source country job type (white occupation=1)	0.020 (0.018)	0.051 ^b (0.020)	0.012 (0.023)
Skilled worker immigrants (yes=1)	0.071 ^a (0.021)	0.108 ^a (0.020)	
Language (fluent=1)	0.078 ^a (0.017)	0.092 ^a (0.016)	0.077 ^a (0.021)
Foreign education (M.A./PhD), dummy	0.124 ^a (0.032)	0.177 ^a (0.035)	0.165 ^a (0.055)
Foreign education (BA/University), dummy	0.083 ^a (0.026)	0.152 ^a (0.027)	0.116 ^b (0.053)
Foreign education (College/Diploma), dummy	0.050 ^c (0.028)	0.081 ^a (0.026)	0.084 (0.057)
Canadian edu before landing	0.093 (0.062)		0.088 (0.068)
Number of Obs	2276	2938	1673
R^2	0.3887	0.3389	0.3755

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

Though most of the trainees in LSIC have participated in training more than once, the duration of their first training is negatively related to wage. Considering that immigrants included in the survey are those that landed from outside of Canada within the first six month period after landing, the first time training they experienced is most likely to represent the acquisition of Canadian labour market information, but it is not directly connected to human capital increment. The most efficient learners, or those that have relatives and/or friends in Canada, will leave the state of unemployment faster and obtain relatively higher paid employment.

Self-reported language fluency at the time of landing also contributes to the wage difference. Immigrants that reported that their English or French is good, or fairly good, earn eight percent more, compared to immigrant that consider their knowledge of both official languages as being poor at the time of the first interview. By using high school as a reference group of educational attainment, immigrants with higher foreign education levels are rewarded with higher wages from the Canadian labour market. However, while using years of education, the return to foreign education is quite low (roughly 2% each year)¹³, which is consistent with previous research (Friedberg, 2000).

The estimates for the after-training regression is shown in column two of Table 4.3. The third-wave wage is used to represent income after the signal. Since the interview for the third wave was conducted four years after landing, there should be enough time for a signal, if it exists, to be effective to reveal an immigrant's actual ability level. As we can see, these estimates demonstrate the same pattern as the ones before training starts¹⁴. However, the estimate for the group index, which represents the wage difference between trainees and non-trainees, is insignificant. Considering this estimate is negative and significant before training starts, we are able to conclude that a general definition of training is not able to work as an effective signal to reveal

¹³Please check Appendix A1, column 1 for the regression results.

¹⁴Estimates for acquired Canadian formal education locate at Appendix, column 1 of Table A2.

an immigrant's actual ability level.

Though a general definition of training cannot work as an effective signal for immigrants, it still reveals some interesting information. The group index, trainee dummy, is estimated with skilled worker immigrants and non-skilled worker immigrants, respectively. The results reveal that the negative effect comes from immigrants that were admitted under the skilled worker immigrants. The estimate of the trainee dummy for the skilled worker immigrants is negative, comparatively large in absolute value, and significant before training starts (shown in Table 4.3, column 3). Conversely, it is small for the non-skilled worker immigrants and insignificant at the same period¹⁵.

The negative sign for skilled worker immigrants, before training starts, may mainly be due to their formal education before landing. The majority of skilled worker immigrants are selected based on their potential human capital, due to the Canadian immigration policies that are in place, which focus on the education level of an individual at the post-secondary level. It would be interesting to take a look at the level of formal education in which the skilled worker immigrants participated after landing.

When the return to an additional year of education is positive, it is worth to notice that 25 percent¹⁶ of immigrants undertook formal education in Canada at a level higher than their education level at the country of origin. However, 75 percent of them repeated their education at the same level in Canada, or obtained education credentials in Canada that are lower than what was acquired in their country of origin¹⁷. Does this reveal the ability difference among these immigrants?

¹⁵Please see Appendix, Table A1, column 2 for the regression results.

