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The Determinants of Skills of Canadian Immigrants

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TABLE OF CONTENTS

LIST OF TABLES.....	IV
LIST OF FIGURES.....	V
ACKNOWLEDGEMENTS.....	VI
ABSTRACT	VII
CHAPTER 1 INTRODUCTION.....	1
SECTION 1.1 THE ROLE OF HUMAN CAPITAL IN INDIVIDUAL WELL-BEING AND NATIONAL ECONOMIC GROWTH.....	1
SECTION 1.2 HUMAN CAPITAL MEASUREMENT.....	3
SECTION 1.3 OBJECTIVES AND CONTRIBUTION OF THE THESIS.....	5
SECTION 1.4 STRUCTURE OF THE THESIS	8
CHAPTER 2 LITERATURE REVIEW	9
SECTION 2.0 PRELUDE – THE HUMAN CAPITAL PRODUCTION FUNCTION.	9
SECTION 2.1 MEASUREMENT OF HUMAN CAPITAL.	11
2.1.1 <i>Enrolment rates, years of schooling, and the Mincer approach</i>	11
2.1.2 <i>Skills An output-based approach</i>	15
2.1.3 <i>Income approaches</i>	20
SECTION 2.2 SKILL GAPS BETWEEN IMMIGRANTS AND THE CANADIAN-BORN	23
SECTION 2.3 THE DETERMINANTS OF SKILLS.	26
2.3.1 <i>Conceptual framework of skills development</i>	26
2.3.2 <i>The quantity of education</i>	28
2.3.3 <i>Pre-immigration versus host-country schooling</i>	30
2.3.4 <i>Quality of education</i>	33
2.3.5 <i>Accounting for the quality of schooling across countries The economic development level</i>	36
2.3.6 <i>Accounting for the quality of schooling across countries Public expenditures on education</i>	38
2.3.7 <i>Language</i>	40
2.3.8 <i>Work experience and portability of human capital</i>	45
2.3.9 <i>Age, age of landing, and years since migration</i>	47
2.3.10 <i>Family</i>	51
SECTION 2.4 INTERNATIONAL COMPARISON	53
2.4.1 <i>Background of immigration policy</i>	53
2.4.2 <i>Skills of immigrants</i>	55

CHAPTER 3 DATA	57
SECTION 3.1 DATA SETS ..	57
3 1 1 <i>The International Adult Literacy and Skill Survey (IALSS)</i>	57
3 1 2 <i>Other data sets</i>	60
SECTION 3.2 SAMPLE SELECTION.....	62
3 2 1 <i>Sample selection for macro analysis</i>	63
3 2 2 <i>Sample selection for micro analysis</i>	67
CHAPTER 4 MACRO EVIDENCE BY COUNTRY OF ORIGIN	68
SECTION 4.1 METHODOLOGY AND VARIABLES ..	68
4 1 1 <i>Empirical model</i>	68
4 1 2 <i>Definition of variables</i>	69
SECTION 4.2 EMPIRICAL ANALYSIS..	81
4 2 1 <i>Skill-schooling gap</i>	81
4 2 2 <i>Skill proficiency</i>	90
4 2 3 <i>Employment income of immigrants</i>	96
SECTION 4.3 CONCLUSION..	98
CHAPTER 5 MICRO EVIDENCE	101
SECTION 5.1 MODEL..	101
SECTION 5.2 VARIABLES ..	105
SECTION 5.3 EMPIRICAL ANALYSIS.....	109
5 3 1 <i>Descriptive analysis</i>	109
5 3 2 <i>Estimation results of skill proficiency</i>	115
SECTION 5.4 COMPARISON BETWEEN MICRO AND MACRO ANALYSIS.....	135
SECTION 5.5 CONCLUSION.....	138
REFERENCES	141
APPENDICES	152
APPENDIX I GROUPING COUNTRIES OF ORIGIN ..	152
APPENDIX II CALCULATING THE SKILL-SCHOOLING GAP ..	153
APPENDIX III LINGUISTIC INFORMATION IN IALSS (2003) ..	156
APPENDIX IV REGRESSIONS ON SKILLS WITH LOGARITHMIC INCOME PER CAPITA ...	157
APPENDIX V INCOME PER CAPITA OF COUNTRY OF ORIGIN ..	158
APPENDIX VI LIST OF VARIABLES FOR MICRO STUDIES ..	160

LIST OF TABLES

Table 3.1	Country of origin	64
Table 3.2	List of source countries and country-groups	66
Table 4.1.1	Mean skill proficiency of countries/country-groups of origin.....	71
Table 4.1.2	Skill-schooling gap	75
Table 4.1.3	Definition of country/country-group specific variables	78
Table 4.1.4	Mean age of immigrants across source country/country-groups	79
Table 4.1.5	Davidson-MacKinnon Test.....	80
Table 4.2.1	Regressions on skill-schooling gap (1).....	82
Table 4.2.2	Regressions on skill-schooling gap (2).....	89
Table 4.2.3	Regressions on skill proficiency (1)	91
Table 4.2.4	Regressions on skill proficiency (2)	95
Table 4.2.5	Annual employment income of immigrants	97
Table 5.3.1	Skill proficiency among different dimensions.....	111
Table 5.3.2	Skill proficiency and Canadian education	112
Table 5.3.3	Skill proficiency and immigrant category	115
Table 5.3.4	Regressions on skill proficiency.....	118
Table 5.3.5	Regressions on skill proficiency with different measure of income per capita of country of origin	121
Table 5.3.6	Regressions on skill proficiency with public expenditure on education of the country of origin	123
Table 5.3.7	Regressions with different measures of language skills	125
Table 5.3.8	Regressions on prose proficiency	126
Table 5.3.9	Regressions on numeracy proficiency	127
Table 5.3.10	Comparison of return of Canadian and foreign education.....	131
Table 5.4	Comparison between micro and macro regressions	137
Table IV	Regressions on skill with logarithmic income per capita	157
Table V	Income per capita of country of origin	158
Table VI	List of variables for micro studies	160

LIST OF FIGURES

Figure 4.1.1	Relationship between skills and schooling for Canadian-born population and international immigrants	72
Figure 4.1.2	The skill-schooling gap of international immigrants.....	74
Figure 4.2.1	The skill-schooling gap and per capita income per country/country-group of origin	84
Figure 5.3.1	Skill proficiency and work experience and education.....	114

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ABSTRACT

In this thesis, I present two empirical analyses to help understand the following question: Why do Canadian immigrants, despite their higher levels of education, have lower level of skill proficiencies than the native-born population in Canada? The first empirical analysis uses country-level macroeconomic data, while the second is conducted with individual level microeconomic data taken from International Adult Literacy Skill Survey (IALSS). In addition, the macro level and micro level results are compared at the end of the thesis.

In the first part (Chapter 2), I summarize and synthesize the findings of previous research that addresses or helps in understanding the main questions analyzed in this thesis. I discuss the various approaches used to measure human capital and suggest that the literacy proficiency scores provided by IALSS are a more appropriate indicator than the commonly used educational data. I also discuss the various factors that play a role in the formation and development of immigrants' human capital, such as the income-per-capita in the country of origin, language proficiency, and education.

The various data used in this thesis are discussed in Chapter 3. I have refined the coding of the country of origin in the original Master file of IALSS, extending the number of cross-sectional units from 28 countries to 50 countries/country-groups for the macro analysis. This is one contribution of my work, since the increase in the number of observations improves the robustness of the empirical analysis.

The empirical analysis that used country-level macro data is carried out and presented in Chapter 4. All the results strongly suggest that the economic development

level of the country of origin, proxied by the income per capita, is a key determinant of the immigrants' skill proficiency. The language barrier also plays an important role in explaining why immigrants have more years of schooling but lower skill proficiencies in Canada than the Canadian-born people. I also estimate regressions using employment earnings. The results concur with the analysis of Hanushek and Woessmann (2008), who show that education which did not contribute to cognitive skills will not affect the economic outcomes of immigrants.

In Chapter 5, I turn to individual-level micro data to examine the factors linked with immigrants' skill proficiency. The micro level evidence also suggests that a country's economic development level that existed during an individual's schooling age plays an essential role for his/her future skill proficiency. The similar marginal effect for Canadian education and foreign education when income-per-capita of country of origin is under controlled suggests that income-per-capita of country of origin is a good proxy of quality of education. A comparison between individual and aggregated level regressions is discussed as well. Both micro-level and macro-level analyses provide consistent findings that income-per-capita of country of origin, years of schooling, and language proficiency in English/French have significant influences on immigrants' skill development. This type of comparison has not been conducted in previous studies in investigating the formation and development of immigrants' cognitive skills, and is considered as another contribution of this thesis.

CHAPTER 1 INTRODUCTION

Section 1.1 The role of human capital in individual well-being and national economic growth

Canada is a traditional country of immigrants, and its immigration history began at the country's birth. Over time, international immigrants have played an important role in Canada's economy.¹ For example, immigrants represented over 20 percent of the Canadian labour force during the 2006–2008 period (Labour Force Survey).

The socio-economic outcomes of Canadian immigrants have attracted the attention of economists and policy makers, and it is widely documented that the economic status of Canadian immigrants is low compared with that of the native-born population (Baker and Benjamin 1994; Bloom *et al* 1995; Grant 1999; Frenette and Morissette 2003; Ferrer and Riddell 2004; Bonikowska *et al* 2008). Various research has investigated the potential determinants of immigrants' unfavourable economic outcomes. Cognitive skills have been found to directly affect wages and may be the most important determinant of workers' productivity (Glewwe 2002). It has also been suggested that the lower skill level possessed by immigrants relative to the native-born population played an important role in explaining immigrants' lower relative earnings (Ferrer, Green and Riddell, 2004; Bonikowska, Green, and Riddell, 2008).

The role of skills or human capital as a key determinant of living standards is highlighted in modern economic growth theory. Since the seminal work of Lucas (1988),

¹ Those who were born outside of Canada are defined as international immigrants in this thesis.

human capital disparities have been given a central role in the analysis of economic development and growth. The analysis of Mankiw (1995) suggests that the share of the return to human capital in national income is about 50 percent in developed countries compared with only 33 percent for physical capital. In addition, in the Barro, Mankiw, and Sala-i-Martin's (1995) open economy growth model with physical capital mobility, the accumulation of physical capital and productivity is driven by the dynamics of human capital.

Section 1.2 Human capital measurement

Unlike physical capital, human capital is an abstract concept that cannot be measured directly. Consequently, even if economists have generally agreed regarding the importance of human capital to economic growth at the macroeconomic level or to individual earnings at the microeconomic level, various approaches have been used to measure it in empirical studies. As a result, the different measures of human capital may lead to contradictory conclusions in terms of the human capital levels of international immigrants. If one uses the percentage of the inflow of immigrants with university degrees or the average years of education, which are standard but indirect measures, immigrants are found to have more human capital than the Canadian-born population (Akbari 1999). In contrast, based on a direct measurement of skills (such as the skill proficiency scores from International Adults Literacy Skill Survey [IALSS]), immigrants are found to have lower skill levels, on average, than the Canadian-born population (Coulombe and Tremblay 2009a; Ferrer *et al* 2004; Bonikowska *et al* 2008). Thus, measuring human capital is a challenge for empirical research and for the determinant of the economic outcome of Canadian immigrants.

Using results from the IALSS (2003), Coulombe and Tremblay (2009a) find that, on average, for the same level of schooling, Canadian immigrants have a skill deficiency relative to the Canadian-born population corresponding to about three years of formal education in Canada. As defined by Coulombe and Tremblay (2009a), this deficiency of three years is called the skill-schooling gap. They show that the skill-schooling gap varies across countries of origin and is negatively correlated with the level of economic development in the country of origin.

Given that immigrants account for around 20 percent of the Canadian labour force, the human capital intensity of Canadian immigrants is a very important issue for the country's living standard and long-term growth in a world where the fortune of development appears to be determined by the skill advantages of labour.

Section 1.3 Objectives and contribution of the thesis

In this thesis, I employ the skill-proficiency scores provided by the IALSS (2003) to proxy the human capital intensity of the Canadian-born population and international immigrants. The purpose of the thesis is to investigate the factors that determine the skills gaps of Canadian immigrants relative to the Canadian-born population.

I review the literature that would help one to understand the determinants of the skill deficiency of Canadian immigrants. I show that measuring human capital is a very important issue, especially when the research purpose is to compare the human capital intensity of individuals who have acquired their education in countries with very different levels of economic development.

A significant contribution of this thesis is its unique data construction using the IALSS (2003) Master file. I investigated at Statistics Canada the answers to the question A3: *In which country were you born?* I found that the answers for this question were coded as “other” for nearly one third of the respondents, which accounts for almost 1,000 answers. I re-coded the answers for this question using real country names instead of “other”.² As a result, the number of countries of origin increased from 28 in the original IALSS file to nearly 150 in the data file constructed for this thesis. Also, the sample size is increased due to the inclusion of those respondents whose value for country of origin is defined as “other” in the original IALSS data file.

Compared with other papers that employ the IALSS (2003) data file, this thesis conducts empirical analyses using the reconstructed IALSS data set with more cross-

² The detailed information regarding country of origin is contained in a separate file in StatsCan. With the help from Yvan Clermont, I was able to access to this file and merged the information of country of origin to the data file constructed for my thesis.

sectional units and a larger sample size, and its regression results are more robust. For example, compared with Coulombe and Tremblay (2009a), this thesis extends the cross-country units from 28 to 50 by recoding the value of “others” with specific country names of the variable of *country of birth*. With the increased cross-sectional units, and more control variables, such as parents’ educational background, Canadian and foreign education and work experience, the performance of the macro is greatly model improved.

Compared with the analysis of Bonikowska *et al* (2008), which does not focus on cross-country differences among immigrants, my thesis center on explaining the skill-schooling gap (a proxy of immigrants’ skill deficiency) using the economic development level of the country of origin. In earlier studies, the return to Canadian education is different from that of foreign education. In this study however, if income per capita of country of origin is under control, the estimated return of Canadian education is about the same as that for foreign education. This finding suggests that income-per capita of country of origin is a very good proxy for the quality of education.

Compared with Sweetman (2004), this thesis centers on the role of economic development in the country of origin for immigrants’ human capital development. Sweetman discusses the relationship between earnings differences among immigrants and school quality in the country of origin. I use data from Penn World Table 6.2 to proxy economic development level of country of origin whereas Sweetman uses school quality index derived by Hanushek and Kimko (2000) from scores of international tests taken in different countries. My approach may suffer from possible selection bias for immigrants while Sweetman’s approach suffers from comparability of test scores across countries.

Using the micro analysis to verify the major findings of the macro analysis is also

an innovative approach of this thesis. The purpose of the macro analysis is to find the factors that are correlated with the skill-schooling gap across countries of origin, while the micro-data based econometric analysis complements the macro analysis and illustrates the robustness of its main results. The individual-level data analyses confirm that the economic development level of the country of origin is an important factor associated with immigrants' skill proficiency in the host country, and that language proficiency and years of education are also factors playing important role in immigrants' skill development. Generally, we get consistent qualitative and quantitative findings in the micro and the macro analyses.

An important difference between the micro and the macro analyses is that the innate abilities of individuals should vary considerably across individuals of the same countries. However, the mean innate ability between populations of different countries should not vary to the same degree. In both the macro and the micro empirical studies, levels of econometric analysis, innate abilities are reflected in the error terms. Consequently, the returns to education, in term of cognitive skills acquired, should be positively correlated with the innate abilities (the error terms); this problem should be particularly serious for the micro-data based econometric analysis. In contrast, aggregating the data eliminate the idiosyncratic differences across individuals, so the return of education on skill proficiency determined in macro analysis will not be entangled with the influence from innate ability. Thus the return of education on human capital in macro analysis is believed be lower than in the micro analysis, which needs empirical evidence to be verified.

Section 1.4 Structure of the thesis

The structure of the thesis is as follows. In Chapter 2, a thorough review of the literature is provided to discuss the issues related to the measurement of human capital and the potential factors that determine the skill deficiency of Canadian international immigrants. In Chapter 3, I focus on the various data sets used in this thesis and on the data construction to extend the cross-sectional units of IALSS. The macro empirical analysis is presented in Chapter 4. The micro analysis and the comparison between macro level and micro level analyses are discussed in Chapter 5.

CHAPTER 2 LITERATURE REVIEW

Section 2.0 Prelude – The human capital production function

In economic growth and in labour economics, human capital is viewed as an input or a determinant in a production function or a Mincerian-wage equation:

$$Y = f(H, Z) \quad (2.1)$$

Here, Y denotes output (e.g. wage), H denotes human capital, and Z denotes the other inputs in the production function f . The Mincer framework in traditional labour economics is derived from this:

$$\log(y_i) = \alpha + \beta \cdot EDU_i + \gamma Z_i + \varepsilon_i \quad (2.1a)$$

and is often used to estimate the return to schooling (EDU) with individual level data (individual i) in labour economics. $\log(y_i)$ is the log of the wage of individual i ; Z_i is the vector of the other determinants of wages; and β is the (Mincerian) return to one extra year of schooling.

This thesis does not focus on analyzing the role of human capital in production functions or in Mincer equations such as in (2.1) and (2.1a). Instead, its purpose is to analyze the *human capital production process*, as set out in:

$$H = h(EDU, \bar{Z}) \quad (2.2)$$

Here, human capital (H) is the outcome (output) of an economic process or a production

¹ Most of the content in Section 2.0 and the conceptual framework with the two production functions have been suggested by Serge Coulombe.

function h , where *schooling* (EDU) is an input among others (\bar{z}) such as experience, health, the education of parents, and the quality of the schooling system. Abowd *et al* (2003) argue that some components of general human capital, like labour market experience, are observable and evolve over time, while others like education, race, and gender are similarly observable but are time-invariant. A number of other factors that contribute to the formation of human capital are harder to observe such as innate ability, educational quality, social capital, and effort. In order to address the concern of endogeneity, this model assumed that the choice of years of schooling is related only to the production of cognitive skills (Bonikowska *et al*, 2008). Consequently, education level can be treated as exogenous.

Equation (2.2) can be estimated using individual data or macro cross-country data. In this thesis, I will estimate various specifications of (2.2) using both micro- and macroeconomic data. Before proceeding to these estimations of (2.2), I review the literature that will help in our understanding why international immigrants, despite their higher levels of education, have lower levels of skill proficiency than the native-born population in Canada.

Section 2.1 Measurement of human capital

Traditionally in economics, human capital is productive and contributes to increased earnings in the labour market. Human capital is also innate to and inseparable from the person. Human capital is created by investing time and financial resources for skill acquisition by the individuals themselves or their parents, employers, or even governments.⁴ Human capital is a concept that captures the attention of economists and policy makers due to its significant impact on personal welfare and a nation's long-run economic growth.

Unlike general physical capital, human capital is an abstract concept. Human capital is multifaceted and includes a complex set of human attributes such as innate ability, plus the experience of learning and working. Thus, human capital is hard to measure with precision in a quantitative form. In practice, for empirical analyses such as in equations (2.1) and (2.2), human capital has been traditionally measured by years-of-schooling or schooling-attainment-rate.

2.1.1 Enrolment rates, years of schooling, and the Mincer approach

By the end of the 1950s, with the pioneering contributions of Mincer (1958, 1970), Schultz (1959, 1961), and Becker (1962, 1975), human capital theory had become an important field of theoretical and applied research. These authors undertook a thorough study of the concept of human capital and analyzed the main forces that

⁴ See, for example, Tilak (1989) and Chiswick and Miller (2001).

contributed to its formation and accumulation.

Mincer's aim (1958) was to analyze the determinants of the distribution of earnings across individuals. His wage equation (2.1a) fits the microeconomic data well and contributed greatly to the quantitative empirical analysis of human capital in labour economics. Today, the Mincer regression might be viewed as the workhorse of labour economics and modern cross-country growth empirics.

Following the pioneer study by Mincer (1958, 1970, 1974), human capital has been traditionally identified as the schooling variable in specification such as (2.1) and (2.1a).⁵ The number of years-of-education was the natural proxy for human capital. The vast majority of existing empirical work on earnings determination takes the quantity of schooling of individuals as a natural measure of human capital. Empirical studies investigating the factors that determine wage differences virtually always employ some readily available measure of the quantity of formal schooling to reflect human capital (for example, Mincer 1974, Friedberg 2000, and Schaafsma and Sweetman 2001). In particular, in studies that analyze the income gap between immigrants and the native-born population, differences in human capital are usually equated with differences in years-of-schooling.

In modern macroeconomic growth theory, human capital is a key determinant of differences in living standards across countries (Mankiw *et al* 1992). On empirical grounds, human capital has been measured by indicators related to education, such as various forms of schooling achievement or enrolment rate in cross-country studies.

⁵ It is worthwhile to note that on job-training and work experiences can be considered as part of human capital in Mincer model for research which is interested in specific skills and training.

School enrolment ratios are available across countries and have been used in numerous studies to proxy the stock of human capital in studies such as in Romer (1990), Barro (1991), Mankiw *et al* (1992), Levine and Renelt (1992), and Levine and Zervos (1993).⁶

However, the disadvantages of using enrolment rate to measure the stock of human capital have been discussed extensively by economists. The enrolment rate measures the flow of schooling, and the accumulation of these flows, net of depreciation, generates the future stock of human capital. Because the educational process takes years, the lag between flows and stocks is significant. If an appropriate lag structure is taken into account, it is possible to construct indicators of the human capital stock from enrolment rates. The potential for measurement error is great for numerous reasons. First, data are needed on initial stocks. Second, mortality, migration, repetition of grades, and dropping-out also exacerbate measurement errors (Barro and Lee 1993). Along this line, Hanushek and Kimko (2000) argue that enrolment ratios cannot accurately represent either the relevant stock of human capital of the labour force or the changes in the stock of human capital during periods of educational and demographic transition.

The problems with school enrolment ratios have motivated economists to define a more appropriate measure of the stock of human capital. Psacharopoulos and Ariagada (1986) compiled information about the educational attainment of the labour force. After their work, and following the Mincer tradition of labour economics, many economists constructed estimates of educational attainment to proxy the stock of human capital at the macroeconomic level (Lau *et al* 1991; Nehru *et al* 1995; Barro and Lee 1993, 1996, 2001; de la Fuente and Doménech 2002; Cohen and Soto 2007). Many theoretical models of

⁶ Earlier studies are Peasle (1965), McClelland (1966), and Marris (1982).

economic growth, such as those of Lucas (1988), Becker *et al* (1990), and Rebelo (1991), also emphasize the role of human capital in the form of educational attainment.

Nevertheless, the measure of educational attainment at the cross-country macro level as a proxy of human capital also has disadvantages. The most important issue is related to the quality of education. Using the Mincerian framework (2.1a) with microeconomic data of a Canadian or U.S. jurisdiction, schooling can be viewed as a relatively good proxy for human capital, since the quality of schooling is not likely to vary considerably across schools in a given jurisdiction. However, across countries, as all cross-country results on test scores and literacy tests have demonstrated, the quality of schooling varies considerable. It is well known that the quality of institutions differs a great deal between the underdeveloped and the developed countries. As the educational system is also an institution, its quality could vary considerably across countries at different stages of development (Jeong 2002; Coulombe and Tremblay 2006a).