¹⁶Calculated based on the total number of immigrants that invested in Canadian formal education after migration, divided by the number of immigrants that went to a level of Canadian education higher than their education level in the country of origin.

¹⁷The comparison of the original and source country education level is based on ED1Q001 and ED3Q297 in LSIC.

Table 4.4: Signal Effect of the Relative Level of Canadian Formal Education

	Before Formal Edu	After Formal Edu
	Estimates (Std.Err)	Estimates (Std.Err)
Constant	1.900 ^a (0.086)	2.100 ^a (0.075)
Signal	-0.059 (0.045)	0.081 ^c (0.046)
Age	0.002 (0.002)	-0.003 (0.002)
Sex	0.117 ^a (0.028)	0.091 ^a (0.023)
Canadian work exp	0.138 (0.087)	0.077 ^a (0.010)
Visible minority (yes=1)	-0.080 ^b (0.039)	-0.059 ^b (0.031)
Canadian job type (white occupation=1)	0.414 ^a (0.040)	0.297 ^a (0.028)
Source country job type (white occupation=1)	0.025 (0.032)	0.027 (0.025)
skilled worker immigrants (yes=1)	0.089 ^b (0.039)	0.107 ^a (0.029)
Language	0.091 ^a (0.030)	0.047 ^c (0.024)
Foreign education (M.A./PhD), dummy	0.038 (0.072)	0.253 ^a (0.068)
Foreign education (BA/university), dummy	0.041 (0.060)	0.158 ^a (0.055)
Foreign education (College/Diploma), dummy	0.098 (0.062)	0.140 ^a (0.049)
Canadian edu before landing	0.221 ^a (0.063)	
Duration of first training		-0.035 ^a (0.014)
Number of Obs	736	1183
R^2	0.3232	0.3435

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

To answer this question, the signal is defined as a dummy variable that equals to one if an immigrant's level of Canadian formal education is higher than his pre-migration education level. Conversely, the outcome is equal to zero if an immigrant repeated his or her educational level or even studied a lower one in Canada, compared to the education that they have acquired in their country of origin. The regression results are shown in Table 4.4. The estimate for the group index reveals that there is no wage difference between these two groups before their Canadian education starts. However, there is a significant wage difference at the end of the survey, four years after landing, the time in which they have most probably graduated¹⁸. This is consistent with the prediction of equation (1). After controlling for observable characteristics, the signal group earn eight percent more than the non-signal immigrants. We therefore are able to conclude that the relative formal education level in which immigrants have participated in after landing is able to work as an effective signal to reveal an immigrant's actual ability level. High ability immigrants, by going to a higher education level in Canada, compared to the education level in the country of origin, signal their actual ability levels to Canadian employers. They therefore are rewarded with a wage higher than the immigrants that repeat their education level, or studying at a lower one.

4.5.2 Foreign Credential Recognition and Arranged Job as signal

While the level of Canadian formal education is able to work as a signal to reveal an immigrant's actual ability level, it is not one of the best signals. Formal education, no matter whether an individual participate at a higher level or not, is not only a financial burden to immigrants themselves, but also leads to an over-education problem for

¹⁸Estimates for Canadian formal education locate at Appendix, Table A2, column 2.

the destination country. Over-education also delays immigrants' contribution to the economic development of the destination country. Looking for other signals would yield economic benefits and be of policy interest.

Foreign Credential Recognition

With unknown developing-country education systems, credentials obtained from developing countries are not generally accepted in the developed destination countries. This results in a low labour market return to these credentials at the destination country. Following the changing structure of the immigrant composition, more educated immigrants (i.e., skilled workers) from developing countries have entered Canada since the 1970s. The attitudes of Canadian employers towards foreign credentials have changed gradually, due to an increasing hiring experience. The descriptive statistics show that around 50% of developing country immigrants have their foreign credentials recognized by either the labour market, educational institutions or the Canadian government. Descriptive statistics also show that there are no natural differences between immigrants with recognized foreign credentials and those without, concerning the mean of age, years of foreign education, and the type occupation in the country of origin. Could this foreign credential recognition work as a signal to reveal an immigrant's actual ability level?