Furthermore, the use of schooling data even at the microeconomic level is also questionable for studies based on long time intervals, since school quality can change substantially over time. An educational reform is likely to affect the quality of schooling. Also, people educated under wartime conditions may receive significantly different educational outcomes per year of schooling than those who were not educated in such circumstances (Hanushek and Zhang 2006). Finally, Hanushek and Zhang (2006) also note that even if one might conceive that human capital can always be growing, the number of years-of-schooling cannot expand in an unbounded manner.

In specification (2.2), enrolment rate and educational attainment can both be viewed as input-based approaches for the purpose of measuring human capital. In

addition to the disadvantages already discussed for each of the measures respectively, these input-based approaches also share other shortcomings. The development of skills is a process that starts in childhood and extends over the entire life of an individual. It is not appropriate to assume that an individual's skills will stay unchanged, at the level when he or she completed school, over the course of the individual's lifetime. Thus, though the level of schooling provides an indication of the past exposure to formal learning in an institutional framework, it is not a precise indicator of the current level of reading, writing, numeracy, or problem-solving skills in the context of daily life, especially for those who have left the formal school environment for a certain period (Corbeil 2006). Also, the assumption that formal schooling is the only source of skill development is questionable as a variety of other factors such as families or peers is also important in the formation of human capital (Hanushek and Woessmann 2008).

2.1.2 Skills: An output-based approach

Economists have always been aware of the differences in the quality of schooling across countries and have attempted to use output-based measures of skills (Bowman and Anderson 1963; Hicks 1980; Wheeler 1980). These earlier attempts used the simple literacy rate, classifying adults as "literate" or "illiterate." However, the simple adult literacy rates measure only one component of skills (reading) in a rather crude way: one knows how to read or one doesn't. There are many other skill components of human capital, such as the ability to understand, to extrapolate, to communicate with written material from several sources, to do sophisticated computations, and to use all these skills

in everyday life. The simple literacy rate approach is not appropriate when human capital is conceptualized as a continuum of proficiency, as it should be.

In search of a better proxy, economists have used various international students' literacy test scores to represent students' human capital or skills.⁷ Among these studies, various test scores have been employed in measuring human capital: High School and the National Longitudinal Survey of the High School Class of 1972, AFTT score in the National Longitudinal Survey of Youth (NLSY) data, National Education Longitudinal Study of 1988 (NELS88), and Ontario Immigrants Literacy Survey (OILS).⁸

At the cross-country level, Lee and Barro (1997) compiled test scores on the examinations in science, mathematics and reading that have been conducted in various years for up to 58 countries.⁹ They find that the correlation between these students' test scores and average years of schooling is not very high. Hanushek and Kimko (2000) constructed a cross-sectional data set of international test scores in the subjects of science and mathematics for 39 countries to measure human capital. Also, numerous other studies used similar standard tests for students to proxy human capital (Lee and Lee 1995; Barro 2001; Woessmann 2002, 2003; Gundlach *et al* 2002; Bosworth and Collins 2003; Jamison *et al* 2007).

⁷ Those tests are conducted by the International Association for the Evaluation of Educational Achievement (IEA) and the International Assessment of Educational Progress (IAEP).

⁸ These studies include: Boissiere *et al* (1985); O'Neill (1990); Bishop (1991); Rivera-Batiz (1990) and (1992); Blackburn and Neumark (1993); Charette and Meng (1994) and (1998); Grogger and Eide (1995); Murnane *et al* (1995); Neal and Johnson (1996); Gregg and Machin (1998); Mulligan (1999); Pryor and Schaffer (1999); Murnane *et al* (2001); Altonji and Pierret (2001); Finnie and Meng (2001) and (2002); McIntosh and Vignoles (2001); Hanushek (2002); Lazear (2003); Nickell (2004); and Hanushek and Zhang (2006).

Although educational test scores can indicate the quality of the students across countries and are certainly an improvement over the normally used years-of-schooling approach, the scores are not representative of the overall stock of human capital intensity in a country's overall or working-age population. For example, following a radical and recent improvement in its schooling system, a country might perform extremely well in international test scores for its 14-year-olds. However, the older population have not benefited from this reform. Measuring the cognitive skills of adults (aged 16 and over, for example) would be a better method for reflecting the stock of human capital of the working population.

There are also other disadvantages in using students' standard test scores to measure cognitive skills. As summarized by Hanushek and Woessmann (2008), the content of tests is undoubtedly narrower than either what is taught in schools or the elements that are important in the labour market including non-cognitive skills. Most of the available tests are given at certain school levels, frequently at the end of lower secondary education. They, therefore, do not directly capture the variation in higher-level education. Additionally, the issue of measurement error in these tests cannot be ignored. The tests may suffer from a variety of problems related to the sampling of knowledge in the particular domain, the reliability of the questions, and even the impact of the test-taking conditions on the scores.

The main shortcoming of using test scores performed at schools is that it might not be a good indicator of the skill of the overall population. This shortcoming is overcome when we use output-based measures of human capital, which focus on adult literacy scores for the overall population. The International Adult Literacy and Skill

Survey (IALSS) (2003) and its previous version, the International Adult Literacy Survey (IALS) (1994), provide information on both adult literacy test scores and labour market outcomes. The literacy proficiency scores from IALSS (2003) and IALS (1994) represent the cognitive skills of individuals aged 16 and over. Recent empirical studies have begun to use such test scores from IALSS (2003) or IALS (1994) to proxy the stock of human capital in micro-data and macro-data based economic empirical studies.¹⁰ Ferrer *et al* (2004) and Bonikowska *et al* (2008) suggest that IALSS (2003) literacy test scores are a direct measure of cognitive skills possessed by the respondent at the time of survey.

Compared with educational or schooling data, Coulombe *et al* (2004) found in their empirical analysis that cognitive skills are more suitable as a proxy of human capital at the cross-country level. This is not surprising since years-of-schooling data only emphasize the quantity of one input in (2.2) — schooling. Cognitive skills, an output measure in (2.2), are related to both the quantity and quality of schooling, and to other determinants of human capital. The variations in schooling quality (especially between developing and developed countries) can result in different skill levels regardless of having the same quantity of schooling in international data sets. As Hanushek and Woessmann (2008) pointed out, the use of cognitive skills to proxy human capital considers the fact that human capital differences might arise from variations in school quality or in other sources of learning. Also, formal schooling is not the only channel for the development of cognitive skills. They can also be acquired from learning in the family circle, from peers, and from work experience.

Coulombe *et al* (2004) compare the performance of various schooling databases

¹⁰ These studies include Finnie and Meng 2001; Green and Riddell 2001, 2003; Ferrer *et al* 2004; Nickell 2004; Coulombe *et al* 2004; Bonikowska *et al* 2008; and Coulombe and Tremblay 2009a.

and skill-based human capital concept (IALS 1994) in a sample of 14 OECD countries. They argue that the direct measures of human capital based on literacy scores outperform measures based on years of schooling in growth regressions of subsets of OECD countries. Contrary to the human capital concept that is based on years of schooling, the effect on economic growth of human capital which is measured on cognitive skills is significant, substantial, and relatively robust. They also conclude that human capital indicators based on average literacy scores per country perform better than comparable indicators based on the percentage of the population that achieved top scores.

Finally, it is worthwhile to note that human capital data based on existing adult literacy test data are also an imperfect measure of human capital. Literacy test scores measure general skills and do not reflect specific skills. Consequently, such tests might not be that useful for a research aiming at focussing on the role of training since literacy tests cannot distinguish general from specific skills.

In fact, the human capital concept, H , is an input in the production function (2.1) and (2.1a) and an output in (2.2). One can view the human capital of an individual, H , as being the sum of two factors:

$$H = S + \tilde{Z} \quad (2.3)$$

Here, S stands for cognitive skills, and \tilde{Z} stands for all the other factors that determine H . These other factors include such things as innate ability, physical beauty, physical strength, capacity to speak in public, speed in running, and so forth. The gravelly voice and the smile of Shania Twain, the skating ability of Sydney Crosby, and the golf swing of Tiger Woods are all examples of potential components of \tilde{Z} that cannot be fully measured in a test like IALS (1994) but that contribute to human capital. Like innate

ability, the components of \tilde{Z} are more likely to vary greatly among individuals of the same country than between the mean populations across countries. For example, physical strength and natural beauty vary a lot across Canadians. However, these two factors do not vary much between, say, the mean Canadian population and the Australian population. Consequently, at the macro level, a human capital measure based on cognitive skills might be a relatively good and unbiased measure of the human capital intensity.

2.1.3 Income approaches

Another approach that has historically been used by economists to measure human capital is the income-based approach. In the set-up of equations (2.1) and (2.1a), human capital is equated with the output that it can generate from the production function. For example, Petty (1690) estimated the human capital of England as the difference between national income and property income. Farr (1853) developed a mathematical approach to estimate the economic value of individual human beings, a measurement of human capital. Observing the salary and maintenance cost of agricultural labourers by age, and adopting a 5 percent discount rate and a given life profile, Farr estimated the average value of net human capital at £150. Following Farr's seminal contribution, Dublin and Lotka (1930) published an influential research monograph on the monetary value of a human being. According to this approach, the net value of a human being at age a is the present actuarial value of a flow of net annual expected earnings.

More recently, for example, Macklem (1997) computes aggregate human capital as the expected present value of aggregate labour income net of government expenditures, based on an estimated bivariate vector autoregressive (VAR) model for the real interest rate, and the growth rate of labour income net of government expenditures. Laroche *et al* (1999) estimate an index of human capital for Canada, with base 100 in 1976. Working with census data from 1971 to 1996, they estimate the index number based on the years of schooling and the years of working experience of the Canadian working-age population (ages between 15 and 64), weighted by an efficiency parameter defined as the proportion of wage income of workers with certain years of schooling and certain years of experience in the total wage bill of the economy. Dagum and Slottje (2000) quantify human capital in money value and national human capital is estimated on the basis of the life cycle mean earned income by age using sample survey data.

Furthermore, recent studies use wages or income differences across workers while controlling for educational levels to measure human capital (Gollop and Jorgenson 1980; Jorgenson *et al* 1987; Baker and Benjamin 1994; Mulligan and Sala-i-Martin 1995; Abowd *et al* 2003). An individual's wage is the expected market value of the employee's productivity. A worker's wage rate is the sum of the market valuation of his/her personal skills/characteristics and the specific compensation policies chosen by the employer (Abowd *et al* 2003).

However, as analyzed by Meng (1987), employers estimate an employee's potential productivity based on incomplete information. For example, due to insufficient information to understand one's foreign education and experience, employers may undervalue an immigrant's skill/productivity. Thus, incomplete information could cause

biased results when using wage as a measure of human capital.

In cross-country studies, however, the income-based approach is not very useful since the purpose of cross-country studies is to estimate the effect of human capital on income as in (2.1). Consequently, income appears as an output in the analysis and so one has to use something other than income as an input.

As discussed in section 2.1, among all the approaches, the approach based on literacy proficiency scores provided by IALSS (2003) appear to be an appropriate candidate to proxy human capital. Compared with educational data, it is more comparable across countries and, consequently, it is more suitable for cross-country studies. The approach bears also some caveats since it does not indicate any information regarding specific skills. The purpose of the thesis is to investigate the factors that have contributed to skill differences among immigrants who came from various countries. With this respect, it appears to be particularly useful to base the human capital concept on literacy test scores.

Section 2.2 Skill gaps between immigrants and the Canadian-born

The fact that immigrants have increasingly higher educational levels than the Canadian-born population has been widely documented. Akbari (1999) finds that the percentage of the inflow of immigrants with university degrees has been rising and has been higher than the percentage for the Canadian-born population since 1956. Over the period 2005–2006, 44 percent of landed immigrants had a university-level education, up from 13 percent in the early 1980s (CIC, Facts and Figures 2006). Immigrants are much more likely to have a university education than the Canadian-born. In the 2006 LFS, 53 percent of the very recent immigrants (fewer than five years in Canada) had a university degree compared with 22 percent of the Canadian-born population of the same age (between 25 and 54 years old).

Comparing the schooling data of the Canadian-born population provided by the 1994 Canadian version of the International Adult Literacy Survey (IALS) with immigrants' educational data provided by Ontario Immigrant Literacy Survey (OILS), the distribution of formal education among various diplomas is also in favour of the immigrants. Sixty-six percent of the native-born workers are without post-secondary education versus 49 percent among immigrants. According to IALSS (2003), immigrants have 13.5 years of schooling, while Canadian-born population has 12.7 years (Coulombe and Tremblay, 2006). According to the Survey of Literacy Skills Used in Daily Activities (LSUDA) database, the native-born Canadians have fewer years of education compared with subgroups of any other ethnic background, and a smaller proportion of native-born Canadians obtained an educational degree than for other ethnic groups (Finnie and Meng 2002). As immigrants have more years of schooling and higher educational levels than

their counterparts in the native-born population, it is common to jump to the conclusion that, when using schooling data to proxy human capital, immigrants have a higher level of human capital or skills than the Canadian-born population.

The above conclusion that the human capital intensity of immigrants is greater than that of the Canadian-born population raises a serious question regarding the broadly documented stylized fact concerning the inferior economic status of Canadian immigrants compared with the native-born population.¹¹ This fact implies that the rate of return to immigrants' human capital is lower than that for the native-born population in the Canadian labour market. Clearly, this raises the question of why foreign credentials are not recognized in Canadian labour markets. In 2000, for example, despite the fact that Canadian immigrants were more educated than the native-born population, their gap in mean annual earnings was about \$12,399 for males and \$8,600 for females. Furthermore, the income gap has grown since year 1980 despite the increased educational attainment of immigrants (Frenette and Morissette 2003).

In contrast, when human capital is measured by cognitive skills, it is found that immigrants hold lower skill levels than the Canadian-born population. Comparing the literacy proficiency of the Canadian-born population provided by the 1994 IALS (Canadian version) and international immigrants' literacy proficiency provided by OILS, the literacy skills distributions of immigrant groups (whether educated in Canada or not) are inferior to those of the Canadian-born population (Ferrer *et al* 2004). Statistics

¹¹ The studies that have documented the inferior economic status of immigrants include: Chiswick (1978); Borjas 1985, 1987, 1994; Baker and Benjamin (1994); Bloom *et al* (1995); Grant (1999); Rivera-Batiz (1990) and (1992); Charette and Meng (1994) and (1998); Neal and Johnson (1996); Raudenbush and Kasim (1998); Pryor and Schaffer (1999); Frieberg (2000); Finnie and Meng (2001) and (2002); and Green and Riddell (2001).

Canada's Survey of Literacy Skills in Daily Use provides similar findings that immigrants have substantially lower tested levels of literacy and numeracy skills than the native-born population. As indicated by the proficiency scores reported by IALSS (2003), the average literacy proficiency score of immigrants is about 243.2, while it is over 270 for the Canadian-born population. With the output-based approach, Canadian immigrants are found to have lower levels of human capital than the native-born population.

In addition, the Canadian-born population has higher average literacy proficiency scores for each year of schooling compared with immigrants (Coulombe and Tremblay, 2009a). In order to quantify the skills gaps between immigrants and the Canadian-born population, Coulombe and Tremblay (2009a) introduce the concept of the *skill-schooling gap*. By using the empirical relationship between years of schooling acquired by the Canadian-born population and their literacy proficiency scores, they suggest that the quantified skill deficiencies of Canadian immigrants corresponds to a gap of three years of Canadian education, on average, relative to the Canadian-born population. According to Coulombe and Tremblay (2009a), one third of this gap (one year) was the result of language deficiencies in English or French of immigrants. The rest (two years) is potentially attributed to variations in the quality of schooling. As discussed in Ferrer *et al* (2004), there is a group of immigrants who could not complete the literacy test due to their insufficient language skills in English or French. When taking a literacy test, language might become a barrier. We will come back to the language issues in the coming section.

Section 2.3 The determinants of skills

In the preceding sections, after clarifying the differences between education and cognitive skills, we found that Canadian immigrants had lower skill levels on average than the Canadian-born population.¹² Despite high levels of education, immigrants (particularly skilled principal applicants) face challenges in adjusting to the Canadian labour market because their skills, education, and work experience do not always match the demands in the Canadian labour market.

Whereas numerous studies have analyzed the vital role of human capital in determining an individual's earnings (labour economics) and a nation's long-run economic growth (growth-convergence analysis), few have focused on how cognitive skills are formed and developed. This is the focus of this thesis: *What are the determinants of the skills of Canadian international immigrants?* In this section, I investigate the factors that contribute to the formation and development of skills and review the relevant literature.

In Section 2.3.1, I highlight our conceptual framework for the development of skills. In the following subsections of 2.3, I will analyze the literature that is related to one of the potential determinants of skills formation.

2.3.1 Conceptual framework of skills development

Broadly speaking, the skills level of an individual at one point in time is

¹² It is general human capital instead of specific human capital.

determined by a host of factors that influence the rate of skill acquisition over the course of the individual's life, from birth through old age, and by innate abilities. An important insight is the fact that education and experience do not "fix" a person's skills level for life. Personal choices, accidents, social factors, sickness, leisure activities, and differences in the nature of skills can lead to skill acquisition, skill maintenance, or significant skill loss over a lifetime. The IALSS (2003) data indeed suggest that a significant skill loss in adulthood can occur at home and in the community due to various reasons (e.g. aging, physical and mental conditions, frequency of skills practicing, etc).

Before going any further in my analysis, I would like to revisit equation (2.3) to underline the fact that cognitive skills, the type of general skills that are measured by the IALSS (2003) test, do not constitute the totality of skills embodied in an individual at one point in time. More specifically, human capital H is the sum of cognitive skills S and the other factors \tilde{Z} :

$$H = S + \tilde{Z} \quad (2.3)$$

Broadly speaking, \tilde{Z} includes non-cognitive skills, innate ability, and measurement error of cognitive skills. This thesis aims to understand the formation and development of cognitive skills and will not consider the \tilde{Z} .

Skills (S) are produced according to a process such as (2.2). For the purpose of my empirical analysis, I assume that the skills of Canadian immigrants are determined by the quantity of education (EDU), by the quality of schooling that received in their country of origin (Q), by a set of family factors (F) such as language and the education of parents, by work experience (EXP), and by a set of factors (X) that are related to the individual's

learning efficiency, such as age, age of landing, years since migration, and gender. One key assumption of my analysis is that the quality of education Q in the home country might be proxied by the relative level (relative to Canada) of per capita income in the country of origin. I will also look at other potential determinants of Q such as the public expenditures on education in the country of origin. My empirical framework for macro analyses is as follows:

$$S = \alpha + \beta_0 EDU + \beta_1 Q + \beta_2 F + \beta_3 EXP + \beta_4 X + \varepsilon \quad (2.4)$$

To simplify notation at this point and to focus on the key points, I adopt in (2.4) a simple notation that abstracts from the vector/matrix nature of some variables and from potential interactions between the controls. In the following sub-sections of 2.3, I discuss and review the relevant literature on the effect of the potential controls of (2.4) on skills and income.

2.3.2 The quantity of education

In labour economics and other fields of economics, education is often viewed as synonymous with human capital. In this thesis, I intentionally focus on the differences between the two concepts as illustrated by equation (2.2). Nevertheless, education remains an important factor for the formation and development of human capital or skills. From basic skills, such as reading, writing, and basic computation, to the sophisticated skills acquired by a physician or an economist, formal education is one of the most important channels of learning. Better-educated individuals are more able to perform more complicated tasks or to adapt to changing conditions and tasks than others (Nelson

and Phelps (1966) and Welch (1970), for example).

Mincer (1970, 1974) develops an earnings function that might be viewed as a micro-production function such as in (2.1a). Becker (1975) derives the earnings function that is a function of years-of-schooling and work experience. Following Mincer and Becker's work, many studies began to discuss the important role of education in skills development.¹¹ Also, for both men and women, both the years of education and the holding of a post-secondary degree have strong positive effects on literacy skills (Finnie and Meng 2002, for example).

It is worthwhile mentioning here that an influential economic theory, the signalling hypothesis of Spence (1973), argues that, based on imperfect information theory, education might increase wages without increasing productivity. In this theory, education acts as a signalling device by conveying information to the labour market about the characteristics of workers. As mentioned by Hanushek and Woessmann (2008), if education does not improve cognitive skills, then education does not help in improving economic growth. The "screening" model (Berg 1970; Spence 1973; Wolpin 1977; Riley 1979; Layard and Psacharopoulos 1974; and Weiss 1983) implies that the social value of schooling may be considerably less than the private value if schools merely identify the more able individuals instead of actually contributing to the improvement of individuals' skills. Screening theories of education emphasize the importance of using both years-of-education and educational degrees obtained as a determinant of wages — the so-called *sheepskin effect* (Jaeger and Page 1996; Boissiere *et al* 1985).

¹¹ The studies that discuss the important role of education on skill development include: Ben-Porath (1967) and (1970); Heckman (1976); Griliches (1977); Psacharopoulos (1994); Card (1999); Glewwe (2002); Harmon *et al* (2003); Psacharopoulos and Patrinos (2004); Heckman *et al* (2006); and Cunha *et al* (2006).

Similarly, Arrow (1973) argues that higher education serves as a screening device to convey information to the purchasers of labour. He calls his model the *filter theory* of higher education. The employers know only whether or not an individual graduated from college. The colleges really serve as a double filter, first in selecting entrants, and second in passing or failing students.

As analyzed and discussed by Coulombe and Tremblay (2009b), the potential of the signalling hypothesis highlights the importance of performing macroeconomic studies at the cross-country level of the return to education. Under the pure signalling hypothesis, the effect of education on skills and wages could be great in microeconomic analysis of individuals because, in microeconomic studies, the positive effect of education may be biased since education is correlated with the innate abilities that are in the error term. In contrast, in macroeconomic empirical analysis, the effect of education on the skill levels or on growth across countries should be null under the pure signalling hypothesis. The hypothetical comparison between micro and macro analyses regarding the effect of education on skills motivates this thesis to use the same data set running both micro and macro regressions to investigate whether the individual-level effects of education is greater than the aggregate-level effects of education on skills.

2.3.3 Pre-immigration versus host-country schooling

As discussed by Sweetman (2004), there exists a commonly held assumption (either implicitly or explicitly) that a year of education, no matter where obtained (in Canada or abroad), always creates the same level of skills that are valued by the Canadian

labour market. This assumption holds even for the Canadian points system for economic immigrants.¹⁴ However, there is extensive empirical literature that tends to find that this is not the case.

It has been recognized earlier in the literature that the return to schooling of immigrants is smaller than for the native born. For example, in Chiswick (1978), an additional year of schooling raises earnings in the United States by 5.7 percent for the foreign-born population and by 7.2 percent for the native-born population. Chiswick and Miller (1985) find that education obtained abroad by the foreign-born population yields a lower return than schooling obtained overseas for the native-born population, and that this difference is even larger if education was received in a non-English-speaking country. More recently, using 1996 census data, Li (2001) finds that foreign credentials have only a minor effect on the earnings of Canadian immigrants relative to the native borns. Bratsberg and Ragan (2002) find that the returns to education are higher for those with U.S. schooling than for those having foreign education only. And finally, using the Survey of Labour and Income Dynamics (SLID), Hum and Simpson (2000) find that being educated primarily outside of Canada has little effect on the earnings of men or women for either visible minorities or others. By using census data of Israel, Friedberg (2000) finds that, for males, foreign education is valued less than education obtained domestically in a host country.

According to Ferrer *et al* (2004), foreign-educated immigrants with a university

¹⁴ Canada uses a point system to assess all skilled and professional worker applicants. To be eligible for permanent residence in Canada, one must obtain a minimum point in the point assessment. There are six factors to consider in pre-determining how many points one receives: education; languages (English and/or French); work experience; age; and arranged employment in Canada.

degree have an average literacy score approximately 60 points lower than native-educated workers holding university degrees. The skill-schooling gap of three years of formal education found by Coulombe and Tremblay (2009a) and discussed in Section 2.2 is another illustration of this phenomenon. Along that line, Corbeil (2006) finds that the quality of the school in the country of origin does not have an impact on the skills of those who immigrated at a young age and obtained their education primarily in Canada. This reinforces the idea that, in terms of skills acquired, the quality of schooling appears on average to be higher in Canada than in the country of origin for its international immigrants.

Generally, the differences between the return to education acquired in the host country and that obtained in the country of origin have been interpreted in three alternative ways. First, the pre-immigration schooling is expected to contribute less to the development of specific skills in the host country, a fact that can be explained by source-country specific knowledge acquired in the home-country school (Chiswick and Miller 2003, for example). Second, the quality of schooling is lower in poor countries (countries of origin) than in rich countries (the receiving countries) (Finnie and Meng 2002, for example). Third, there is insufficient information in the host countries regarding the value of pre-immigration education (Lee and Barro 1997).

One study's results, however, appear to contradict the general direction of the findings regarding foreign versus host-country schooling. Kossoudji (1987) allows the return to schooling to vary for schooling obtained abroad or in the United States. Her regression results indicate that there is very little difference in the return to pre- and post-migration schooling.

The general direction of the results, however, regarding the return to host-country versus origin-country schooling is for the most part clear. In the case of immigrants to developed countries, such as Canada and the United States, the economic return of the skills obtained in the host country appears to be higher than that obtained abroad.

2.3.4 Quality of education

The quality of schooling, both within a country and across countries, is a factor that is increasingly attracting the attention of economists more and more. For example, in their extensive study on the importance of measuring cognitive skills, Hanushek and Woessmann (2008) conclude that improving the quality of education may be as important for the development of poor countries, if not more important, than increasing enrolment rates. Furthermore, from an empirical point of view, accounting for the quality of schooling might be critical in cross-country studies since, according to Hanushek *et al* (2008), school quality and quantity of schooling may be positively correlated. This will lead to an upward bias on the rate of return of years-of-schooling in cross-country studies when the quality of schooling is not accounted for. We may find the same bias in econometric analyses using individual data for immigrants from a variety of countries.

Within a country, the determinants of the quality of schooling across schools have been the subject of numerous studies. For example, Card and Krueger (1992) use three measures to proxy the quality of public education in the United States: teacher-student ratios, length of the school term, and teachers' salaries. They found that the three measures exert not only a significant influence on individuals' choices concerning the

time allocated to learning but also on individuals' future wage rates. Harbison and Hanushek (1992) find that teachers' salaries have significantly positive impacts on students' math and reading performance. Doubling teachers' salaries may raise the reading test score by 0.14 standard deviations (SD) and the math scores by 0.15 SD for the developing countries.

A determinant of the quality of schooling, using immigrant data in the United States, has been isolated in Bratsberg and Terrell (2002). Using 1980 and 1990 census data from the United States, they find that, holding per capita GDP and other factors constant, immigrants from countries with lower pupil-teacher ratios and greater expenditures per pupil (which are the proxies for the quality of schooling) are rewarded with higher returns to education in the United States.

A study that is very much related to ours is the one of Bonikowska *et al* (2008). Using the same IALSS (2003) as the one used in this thesis, they investigate the determinants of individual skills. In order to examine the relationship between cognitive skills and labour market outcomes experienced by immigrants, Bonikowska *et al* (2008) first investigate the determinants of individual skills for Canadian-born and the immigrant population. They note that the lower incomes of immigrants in Canada, other things being equal, can be explained by the fact that immigrants have lower skill levels than the Canadian-born population or by discrimination against immigrants in the Canadian labour market. They first report that the immigrant population has lower skill levels than the native ones. They also find that immigrants who have completed part, or all, of their education in Canada have more skills than the ones who have completed their education prior to arriving in Canada. Furthermore, the hypothesis that the monetary returns to

skills of immigrants differ from the return to the native-born population is rejected by fact. They conclude that the discrimination hypothesis against the immigrant population in the Canadian labour market is rejected. So the wage disadvantage is explained by skills.

Disentangling the effect of separate determinants on the quality of education across countries, however, is not easy. In a survey of the issues of education and skills across underdeveloped countries, Glewwe (2002) argues that studies which typically have only one indicator of school quality, such as spending per pupil or the average educational level of teachers, cannot reach a strong conclusion regarding what makes one school better than others. Clearly, any single indicator of school quality is likely to be correlated with many other school-quality variables. Thus, a particular variable of a school's quality that improves students' learning performance is difficult to isolate at the cross-country level.

IALSS is designed to test the general skills that are comparable among countries. By design, IALSS test is independent of the influence from any country's specific culture and customs. Immigrants from countries with high quality of education are expected to have higher income than those from countries with lower quality of education by assuming that quality of education determines an individual's human capital. IALSS test scores are measuring human capital instead of quality of education, so a lower mean scores of a country of origin do not indicate by itself a low quality of education for this country. Though income per capita of a country of origin captures more information than quality of education, it can be considered as a sound proxy for the quality of education. Theoretically, if this variable is a good proxy for the quality of education, using it as a

control in a regression should tend to equalize the estimated return of foreign and Canadian educations.

Due to the above reasons, the best way to isolate the quality of education across countries with wide differences in their level of development might be to find a synthetic indicator for which we have good and comparable measures across countries. This is why, in this thesis, we choose per capita income as a proxy for the quality of schooling.

2.3.5 Accounting for the quality of schooling across countries: The economic development level

To my knowledge, Borjas (1987) is the first to use per capita income in the country of origin to explain the quality differences among immigrants. In this cited study, Borjas (1987) investigates the factors that determine the income differential between immigrants to the United States and native-born Americans. He uses census data from 1970 and 1980 that is broken down into 41 source countries. The target individuals in his research are males aged between 25 and 64 years. The paper is intended to account for the self-selection of immigrants by using the Roy model,¹⁵ in which country-specific characteristics of income distribution will determine the quality of immigrants in the United States.

In Borjas (1987) regression, most of the potentially relevant determinants of the income differential stem from the characteristics of the immigrant population itself, such

¹⁵ See A.D. Roy (1951).

as years of completed schooling, age, age-squared, health status, marital status, spouse, parents, and location. One of his key findings is that the logarithm of per capita gross national product (GNP) in the country of origin is positive and highly significant. Its inclusion in the list of controls greatly improves the explanatory power of the regression model. The richer the country of origin, the higher the wage of an immigrant in the United States is, all other things being equal. A 10 percent increase of GNP in the country of origin translates into an improvement of 1.2 percent in the immigrants' wage in the U.S. labour market. The finding that the economic development level of the country of origin is correlated with the economic outcome of immigrants in Canada has been noted in recent studies (Chiswick and Miller 2001; Ferrer *et al* 2004; Corbeil 2006).

The methodology for this thesis applies more closely to Coulombe and Tremblay (2009a), who use IALSS (2003) data to conduct a cross-sectional analysis to find the factors that are related to the skill-schooling gap among immigrants from 28 source countries.¹⁶ Following Borjas's (1987) methodology, Coulombe and Tremblay (2009a) use income per capita of 1996 from the Penn World Tables as a proxy for the quality of education in the country of origin. Their findings concur with Borjas' (1987) results, since the skill level of an immigrant, for a given number of years of schooling, is much higher in countries with high per capita income. However, due to the limitation of data (around 1,000 immigrant respondents from IALSS are coded as from "other" country), only 28 countries of origin are included in Coulombe and Tremblay's (2009a) cross-sectional regression. Their regression illustrates only the correlation between the economic condition of source countries and immigrants' cognitive skills in Canada

¹⁶ See Section 4.1.2 for a definition of the skill-schooling gap.

without controlling for the relevant characteristics of the immigrant population as Borjas (1987) does.

2.3.6 Accounting for the quality of schooling across countries: Public expenditures on education

The findings from the earlier section are that the quality of schooling, measured in terms of skills acquired, appears to be lower in poorer countries. One of the most important reasons for this is that poor countries are not able to expend resources to educate their people compared to richer countries. Consequently, a more direct approach to account for schooling quality across countries is to look at the resources spent on education. In this section, we review the studies that have attempted to link public expenditures on education to economic outcome (e.g. economic growth or wages of workers).

In almost all countries, government plays an important role in human capital accumulation by providing funds for the delivery of formal education. A large part of public expenditures are used for providing primary and secondary education, which tends to create general skills (Blankenau *et al* 2007). Tilak (1989) finds that during the period from the 1960s to the 1980s, public expenditures on education increased by about 13 times, from \$53.8 billion to \$689.6 billion (in 1989 prices), for the world as a whole. As a percentage of world's gross product, adjusting for inflation, educational expenditures increased from 3.9 percent in 1960 to 5.8 percent in 1985. Public expenditures on education increased by 13.5 times in developing countries during the 1960–1985 period compared with 9.9 times in the developed countries. Tilak also finds

that adult literacy levels increased in developing countries by 21 percent from 1960 to 1985.

A number of papers have formalized the link between government spending on education and national economic growth by building endogenous growth models where public education expenditures directly influence human capital accumulation and consequently affect a nation's long-run growth (Glomm and Ravikumar 1992, 1997, 1998; Eckstein and Zilcha 1994; Kaganovich and Zilcha 1999; Cassou and Lansing 2002; Blankeanu *et al* 2007).

There is considerable evidence at the micro level to support the link between government expenditures on education and the accumulation of human capital. For example, Bratsberg and Terrell (2002) find that immigrants from countries with greater public expenditures per pupil receive higher wages in the United States. Card and Krueger (1992) suggest a strong relationship between pupil-teacher ratios and the wages of workers. Green and Riddell (2003) argue that investment in formal schooling is necessary for producing cognitive skills. Bratsberg and Terrell (2002) affirm the positive relationship between relative education expenditures and the rate of return to education.

In contrast, although it is expected that educational expenditures influence the level of human capital through educational quality, Hanushek (1986) finds a puzzling result: that increasing public expenditures on education did not result in the improvement in the quality of education as measured by Scholastic Aptitude Test (SAT) scores. Betts (1996) finds little or even no relation between wages (index of human capital) and public expenditure on education. Blankenau (2005) finds that public expenditures on mandatory education do not directly promote the enrolment rate.

Blankenau *et al* (2007) provide an analysis to explain why the empirical findings are mixed concerning the relationship between economic growth and public educational expenditures. The government influences economic growth both by choosing the level of expenditure on education and by choosing the form of taxation to finance it. Consequently, the net growth effect of increasing the level of public educational spending depends upon the failure to control for the method of financing, which will underestimate the effects of public educational expenditures. Taxation can alter the positive growth effects from increased public expenditures on education. Using a panel data bank of 23 developed countries in the 1960–2000 period, Blankenau *et al* (2007) found that public education matters for growth only when we control for the government budget constraints. In my thesis, due to data limitation, government budget constraints cannot be controlled in investigating the effect of public-expenditure-on-education of country of origins on accumulation of immigrants' human capital.

2.3.7 Language

The skill in using the host country's language has long been recognized as a component of immigrants' human capital (Chiswick 1978; Chiswick and Miller 2001, 2003; Berman *et al* 2003; Alboim *et al* 2005; and Corbeil 2006). There are many reasons to explain why language skills are a form of human capital, especially for international immigrants. Like other forms of human capital, language skills are part of the person and cannot be separated from the person. Most importantly, language skills are productive in that they may increase earnings for some productive activities or decrease the costs of

consumption by lowering the costs of communicating with others (e.g. bargaining for a good deal). Furthermore, language skills increase the productivity of other elements of human capital. Consequently, there is some sort of complementarity between language skills and other elements of human capital. Despite a high level of education and job training (work experience), a person with no knowledge of the destination language may be little different from an unskilled one (Chiswick and Miller 2001).

Using data from the 1991 Census of Canada, Chiswick and Miller (2001) analyze the language proficiency of Canadian immigrants. They argue that the factors influencing the development of language skills are the ones correlated with the accumulation of human capital. Language skills of immigrants are determined by the factors of exposure, efficiency,¹⁷ economic incentive, and wealth. Destination language practices within a family or a community, which are related to the factors of exposure and efficiency, influence international immigrants' language proficiency. The intense use of the source country language results in less proficiency in the destination language, and thus less human capital accumulation in the destination country (Chiswick and Miller 1996, 2001). Corbeil (2006) provides findings regarding the process of acquiring literacy by the destination language minorities (destination language is the second language). Living in a minority situation is likely to lead to the erosion of literacy skills, and continuously speaking the non-destination language might have a negative impact on improving literacy skills required by the Canadian labour market.

Carliner (2000) noted that language proficiency rises with education. Better-educated individuals are far more efficient in language acquisition, which may be due to

¹⁷ Efficiency refers to the extent of improvement in destination-language skills per unit of exposure.

their better mastery of their mother tongue and their greater ability to learn new concepts and languages.

In addition, language skills interact with other factors to influence the formation and the development of human capital or cognitive skills. Language ability in French and English can be assumed as an input into the production of usable human capital attributes. Thus, greater language ability could lead to higher usable attributes of human capital at any given level of other inputs (Ferrer *et al* 2004). In other words, there exists a complementarity between language skills and any forms of human capital (Chiswick and Miller 2003). As an immigrant's destination language skills improve, the impact of schooling and pre-immigration experience in the destination labour market will be increased in determining his/her economic status. In contrast, if an immigrant cannot conduct a conversation in the host country's language, pre-immigration education and experience cannot be associated with higher social and economic outcomes. For instance, an engineer who has been well trained but cannot communicate with his/her employer or fellow employees would be counted as having zero usable engineering skills (Ferrer *et al* 2004).

For Canadian immigrants, proficiency in the destination language is a crucial factor for their successful economic and social incorporation (Borjas 1994; Mesch 2003; Chiswick and Miller 2003; Sanromá *et al* 2008). Understanding English or/and French well is important to be able to participate successfully in Canadian social and economic activities. Greater proficiency in the official languages enhances the effects on earnings of schooling and pre-immigration labour market experience. In contrast, less-proficient English and/or French language skills prevent Canadian international immigrants from

fully utilizing, and thus receiving the fair benefits of, their skills (Alboim *et al* 2005). Where an immigrant cannot conduct a conversation in an official language, pre-immigration experience, such as educational attainment, is not associated with higher earnings (Chiswick and Miller 2003).

Also, the substantial effect of host-country language acquisition on immigrant earnings has been documented. Berman *et al* (2003), examining how language acquisition affects the earnings of Russian immigrants to Israel, find that language complements high-skill occupations. Factors related to language skills account for two thirds or three quarters of the differences in earnings growth between immigrants and native-born workers. Many previous studies agree that immigrants experience faster wage growth than the native-born workers. One explanation for this is that, over time, immigrants learn the host-country language and become more productive in the labour market. Fluency in the host-country language can account for a significant portion of that wage convergence and an accurate measure of the effect of language acquisition on wages is important. If growing fluency accounts for a significant portion of wage convergence, receiving countries can hasten that convergence by supporting effective language programs. However, most studies use self-reported language variables, which tend to exacerbate measurement error.

Abbott and Beach (1987) discuss the fact that language can essentially serve two roles in an earnings equation. Current fluency in a language that is frequently used in the labour market affects the range of tasks a worker can perform and how well he/she can perform. It is thus a skill that affects his/her labour market productivity and remuneration. As such, one would expect greater language skills (such as ability to function fluently in

both English and French in Canada) to be rewarded with higher earnings. But language, particularly the mother tongue, can also serve as the basis for ethnic labelling and potential labour market discrimination. To this extent, a mother tongue variable may receive a negative return if the mother tongue is different from the destination language.

Berman *et al* (2003) argue that knowledge of the native language may facilitate the job search. They investigate the role of language acquisition in wage assimilation within jobs. They study immigrants from the former Soviet Union to Israel according to the type of occupations they have in Israel. They find that fluency in Hebrew had almost no effect on wage growth in the low-skill occupations. Moreover, these occupations show no evidence of wage convergence. In contrast, computer technicians and software engineers show evidence of considerable wage convergence, much of which can be accounted for by increasing Hebrew fluency among workers in these occupations. They interpret their findings as strong evidence for the effect of language on earnings, as it is free of bias due to time-invariant heterogeneity in ability. Their results indicate that language complements occupational skills.

In general, the IALSS (2003) literacy test scores reflect a combination of cognitive skills and language (reading) skills. Thus, one's inability to answer IALSS test questions does not mean that the surveyed respondents have zero level of cognitive skills. Instead, it may indicate a lack of reading fluency on English or French (Ferrer *et al* 2004). However, due to the existing complementarity, it is impossible to untangle language skills from cognitive skills. The association between improvement in literacy scores and time spent in Canada reflects the fact that the increasing language skills will then improve the proficiency of immigrants' cognitive skills (Ferrer *et al* 2004).

2.3.8 Work experience and portability of human capital

Work experience is usually perceived as contributing to human capital and is generally found to have a significant effect on wages (for example, Friedberg 2000). However, the returns to work experience in the country of origin is far less clear-cut in the host country.

Ferrer *et al* (2004) find very low returns to foreign experience for Canadian immigrants. Schaafsma and Sweetman (2001) find that foreign work experience has little impact on immigrants' earnings in Canada. Alboim *et al* (2005) find that one year of host-country work experience generated the same return in Canada as two-and-a-half years of foreign experience. Kossoudji (1989) finds a significant relationship between U.S. work experience and earnings. She finds no significant gains associated with experience received in the country of origin, which indicates that, while general training and labour market experience are important, it must be U.S. specific for it to be profitable. Friedberg (2000) concludes that labour market experience acquired abroad is significantly less valued than human capital obtained domestically in Israel.

Nevertheless, Duleep and Regets (2002) argue that many skills acquired in the country of origin are useful to the acquisition of host-country skills, even though they are not immediately valued in the host country. Learning skills — the set of abilities and experiences that aid in learning new knowledge and skills — would transfer more readily to the host country than the skills more specifically related to the business and production practices in the origin and destination countries. Previously learned work and study habits may greatly facilitate the learning of destination-country skills.

Substantial declines in returns to foreign experience play an important role in the

decreases in entry earnings across immigrant cohorts that have been discussed in the literature. The declining return to foreign experience is strongly related to shifts in the source country's composition of immigrants. For immigrants landing between 1980 and 1982 (the 1980–1982 cohort), there exist substantial returns to foreign experience. In contrast, for the 1990–1992 cohort, there is no evidence showing that foreign experience can earn any return (Green and Worswick 2010).

There is a commonly-held idea in the literature on immigrant earnings that education and experience obtained in most of the source countries will not be as productive in Canada as Canadian education and experience due to the problems of credentials recognition and the mismatches in technological requirements. The work experience acquired in the source country is often viewed as specific to that particular source country, i.e., adapted to the cultural, social, institutional, economic, technological or organizational environment that is often different from that of the destination country (Sanromá *et al* 2008). As a result, human capital imported by immigrants is comparatively less productive and less well paid than that held by the native-born population. Only a limited part of the human capital acquired in the source countries is portable for immigrants to the host country.

Portability of human capital denotes human capital that immigrants acquired in their countries of origin and that can be transferred into earning potential in the destination country. The portability of human capital acquired in the country of origin varies depending on the type of country an immigrant comes from. Thus, the greater the differences in terms of language and culture and the greater the difference in the degree of economic development level, the less portable human capital acquired abroad becomes

(Shields and Price 1999; Friedberg 2000). The closer the origin and destination countries are in terms of their economic development level, industrial and occupational structures, institutional settings, and so forth, the more likely it is that the education and work experience received in the country of origin will be fairly valued in the destination labour market.

Human capital is certainly not completely portable between countries, especially from countries at very different levels of development. However, the fact that capital is not perfectly portable cannot by itself explain the differences in scores in tests that are designed to measure cognitive skills across very different cultures, such as IALSS (2003).

2.3.9 Age, age of landing, and years since migration

In this section and the next two sections, we review briefly the literature on three subjects that are important for the determination of skills of immigrants and that are intrinsically related: age, and two aspects of age: age-of-landing, and years-since-migration.

Since 1967, Canada has employed a points system to determine the eligibility of applicants to immigrate; one of the variables for which points are awarded is *age*. The points system is based on the assumption that older immigrants may be less able to adjust to the linguistic and cultural challenges associated with entering a new country, and that this may make it difficult for them to generate earnings commensurate with their formal educational and occupational skills.

Literacy skills can be acquired, developed, maintained, or even lost during a

lifetime; thus, the relationship between proficiency level and age is complex (OECD 2005). At a young age (for instance, ages between 6 and 22), an individual acquires knowledge efficiently, and the resulting cognitive skills can be improved over years as a result of accumulating various reading and writing-related experiences. However, as time passes, the level of some cognitive performance tends to diminish along with a decreasing ability to concentrate, memorize, reason, and quickly process information. The IALSS (2003) data clearly indicate that the average score of immigrants declines along with age. Also, there is greater variability of performance among the elderly, a situation that generally results from the accumulation of various types of experience over the course of a lifetime (Corbeil 2006).

2.3.9.1 Age of landing

The age-at-migration is a potentially important factor that determines host-country language proficiency, which, as we have seen earlier, is an important component of cognitive skills (Veltman 1983). As discussed in Section 2.3.5, Chiswick and Miller (2001) build up a reduced-form language proficiency equation and propose that the factors influencing the development of language proficiency are exposure, efficiency, economic incentive, and wealth. Efficiency refers to the extent of improvement in destination-language skills per unit of exposure.

One of the most important variables influencing efficiency, while also affecting human capital, is the age of landing. Immigrants who landed before graduating from school are likely to gain more skills in the host country. So it is important to distinguish adult and child migrants. Those who arrive at an older age experience low returns to both foreign labour market experience and foreign education. Age-of-landing matters because

young people accumulate language skills more easily than older persons. Younger people have a far greater capacity for learning a new language than older individuals (Jasso and Rosenzweig 1990). This could account for the findings of Kossoudji (1989) that visible-minority immigrants who landed before their teen years do not have an earnings deficit relative to observationally equivalent native-born with U.S. data.