To test whether recognized foreign credentials is able to work as an effective signal, the same method that distinguishes the signal effect of Canadian formal education in the previous section has been adopted here. The regression results are shown in Table 4.5, column 1 and 2. The estimates are similar to those with level of Canadian formal education as signal.

The group index, representing immigrants with recognized foreign credentials relative to those without, is positive before recognition; however, it is statistically insignif-

Table 4.5: **Signal Effect of Foreign Credential Recognition**

	Before Credential Recognition	After Credential Recognition
	Estimates (Std.Err)	Estimates (Std.Err)
Constant	1.901 ^a (0.082)	2.121 ^a (0.077)
Signal	0.015 (0.019)	0.072 ^a (0.019)
Age	-0.001 (0.001)	-0.005 ^a (0.001)
Sex	0.105 ^a (0.018)	0.126 ^a (0.017)
Canadian work exp	0.206 ^a (0.054)	0.069 ^a (0.007)
Visible minority (yes=1)	-0.137 ^a (0.025)	-0.105 ^a (0.020)
Canadian job type (white occupation=1)	0.491 ^a (0.025)	0.359 ^a (0.020)
Source country job type (white occupation=1)	0.030 (0.019)	0.047 ^b (0.020)
skilled worker immigrants (yes=1)	0.082 ^a (0.021)	0.133 ^a (0.019)
Language	0.080 ^a (0.018)	0.090 ^a (0.017)
Foreign edu, by Year	0.017 ^a (0.005)	0.017 ^a (0.004)
Duration of first training	-0.058 ^a (0.011)	-0.006 (0.011)
Canadian edu before landing (dummy)	0.079 (0.068)	
Canadian edu, before & after landing(dummy)		0.002 (0.018)
Number of Obs	2030	2923
R^2	0.3650	0.3036

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

icant. The null hypothesis that there is no wage difference between the signal and non-signal group before their foreign credential recognized, therefore, is not rejected. Further, the group index that represents the wage difference after credential recognition reveals that the signal group earns seven percent more, which is both statistically and economically significant, than the non-signal group. This result corroborates the signal effect of the foreign credential recognition. It also reveals that foreign credential recognition is an important and effective method to help immigrants that migrate from developing countries and the success of their economic assimilation.

Arranged Job Before Migration

While the level of Canadian formal education and the recognition of foreign credentials are effective signals to reveal an immigrant's actual ability level, would the same apply to these immigrants whose productive ability is directly observable to Canadian employers?

With a worldwide economy, international economic cooperation is common. The branches of international firms in developing countries provide an opportunity for employers in the destination country to observe their ability. While considering the requirements in the destination country's labour market, the wage the firm provides to immigrants with an arranged job would be an equilibrium wage. This implies that the benefit to immigrants, represented by this wage, is at least equal to the migration and opportunity cost. At the same time, the firm has maximized its profit. Thus, the firm will select the most able people in the developing-country population at the offered wage level. The wages for immigrants with arranged jobs before migration therefore correspond to the wages after a signal takes effect. Therefore, immigrants with pre-arranged jobs should have comparatively higher wages than all other immigrants' at the first wave (within six months after landing), when it is too early for