Also, migrating at an older age means a greater exposure, and perhaps attachment, to the language and culture of the immigrant's home country (McManus *et al* 1983). The deep attachment to the origin language and culture makes it harder for immigrants, whose source countries differ significantly in language and culture from the host country, to transform their country-of-origin skills to destination skills. In addition, the ability to memorize, adapt, and quickly process information is lower for aging immigrants than for the young ones.

The correlation between the year-of-immigration and the age-at-migration has been discussed by Schaafsma and Sweetman (2001). They claim that distinguishing the effect of age-at-immigration from cohort effects in cohort studies is important because the normal procedure for constructing a sample for analysis from cross-sectional data induces a correlation between the year-of- immigration (arrival cohort) and age-at-immigration. Kossoudji (1987) argues that it is the age of migration (school age or working age) that matters for economic assimilation, not how long an individual has been in the host country.

2.3.9.2 Years since migration

Assimilation is the process whereby immigrants become similar to the native-born

population in the dimensions of social, cultural, skills and economic outcomes (Grant 1999). Time spent in the host country affects skill transferral and the acquisition of credentials, improvements specifically in language ability, general training, and knowledge of the labour market. Once other skills are accounted for, time in the host-country labour market represents both an accumulation of general training and knowledge and a decrease in employers' assessments of immigrants as risky workers (Kossoudji 1989).

A variable such as years-since-migration is potentially an important determinant of the skills development of immigrants in a host country. Many empirical studies suggest that, after residing in the host country for years, the earnings of immigrants reached the level of the native-born population (Chiswick 1978; Borjas 1994; Becker 1993; Alboim *et al* 2005; etc). Borjas (1994) argues that immigrants' wages rise relative to those of the native-born population as the time spent by the immigrants in the receiving country increases. Immigrants' relative wages rise as they master the language of the receiving country. Knowledge of the host-country language is correlated with higher wages and with years since migration as well. Carliner (2000) finds that each additional year of U.S. residence increases the probability of English fluency (an indicator of destination skills) by 1.1 percentage points for immigrants from non-English speaking countries.

2.3.10 Family

Human capital is not accumulated just in school (education) or in the workplace (experience). According to Hanushek (2002), skills are also accumulated through interactions with the family, peers, and the neighbourhood. Becker (1993) has already suggested the three factors that are the most important determinants of human capital are education and training, family, and the economic development level. Thus, discussion regarding human capital should not omit the influence of the family network on children's knowledge, skills, and habits. Differences among children in regards to the investment in human capital provided by their families are frequently multiplied over time into large differences when they are teenagers (Becker 1993).

According to Hanushek *et al* (2008), any empirical approach that ignores family background and individual ability differences, which themselves influence individual knowledge and skills, yields biased estimates of school quality effects. Ashenfelter and Zimmerman (1997) find that including parental education as a control variable in a regression equation lowers the measured return to education by 5 to 10 percent, which indicates the importance of parental effects.

Parental education plays some role in determining an immigrant's literacy skills. The strength of family background as a determinant of schooling output has been recognized broadly (Coleman 1966; Abbott and Beach 1987). Children of skilled parents are likely to have above-average skills (Borjas 1985). Children's schooling outcomes are highly correlated with the characteristics of their parents, and in particular with parents' education (Card 1999). Glewwe (2002) argues that a child's learning efficiency represents several different factors, such as parental motivation and capacity to help

children with their school work. Hanushek (1986) argues that family background is clearly very important in explaining differences in children achievement levels. No matter how it is measured, wealthier and more educated parents have children who perform better on average. For a variety of sub-samples, each additional year of schooling of either parent raises children's completed education by about 0.2 (Card 1999). Roughly 30 percent of the observed variation in education among U.S. adults is explained by parental education.

On the other hand, the significant negative impacts of disadvantaged family factors on the labour market outcomes of children (Gregg and Machin 1998) provide other evidence of the important role family plays in determining children's skills and future labour market outcomes. Disadvantaged families are defined as parents who left school at age 15 or younger or who are lone-parent families. Since the development of literacy is a process that begins in childhood and continues throughout an individual's life, less-literate parents are also much more likely to have difficulty in transmitting reading, writing, numeracy, and problem-solving skills to their children (Corbeil 2006).

Section 2.4 International comparison

2.4.1 Background of immigration policy

Australia, United States, and Canada have, to some extent, similar rationales for the selection of immigrants. All of them aim at improving their economic performance by encouraging the inflow of skilled immigrants and, at the same time, they also support a moderate level of family reunion. But they have different administrative methods; for example, in Canada, federal and provincial governments share the responsibility for immigration, while immigration to Australia is a federal responsibility. Due to the application of different approaches in admitting skilled immigrants, human capital intensity of immigrants in the three countries may differ. The purpose of the international comparison in this section is to provide background information for drawing policy implication following empirical analyses.

The Canadian 1962 *Immigration Act* emphasizes the admission of skilled immigrants and the reunion of families. In the spirit of the 1962 *Immigration Act*, the “point system” was established in 1967, whereby applicants for immigration were assessed based on their potential contribution to the Canadian economy instead of considering their country of origin (Akbari 1999). Canada’s legislation distinguishes permanent migration from temporary flows. The permanent program has three main categories of admission: economic (including the skilled worker program and business migration),¹⁸ family class (for spouses, children, parents, and grandparents of Canadian permanent residents or citizens), and humanitarian. According to CIC administrative

¹⁸ In the 1980s, a new category of “business class” immigrants was added to the independent class. That is, anyone who wants to bring significant entrepreneurial or business funds to Canada could immigrate here.

records, about 55 percent of landed immigrants in 2006 can be allotted to the economic class (CIC, Facts and Figures 2006).

To be eligible as a permanent resident in Canada, one must obtain a minimum score in the point system. The system is determined according to the following six factors: education (points are awarded over a wide range: 5 points for completion of secondary education and 25 points if the applicant has completed a master's or doctoral degree); ability in English and/or French (points are awarded according to the approved language tests or written documentation); work experience; age (points for ages between 21 and 49); arranged employment in Canada; and adaptability. An applicant can compensate for doing poorly in one element by performing well in another.¹⁹

U.S. policy provides permanent (family class, workers in occupations, refugees, and people from a diverse set of countries) or temporary paths for the admission of immigrants. Permanent residents are eligible to work in the United States; in 2004, the United States granted permanent admission to about 946,000 people. The *Immigration Act* of 1990 added a category of admission based on diversity and increased the worldwide immigration ceiling to the current "flexible" cap of 675,000 persons per year. U.S. immigration policy has sought to bring in workers with certain job skills using employment-based preference admissions. For most immigrants to be admitted under the employment-based preference program, an employer must first submit a labour certification request to the Department of Labour. The department must then certify that

¹⁹ After achieving a pass mark against the selection factors above, applicants for skilled migration must then meet two additional requirements. First, they must meet the minimum work experience requirements according to the Canadian National Occupation Classification Matrix. Second, they must prove that they have the funds to support their family for six months after arrival.

there are not enough U.S. workers available locally to perform the intended work or that the employment of the immigrant worker will not adversely affect wages and working conditions in the United States (CBO paper, 2006).

Australia has a points system, similar to Canada's, for admission of immigrants in the skilled stream/economic class. However, Australia has a more stringent set of requirements for admission of immigrants. Points are awarded for specified attributes: skill, age, English language ability, specific work experience, an occupation in demand, a job offer, etc. Migrants are accepted only if they can acquire the minimum number of points. In addition to obtaining the required number of points, the primary applicant must have be able to satisfy all of the following requirements: post-secondary education; vocational English for working in Australia and a higher level of English for certain occupations where English ability forms part of the skills assessment; age younger than 45 years; certain years of work experience; and skills assessed by the relevant Australian assessing authority.

2.4.2 Skills of immigrants

According to the 2006 Census, the foreign-born accounted for 19.8 percent of Canada's total population, which is a higher proportion than in the United States (12.5 percent) but lower than in Australia (22.2 percent). Canada's annual immigration flow is proportionally one of the highest among developed countries at roughly 0.7 percent of the population, a share that persisted through the 1990s and into this decade.

The analysis in Section 2.4.1 clearly implies that the traditional immigration

countries emphasize the importance of skills held by immigrants when they land. But the assessment of human capital is based on educational or work experience data, which cannot accurately represent the real skill level of immigrants, as emphasized in this thesis. Thus, the real human capital level of immigrants needs further investigation.

It has been documented in empirical studies that immigrants in host countries — Canada, United States, or Australia — have lower economic outcomes than the counterpart native-born populations if everything else is identical (Chiswick 1978; Borjas 1985, 1987; Baker and Benjamin 1994; Grant 1999; and Green and Worswick 2010). However, recent immigrants to Australia appear to have performed well in the labour market compared with their Canadian counterparts, and better than those in other OECD countries. The points test applied in Australia for skilled migrants appears to provide an important part of the explanation for the superior employment outcomes of migrants to Australia.

The educational attainment of immigrants has been rising in Canada and falling in the United States. Borjas (1991) showed that the average Canadian immigrant has about one more year of education than the average immigrant to the United States. Most countries actively seek to attract skilled immigrants with high credentials. However, education credentials do not necessarily translate into functional-level skill proficiency in the official languages of the host country. According to IALSS (2003), immigrants in Canada and the United States have significantly lower average skills than their native-born counterparts.

CHAPTER 3 DATA

Section 3.1 Data sets

As discussed in Chapter 2, direct measurement of human capital, proxied by IALSS (2003) test scores, is more appropriate for cross-sectional studies than other measures. This thesis uses both individual- and aggregate-level data from the Master file of the 2003 Canadian version of the International Adult Literacy Skill Survey (IALSS) to examine the factors that are associated with formation and development of immigrants' human capital and to investigate the reasons for the skills gap between immigrants and the Canadian-born population. We also provides a straightforward comparison of our main variables of interests (income per capita of country of origin, years of education, language proficiency in English and French) between individual- and aggregated-level data.

3.1.1 The International Adult Literacy and Skill Survey (IALSS)

The IALSS was initially conducted for seven countries in 2003; its major goal was to shed light on the twin processes of skill gain and skill loss in adult populations. The IALSS interviewed and tested Canadians, in 2003, to find out how well Canadian adults used printed information to function in Canadian society. The psychometric test was applied to measure skills in four domains: *prose, document, numeracy, and problem-solving*. The IALSS test scores provide a measure of cognitive skills held by immigrants from various countries of origin and measured in Canada. The IALSS received responses

from more than 23,000 Canadian residents, among which 4,077 are immigrants. All the respondents were aged 16 and over. The following groups were excluded from the sample selection of IALSS: long-term institutional residents, members of the armed forces, and individuals living on Indian reserves.

Proficiency is conceptualized along a continuum to denote how well Canadian adults use information to function in the society and the economy. No arbitrary standard exists to distinguish adults who have or do not have skills. For each skill domain (prose, document, numeracy, and problem-solving), individual proficiency is denoted by a score on a scale ranging from 0 to 500 points. Thus each respondent is marked on each of the four domains and is awarded four test scores. Each of the test scores denotes a level at which a respondent has an 80 percent chance of successfully completing tasks that are associated with a similar level of difficulty, and thus provides a direct quantitative measurement of skills possessed by an individual. Furthermore, the skill proficiency data provided by IALSS (2003) is comparable across countries.²⁰

Besides literacy test scores, the IALSS (2003) data include rich background information on the respondents. The background and demographic information is obtained by asking the respondents a series of questions on country of birth, educational attainment, literacy practices at home and at work, labour market attachment, technologies used for communications, job-related training, and literacy self-assessment. The design of the background questionnaire is such that information about skills and their outcomes can be matched.

²⁰ For the prose, document, and numeracy domains, five broad levels of difficulty are defined, and each level corresponds to a range of scores. For the problem solving domain, four broad levels of difficulties are defined.

As explained in section 1.3, a significant contribution of this thesis is the recoding the answers for the question of *country of birth* with specific country names for those which were coded as “other” in the original Master file of IALSS. The number of countries of origin increased from 28 in the original IALSS file to nearly 150 in the data file constructed for this thesis.

Apart from providing direct measurement of human capital, another advantage of IALSS is that it includes information on self-reported total years of work experience. The self-reported work experience is a better proxy of experience than the commonly used Mincer approach that derives work experience from age and educational data. Compared with self-reported information, derived variables (e.g. Mincer approach) may introduce more measurement errors, especially in cross-country analysis, as the school entry-age is not identical across countries and/or over time.²¹ Also, as discussed in Section 2.2.3, immigrants will not homogeneously look for and obtain a job immediately in a homogenous function after their landing. The lag between the time of landing and the time at which a job is found varies significantly across immigrants.

One more advantage of the IALSS is that, by design, it collects extensive information on respondents’ family background. For example, it contains rich details concerning parents’ education, occupation, income, and country of origin. The IALSS also provides different dimensions to understand the language background of immigrants. For example, it includes information on whether their mother tongue is English and/or French, whether they speak English and/or French at home, and even whether they speak other languages at work.

²¹ Refer to Section 2.3.7 for more discussion of the shortcomings of the Mincer approach in measuring work experience.

While the IALSS has several substantial advantages, it also has deficiencies. The fact that it provides a single cross-sectional data set makes it impossible to use standard panel data techniques to separate time-in-the-host-country effects from cohort effects. Thus the years-in-Canada estimates potentially represent a combination of the cohort effects and assimilation effects.

In addition, personal income information for immigrants in IALSS, such as monthly employment income, is not reliable. First, it is found that 25% of immigrant respondents did not provide answers to the question of *d42, approximately how much were you paid per month at this job?* Second, as the IALSS provides great flexibility for respondents to report income, different income calculation bases (e.g. hourly, daily, weekly, monthly, or annually) across individuals exist. The inconsistency of calculation base may cause significant measurement error.

3.1.2 Other data sets

This thesis combines information from other data sets, in addition to IALSS, to find factors related to the formation and development of cognitive skills. The criteria employed to match the various data sets is the country of origin.

The Penn World Table 6.2 provides national income accounts converted to international prices for 188 countries for some or all of the years between 1950 and 2004. This thesis uses the Penn World Table 6.2 to obtain income per capita information of the source countries.

The United Nations Educational, Scientific and Cultural Organization (UNESCO)

conducts annual educational surveys to produce quality education data across international communities. It provides data on public expenditures as a percentage of GDP, and public expenditures per pupil as a percentage of GDP per capita.

The Longitudinal Administrative Databank (LAD) is a longitudinal sample of tax filers for the years 1982 to 2006. It is linked with migration data, Longitudinal Immigration Database (IMDB). Therefore, the data of country of origin are available. The *employment income* information from LAD are grouped by country of origin (provided by IMDB) and restricted with immigrants from the ten provinces in 2003 and aged at 16-65. The aggregated employment income data from LAD are merged with IALSS by country of origin. Compared with census data, LAD data has the following advantages: it contains income information for year 2003 which is the year where IALSS test was performed; and employment income is calculated according to tax files instead of self-reported data, which may contain more measurement error or missing values.

Section 3.2 Sample selection

As the objective of this thesis is to investigate the determinant factors associated with Canadian immigrants' skill proficiency, its basic sample selection criteria are: born out side of Canada (immigrants), aged between 16 and 65 years, and resident in the ten provinces. As a result, the sample size of the immigrants is 3,405. The Canadian-born population aged between 16 and 65 who resided in the 10 provinces in 2003 is the comparison group for calculating the skill deficiency of Canadian immigrants.

In the process of defining more explanatory variables from the IALSS or by merging IALSS with other data sets (Penn world table 6.2, LAD, and UNESCO data), further observations are dropped due to missing data. The merge of *income per capita of country of origin* from Penn world table 6.2 into IALSS by country of birth decreases the sample size to 3,088. To get the work experience information from IALSS reduced the sample size 3,028. The sample size was further reduced to 3,014 to obtain Canadian educational information from IALSS. Finally, merging data on *public expenditure on education as percentage of GDP of country of origin* from UNESCO to IALSS by country of origin decreases the sample size to 2,841.

It is understood that the dropping of observations may cause a problem of sample-selection bias. In general, sample selection bias refers to problems where the dependent variable is observed only for a restricted, nonrandom sample. In this thesis, the sample selection bias problem is suspected since an immigrant's skill proficiency is observed only if this individual has immigrated to Canada. Heckman selection correction model has been applied to diagnose this issue. The Heckman correction, a ML (maximum likelihood) approach, offers a means of correcting for non-randomly selected samples.

However, the results suggest that there is no sample selection issue in this data set structured for my thesis.

This thesis employs both macro and micro approaches in investigating the factors associated with the formation and development of skills, where the macro analysis uses averaged by country data and the micro analyses use individual level data. Different methods are applied by macro and micro analyses in selecting samples and defining variables.

3.2.1 Sample selection for the macro analysis

The analysis based on macro-level data requires the sampled individuals to be grouped by countries of origin. However, in the released Master data file of the IALSS, one third of the answers on question A1.D (*In what country were you born?*) are coded as “other”. The IALSS lists only 28 countries of origin (see Table 3.1) in its questionnaire, while defining all the other source countries as “other.” Nevertheless, the IALSS provides the option for respondents to specify the specific country of birth for the interviewers to record.

The number of cross-sectional units would associate with the statistical power of a cross-sectional analysis: more cross-sectional units are positively correlated with statistical power. Thus, the 28 cross-sectional units provided by the original IALSS data file may not help to yield greater precision in a cross-sectional estimation. Expanding the number of cross-sectional units by filling in the missing data concerning country of origin is very meaningful to help in reaching greater precise regression results. I therefore restructured the data set, which remains one of the major contributions of this thesis.

China	Philippines
El Salvador	Poland
France	Portugal
Germany	Romania
Guyana	Russia
Hong Kong (HK)	South Korea
India	Sri Lanka
Iran	Taiwan
Italy	Ukraine
Jamaica	United Kingdom (UK)
Lebanon	United States (US)
Mexico	Union of Soviet Socialist Republics (USSR)
Netherlands	Vietnam
Pakistan	Yugoslavia

Source: IALSS (2003)

Note: USSR no longer exists.

A separate draft questionnaire file containing the original answer records regarding the country of origin is kept in Statistics Canada and was utilized for this study. Most of the individuals whose counties of birth were grouped as “other” in the released IALSS file actually specified their countries of origin in answering the question A1.D (*In what country were you born?*) when they were interviewed. Combining the information from the separate file, the values of the variable — country of origin — are re-coded for the sampled individuals. Consequently, the number of source countries reached 150, which increased the number of the cross-sectional units significantly from the original 28 (see table 3.2).

Although it would be desirable to conduct cross-sectional research with all

150 units, the very limited sample size from some source countries²² forced me to aggregate countries of origin containing fewer than 30 respondents into country-groups according to the following criteria: geographical locations, economic development level, social institutional structure, or a mixture of any of the mentioned three factors (see Table 3.2 and Appendix I for details).

During the process of grouping countries, I tried to keep as many cross-sectional units as possible by defining each individual source country containing over 30 respondents as an independent cross-sectional unit, not grouping it with other countries. It is worthwhile to mention that some small countries such as Haiti, Jamaica, Morocco, Trinidad and Tobago, Vietnam, and South Korea have more than 30 respondents and are kept as individual cross-sectional units.²³ Also, each of the major source countries of immigrants, such as China, India, United Kingdom, France, United States, and the USSR, has more than 100 respondents, respectively, and could be defined as an individual cross-sectional unit. On the other hand, as there are only a few respondents from North Korea, Monaco, Macau, Cyprus, Mauritius, and Spain, and the skill proficiency performance of the respondents from these countries was significantly different from their neighbour countries, these countries are eliminated from the macro analysis.

²² Some source countries only have one or two respondents, such as Iceland, Luxemburg, and Bermuda.

²³ Other countries with a sample size just over 30 include Japan, Ireland, Israel, and Iraq. In any case, grouping these countries with neighbouring countries may not be appropriate given the heterogeneity in economic conditions.

Table 3.2 List of source countries and country-groups

<u>Geographical locations</u>		
Central-America ¹	Costa Rica, Nicaragua, Panama, Guatemala	
Other-Caribbean	Bermuda, Barbados, Dominican, Cuba, Grenada, West Indies, St. Kitts and Nevis, St. Lucia	
North Europe	Denmark, Finland, Greenland, Norway, Sweden and Iceland	
Austria and Switzerland	Austria, Switzerland	
Belgium and Luxemburg	Belgium and Luxemburg	
Algeria and Tunisia	Algeria and Tunisia	
<u>Geographic location and language issue</u>		
Africa-English Group ²	Ethiopia, Ghana, Kenya, Nigeria, Sudan, Tanzania, Uganda Zambia	
Africa-French Group	Congo, Cameroon, Gabon, Guinea, Madagascar, Rwanda, Senegal, Togo, Burundi	
<u>Geographic location and economic development level</u>		
Australia and New Zealand ¹	Australia and New Zealand	
Other Oceania	Cook Islands, Fiji, Papua, New Guinea, Samoa	
South East Asia	Cambodia, Laos, Indonesia	
South East Asia-developed	Malaysia, Singapore, Thailand	
Jordan, Syria, Turkey ⁴	Jordan, Syria, Turkey	
Saudi Arabia, United Arabia ⁵	Saudi Arabia, United Arabia, Emirates, Kuwait Emirates, Kuwait	
Argentina, Brazil, and Uruguay	Argentina, Brazil, Uruguay	
Bolivia, Chile, Peru, and Paraguay	Bolivia, Chile, Peru, Paraguay	
Other South America	Columbia, Ecuador, Venezuela	
<u>Geography and social structures</u>		
East Europe	Hungary, Bulgaria, Czech, Albania	
<u>Individual countries</u>		
Bangladesh	<i>China</i>	Egypt
<i>El Salvador</i>	<i>France</i>	<i>Germany</i> ⁶
Greece	<i>Guyana</i>	Haiti
<i>Hong Kong</i>	<i>India</i>	<i>Iran</i>
Ireland	<i>Italy</i>	<i>Jamaica</i>
Japan	<i>Lebanon</i>	<i>Mexico</i>
<i>Morocco</i>	<i>Netherland</i>	<i>Pakistan</i>
<i>Philippines</i>	<i>Poland</i>	<i>Portugal</i>
<i>Romania</i>	<i>Russia</i>	South Africa
<i>South Korea</i>	<i>Sri Lanka</i>	<i>Taiwan</i>
Trinidad and Tobago	<i>United Kingdom</i>	<i>United States</i>
<i>Union of Soviet Socialist Republics</i>	<i>Ukraine</i>	<i>Vietnam</i>
<i>Yugoslavia</i>		

Note

- 1 It has been eliminated from the following regressions since the sample size is too small. In addition, per capita income data cannot be found for the members in this group
- 2 The major foreign language in Ethiopia is English, English is a minority language in Sudan
- 3 It has been excluded from the following regressions since the sample size is too small. The skill performance is extremely high
- 4 Afghanistan and Pakistan are excluded from this group due to the unavailability of per capita income data
- 5 It was eliminated from the subsequent regressions since per capita income data are not available
- 6 The countries in *italic* are the ones that are defined in the original IALSS file

As a result, 55 source countries/country-groups, each of which contains at least 30 respondents, remained in the research sample. However, the number of source countries/country-groups is reduced further to 50 after merging the GDP information from the Penn World Table 6.2, as some source countries have missing GDP data in the Penn World tables. Furthermore, when the variable of public expenditure on education is merged, the number of source countries/country-groups is reduced further to 41 due to the issue of missing data. The sample omissions could bias the regression results due to sample-selection issue, which has been discussed in section 3.2.

3.2.2 Sample selection for micro analysis

The concept of source country-group is not applied in the micro level analysis. The country of origin for any immigrant respondent is used to find the corresponding data on income per capita and public expenditures on education from other data sources for this particular immigrant. If the information regarding the above two variables (income per capita and public expenditures on education) is missing from the Penn World Table 6.2 and UNESCO, immigrants from that particular country of origin are dropped. The sample omissions could bias the regression results due to sample-selection issue, which has been discussed in section 3.2.

This thesis also uses the exact same countries of origin in the micro analysis to see if the results are consistent to those of the macro analyses.

CHAPTER 4 MACRO EVIDENCE BY COUNTRY OF ORIGIN

Section 4.1 Methodology and variables

An empirical model to investigate the factors that are associated with Canadian immigrants' skill deficiency relative to the Canadian-born population is estimated in this chapter. The empirical model and variables are presented in this section, while the results are discussed in Section 4.2.

4.1.1 Empirical model

Following the analysis in Chapter 2, human capital is the result of investment in skills and other factors according to a process that can be represented as follows:

$$h_{i,t} = F(g_{i,t}, f_i, e_{i,t}, x_{i,t}) \quad (4.1)$$

where $h_{i,t}$ is the human capital of individual i at time t ; $g_{i,t}$ are the socio-economic factors in the country of origin, including government investment in the formation of human capital, f_i are the time-invariant family background factors, which proxy the parents' investment in their children, $e_{i,t}$ is the personal investment in human capital, and $x_{i,t}$ represents other factors. Equation (4.1) can be seen as the human capital formation process that underlies the regression models estimated below.

Aggregating the individuals by country/country-groups of origin, the corresponding cross-sectional OLS regression equation regarding the skill-schooling gap (GAP) (see Section 4.1.2 for definition) is specified as follows:

$$GAP = \alpha + \beta_1 GDP + \beta_2 Fam + \beta_3 EXP + \beta_4 X + \varepsilon \quad (4.2)$$

where *GDP* includes both the income per capita of the country of origin and the public expenditures on education in the country of origin, *Fam* includes parents' educational background, and language spoken at home, *EXP* includes the factors of work experience, and years-since-migration, and the *X* includes variables such as age, and age-of-landing.

In addition to investigating the factors related to the skill-schooling gap, the macro analysis investigates the factors related to immigrants' skill proficiency in a separate regression equation:

$$SKILL = \alpha + \beta_1GDP + \beta_2Fam + \beta_3EDU + \beta_4EXP + \beta_5X + \varepsilon \quad (4.3)$$

where *SKILL* is measured by the literacy indicators from IALSS, and *EDU* represents years of schooling.

4.1.2 Definition of variables

Individual respondents' demographic information and skill proficiency scores from the 2003 IALSS are extracted and aggregated into cross-sectional macro data. The skill-schooling gap and the literacy scores are the dependent variables in the following regressions.

1) Mean skill proficiency

As explained in Chapter 2, the literacy scores provided by IALSS can be considered as a good proxy for human capital. The IALSS measures individuals' literacy proficiency from four domains: prose, document, numeracy, and problem solving. Each

individual has been tested and is awarded a score for each of the four domains.²⁴ For each individual respondent, the arithmetic average of the scores of the four domains is defined as his/her skill proficiency score:

$$\text{Skill}_i = (\text{Score}_{\text{doc},i} + \text{Score}_{\text{prose},i} + \text{Score}_{\text{num},i} + \text{Score}_{\text{prob},i}) / 4 \quad (4.4)$$

The mean proficiency score (skill) for a particular country of origin, i , is the mean of the proficiency scores of all the respondents who migrated from that particular country, which is calculated with the population weights provided by the IALSS (2003). The mean score for a country-group is calculated as the weighted average mean scores of source countries within that country-group, where the weight of country i in the country-group is defined as the share of the number of IALSS respondents from country i in the total number of IALSS respondents from that country-group.

It may be noticed from Table 4.1.1 that the variation of the mean scores across the source country/country-group is significant. While the average score is 251.5, the lowest score is below 200, and the highest score is above 300. The average of that for the otherwise similar Canadian born is 283.5.

²⁴ In the Master data file, there are five plausible scores for each domain. This study utilizes the first plausible value from each domain in calculating the mean score.

Table 4.1.1 Mean skill proficiency of countries/country-groups of origin

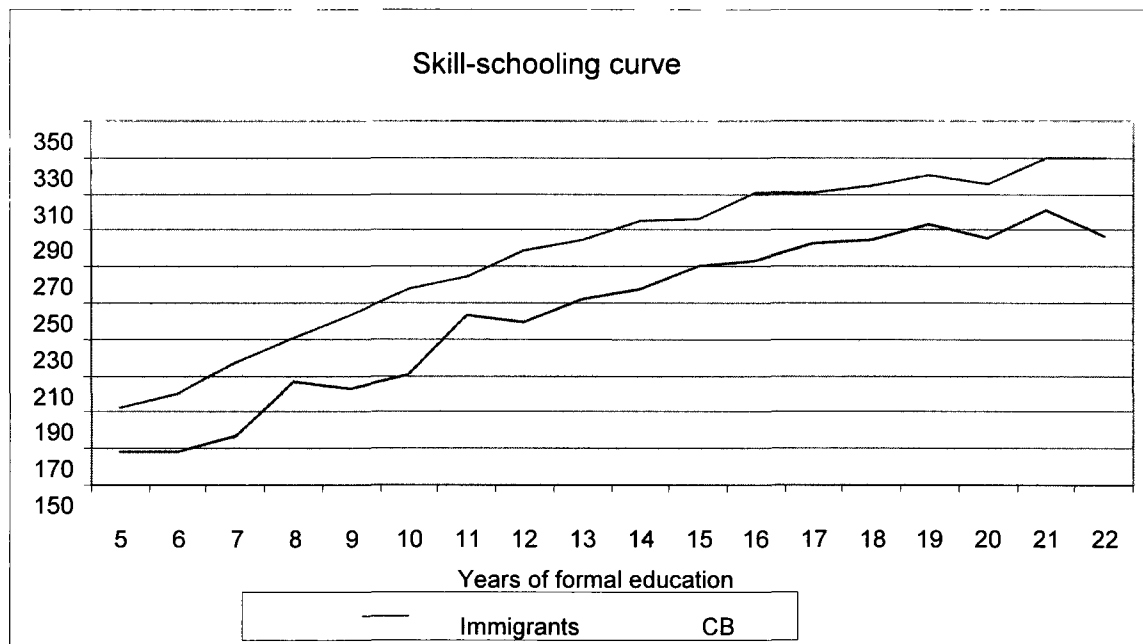
Country of origin	Skills proficiency	Country of origin	Skills proficiency
Algeria and Tunisia	287.71	Mexico	222.07
Argentina, Brazil, and Uruguay	284.70	Morocco	244.30
Austria and Switzerland	297.16	Netherlands	282.30
Bangladesh	250.79	North Europe	258.42
Belgium and Luxemburg	284.87	Other Caribbean	244.21
Bolivia, Chile, Peru, and Paraguay	223.45	Other Oceania	226.06
China	248.56	Other South America	256.49
East Europe	251.23	Pakistan	224.29
Egypt	263.46	Philippines	247.23
El Salvador	207.44	Poland	238.84
France	281.60	Portugal	209.79
Germany	265.88	Romania	289.88
Greece	220.46	South Africa	302.93
Guyana	240.40	South Korea	257.39
Haiti	237.34	Southeast Asia	194.64
Hong Kong	267.35	Southeast Asia - Developed	289.59
India	227.66	Sri Lanka	217.42
Iran	285.49	Sub-Saharan English	245.51
Ireland	262.74	Sub-Saharan French	274.29
Israel	287.55	Taiwan	259.25
Italy	225.25	Trinidad and Tobago	237.11
Jamaica	225.06	United Kingdom	285.05
Japan	263.38	United States	298.09
Jordan, Syria, Turkey, and Cyprus	249.61	Union of Soviet Socialist Republics (USSR)	241.30
Lebanon	251.59	Vietnam	237.03

Source IALSS (2003)

2) Skill-Schooling gap

The skill scores and years of schooling (skill-schooling curves) are presented in Figure 4.1.1 for the Canadian-born population and immigrants.²⁵ The fact that the skill-schooling curve for the international immigrants lies continuously beneath the one for the Canadian-born population at each level of schooling indicates that, for each single year of schooling or at each single level of education, the average literacy proficiency scores of international immigrants are lower than those of the Canadian-born population. Therefore, there is a skill deficiency for international immigrants compared with the Canadian-born population independently, of the level of education.

Figure 4 1.1 Relationship between skill and schooling for Canadian-born population (CB) and international immigrants

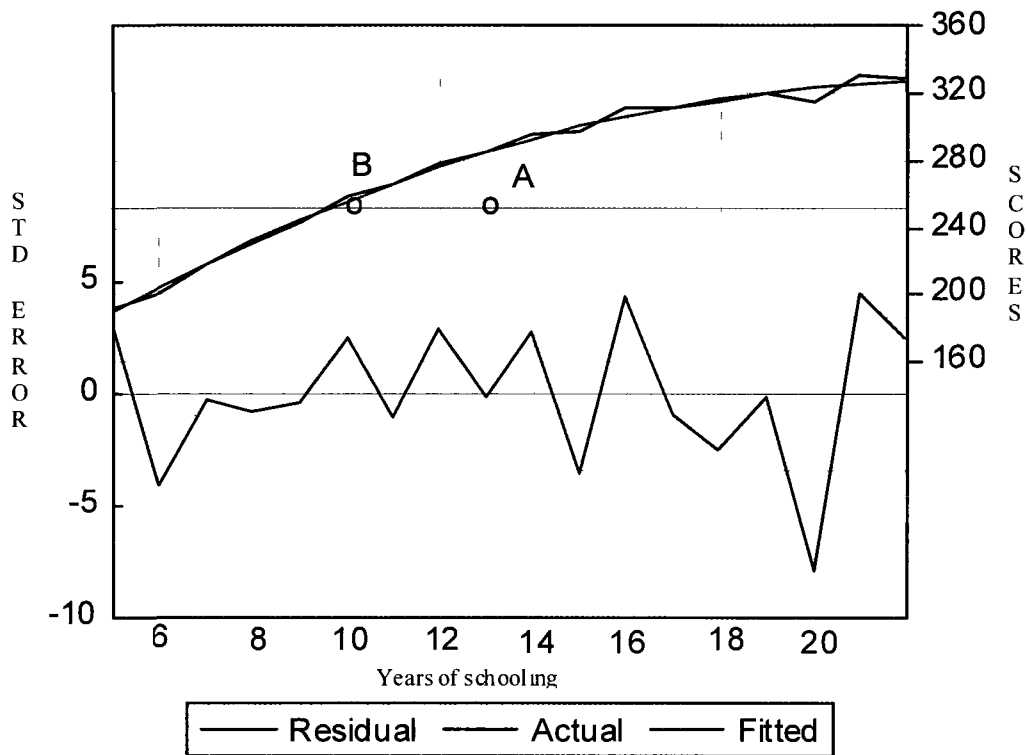


²⁵ The mean skill levels for those who have fewer than 5 years or more than 22 years of schooling are not reported, as the sample sizes are too limited.

To quantify the skill deficiency, the concept of the skill-schooling gap defined by Coulombe and Tremblay (2009a) is utilized in this thesis. After converting the skill proficiency scores into years of Canadian education (see Figure 4.1.2), the skill deficiency of Canadian immigrants can be measured in terms of years of formal Canadian schooling. As displayed in Figure 4.1.2, the horizontal distance between point A and point B is the skill-schooling gap for the overall immigrants, where point A represents the combination of immigrants' average literacy scores and schooling, and point B represents the corresponding schooling for the Canadian-born population that has the same level of literacy skills as immigrants. As illustrated in Figure 4.1.2, Canadian immigrants on average have about three years of a skill-schooling gap compared with the Canadian-born population. The skill-schooling gap essentially translates the skill deficiency into years of Canadian schooling. It can also be interpreted as the extra Canadian educational years that immigrants from a particular source country need, on average, to have the same test scores as the otherwise similar Canadian-born population.

This thesis calculates the skill-schooling gap in a slightly different way than Coulombe and Tremblay (2009a). The detailed explanation on how to calculate the skill-schooling gap for each source country/country group is provided in Appendix II, and the results are displayed in Table 4.1.2. The results from the extended cross-sectional unit data (50 countries/country-groups of origin) are similar to those of Coulombe and Tremblay (2009a) (28 countries of origin). But for few countries, for example the USSR, the results are somewhat different, which can be explained by the different methodology.

Figure 4.1.2 The skill-schooling gap of international immigrants



Note: The red line is the actual skill-schooling curve, while the green is the predicted skill-schooling curve according to the regression: $Skill = \beta_0C + \beta_1schooling + \beta_2schooling^2$

The figures in Table 4.1.2 demonstrate that most of the 50 countries/country-groups have positive skill-schooling gaps while a couple have negative skill-schooling gaps. The finding that countries have negative skill-schooling gaps implies that immigrants from those countries hold a higher skill proficiency than the Canadian-born population, while the opposite holds in the case of positive skill-schooling gaps. The figures in Table 4.1.2 also indicate that the developed countries have a negative or smaller positive gap while most of the developing countries have large positive skill-schooling gaps.

Table 4.1.2 Skill-schooling gap

Country/country group of origin	Skill-schooling gap	Country/country group of origin	Skill-schooling gap
Algeria and Tunisia	4 11	Mexico	3 94
Argentina, Brazil, and Uruguay	1 50	Morocco	5 10
Austria and Switzerland	-0 79	Netherlands	0 04
Bangladesh	5 03	North Europe	2 60
Belgium and Luxemburg	0 75	Other Caribbean	5 10
Bolivia, Chile, Peru, and Paraguay	6 12	Other Oceania	4 35
China	4 11	Other South America	5 26
East Europe	3 65	Pakistan	6 18
Egypt	4 58	Philippines	4 27
El Salvador	4 93	Poland	5 65
France	2 09	Portugal	1 8
Germany	2 45	Romania	2 42
Greece	5 72	South Africa	-0 16
Guyana	3 78	South Korea	5 48
Haiti	5 65	Southeast Asia	3 36
Hong Kong	2 82	Southeast Asia - Developed	0 64
India	5 26	Sri Lanka	5 03
Iran	3 01	Sub-Saharan English	5 92
Ireland	2 38	Sub-Saharan French	1 09
Israel	3 11	Taiwan	3 56
Italy	1 73	Trinidad and Tobago	3 46
Jamaica	4 96	United Kingdom	1 08
Japan	3 66	United States	0 65
Jordan, Syria, Turkey, and Cyprus	3 95	Union of Soviet Socialist Republics (USSR)	5 69
Lebanon	4 06	Vietnam	3 75

Source 2003 IALSS

The IALSS data also indicate that international immigrants, on average, took 9.8 years of schooling outside of Canada, while 4 years of schooling were taken in Canada. In addition, for those who landed in Canada at the age of 6 or younger and took only Canadian education, their average IALSS test score is 283.6, which is the same as

that of the Canadian born population. However, in order to simplify the process of defining and constructing the skill-schooling gap, these factors are not taken into account.

3) Income per capita of the source country/country-group

Source countries' per capita income data is obtained from the Penn World Table 6.2. The real gross domestic income, adjusted for terms of trade changes in 1996 and measured in U.S. dollars at 1996 constant prices, is chosen as the per capita income measure. The value of per capita income for a country-group is the weighted average of each member country in the country group, where the weight for each country is the share of respondents in the total respondents of the group.²⁶

4) Source countries/country-groups' public expenditures on education

This data is obtained from UNESCO, Institute for Statistics. The variable used is the total public expenditures on education (current and capital) expressed as a percentage of the gross domestic product (GDP). This indicator represents the proportion of a country's annual production that is spent by government authorities on education.

5) Canadian immigrants' employment income

These data are obtained from the Longitudinal Administrative Dataset (LAD). Data for the IALSS interview year, 2003, are aggregated according to country of origin; and the annual employment income is in 2000 constant dollars. The statistics of income

²⁶ Unfortunately, there are no data in Penn World Table 6.2 for the following countries: Afghanistan, Iraq, Brunei, Burma, Chad, Palestine, Guatemala, Zaire, Saudi Arab and Yugoslavia. Therefore, these countries have to be eliminated from the sample. With this further restriction, there are 50 countries/country-groups remaining. As a result, all the variables were adjusted and created based on the 50 countries/country-groups.

for country-groups are calculated as weighted averages where the weight of each country is determined by its relative share of IALSS respondents. Though IALSS provides income data as well, LAD data is more appropriate as discussed in section 3.1.2.

6) English/French proficiency

Section B of IALSS (2003) asks respondents about their linguistic background. Questions B5 to B7 (see Appendix III) collect self-assessed information regarding language proficiency. However, this information is not necessarily reliable in measuring language skills as the personal perception of good or poor language skills varies greatly across individuals, which may cause the results to be biased upwards or downwards.

Questions B1, B2, and B4 (see Appendix III) are about the practice of English and/or French at home. Language used at home is the one in which a person has the strongest skills and feel most comfortable with, which can be different from one's mother tongue. For instance, a German immigrant may speak English at home though his/her mother tongue is German if he/she feels more comfortable when communicating in English. Furthermore, practicing a language at home helps improve one's ability in that language. Thus these questions collect appropriate information to measure the language skills of the immigrants. According to the individual-level data testing (see Table 5.3.7), the one in B2 is the best compared with other variables in regression. The macro analysis uses this variable, *the language most spoken at home*, to represent the immigrant's skill proficiency in English or French. The aggregate variable on English and/or French proficiency is defined as the percentage of individuals from a source country/country-group who speak English or French at home.

7) Others

Other explanatory variables are listed in Table 4.1.3.

Table 4.1.3 Definition of country/country-group specific variables

Variable	Definition
Mean years of education	It is the arithmetical mean of the years of formal schooling of immigrants from a particular country of origin. The value of years-of-education is reported by respondents in question A3. (<i>During your lifetime, how many years of formal education have you completed beginning with grade one and not counting repeated years at the same level?</i>) in IALSS (2003).
Mean age	It is the arithmetical mean of age of immigrants from a particular country of origin. The age is when the respondents were interviewed by IALSS.
Mean age at landing	It is the arithmetical mean of the age when immigrants landed in Canada, by country of origin. Age at landing is a derived variable according to Question A2 (<i>In what year did you first immigrate to Canada?</i>) and the age of respondents in 2003, when the interview and test were administrated.
Mean age at getting the highest education level	It is the arithmetical mean of the age when immigrants reached his/her highest educational level by country of origin. (Question A6: <i>How old were you when you completed your highest level of schooling?</i>)
Years since migration	It is the arithmetical mean of the number of years that immigrants have lived in Canada by country of origin. (Question A2B: <i>In total, how many years have you lived in Canada?</i>).
University or higher level of education	The fraction of immigrants from a particular country of origin who have university or higher level of education. Having university or higher level of education is a dummy variable obtained from question A4C (<i>What is the highest level of schooling that you have ever completed?</i>).
Years of education taken in Canada	It is the arithmetical mean of Canadian years of education for immigrants from a particular country of origin (computed using question A3B: <i>Of the years of formal education, how many years did you complete outside of Canada?</i>).
Work experience	It is the arithmetical mean of years of work experience of immigrants from a particular country of origin (question D43A: <i>Considering all jobs you have held, how many years of full-time working experience do you have?</i>). It includes both Canadian and outside-of-Canada working experience.

Source. IALSS (2003)

Table 4.1.4 Mean age of immigrants across source countries/country-groups

Country	Mean age	Country	Mean age
Afghanistan, Jordan, and Syria,	34.5	Mexico	38.8
Algeria and Tunisia	37.2	Morocco	39.0
Argentina, Brazil, and Uruguay	33.0	Netherlands	54.0
Austria and Switzerland	44.6	North Europe	50.5
Bangladesh	36.7	Other Caribbean	41.8
Belgium and Luxemburg	56.1	Other Oceania	37.9
Bolivia, Chile, Peru, and Paraguay	42.5	Other South America	37.3
China	39.5	Pakistan	36.6
East Europe	49.1	Philippines	39.7
Egypt	48.9	Poland	42.3
El Salvador	38.8	Portugal	45.5
France	41.0	Romania	35.9
Germany	48.1	South Africa	32.3
Greece	47.9	South Korea	35.7
Guyana	38.7	Southeast Asia	41.4
Haiti	37.2	Southeast Asia - Developed	43.0
Hong Kong	39.1	Sri Lanka	40.6
India	42.5	Sub-Saharan English	35.4
Iran	35.6	Sub-Saharan French	33.1
Ireland	42.9	Taiwan	33.9
Israel	36.0	Trinidad and Tobago	46.7
Italy	52.9	United Kingdom	46.9
Jamaica	42.7	United States	45.5
Japan	38.9	Union of Soviet Socialist Republics (USSR)	40.9
Lebanon	38.5	Vietnam	38.4

Source IALSS (2003)

4.1.3 Specification of income per capita

Another issue regarding the empirical methodology for the macro analysis is the specification of the variable of income per capita in the regression equation, or whether

income per capita should appear in level or logarithmic form in the regressions. To investigate this issue, the Davidson-MacKinnon test can be used. Consider the following two models:

$$\text{Model 1: GAP or Skill} = \beta_0 + \beta_1 (\text{income per capita}/1000) + \varepsilon \quad (4.6)$$

$$\text{Model 2: GAP or Skill} = \gamma_0 + \gamma_1 \log(\text{income per capita}) + \varepsilon \quad (4.7)$$

Table 4.1.5 Davidson-MacKinnon test

	Skill
Fitted Skill from Model (1) in Model (2)	0.89 (<i>t</i> =1.14)
Fitted Skill from Model (2) in Model (1)	0.28 (<i>t</i> =0.14)
Skill-Schooling Gap	
Fitted Gap from Model (1) in Model (2)	0.08 (<i>t</i> =0.06)
Fitted Gap from Model (2) in Model (1)	0.97 (<i>t</i> =1.77) *

Note: * Coefficient is significant at the 10% level; t-ratios are in the parentheses.

The Davidson-MacKinnon test implies that if Model 1 is true, then the fitted values from Model 2 should be insignificant in Model 1 and vice versa. Regarding the regression of the skill-schooling gap, the figures in Table 4.1.5 indicate that the fitted values from Model 2 are significant at 10% level in Model 1, while the fitted values from Model 1 are not significant in Model 2. Therefore the Davidson-MacKinnon test suggests that Model 1 should be seen as the true model to explain the skill-schooling gap. On the other hand, for skills, both models can be true models, since the fitted values from each model are not significant in the other model.