Table 4.6: Signal Effect of Arranged Job before Migration

	Arranged Job First Wave	Arranged Job Third Wave
	Estimates (Std.Err)	Estimates (Std.Err)
Constant	1.934 ^a (0.063)	2.078 ^a (0.061)
Signal	0.238 ^a (0.041)	0.176 ^a (0.039)
Age	-0.001 (0.001)	-0.004 ^a (0.001)
Sex	0.104 ^a (0.017)	0.133 ^a (0.015)
Canadian work exp	0.140 ^a (0.048)	0.063 ^a (0.006)
Visible minority (yes=1)	-0.132 ^a (0.023)	-0.104 ^a (0.019)
Canadian job type (white occupation=1)	0.475 ^a (0.024)	0.363 ^a (0.018)
Source country job type (white occupation=1)	0.031 ^c (0.018)	0.066 ^a (0.018)
Skilled worker immigrants (yes=1)	0.071 ^a (0.019)	0.128 ^a (0.016)
Language	0.085 ^a (0.016)	0.099 ^a (0.015)
Foreign edu, by Year	0.015 ^a (0.004)	0.018 ^a (0.003)
Duration of first training	-0.054 ^a (0.010)	-0.007 (0.011)
Canadian edu before landing (dummy)	0.007 (0.059)	
Canadian edu, before & after landing(dummy)		0.004 (0.017)
Number of Obs	2393	3474
R^2	0.3731	0.3252

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

other signals to have effect.

The regression results for immigrants with arranged job are shown in column 1 and column 2 of Table 4.6. Column 1 shows the estimates for immigrants' first main job in Canada, and the estimates corresponding to their hourly wage in the third wave of the survey are in column 2.

In order to control for immigrant occupational differences, two dummy variables are included to represent occupational categories. One represents immigrants' occupations in the country of origin, and the other in the Canadian labour market. These occupational dummies are equal to one if an immigrant works in an university-educated professional occupation, i.e., a white-collar occupation. The outcome is equal to zero if an immigrant is working in a routine or semi-routine job, i.e., a blue-collar occupation. This is in line with previous research that examines occupation and wage changes (Cohen and Eckstein, 2008).

Holding other observable characteristics constant, immigrants with an arranged job before migration earn 24 percent more than the rest immigrants in the period within the first six month period after landing; they earn 18 percent more at the end of the survey, four years later, when other signals, such as the level of formal education and the recognition of foreign credentials, start showing effects.

4.5.3 Employment Duration and Income Variance Analysis

To test the signal effect of employment duration and the change of income variance, the upper three signal groups are integrated into one larger group. This compares immigrants with high ability, that choose to signal their ability levels and at least have a job after the signal becomes effective, with the rest immigrants that do not have any effective signal in the four year survey period. This identification strategy, and the associated regression results are discussed in the following two paragraphs.

Table 4.7: **Employment Duration and Income Variance Analysis**

	Employment Duration	Variance Analysis
	Estimates (Std.Err)	Estimates (Std.Err)
Constant	2.656 ^a (0.165)	0.068 (0.064)
Signal	0.104 ^b (0.046)	0.036 ^b (0.017)
Age	-0.002 (0.003)	-0.001 (0.001)
Sex	0.375 ^a (0.044)	0.002 (0.017)
Visible minority (yes=1)	-0.091 ^c (0.054)	-0.015 (0.024)
Canadian job type (white occupation=1)	0.423 ^a (0.048)	-0.006 (0.023)
Source country job type (white occupation=1)	-0.198 ^a (0.053)	0.061 ^b (0.023)
Skilled worker immigrants (yes=1)	-0.012 (0.058)	0.020 (0.022)
Language	0.431 ^a (0.046)	0.005 (0.020)
Foreign education, by Year	-0.008 (0.009)	0.007 ^b (0.003)
Duration of first training	-0.212 ^a (0.033)	0.006 (0.027)
Canadian education, before & after landing (dummy)	-0.345 ^a (0.055)	0.000 (0.027)
Canadian work experience		-0.015 ^c (0.008)
Number of Obs	3820	2165
R^2	0.1253	0.0221

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

For the analysis of income variance, a two-stage regression is undertaken as explained in the model setup, equation (2) and (3). The estimates of the second stage regression are shown in Table 4.7, column 2. Corresponding to the other immigrants, the estimate for the group index shows that the immigrants that choose to signal their ability levels have experienced a larger change of their wage variance, compared to immigrants without any effective signals. This is consistent with the prediction of the model.

While receiving wages higher than the others, high ability immigrants are less likely to become unemployed. Besides their high productive ability, these immigrants may acquire local labour market information easily and utilize it more efficiently. This gives them better opportunities to become employed. This simultaneously implies that these immigrants have longer employment duration since landing. Equation (4) is used to test this prediction and the regression results are shown in Table 4.7, column 1. For immigrants that choose one of the three effective signals, the duration of their employed periods in the first four years after landing is ten percent longer than immigrants that do not choose to signal their ability levels. This result is significant at the 5% level. The result corroborates the prediction of the model.

4.5.4 Permanent Wage Difference

Following the corroborative evidence of the existence of effective signals and immigrants with different productive ability levels, a permanent wage difference between high ability immigrants and the rest has been predicted. Is this true for the immigrants in LSIC? Using average wage in the four years of survey periods as dependent variable, a regression is estimated using the same independent variables as in previous analysis. The group index variable equals to one if an immigrant chooses to signal his ability level and he or she at least has a job after the signal comes into effect. The

Table 4.8: **Permanent Wage Difference**

	Formal Edu level	Arranged Job	Credential Recognition	All Signal Group
	Estimates (Std.Err)	Estimates (Std.Err)	Estimates (Std.Err)	Estimates (Std.Err)
Constant	1.905 ^a (0.052)	1.945 ^a (0.051)	1.935 ^a (0.052)	1.932 ^a (0.051)
Signal	0.094 ^a (0.028)	0.207 ^a (0.036)	0.044 ^a (0.015)	0.075 ^a (0.015)
Age	-0.003 (0.001)	-0.003 ^a (0.001)	-0.003 ^a (0.001)	-0.003 ^a (0.001)
Sex	0.110 ^a (0.013)	0.106 ^a (0.013)	0.111 ^a (0.013)	0.109 ^a (0.013)
Canadian work experience	0.062 ^a (0.005)	0.057 ^a (0.005)	0.061 ^a (0.005)	0.060 ^a (0.005)
Visible minority (yes=1)	-0.105 ^a (0.017)	-0.100 ^a (0.017)	-0.103 ^a (0.017)	-0.103 ^a (0.017)
Canadian job type (white occ=1)	0.369 ^a (0.017)	0.355 ^a (0.017)	0.368 ^a (0.017)	0.361 ^a (0.017)
Source country job type (white occ=1)	0.050 ^a (0.014)	0.054 ^a (0.014)	0.049 ^a (0.015)	0.051 ^a (0.014)
Skilled worker immigrants (yes=1)	0.104 ^a (0.015)	0.105 ^a (0.015)	0.099 ^a (0.015)	0.098 ^a (0.015)
Language	0.084 ^a (0.013)	0.085 ^a (0.013)	0.083 ^a (0.013)	0.080 ^a (0.013)
Foreign education, by Year	0.023 ^a (0.003)	0.020 ^a (0.003)	0.021 ^a (0.003)	0.020 ^a (0.003)
Duration of first training	-0.025 ^a (0.009)	-0.018 ^b (0.009)	-0.023 ^b (0.009)	-0.024 ^a (0.009)
Canadian edu, before & after landing (dummy)	-0.036 ^b (0.015)	-0.022 (0.015)	-0.024 (0.015)	-0.032 ^b (0.015)
Number of Obs	3820	3820	3820	3820
R^2	0.3666	0.3759	0.3664	0.3773

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

estimates of the regression are shown in Table 4.8.

For immigrants that participated in a level of formal Canadian education higher than their pre-migration education level, their average income is nine percent higher than the remaining immigrants, including other signal groups, within the first four years period after landing. For immigrants with an arranged job before migration, their average wage is 21 percent higher than that of other immigrants. Immigrants with recognized foreign credentials on average earn four percent more than immigrants that their foreign credentials have not been recognized. When all the three signal groups are integrated into one group, their average hourly wage is 7.5 percent higher than the non-signal group, in the first four years landed in Canada.