Section 4.2 Empirical Analysis

In this section, the macro analysis is conducted using, in turn, the skill-schooling gap and the skill proficiency variables as dependent variables. In each case, several regressions are performed including different sets of explanatory variables.

4.2.1 Skill-schooling gap

Regression results for the skill-schooling gap are reported in Table 4.2.1. The figures in column 1 display the results of the basic model, which only investigates the role of economic development of the source countries/country-groups and average language proficiency of immigrants. Columns 2 to 4 display the results of extended models, which add extra variables to the basic specification. Although various extended models have been tested, Table 4.2.1 only reports the results that are statistically significant. All the regressions, including those that are not included in Table 4.2.1, strongly support the hypothesis that the source country's economic characteristics (proxied by income per capita) and the language proficiency of immigrants are significantly negatively associated with immigrants' skill deficiency. Other variables, such as age-at-landing and years-since-migration, have been tested in various equations, but none of them showed a statistically significant correlation with Canadian immigrants' skill deficiency.

Table 4.2.1 Regressions on skill-schooling gap (1)

Dependent variable: Skill-schooling gap				
Explanatory variables:	(1)	(2)	(3)	(4)
Income per capita of country of origin/1000	-0.110*** (0.0273)	-0.111*** (0.0282)	-0.104*** (0.0276)	-0.100*** (0.0281)
Language proficiency in English/ French	-1.687** (0.6746)	-1.804** (0.6564)	-1.468** (0.6601)	-2.617*** (0.7522)
Mean Age		1.262** (0.4358)	1.466*** (0.4358)	1.371*** (0.4487)
Mean Age²		-0.014** (0.0051)	-0.015*** (0.0049)	-0.016*** (0.0052)
Having university degree				-2.689* (1.4353)
Age at getting degree				0.206* (0.1086)
Working experience			-0.135* (0.0696)	
Constant term	5.493*** (0.4024)	-21.794** (9.3099)	-26.343** (9.3346)	-27.421** (10.3559)
Adjusted R²	0.4133	0.4881	0.5178	0.5125
Observations	50	50	50	50

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at the 1% significance level; ** implies that the coefficient is significant at the 5% significance level; and * means that the coefficient is significant at 10% significance level.

Income per capita of source country/country-group

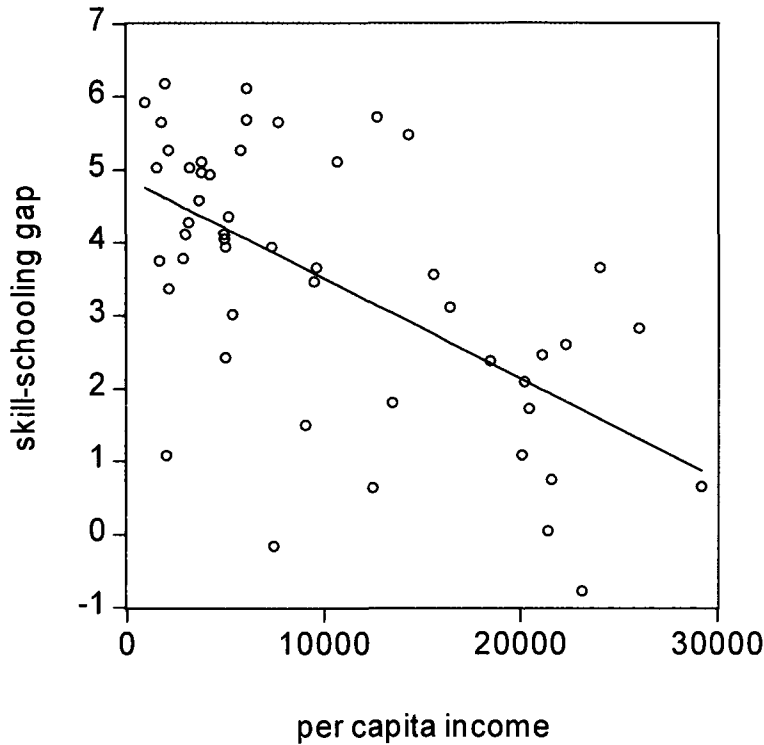
There is a commonly accepted notion that the higher the economic development level of the country of origin, the greater the resemblance between that country's economic structure and that of Canada, as well as the greater skill levels of the immigrants. Hence, the income per capita of the country of origin is likely to be one of the most important factors associated with immigrants' skill deficiency in Canada. The regression results from the basic model and all the extended models illustrate that the economic development level of a source country/country group has a significantly negative correlation with the skill-schooling gap, a measure of skill deficiency.

The negative sign indicates that the higher the economic development level of a country of origin, the less the skill deficiency for immigrants from that country. This is consistent with the findings of Borjas (1987) regarding the prominence of economic characteristics in determining skill formation. Also, the magnitude of the coefficients of income per capita from various models indicates that the skill-schooling gap will decrease for one year if income per capita of country of origin increases by around 11%.

In addition, Figure 4.2.1 provides visual evidence of the negative correlation between income per capita of country of origin and the skill deficiency of immigrants from that particular country.

Figure 4.2.1 The skill-schooling gap and per capita income per country/country-group of origin

Figure: the skill-schooling gap and per capita income per origin country, 50 country/country group



Language proficiency

Immigrants with higher English and/or French proficiency skills have more ability to adapt to Canadian social and labour markets. As discussed in Section 2.3.5, having limited proficiency in language skills is a barrier for immigrants in assimilating into Canadian society. As the Canadian version of the IALSS is administered in English or French, the respondents' language skills in English or French obviously affect the test scores considerably. Thus, controlling for the impact of language proficiency is very important in investigating the correlation between skill deficiency with other factors. The

impact of immigrants' language proficiency on the skill-schooling gap is examined in the basic and the extended models.

As explained in Table 4.1.3, language proficiency is defined as the percentage of immigrants who speak English and/or French at home in a source country/country-group. Language spoken at home also captures the impact of family and parents. Those from English/French speaking families are expected to have stronger abilities in using information efficiently in Canadian daily life. The results from the basic model (column 1) and all the extended models (columns 2 to 4) show that language proficiency is significantly negatively correlated with the skill-schooling gap. The negative sign indicates that a strong ability in English or French decreases immigrants' skill deficiency. Greater language ability could lead to higher usable attributes of human capital at any given level of other inputs as language skills interact with other factors to influence the formation and development of human capital or cognitive skills.

Age

Age may capture some unobservable factors that influence skill deficiency. First, to some extent, *mean age* reflects the impact of knowledge depreciation. Along with the fast pace of technological innovation, some skills obtained decades ago are rarely employed broadly in current society. Second, *age* could capture the impact of technological progress. In contrast to knowledge depreciation, some skills that were not known and employed in the general population decades ago may become the basic skill requirement in current society (e.g., operating computers). Third, *age* can even contain information regarding the changing relative quality of education across countries and over time.

Accordingly, including mean age in the regressions may actually help in taking into account the unobservable factors mentioned above. The results in column 2 of Table 4.2.1 indicate people's age is significantly and positively correlated with the skill-schooling gap. The older the population, the greater is the skill deficiency. Also, the adjusted R^2 has been improved slightly by controlling for age compared with the basic model.

The positive sign of age is consistent with the notion that knowledge depreciation increases skill deficiency. On the other hand, the findings from descriptive analysis plus the positive sign in the regression could possibly indicate that faster technological progress and higher education quality reduces the skill deficiency. Without advanced education quality and technology, the older immigrants from countries in Western Europe (whose mean age is 45, which is older than the average of 41; see Table 4.1.4) would have a higher skill-schooling gap and lower skill proficiency than what has been found in the data. However, the positive sign of the coefficient of age may also indicate that the impact of age on skill and knowledge depreciation is surpassing the impact of technological progress.

The regression also includes age-squared in the set of explanatory variables to examine whether age affects the skill-schooling gap at an increasing or decreasing rate. With the addition of the age-squared variable, the adjusted R^2 improves from 0.4108 to 0.4881. The higher adjusted R^2 suggests that this variable should be included in the regressions. In addition, the coefficient of this variable is significantly negative. Thus, controlling for the economic development level and language proficiency in English or French, age is found to increase the skill-schooling gap but at a decreasing rate.

University or higher-level education

Another interesting question is whether the skill deficiency originated mainly from the lack of post-secondary education or high school education. In order to answer this question, this study constructs a series of variables to categorize the education level of immigrants: education level higher than high school but lower than university, or bachelor degree or higher. Not surprisingly, the results that are reported in column 4 of Table 4.2.1 indicate that having a bachelors or higher degree has a significant negative effect on the skill-schooling gap. The adjusted R^2 is also slightly improved compared with column 2.

In addition, this analysis finds that the age at which immigrants received their degree is significantly correlated with the skill-schooling gap. The positive sign of this variable, as shown in column 4 of Table 4.2.1, tells that graduating from university at a younger age is marginally helpful in narrowing the skill-schooling gap.

Work experience

As discussed in many studies, it is not only education that produces human capital; work experience is also an alternative way to produce human capital. The macro analysis examines the impact of full-time work experience on skill deficiency and finds that work experience is significantly correlated with skill deficiency at margin. Ten years more of work experience may help to reduce the skill-schooling gap by one year. Also, adding work experience in the regression improves the adjusted R^2 slightly.

Public expenditures on education as a percentage of GDP

Public expenditures on education as a percentage of GDP is a factor that may impact the quality of education in the countries of origin, and, thus it is expected that it will influence the aggregate skill proficiency. As explained in Section 3.1, due to the issue of missing data, the cross-sectional units had to be reduced to 41 after adding this variable into the regressions (see Table 4.2.2). The regression results, shown in Table 4.2.2, indicate that public expenditures on education are not significantly related to skill deficiency. A number of specifications are tested (not listed in the table), and none of them finds a significant role for this variable with respect to skill deficiency of immigrants.

Other factors

Other variables, such as age-at-landing, years-since-landing, and parents' education, have been tested as well. However, none of them has a significant correlation with the defined skill-schooling gap. Since schooling is included in the calculation of the dependent variable, it will not be tested on the right-hand side of regressions.

Table 4.2.2 Regressions on skill-schooling gap (2)

Dependent variable: Skill-schooling gap			
Explanatory variables	(1)	(2)	(3)
Income per capita of the country of origin/1000	-0.1125*** (0.0311)	-0.1173*** (0.0316)	
Language proficiency in English/French	-1.735*** (0.7012)	-2.132** (0.8238)	-2.564** (0.9489)
Age	1.595*** (0.4712)	1.637*** (0.4744)	1.617** (0.5519)
Age-squared	-0.018*** (0.0054)	-0.018*** (0.0054)	-0.019*** (0.0063)
Public expenditures on education		0.922 (0.9983)	0.319 (1.1461)
Constant term	-29.298** (10.1623)	-30.678** (10.2921)	-29.286* (11.9681)
Adjusted R²	0.5197	0.5177	0.3470
Observations	41	41	41

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at the 1% significance level; ** implies that the coefficient is significant at the 5% significance level; and * means that the coefficient is significant at the 10% significance level.

4.2.2 Skill proficiency

In addition to analyzing the determinants of the skill-schooling gap, this section investigates the factors contributing to the skill proficiency levels. Since education is the major factor in producing human capital, the basic model will investigate the effects of schooling while controlling for two other variables: language and income per capita of the country of origin. The extended specifications presented in the other columns keep the three basic variables while adding other factors.

Income per capita of country of origin

The dependent variable is the mean literacy score computed from the 2003 IALSS. Since both the level and the logarithm of per capita income are proper independent variables according to the Davidson-MacKinnon test conducted earlier, both of them are tested in the basic model. However, the basic model using the level of per capita income shows a higher adjusted R^2 . Thus the basic model utilizing the level of income per capita is reported in the main text and is the benchmark for all the extended specifications. The regression results for the basic model with the logarithmic form of per capita income can be found in Appendix IV.

The coefficient for income per capita is significant and has a positive sign in any the regressions (tables 4.2.3 and 4.2.4), which indicates that the economic level in the country of origin contributes significantly to the production of human capital. In addition, the magnitude of the coefficients from the six regressions in Table 4.2.3 and Table 4.2.4 stay consistently at around 1.2.

Table 4.2.3 Regressions on skill proficiency (1)

Dependent variable: Skill proficiency				
Explanatory variables:	(1)	(2)	(3)	(4)
Income per capita of country of origin/1000	1.184*** (0.2484)	1.274*** (0.2403)	1.253*** (0.2144)	1.186*** (0.2058)
Language proficiency in English/French	17.358** (7.0326)	19.948*** (6.6435)	26.684*** (6.6172)	23.570*** (6.7814)
Years of formal education	10.270*** (0.87777)	9.101*** (0.9164)	6.700*** (1.1565)	7.301*** (1.2884)
Age		-14.745*** (3.932)	-13.063** (4.4253)	-14.257*** (4.3877)
Age²		0.164*** (0.0440)	0.144** (0.0497)	0.151*** (0.0479)
University or higher degree			34.203** (15.2246)	31.880** (15.4182)
Working experience				0.907* (0.4844)
Constant term	88.855*** (11.3132)	427.247*** (90.2791)	411.252*** (96.6486)	429.53*** (96.3605)
Adjusted R²	0.7215	0.7739	0.7996	0.8029
Observations	50	50	50	50

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at the 1% significance level; ** implies that the coefficient is significant at the 5% significance level; and * means that the coefficient is significant at the 10% significance level.

Total years of formal education

Since education is the major factor in producing human capital, regressions to examine the development of skills need to include education as an independent variable. The results from the basic model, in column 1 of Table 4.2.3, suggest that total years of schooling have a significant positive effect on skill formation.²⁷ The magnitude of the schooling coefficient is 10.270, which is very close to the findings in OECD (2000), according to which an additional year of schooling increases the literacy score by 10 points on average on the 1994 IALS 0-500 scale.

The extended specifications (from both tables 4.2.3 and 4.2.4) confirm the significant positive effect of schooling. However, the magnitude decreases if other factors are included. In particular, the magnitude of total years of education changed when mean *age* is controlled for. *Age*, to some extent, may capture the improvement of schooling quality over time. If this is the case, ignoring the factor of *age* may cause a biased estimation on the effect of total years of education. For examples, when the mean age is excluded from the regression, the coefficient of education is around 10, while it decreases to around 9 if mean age is included in the model.

It is also noted that, when educational degree is controlled in the regression, the magnitude of the coefficient of quantity of education decreases further (column 3 of Table 4.2.3) and the magnitude of the coefficient of educational degree is much higher than that for quantity of education. This finding suggests that post-secondary education is a major factor in building a population's skill proficiency: the difference between those

²⁷ The coefficient for the years of education from the basic model regression with 41 countries/country-groups of origin is 10.425.

who have a university degree and those who do not is about 30 points, while one more year of schooling would improve skill proficiency scores by about 7 points among those who do not have a university education.

Language proficiency

All the regressions in tables 4.2.3 and 4.2.4 have consistent results that language proficiency in English and/or French is a factor significantly correlated with skill proficiency. Compared with those who do not speak English/French at home, the individuals who communicate with families in English/French have skill proficiency scores 20 points higher. When *age* is included as a control in regressions, the magnitude of the estimated coefficient of language increases, which indicates that language exerts more influence among people of the same age than among people in different age groups.

Age

The first extended specification adds the variable of *age* and *age-squared* in the regression, and the results are reported in column 2 of Table 4.2.3. The inclusion of the two variables improved the explanatory power of the regression as the adjusted R^2 increases from 0.7215 to 0.7739.

The regression results show that *age* has a significant negative impact on the skill proficiency of immigrants. And the estimated magnitudes for the coefficients of *age* are quite close to each other, around 14, across regressions. The negative sign is easy to understand, since an individual's ability to obtain and retain skills may decrease over time. As individuals get one year older after graduating from school, their skill proficiency scores would fall by about 14 points.

As explained in previous sections, *age* may also capture some unobservable factors, such as knowledge depreciation, and the changing of quality of education over time. Knowledge obtained decades ago may contribute less to current skills, and the quality of education obtained by senior individuals may also be less relevant to today's skill requirements.

Public expenditures on education as percentage of GDP

Although only two sets of regression results are reported in Table 4.2.4 (with sample of 41 countries), a number of regressions were estimated in order to investigate the influence on skill proficiency of public expenditure on education. The regressions indicate that this variable does not have a significant impact on the skill proficiency of immigrants. By replacing income per capita with this variable, the adjusted R^2 falls, and this variable is generally not statistically significant.

In addition to public expenditures on education, *private expenditures on education* is another factor of interest. It is expected that private expenditures on education could play an important role if public expenditures on education are not sufficient, especially in developing countries. However, because of the lack of data on private expenditures on education, it is not possible to do further research on the impact of private investment on education on the accumulation of skills.

Table 4.2.4 Regressions on skill proficiency (2)**Dependent variable: Skill Proficiency**

Explanatory variables	(1)	(2)	(3)
Income per capita of country of origin/1000	1.402*** (0.3195)	1.434*** (0.3235)	
Years of formal education	8.430*** (1.3193)	8.533*** (1.3321)	10.533*** (1.5518)
Language proficiency in English/French	19.126** (6.7547)	22.435** (7.9299)	26.785** (9.7421)
Age	-18.726*** (4.6759)	-18.986*** (4.7103)	-17.030*** (5.8059)
Age-squared	0.205*** (0.0530)	0.208*** (0.0534)	0.200** (0.0660)
Public expenditure on education		-7.791 (9.6504)	-2.654 (11.8612)
Constant term	527.810*** (108.5037)	535.733*** (109.488)	450.569*** (133.448)
Adjusted R²	0.7954	0.7934	0.6833
Observations	41	41	41

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at the 1% significance level; ** implies that the coefficient is significant at the 5% significance level; and * means that the coefficient is significant at the 10% significance level.

University or higher degree

Holding a university degree or a post-graduate degree helps to improve skill proficiency according to the results shown in Table 4.2.3. Compared with those who do not have a university education, university graduates have proficiency scores more than 30 points higher. Also, the inclusion of educational degree variable improves the adjusted R^2 of regressions.

Other variables

Further factors have been investigated in the regressions. The variables that have been tested include age-at-landing, full-time work experience, parents' education, etc. But no evidence could be found that any of them has a significant impact on the formation and development of skills.

4.2.3 Employment income of immigrants

The impact of skill proficiency on employment earnings of immigrants is examined here in a set of simple regressions.²⁸ Regression results are reported in Table 4.2.5 and indicate that skill proficiency is significantly correlated with employment earnings for immigrants. On the other hand, years-of-education is not statistically significant once the skill proficiency is controlled for. So education that does not produce cognitive skills does not contribute to improving the economic outcomes of immigrants, on average.

²⁸ As explained in Chapter 3, income data are from LAD.

The results also indicate that years since migration is significantly related to employment earnings, though it does not significantly affect skill proficiency. Public expenditures on education in the country of origin have been tested, but no significant impacts have been found.

Table 4.2.5 Annual employment income of immigrants

Dependent variable: Employment income relative to Canadian born population

Explanatory variables	(1)	(2)	(3)
Skill proficiency (test scores)	0.002*** (0.0002)		0.004** (0.0015)
Years of formal education		0.035*** (0.0042)	-0.023 (0.0245)
Skill proficiency in English/French	0.221** (0.1015)	0.255** (0.1070)	0.207* (0.1027)
Years since migration	0.010*** (0.0034)	0.013*** (0.0034)	0.008** (0.0037)
Adjusted R²	0.5592	0.5024	0.5581
Observations	50	50	50

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at the 1% significance level; ** implies that the coefficient is significant at the 5% significance level; and * means that the coefficient is significant at the 10% significance level.

Section 4.3 Conclusion

Data extracted from IALSS (2003) indicate that Canadian immigrants have lower skill proficiency, on average, than the Canadian-born population despite having relatively longer years of schooling. Moreover, the relative skill deficiency holds for subsets of immigrants with any number of years of schooling. Following Coulombe and Tremblay (2009a), this chapter uses the concept and variable of the skill-schooling gap to provide quantitative estimates of the skill deficiency of immigrants. By converting the international immigrants' literacy scores into years of Canadian schooling, the skill deficiency of immigrants can be measured in years of Canadian education. On average, international immigrants had around three years of a skill-schooling gap compared with the Canadian-born population.

By redefining and re-coding the answers to the interview question, *in what country were you born*, this thesis extends the number of countries of origin to more than 150. However, given the limited number of respondents from a subset of countries of origin, the respondents from a number of countries were excluded from the sample or aggregated into country-groups based on the geographic area, the economic development level, and language similarity. As a result, the number of the cross-sectional units is enlarged from the original 28 to the current 50, which improves the robustness of the cross-sectional analysis.

The results from a large number of cross-sectional regressions strongly suggest that the economic development level (proxied by income per capita) of the country of origin is significantly correlated with the skill-schooling gap and the skill proficiency of immigrants. Thus, the Canadian international immigrants' skill-schooling gap can be

explained, to some extent, by the economic development level of the country of origin. Immigrants from countries with similar economic development levels as Canada had lower skill-schooling gaps, while immigrants from less-developed countries are far less proficient in cognitive skills.

All the regressions suggest that, for international immigrants whose first language is neither English nor French, language is a barrier to assimilating into Canadian society and transforming their human capital obtained in their country of origin into Canadian-specific cognitive skills. Also, as IALSS (2003) is administered in English or French in Canada, it is to some extent testing the language skills of immigrants. Government programs that help immigrants improve their language proficiency may be an efficient approach in improving their cognitive skills.

Some other factors are significantly correlated with immigrants' skill-schooling gap and skill proficiency, such as university or higher level of education, and *age*. But public expenditures on education in the country of origin, the age of landing, and years since migration are not found to be significantly correlated with immigrants' skill proficiency and skill deficiency relative to the Canadian-born population.

The macro analysis also investigates whether skill proficiency is correlated with the employment earnings of immigrants. When skill proficiency is included in the regressions that model earnings, years-of-education is not statistically significant. This finding indicates that education that does not contribute to developing cognitive skills could not contribute to improving economic outcomes. In contrast, cognitive skills do contribute to immigrants' earnings in the Canadian labour market.

This cross-sectional macro analysis also examined the impact of parents' secondary education on skill proficiency and deficiency relative to the Canadian-born population, but the aggregated structure of the variable makes it difficult to find a robust result. Also, the macro analysis ignores the idiosyncratic differences in terms of ability, motivation, and other personal characteristics across individuals. Thus, conducting a micro analysis, using the individual-level data provided by IALSS, may help to obtain a more complete understanding of the formation and development of human capital. Another motivation for conducting the micro analysis using the same data set is to verify the hypothesis that the return to education in micro level data will be higher than it is in macro level data because in micro data, some unobservable factors, such as innate ability, will be captured by the variable of education while the idiosyncratic differences will be eliminated in macro level data.