Though significant or insignificant at five percent level, the negative return to Canadian education looks unreasonable. However, descriptive statistics shows about 54 percent of immigrants participate in college and/or diploma level education. Furthermore, another 24 percent seek a bachelor level education; some drop out prior to completing their degree. Most individuals that pursue bachelor or lower level of education are skilled worker immigrants. Considering the requirements of Canadian immigration policies, it is almost impossible for a person to be a skilled worker immigrant to Canada when his or her education level is lower than college education.¹⁹ The comparison of pre- and post-education level confirms that a large percentage of immigrants that migrate from a developing country repeat their Canadian education at the same level as their country of origin, or pursue a level of education lower than their country of origin after landing. This drags down the return to Canadian education and contributes to the negative sign ²⁰.

¹⁹Canadian immigration policy allows people with education lower than college to apply for migration, but it requires that the immigrant works in a designated occupation area and receives full score on age, work experience, language, and adaptive ability section in order to reach 67, the official passing score. Under the prescribed rules, it is nearly impossible for a low educated developing-country person to immigrate as skilled worker to Canada.

²⁰Caponi, 2011, also reports a negative return to education for Mexican American.

4.6 Summary and Conclusions

Contrary to the prediction of standard human capital theory that only a single group of people migrate, either the upper or the lower tail of ability distribution in the source country population, this paper shows that Canadian immigrants who landed in the early 2000s are drawn from the entire spectrum of the ability distribution. By developing intuitively plausible and testable predictions under the assumption of existence asymmetric information, this paper has provided a quantitative evidence-based model that is consistent with the predictions of the asymmetric information model on immigrant selection. It has also provided further analysis of immigrant quality resulting from Canadian immigration policies.

The empirical results indicate that, no matter what the initiatives of Canadian immigration policy are, immigrants that landed in the year 2000 are mixed with both high and low abilities. These two groups of immigrants assimilate differently into the Canadian economy in the first four years after landing. This result is consistent with the first and the second essay that find that heterogeneity exists in the immigrant population, and this heterogeneity affects the increment of immigrants' wages and therefore their assimilation process.

By discussing three plausible signals and their predictions in the Canadian labour market, this paper has also provided various implications for future immigrant selection and assimilation policies. For example, while foreign credential recognition helps to increase immigrant wages and to decrease unemployment duration, immigrants with an arranged job belong to the most able class, and are the most adaptable to the requirement of the Canadian labour market. Compared to other immigrants, immigrants with an arranged job earn a higher income and fill instantaneously the demand of the Canadian labour market. As one of the sufficient conditions that are required to apply for migration to Canada²¹, a pre-arranged job before landing brings

²¹To be eligible to apply for migration to Canada, the applicant has to have either an arranged

the most needed, and the most able immigrants, to the Canadian economy. As for the signal of participating in formal education in Canada that exceeds the level from their original country, it is able to work as a signal to reveal an immigrant's high ability. However it engages more personal and social resources. Furthermore, it also delays immigrants' contribution to the economic development of Canada.

Through the analysis of three possible signals and their screening effect on immigrants' ability, this paper suggests some further potential research topics. Although this paper has discussed ability differences among developing country immigrants, it is worth comparing the high and/or low ability immigrants with the Canadian born to find the difference in their the long-run assimilation. Looking for other potential effective signals also attracts policy and economic interest, under the automatic labour market screen mechanism.

job or one year work experience in designated occupations.

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Chapter 5

Limitation and Possible Extension

This dissertation analyzes the early integration process of recently landed immigrants to Canada. In order to examine this process, data is utilized from the LSIC by looking at immigrants that landed in Canada between October 1, 2000 and September 30, 2001. Empirical results from this research provide further evidence on immigrant post-migration human capital investment, labour market integration, and the selection effect of Canadian immigration policy in the corresponding survey period.

The LSIC is designed to provide information on how newly arrived immigrants integrate into Canadian society, both economically and socially. The LSIC contains detailed information pertaining to an immigrant's educational attainment, foreign credentials recognition, employment status, labour market income, social networks, and accommodation, etc, in Canada. These indicators cover the first four years immigrants first landed in Canada. This design, however, limits this research on immigrants to a short time span: the first four years after landing. Furthermore, because the LSIC only includes immigrants, it is impossible to make a comparison between immigrants and Canadian born.

The integration of immigrants into the destination country is a long process. Previous research reveals that immigrant's income, on average, increases faster than the native born. However, it takes decades to close the initial wage gap between immi-

grants and the native born, and for immigrants to obtain the same income level as their Canadian counterparts. As a result of this, it is prudent to explore whether the initial wage gap experienced by immigrants is influenced by the acquisition of human capital and the requirements of Canadian labour market. Moreover, it is important to determine the effect of a skill mismatch on the immigrant initial wages. Furthermore, how this affects immigrants' long-run assimilation. Therefore, this research will be extended in the following four possible dimensions:

1. Extending current analysis to a long time frame, analyzing the influence of the early stage post-migration human capital investment on immigrant catch up effects, and investigating the dynamics of immigrant occupational choices.
2. Comparing immigrants with Canadian born, analyzing their income and occupation differences in both a short and a long time frame.
3. Investigating the results of the selection process implemented through Canadian immigration policy on immigrants that migrated from developed countries and, identifying the determinants and making a comparison to immigrants that were originally from developing countries.
4. Exploring the mismatch of immigrants' acquired human capital with the job requirements in the Canadian labour market, and the results of this mismatch.

Appendix A

Table A.1: **Signal Effect of Canadian Training and Formal Education, by Length of Education**

	Before Training (years of education)	Before Training (Non-skilled worker)
	Estimates (Std.Err)	Estimates (Std.Err)
Constant	1.874 ^a (0.067)	2.070 ^a (0.073)
Signal	-0.056 ^a (0.017)	-0.030 (0.029)
Age	-0.001 (0.001)	-0.001 (0.002)
Sex	0.117 ^a (0.017)	0.075 ^a (0.027)
Canadian work exp	0.258 ^a (0.050)	0.179 ^b (0.080)
Visible minority (yes=1)	-0.125 ^a (0.024)	-0.071 (0.052)
Canadian job type (white occupation=1)	0.519 ^a (0.025)	0.433 ^a (0.072)
Source country job type (white occupation=1)	0.020 (0.018)	0.049 ^c (0.029)
Language (fluent=1)	0.078 ^a (0.017)	0.075 ^a (0.025)
Canadian education before landing	0.049 (0.061)	0.135 ^c (0.076)
Years of foreign education	0.017 ^a (0.004)	
Skilled worker immigrants (yes=1)	0.068 (0.020)	
Foreign education (M.A./PhD), dummy		-0.005 (0.076)
Foreign education (BA/university), dummy		0.078 ^b (0.032)
Foreign education (college/diploma), dummy		0.039 (0.336)
Number of Obs	2276	603
R^2	0.3919	0.2611

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.

Table A.2: Return to Canadian Education, by Education Category

	After Training	After Formal Education
	Estimates (Std.Err)	Estimates (Std.Err)
Canadian education (M.A./PhD), dummy	0.161 ^b (0.066)	0.230 ^a (0.069)
Canadian education (BA/university), dummy	0.121 ^c (0.062)	0.171 ^a (0.052)
Canadian education (college/diploma), dummy	0.094 (0.058)	0.126 ^a (0.046)
Canadian education (high school), dummy	-0.019 (0.070)	-
Training with diploma, dummy	0.146 ^b (0.065)	
Duration of first training	-0.032 ^b (0.016)	

a, Significant at 1% level; b, Significant at 5% level; c, Significant at 10% level.