CHAPTER 5 MICRO EVIDENCE

This chapter provides evidence from micro data on the factors that are associated with the formation and development of immigrants' human capital/cognitive skills. The analysis uses the same IALSS (2003) data as the macro analysis of the previous chapter.

Section 5.1 Model

The level of human capital of an individual is the result of past investments in education, learning-by-doing, and skills depreciation (Coulombe and Tremblay 2009b). We can use a reduced-form equation to represent the process of skills accumulation for immigrants as follows:

$$\text{Skill}_i = \alpha + \beta_1 E_i + \beta_2 L_i + \beta_3 \text{GDP}_i + \beta_4 D_i + \varepsilon_i \quad (5.1)$$

where E represents education, L stands for learning-by-doing, D represents skills depreciation, and GDP is the level of income per capita in the country of origin.

This model may suffer from an endogeneity issue because of the loop of causality between years of schooling and proficiency skills. The error term in equation 5.1 may contain the impact of ability and, potentially, the interaction of ability with skill inputs such education, experience and language. If ability is also an input into choices about levels of schooling and skills, then skills and education are endogenous. This implies that the coefficients in the OLS regressions could be biased.

There are many ways of overcoming an endogeneity problem. If it is assumed that schooling choices are related only to the generation of cognitive skills (e.g., schooling may help create social skills but that is not why people choose to go to school),

then education is exogenous. Another solution is to split the overall immigrants into several sub-groups (such as age groups, visa groups, or age-of-landing groups). Instrument variable (IV) estimation is another approach. Some examples of good instruments in previous studies include: presence of sisters in a family; the distance to the nearest 2-year and 4-year colleges and state-specific tuition rates; identical twins observed at the same point in time; and compulsory schooling laws. However, based on the data set constructed for this thesis, it is hard to define a sound instrument, and it is understood that a weak instrument may induce even worse regression results.

Education

Education includes different components, such as formal schooling and skills transmission by parents, and is one of the main channels through which skills are accumulated. The contribution of this second component will certainly depend, in part, on the level of education of parents. Well-educated parents may be more likely to invest time and financial and/or other resources to educate or train their children. As discussed by Borjas (1994), children of skilled parents are likely to have above-average skills.

The positive effects of years of schooling on the formation and development of human capital are generally accepted. In addition to quantity of schooling, the quality of schooling is closely associated with the outcomes of education as well. It is expected that public investment in education, which is likely to affect the quality of education, will be positively correlated with the results/outcomes of education.

Learning-by-doing

Apart from learning at school, learning-by-doing is another channel for investment in human capital. Time spent in a community/workplace contributes to skills formation. Therefore, both life experience and work experience influence one's skills development. Utilizing skills to carry out new tasks in a workplace also helps to develop new skills. The degree of exposure to English/French and to the Canadian labour market may also matter for skill proficiency in Canadian labour markets.

The use of English/French and the skill level of English/French before migration vary across individuals (pre-migration exposure). After landing in Canada, immigrants are exposed to the new language and cultural environment (post-migration exposure). Language practices within a family/community can influence immigrants' exposure to and proficiency in English/French. The frequent use of one's origin language at home results in less proficiency in the destination language, and lower destination language proficiency may result in lower destination skill proficiency.

There are also some particular technical skills that contribute to human capital (e.g., computer programming, mathematical skills, and manual work). Work experience will contribute to the accumulation of such skills.

Economic development level of country of origin

The level of economic development in the country of origin can again be used as a proxy to capture the quality of education. It may also be the case that, in the more-developed countries, more opportunities for exposure to English or French are provided, even if the official language of the country is not English or French. Also, in the more-developed countries, there may also be greater opportunities to acquire skills through

means other than formal education (e.g., better access to the Internet). There may also be more opportunity to acquire skills through work experience, or acquire particular kinds of skills in the workplace that may be useful in the Canadian labour market.

Skills depreciation

As for any capital goods, human capital is subject to depreciation (Coulombe and Tremblay 2009b), which might simply be the result of aging and the loss of intellectual and physical capacities. Accordingly, the age at interview and age at landing are factors that will affect the development of human capital. Younger people have a far greater capacity for learning a new language and new skills than do older individuals. Also, after a certain age, the ability to learn is reduced. So the discussion about the impact of education on the formation of skills should consider individuals' age.

Section 5.2 Variables

This sector explains the definition of variables that will be employed in the micro analysis.

Skill proficiency: As in Chapter 4, the mean score from the four domains (prose, document, numeracy, and problem-solving) is employed to proxy the skill proficiency of each individual.

Relative income per capita of country of origin: Data for source countries' per capita income data are obtained from Penn World Table 6.2. It is defined as the real gross domestic income adjusted for terms of trade changes in 1996 and is measured in U.S. dollars at 1996 constant prices. The absolute value of the income per capita of each source country is divided by the income per capita of Canada to obtain relative income per capita data.²⁹ This variable proxies the relative economic development level of the source countries. As it uses constant one year data, 1996, it will be referred as constant income per capita data.

However, choosing constant value of income per capita of countries of origin might reduce the estimated impact of the level of development on immigrants' skill proficiency, for two reasons. First, most of the source countries experienced a different pace of economic growth relative to Canada over time (see Appendix V). For example, the ratio of income per capita of Hong Kong to Canada was 0.39 in 1966, while it rose to 1.13 in 1996. Second, source countries' economic development level following individuals' emigration cannot affect emigrants' skill proficiency in the host country.

²⁹ In Chapter 4, the absolute value of income per capita divided by 1000 is used in the macro regressions.

Thus, using constant income per capita data from a particular year (1996 for this study) to represent the source countries' economic development level of any period without adjusting for landing time may be misleading. Therefore, two other measures of income per capita are defined: landing-time-adjusted relative income per capita, and landing-time-and-landing-age-adjusted income per capita.

Landing-time-adjusted income per capita: Relative income per capita of the particular year when an individual emigrated may better reflect the economic situation that actually had an impact on his/her skills development. However, due to the limitation of data, years for which the last digit is 6 from each decade are employed to represent any years during the same decade. For example, income per capita data of 1986 is used to represent income per capita of source countries between 1980 and 1989.

Landing-time-and-landing-age-adjusted income per capita: If it is assumed that only those who obtained their education before 18 years of age in the countries of origin (equivalently, individuals who landed in Canada after 18 years of age) could have been being affected by the source countries' economic development level, further restrictions should be imposed to the income per capita data. For instance, for an individual who landed in Canada in 1986 at 47 years of age, income per capita of the source country before 1986 might affect the formation and development of his/her skill proficiency since he/she obtained their education from the country of origin (assuming that he/she did not move to other nations before landing in Canada). In contrast, if an individual landed in Canada in 1986 at age 12, the country of origin can only partially affect this person's skills since he/she will be educated mainly in Canada. Therefore, Canada's income per

capita might have more effect than the country of origin on the immigrants who landed in Canada at a young age (especially before 18 years of age).

The criteria to determine the value of this variable are as follows. If an immigrant was over the age of 18 years at the landing year, the source country's income per capita for the year of landing will be used to represent the income per capita of the source country. If an immigrant landed in Canada when he/she was younger than 18, Canada's income per capita of the year of landing will be used.

Education expenditures as percentage of GDP in the country of origin: Total public expenditures on education, expressed as a percentage of the gross domestic product (GDP) in 1999 of each country of origin are obtained from UNESCO.³⁰ Since only data after 1999 are available, the factors of landing time and landing age have to be disregarded. Therefore, this variable holds a constant value for each source country.

Skills proficiency in English or French: It is hard to separate language and skills proficiency, as discussed in Section 2.3.5, so the micro analysis investigates the role of language in development of skills. There are various approaches to define language skills, but for each approach, the language variable is a binary one; *1* stands for speaking English/French, while *0* means speaking other languages.

The first language measurement option in this paper is the mother tongue, which is defined as the language that an individual first learned and still knows. The second option is the language spoken at home, which indicates whether an immigrant speaks English or French at home. Many studies (Stevens 1999; Davila and Mora 2000a) apply

³⁰ UNESCO is the abbreviation of United Nations Educational, Scientific and Cultural Organization.

the same procedure to measure language. They measure language proficiency with items (in census data) that actually inquire about language usage, such as which language one speaks at home or daily. Thus, the second measurement option is commonly one used in studies. The third option is the language of the workplace, which is defined as the language utilized in the work environment. And the fourth option is the official language of the country of origin.

Parents' post-secondary education: This variable indicates whether the mother or father of an immigrant had a post-secondary level of education to capture the impacts of family background on individuals' skills development.

Educational level: A group of dummy variables are employed to indicate immigrants' education degrees, such as a university degree, high school degree, trade level degree, or less than high school.

Years of work experience: This variable is measured by the self-reported years of full-time work experience. It includes both Canadian and non-Canadian work experience. IALSS (2003) asks about both total and Canadian work experience, so work experience abroad is the difference between the two.

There are other variables used, such as years-since-migration (YSM) and years-of-formal-education. Appendix VI provides detailed explanations of each variable used in the micro analysis.

Section 5.3 Empirical analysis

This section presents the empirical analysis based on individual-level data. Some descriptive analysis is first conducted in the next sub-section, followed by the regression analysis in sub-section 5.3.2.

5.3.1 Descriptive analysis

Some descriptive analysis is provided in tables 5.3.1 and 5.3.2 to display the relationship between skill proficiency and other factors. Figures in Table 5.3.1 indicate that skill proficiency is highly correlated with educational levels. The average skill proficiency score for those who had university or higher degrees (283.5) was almost equal to that of the Canadian-born population (283.4). No skill gap is found between immigrants who are university graduates and the Canadian-born population in general.³¹ In contrast, those who did not complete high school possessed a very low level of skill proficiency, 196.2.

English or/and French skills, no matter how they are measured, are positively related with the literacy skill proficiency of immigrants. But the skill proficiency differences between English/French speakers and non-English/French speakers vary across different measures of language. When it is measured by language spoken at home or at the workplace, the difference between English/French speakers and non-English/French speakers is about 32 points. The difference is 16.4 points when it is measured by the official language of the countries of origin.

³¹ However, compared with Canadian-born university graduates, the skill gap still exists for immigrants who are university graduates (Coulombe and Tremblay 2009).

Canadian work experience is positively correlated with skill proficiency, as it is associated with higher skill proficiency scores. Those who had Canadian work experience had scores 14 points higher than those without Canadian work experience.

Age-of-landing seems associated with immigrants' skill proficiency. For those, who landed in Canada at school-age, such as 12 years old or younger, they had similar skill proficiency scores as the Canadian-born population. For those who landed in Canada at a very young age and may only take Canadian education, their test scores is exactly the same as that of the Canadian-born population.

Parents' post-secondary education, as expected, improves immigrants' skill proficiency scores. The score difference reached 30 points between immigrants whose parents had post-secondary education and those whose parents did not have post-secondary education.

On the other hand, the figures in Table 5.3.1 show that the number of years since migration does not have an obvious correlation with skill proficiency of international immigrants. Also, it is worthy to note that no sub-groups, except university graduates, reached the average skill proficiency level of the Canadian-born population, 283.4.

Table 5.3.1 Skill proficiency among different dimensions

Category		Average Skill Proficiency
University or higher degree		283.5
Trade degree		258.8
High school degree		235.9
Less than high school		196.2
Language spoken at home	English and/or French	267.9
	Non English or French	235.2
Mother tongue	English and/or French	272.2
	Non English or French	242.7
Official language of source country	English and/or French	259.8
	Non English or French	243.4
Language used at work	English and/or French	260.6
	Non English or French	227.1
Canadian experience	Yes	252.2
	No	238.8
Years-since-migration <=10		253.1
Years-since-migration >10		250.2
Immigrated to Canada at age younger than 12		280.5
Immigrated to Canada at age younger than 6		283.6
Parents had post-secondary education	Yes	267.8
	No	237.5
Canadian-born population		283.4
Sample Size:	3,036	

Source: IALSS 2003

Note: It is weighted statistics.

Table 5.3.2 Skills proficiency and Canadian education

			Average skill proficiency
Highest level of education completed in Canada			265.5
Highest level of education completed outside of Canada			243.9
Educated in Canada			270.6
	Educational degree		
		university	298.0
		trade	270.4
		HS	253.7
		LTHS	229.7
Never educated in Canada			233.4
	Educational degree		
		university	269.7
		trade	246.3
		HS	219.6
Canadian-born population			283.4
Sample size		3,036	

Source IALSS 2003

Notes It is weighted statistics HS stands for High School, LTHS means Less Than High School

The figures in Table 5.3.2 examine whether Canadian education can contribute more to the cognitive skills required in Canadian society than foreign education; the figures indicate that being educated in Canada helps to improve immigrants' destination-skill proficiency. For instance, the average score of those who received a university degree in Canada³² (298) is higher than the Canadian-born in general, 283.4. For those without a Canadian education, even if they hold university degrees, their skill scores (269.7) still could not reach the level of the Canadian-born population.

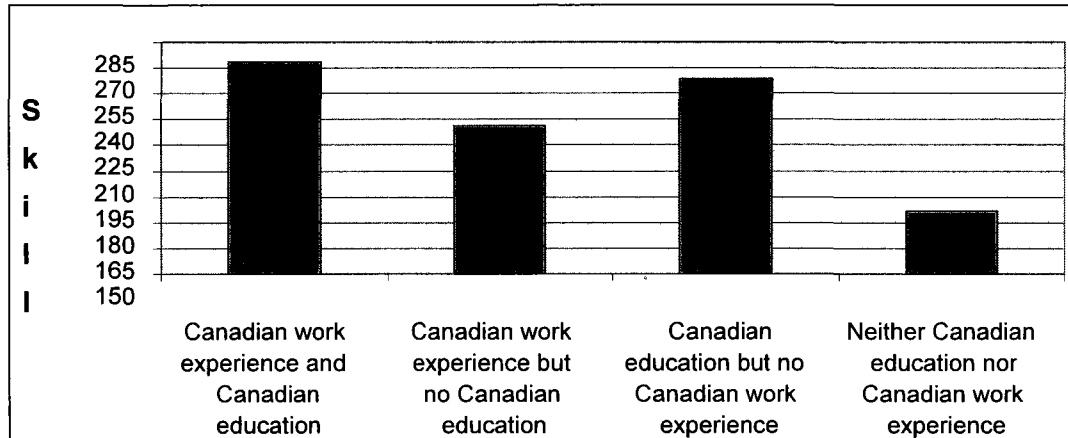
³² It does not matter if part of one's education was abroad.

Furthermore, the combination of Canadian work experience and Canadian education raises the skill proficiency level of immigrants. In Figure 5.3.1, individuals are grouped into four categories: those with both Canadian education and Canadian work experience (group 1); those who had Canadian work experience but did not have a Canadian education (group 2); those who had a Canadian education but did not have Canadian work experience (group 3); and those who had neither Canadian work experience nor a Canadian education (group 4).

There is evidence that, for immigrants who finished their education in Canada, there is a relatively strong relationship between Canadian experience and literacy (Ferrer *et al* 2004). Figure 5.3.1 indicates that immigrants holding Canadian education without Canadian work experience are more skilled than those who only have Canadian work experience. But one has to be cautious in interpreting the results since the data only indicate whether an individual has Canadian work experience or education, without providing quantitative information in terms of years of education/work experience. Therefore, Figure 5.3.1 is silent on the magnitude of the effects of Canadian education and work experience on skill proficiency.

The fact that group 3 performed better than the other groups may also be related to the age of immigrants. Those who have more years of working experience are likely to be older than those who have never worked.

Figure 5.3.1 Skill proficiency and work experience and education



Data Source IALSS

As Chiswick and Miller (2001) mentioned, immigrants differ in their reasons for migration. Those who move primarily for labour market opportunities are known as economic migrants, while other groups include tied movers (moving primarily to accompany or join another family member), and refugees or ideological migrants (moving for nationalistic or political reasons). Refugees, tied movers, and ideological migrants are less likely than economic migrants to have labour market success in the destination country because, by definition, such success is less important in their migration decision. Thus, non-economic immigrants could be less proficient in destination country skills than otherwise similar economic migrants. Table 5.3.3 indicates that persons holding worker visas had the highest skill performance, and refugees had the lowest skill proficiency scores. The difference between the two categories is over 40 points.

Table 5.3.3 Skill proficiency and immigrant category

Category	Proficiency
Landed immigrant	245.9
Canadian citizen by naturalization	252.2
Refugee	229.3
Visitor visa	232.9
Student visa	272.6
Worker visa	272.9
Other	253.7

Source IALSS

5.3.2 Estimation results of skill proficiency

Following equation (5.1), this section estimates OLS regressions to investigate the factors that are correlated with skill proficiency of international immigrants. The estimation results are displayed in Table 5.3.4.

5.3.2.1 Income per capita of the country of origin

As discussed in Section 2.3.2, there are limited studies that examine the relationship between income per capita of the source countries and human capital possessed by immigrants, and their conclusions are mixed. This section investigates the impacts of economic development level (measured by income per capita) of the country of origin on immigrants' skill development.

Before starting to interpret the regression results in Table 5.3.4, it is worthwhile to explain why the landing-time-and-landing-age-adjusted income per capita variable is applied in all the OLS regressions. As discussed in Section 5.2, three different measures of income per capita of country of origin are defined (constant, landing-time-adjusted, and landing time-and-landing-age-adjusted income per capita).³³ In addition to the qualitative explanation in Section 5.2 about the limitation of the constant measure, figures in Table 5.3.5 provide some quantitative evidence that the landing-time-and-landing-age-adjusted income per capita measurement is superior to the other two proxies.

The comparison of the fitness of the model (R-squared) indicates that the model with landing-time-and-landing-age-adjusted income per capita of the country of origin (column 1) is more robust than the other two models (column 2 and 3). Moreover, the comparison of the magnitude of the coefficients of the three measures of income per capita of the country of origin implies that the economic development level of the source country during schooling age exerted greater effects on skill formation than the level of development unadjusted for landing age and landing time. Thus, landing-time-and-landing-age-adjusted income per capita is employed in the proceeding OLS regressions.³⁴

As displayed in all specifications (from column 1 to column 10) in Table 5.3.4, income per capita of the country of origin is statistically significant, and the magnitudes of the coefficients are consistently within the range of 34–41. This indicates that, if there is 1 percent increase in the standard deviation of the GDP per capita of a source country relative to Canada, the skill proficiency of an immigrant from that country would

³³ All three measurements of income per capita are relative data. The value is relative to the mean of the Canadian-born population.

³⁴ In order to simplify the terminology, the rest of the study will use GDP per capita to represent the landing-time-and-landing-age-adjusted income per capita of the country of origin.

improve by 34 to 41 points. Given that the average score is just under 300, 34 to 41 points is a sizeable difference. The impact is quantitatively significant in addition to being statistically significant. This finding is in line with Borjas (1985) and is not consistent with the conclusion of Jasso and Rosenzweig (1990).

As discussed in Section 5.1, among other implications, the statistically positive coefficient of the economic development level of the country of origin provides insights into the channels through which the country of origin exerts its influence on its residents' skill proficiency. The positive sign of the coefficients suggests that Canadian immigrants who come from well-developed countries may have had access to higher quality education, may have had more opportunities to learn and practice English or French before landing, and their home country's work environment would be more likely to be similar to Canada's. Pre-migration exposure to an economic environment more similar to Canada's contributes to the positive correlation between skill proficiency and economic development level of source country

Table 5.3.4 Regressions on skill proficiency

Dependent variable: Skill proficiency										
Explanatory variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
GDP per capita of										
the country of origin	34.592*** (3.4946)	34.505*** (3.4824)	40.705 *** (3.3318)	38.258*** (3.8244)	37.936*** (3.8222)	37.770*** (3.8248)	38.008*** (3.7579)	35.513*** (3.8000)	34.390*** (3.5159)	36.235*** (3.7229)
Total years of formal education	7.157*** (0.3280)	6.942*** (0.3284)								3.430*** (0.4933)
Total years of education in Canada									7.365*** (0.3904)	
Total years of education abroad									7.223*** (0.3465)	
Index of education in Canada								7.283** (3.0470)		
University degree or higher			51.532*** (3.4482)	51.751*** (3.5203)	51.797*** (3.5189)	51.870*** (3.4925)	51.859*** (3.4930)	50.953*** (3.5269)		34.688*** (4.3180)

Trade level education			21 945*** (3 5259)	22 081*** (3 5306)	22 121*** (3 5293)	21 721*** (3 5122)	21 692*** (3 5194)	21 440*** (3 5666)		15 076*** (3 6432)
High school education			--	--	--	--	--	--	--	--
Less than high school education			-30 313*** (3 8559)	-30 544*** (3 8386)	-30 590*** (3 8366)	-30 219*** (3 7561)	-30 145*** (3 7855)	-30 419*** (3 8371)		16 802*** (4 2534)
Index of getting highest education level in Canada								1 593 (2 5449)		
Language spoken at home	16 802*** (2 9605)	15 993*** (2 9740)	17 468*** (2 7299)	16 430*** (2 8404)	16 306*** (2 8403)	16 004*** (2 8236)	16 040*** (2 8148)	16 289*** (2 8307)	14 182*** (2 9540)	14 310*** (2 7635)
Male	6 439 ** (2 5911)	6 578** (2 5984)	7 698*** (2 4179)	7 822*** (2 4053)	7 828*** (2 4050)	5 730** (2 4834)	5 738** (2 4840)	7 776*** (2 4049)		3 928 (2 4045)
Age	-0 638** (0 1065)	-0 575*** (0 109)	-0 697*** (0 0995)	-0 667 (0 6249)	-0 489 (0 6221)	-0 9156 (0 6458)	-0 886 (0 6433)	-0 652*** (0 1506)	-1 016*** (0 1876)	-0 809 (0 6300)
Parents had university level education		7 800*** (2 7577)	8 560*** (2 5960)	8 596*** (2 6332)	8 583*** (2 6331)	8 695*** (2 6162)	8 720*** (2 6246)	8 3066*** (2 6104)	8 044*** (2 7151)	6 680*** (2 5802)

Years since immigration (YSM)			0.172 (0.1352)			-0.004 (0.3834)	-0.066 (0.3441)	0.050 (0.1461)		-0.058 (0.3366)
Age at landing						-0.194 (0.1352)				
Total work experience								0.398** (0.1743)		0.497*** (0.1746)
Canadian work experience						0.359* (0.2092)			0.590** (0.2158)	
Work experience abroad						0.464 (0.3237)			0.823** (0.3074)	
Constant term	145.622*** (6.853)	144.948*** (7.2533)	222.122*** (5.7495)	222.426*** (13.3701)	223.024*** (13.3903)	230.179*** (13.4705)	229.919*** (13.5075)	219.289*** (6.7118)	152.290*** (7.7397)	
Observation	2841	2841	2841	2841	2841	2841	2841	2841	2841	2841
R²	0.4243	0.4281	0.4491	0.4497	0.4498	0.4526	0.4525	0.4525	0.4286	0.4727

Source: IALSS (2003) and Penn World Table 6.2

Note: OLS estimation. *** represents significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% level. Standard error is reported in brackets.

Table 5.3.5 Regressions on skill proficiency with different measures of income per capita of country of origin

Dependent variable: Skill proficiency			
	(1)	(2)	(3)
Landing-time-and-landing-age-adjusted income per capita of the country of origin	39.806*** (3.4898)		
Constant income per capita of country of origin		28.346*** (3.3311)	
Landing-time-adjusted income per capita of country of origin			31.168*** (3.6622)
Total years of formal education (self-reported)	7.604*** (0.3318)	7.619*** (0.3407)	7.518*** (0.3428)
Language spoken at home	12.594*** (2.9497)	17.821*** (2.9718)	17.725*** (3.0019)
Constant term	116.819*** (4.8524)	124.458*** (4.7391)	125.818*** (4.7078)
Observation	3010	3010	3010
R²	0.4099	0.3783	0.3771

Source: IALSS (2003), Penn world Table 6.2

Note: OLS estimation. *** represents significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% significant level. Standard error is reported in brackets.

5.3.2.2 Public expenditures on education as a percentage of GDP

Improving the quality of an educational system enhances the productivity of workers who received education from that particular educational system. Different proxies can be applied to index the quality of educational systems, and public-expenditures-on-education is one of them.

However, according to the figures in Table 5.3.6, public expenditures on education (as a percentage of GDP) of the source country are not significantly correlated with immigrants' skill proficiency. Though it is expected that a higher ratio of GDP being invested in the education system could improve the quality of education, both the micro and macro (Chapter 4) analyses cannot find evidence that source countries' spending on public education created significantly positive effects on skill proficiency. One reason for the non-significance of public educational expenditures of the country of origin may be that around 50 percent of the immigrants had both Canadian and source country's education. Thus, the impact from the source country's educational quality was reduced significantly.

There is also a related result in Blankenau *et al* (2007), who found that public expenditures on education do not have a statistically significant effect on economic growth, if the analysis does not control for government taxation. One potential explanation for this is that the taxation required to finance higher public education expenditures may have negative effects on economic activity. In turn, this could reduce opportunities for skill accumulation through learning-by-doing and may increase skill depreciation.

Table 5.3.6 Regressions on skill proficiency with public expenditure on education of the country of origin

Dependent variable: Skill proficiency		
	(1)	(2)
Relative income per capita of the country of origin		38.151*** (4.3267)
Public expenditures on education as percentage of GDP (relative to Canada)	2.661 (7.9471)	1.105 (6.7301)
Total years of formal education (self-reported)	7.623*** (0.3683)	
University degree or higher		50.542*** (3.8419)
Trade level education		21.289*** (3.8451)
High school education		--
Less than high school education		-32.163*** (4.1639)
Language spoken at home	20.499*** (3.1560)	14.104*** (3.0436)
Male		6.403** (2.6776)
Age		-0.564 (0.6998)
Parents had university level education		8.128*** (2.8057)
Years since immigration (YSM)		-0.3009 (0.3723)
Total work experience (self-reported)		0.3837** (0.1817)
Constant term	135.193*** (7.2478)	226.884*** (15.4771)
Observation	2841	2841
R²	0.3489	0.4522

Source: IALSS (2003), and Penn World Table 6.2

Note: OLS estimation. *** represents significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% significant level. Standard error is reported in brackets.

5.3.2.3 Language skills

Language skills play an important role in determining immigrants' social and economic outcomes. Ferrer *et al* (2004) argue that the inability to answer the IALSS test indicates a lack of English and/or French reading fluency. In general, the IALSS literacy test scores for immigrants reflect a combination of cognitive skills and language (reading) skills. A complementarity exists between language skills and other forms of human capital, and it is difficult to untangle these two elements.

Four different approaches are employed in this chapter to measure English and French proficiency: whether the mother tongue is English/French, whether English/French is spoken at home, whether the official language of the country of origin is English/French, and whether English/French is used at work if ever employed in Canada. Accordingly, four regressions are estimated to test the impact of each of the four language measures on immigrants' skill proficiency (see Table 5.3.7). Except for the official language of the country of origin, the estimated coefficients of the other three language measures are statistically significant. The model with English/French spoken at home has the highest R-squared.

Therefore, the micro analysis uses the variable based on whether English/French is spoken at home to measure language skills in all the subsequent regressions.³⁵ An immigrant who is not proficient in English/French may more likely avoid exposure to English/French if this individual lives in an area (e.g., with his/her family) where his/her origin language can be used. Language practiced within a family will influence

³⁵ According to Chiswick and Miller (2001), language spoken at home better measures the usage of English/French.

proficiency, and frequent use of languages of origin at home results in less proficiency in destination language (Chiswick and Miller 2001). Therefore, living in an area where origin country languages can be used easily is likely to lead to the erosion of literacy skills.

Table 5.3.7 Regressions with different measures of language skills				
Dependent variable: Skill proficiency				
	(1)	(2)	(3)	(4)
GDP per capita of the country of origin (relative to Canada)	38.927*** (3.6048)	41.267*** (3.5892)	43.505*** (3.299)	43.976*** (3.4287)
Total years of formal education	7.579*** (0.3426)	7.678*** (0.3428)	7.448*** (0.3541)	7.743*** (0.3386)
Language spoken at home	12.679*** (3.0058)			
Mother tongue		9.229*** (3.4500)		
Language spoken at work			13.168*** (3.2450)	
Official language of country of origin				1.990 (2.8179)
Constant term	117.466*** (4.9798)	118.325*** (5.1338)	113.002*** (4.8726)	117.316*** (4.939)
Observations	2841	2841	2841	2841
R²	0.4039	0.3984	0.4034	0.3944

Note: OLS estimation *** represents significant at 1% level, ** represent significant at 5% level, and * represents significant at 10% significant level. Standard error is reported in brackets

Table 5.3.8 Regressions for prose proficiency

Dependent variable: Prose proficiency		
	(1)	(2)
Relative GDP per capita of the country of origin	35 353*** (4 0466)	33 517*** (4 1548)
Total years of formal education		7 173*** (0 3396)
Index of education in Canada	7 988** (3 1532)	
University degree or higher	50 113*** (3 6943)	
Trade level education	23 366*** (3 7017)	
High school education	--	
Less than high school education	-31 718*** (4 1163)	
Language spoken at home	20 231*** (3 0265)	19 749*** (3 1961)
Age	-0 623*** (0 1557)	-0 568*** (0 1409)
Male	1 725 (2 5411)	0 317 (2 6842)
Parents had university level education	8 755*** (2 7144)	7 883** (2 8427)
Years since immigration (YSM)	0 112 (0 1521)	0 118 (0 1435)
Constant term	219 062*** (6 9375)	141 953*** (7 5799)
Observations	2863	2863
R ²	0 4278	0 4147

Source IALSS (2003), Penn world Table 6 2

Note OLS estimation *** represents significance at 1% level, ** represents significant at 5% level, and * represents significant at 10% level Standard error is reported in brackets

Table 5.3.9 Regressions for numeracy proficiency

Dependent variable: Numeracy proficiency		
	(1)	(2)
GDP per capita of the country of origin (relative to Canada)	37 308*** (3 9842)	34 205*** (4 2512)
Total years of formal education (self-reported)		7 309*** (0 3748)
Index of education in Canada	6 681** (3 2528)	
University degree or higher	60 206*** (4 1351)	
Trade level education	26 254*** (4 0012)	
High school education	--	
Less than high school education	-26 466*** (4 1562)	
Language spoken at home	14 213*** (3 0623)	13 322*** (3 4670)
Age	-0 612*** (0 1712)	-0 508*** (0 1573)
Male	17 170*** (2 6917)	16 077*** (2 9413)
Parents had university level education	5 241* (2 9683)	5 244 (3 1961)
Years since immigration (YSM)	0 0243 (0 1618)	-0 142 (0 1582)
Constant term	210 928*** (7 7586)	135 719*** (8 5834)
Observation	2863	2863
R2	0 4188	0 3821

Source IALSS (2003), Penn world Table 6 2

Note OLS estimation *** represents significance at 1% level, ** represents significant at 5% level, and * represents significant at 10% level Standard error is reported in brackets

Speaking English/French at home had statistically positive impacts on immigrants' skill proficiency, and the magnitudes of the coefficients of the language variable are very close to each other (around 15) among the eight models (see Table 5.3.4).

In order to provide further evidence on the importance of English/French for immigrants' skill proficiency, in this chapter, I present regressions on prose numeracy proficiency separately (see tables 5.3.8 and 5.3.9).³⁶ Prose and numeracy have different English and French skills requirements. The former requires higher English/French skills, while the latter needs relatively lower English/French skills. As the figures in tables 5.3.8 and 5.3.9 indicate, the magnitude of the coefficient of language for prose literacy is around 20, while it is around 13 for the numeracy domain. Comparing the impact of language on prose and numeracy indicates that the IALSS test is partially a language test, especially for prose or document dimensions, which have higher language requirements. The statistical results suggest that the English/French skill level is a significant barrier for international immigrants to overcome in order to perform as well as the Canadian-born population in processing and acting upon daily information.

If an immigrant cannot conduct a conversation in any official language, pre-migration education and work experience cannot be associated with higher social and economic outcomes in the host country (Chiswick and Miller 2003). For instance, an engineer who is well-trained in that profession but cannot communicate with his/her employers or fellow employees would be counted as having very low usable engineering

³⁶ Ferrer *et al* (2004) argue that the document literacy score partially reflects language fluency for immigrants.

skills (Ferrer *et al* 2004). Thus skills generated through education or work experience in the source country cannot be directly transferred to the host country due to the barrier of language if an immigrant's first language is not English or French. English/French skills are another major factor, other than source countries' economic development level, in explaining why international immigrants attain lower literacy scores despite having more years of education compared with the Canadian-born population. If the IALSS test was conducted in the immigrants' origin language, immigrants' skill performance might increase. Thus, providing effective language training for immigrants could help for their skill development.

On the other hand, language spoken at home is highly correlated with cultural factors. If the language variable is used as a proxy of culture, the significant positive coefficient of language also indicates that skill proficiency is influenced by cultural factors. Individuals who came from a cultural background different from Canada's may face more difficulties in catching up with Canadian-born population in terms of Canadian skill proficiency.

Language skill is also a component of the immigrant assimilation experience. The longer the immigrant stays in Canada, the more likely it is that his/her English/French skills will improve as the chances of exposure to English/French increase. Ferrer *et al* (2004) argue that the association between improvements in literacy scores and the length of time in Canada may reflect increased language skills, which then improve the usability of immigrants' cognitive skills.

5.3.2.4 Total years of formal education

Figures in Table 5.3.4 show that total years of schooling have a significant positive correlation with skill proficiency. Models 1 and 2 (without educational degree information) indicate that one additional year of education will improve skill proficiency by about 7 points in the 0–500 scale. The magnitude of the coefficient of years-of-education decreases along with the inclusion of educational degree variables.

As discussed by some studies (e.g., Ferrer and Riddell 2004), education obtained abroad is significantly less valued in the host country. However, the figures in column 9 of Table 5.3.4 show that education obtained outside of Canada has a similar impact on skill proficiency. This finding supports Friedberg's (2000) argument that acquiring further human capital following immigration is associated with a rise in the return to education obtained abroad. Education provides individuals with the learning capability to acquire new knowledge after migration. Attending school in the host country may aid in the transferability of an immigrant's human capital by giving him/her language proficiency. Attending school may also provide him/her with other country-specific human capital that will enable him/her to better apply his/her previously acquired skills in the new labour market setting.

In addition, the regression results showed in Table 5.3.10 indicate that when income per capita in the country of origin is controlled for, the estimated return of foreign education is quite close to that of Canadian education. Theoretically, if there exist a good variable which could capture the effect of quality of education, and the regression includes that variable, there should be no difference in the marginal effect estimated from foreign and Canadian education. This, my finding suggests that income-per capita in the

country of origin may be a very good proxy of quality of education in empirical studies.

Also, years of education may provide a signal of ability (Boissiere *et al* 1985). Individuals having higher education levels might have a greater ability to learn and use literacy skills. The growth rate of human capital decreases as the duration of schooling increases.

The result in column 8 of Table 5.3.4 confirms the fact that education in Canada contributes significantly to one's Canadian skill formation even when the levels of education are controlled for.

Table 5.3.10 Comparison of return of Canadian and foreign education

Dependent variables: Skill proficiency		
Explanatory variables	(1)	(2)
In come per capita of country of origin		34.390*** (3.5159)
Language	22.238*** (1.8365)	14.182*** (2.9540)
Canadian education	7.539*** (0.2632)	7.365***(0.3904)
Foreign education	6.472*** (0.2340)	7.223*** (0.3465)
Parents' secondary education	9.906*** (1.7795)	8.044*** (2.7151)
Age	-1.030** (0.4099)	-1.016*** (0.1876)
Constant term	178.662*** (7.9923)	152.290***(7.7397)
R ²	2841	2841
Observations	0.3516	0.4286

Source IALSS (2003), Penn world Table 6 2

Note OLS estimation *** represents significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% significant level Standard error is reported in brackets

5.3.2.5 Educational level

Both years of education and educational degrees should be taken into account in analyzing immigrants' earnings (Ferrer and Riddell 2004). Accordingly, a series of dummy variables corresponding to bachelor's or higher degree, trade degree, and less

than high school education are included (see column 8 in Table 5.3.4) in some regressions. The omitted category reflects individuals with completed high school education. Those who have a diploma have more ability measured by literacy proficiency than those who did not complete high school. For example, a university graduate individual will have 50 more points on the proficiency score than those who did not finish high school if total-years-of-education is not included as a control (columns 3–8 in Table 5.3.4).

To further explain the positive correlation between diploma and skill proficiency, a further regression is estimated by controlling for the years of education (see Table 5.3.4). The coefficients for years-of-education, university degree, and trade education are all significantly positive, but the magnitude of the coefficients decreases. For example, when total-years-of-education is included as a control, the improvement in points decreased to 34, which is still a significant increase (column 10 in Table 5.3.4).

5.3.2.6 Work experience

Whether skills generated through work experience in the country of origin can be directly transferred to the host country and result in well-qualified immigrants is an interesting question to address. This chapter uses self-reported years-of-work experience to measure work experience. The figures in column 7 of Table 5.3.4 indicate that total work experience is positively and significantly correlated with skill proficiency, but the level of impact is very limited: 10 more years' work experience may help to increase the proficiency score by only 3 points. In addition, model 6 in Table 5.3.4 shows that

Canadian work experience is positively significant at the 10% level. However, work experience obtained abroad is not significantly correlated with skill proficiency. Moreover, experience could interact with language to affect skill proficiency. When an immigrant cannot conduct a conversation in the host country's language, pre-migration experience cannot be associated with better economic and social outcomes.

5.3.2.7 Parents' post-secondary education

Parents are the initial teachers of their children. The development of literacy is a process that begins in childhood and continues throughout an individual's life. Less-literate parents are also more likely to have difficulty transmitting reading, writing, numeracy, and problem-solving skills to their children. In contrast, well-educated parents are more likely to invest time and financial resources in their children's education. This chapter uses a dummy variable, namely whether parents had post-secondary education, to indicate whether parents are well educated. The regression results in Table 5.3.4 indicate that parents holding a post-secondary level of education exerted strong positive effects on their children's skill proficiency, and the magnitude of the impact of the parents' education is not less than that of years of schooling.

5.3.2.8 Years in Canada

In the cross-sectional analysis, this variable might capture both cohort and assimilation effects. The longer immigrants stay in Canada, the more they get used to daily life in Canada. Although previous studies discuss the importance of this variable,

the current analysis does not find it to have a statistically significant impact on immigrants' skill proficiency.

5.3.2.9 Age at immigration

Younger people have a far greater capacity for learning a new language and skills than do older individuals. Older immigrants may be less able to adjust to the linguistic and cultural challenges associated with entering a new country (Schaafsma and Sweetman 2001). At least in part, this seems to be a biological process: as a person ages, the brain loses some of its capability in adapting to new languages/cultures. It is expected that destination country skill proficiency will decline with an older age at immigration, all else being equal. However, the figures in Table 5.3.4 did not provide evidence that age of immigration is significantly correlated with skill proficiency.

Section 5.4 Comparison between micro and macro analysis

In this section, simple regressions have been run to investigate whether micro level analyses support the findings from macro level regressions. In order to ensure the comparability between macro level and micro level analyses, the regressions from macro-level data and micro-level data are conducted for the same sample of individuals. Among all the explanatory variables, only the three variables of most interest (income per capita of country of origin, years of education, and language proficiency in English or French) are examined (see table 5.4).

5.4.1 Income per capita of country of origin

Both the micro level regressions and macro level regressions find a significant positive effect of income per capita in the country of origin on immigrants' skill proficiency. Note that the marginal effect of the coefficient from the micro level analysis is bigger than that from the macro level regressions. The results are as expected since the construction of this variable in the micro analysis is improved in comparison with its construction in the macro analysis. As explained in section 5.2, income per capita in the country of origin in the micro analysis considers the factors of age-of-landing and time-of-landing.

5.4.2 Years of education

Based on the analysis of the omitted variable bias, the coefficient of years-of-education in the aggregated data econometrics should be smaller than the coefficient estimated from the micro level. The reason is that the variable of years-of-education in the individual-level data is correlated with the error terms as we do not control for innate

abilities. One could think that, across individuals, innate abilities are distributed normally. People with more innate abilities should, on average, spend more time at school. Consequently, in the individual data analysis, years-of-education is positively correlated with the error terms, and its point estimate should be positively biased.

At the macro level, taking the mean of variables across individuals of the same country eliminated idiosyncratic differences on unobservable factors, such as innate ability or self-motivation.

But the comparison of the regression results (see Table 5.4) reveals that the hypothesis regarding the effect of the omitted variable bias is rejected. The micro regressions suggest that one additional year of education could help to improve literacy scores by about 7 points (column 2), while the macro regressions suggest that about 10 points (column 1) of the average proficiency scores could be improved if the average years-of-education of the population is increased marginally by one year.

However, when parents' post secondary education (family impacts) is controlled for in the regression, the marginal effect of years of education from macro analysis decreased to 6.7 (column 3), which is closed to the finding from micro regression in column 2.

5.4.3 Language proficiency in English/French

Both macro level and micro level regressions indicate that language proficiency in English or French has significant positive effect on immigrants' skill proficiency. Both approaches indicate that language played a major factor for the formation of immigrants' human capital in Canadian social and labour market. Since the structure of this variable in

micro data (binary variable) is different than in the macro analysis (percentage of immigrants who spoke English or French at home) it is not appropriate to compare the marginal effects directly.

Table 5.4 Comparison between micro and macro regressions				
Dependent variable: Skill proficiency				
Independent variables	Macro	Micro	Macro	Micro
Relative income per capita	26.7519*** (4.8426)	35.8578*** (2.2495)	28.9390*** (9.9505)	38.6355*** (2.2474)
Years of education	10.9837*** (1.4867)	6.7295*** (0.2161)	6.7001*** (1.1565)	5.5524*** (0.2677)
Language proficiency on English/French	16.6810*** (6.4279)	14.2094*** (1.8204)	16.6838** (6.6172)	16.7530*** (1.8013)
Post secondary education			34.2030** (15.2246)	19.491*** 2.2173)
Observation	50	3010	50	3010
Adjusted R²	0.8187	0.4053	0.7996	0.4116

Source: IALSS(2003); Penn World Table 6.2.

Note: *** represents significant at 1% level, ** represents significant at 5% level, and * represents significant at 10% level. Standard error is reported in brackets.

The macro weight is defined as the number of sample respondents of each country of origin.

Section 5.5 Conclusion

5.5.1 Micro analyses

This chapter investigates the factors that are correlated with Canadian international immigrants' skill proficiency by using micro-level data from IALSS (2003). First, it finds strong evidence that the economic development level of the country of origin, proxied by the income per capita, plays an important role in individuals' skill development. Individuals who migrated from developed countries exhibit higher skill levels than those from less-developed countries. The result is consistent with the findings of Borjas (1987) and Jasso and Rosenzweig (1990).

Second, it suggests that income per capita in the country of origin is a great proxy of quality of education. When it is included in the regression, the marginal effects of Canadian education and foreign education are similar to each other.

Third, both years of schooling and post-secondary education have significant positive impacts on individuals' skill proficiency. Immigrants who are university graduates (including post-graduate levels) hold higher skill proficiency levels than the Canadian-born population in general. In addition, education obtained in Canada helps in developing skills at dealing with information in Canada. When levels of education are controlled for, studying in Canada still keeps its positive correlation with skill proficiency. Those who never received education in Canada have a lower skill proficiency than the Canadian-born population, despite having university degrees. Nevertheless, education obtained abroad has a positive correlation with the skill development of immigrants. Whatever the curriculum of a school, students can gain some

learning ability from their school learning experience, which is helpful for their future learning activities.

Fourth, fluency in the host country's language (English and/or French in Canada) plays an essential role for immigrants' skill development. Insufficient skills in reading and/or speaking English/French are a barrier for immigrants to improve their skills at dealing with daily information in Canada and even their labour market outcome.

Fifth, the impact from family background, which is indexed by whether parents had university or higher education degrees, is significantly and positively correlated with individual's skill proficiency. Well-educated parents may spend time with their children and invest money to train them academically. Finally, the study finds some marginal positive effects of work experience on skill development.

The above factors worked together to explain why Canadian immigrants had lower skill proficiencies than the Canadian-born population despite having more years of schooling. However, age-of-landing and years-since-migration were not found to have any significant effects on immigrants' skill proficiency. Also, there is no evidence that public expenditures on education in countries of origin are positively correlated with the skill proficiency of immigrants in Canada.

5.5.2 Comparison of micro and macro analyses

The comparison shows that both micro level and macro level analyses provide consistent results regarding the significant positive effect of income per capita of country of origin, years of education, and language proficiency in English or French on

immigrants' skill proficiency. However, due to different variable structures in the micro and macro data sets, the estimated coefficients should not be compared directly.

5.5.3 Policy implication

Based on the empirical findings from micro and macro analyses, some policy implications can be drawn. First, since the skill intensity of immigrants, for given levels of education, varies substantially across countries of origin, the point system for selecting immigrants, which gives equal importance to years of education independently of where the education was received, does not maximize the overall skills contribution of immigration.

Second, as employers may have better information about the productive skills of potential immigrants, facilitating the admission of those who have job offers in Canada may increase the average skill intensity of immigrants.

Third, as those holding student visas have higher literacy proficiency scores compared with other immigrants, increasing the proportion of international students who stay in Canadian labour markets after finishing their studies may improve the accumulated human capital intensity of Canadian immigrants.

Fourth, due to the significant impact of English or French skills on immigrants' human capital intensity, language training after immigration may also have high benefits in terms of better integration of immigrants into Canadian labour markets.

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APPENDICES

Appendix 1 Grouping countries of origin

Those source countries containing fewer than 30 respondents are aggregated based on the following considerations:³⁷

a. Geographic location

Central America and Other Caribbean are split as two individual groups since Other Caribbean has over 30 respondents.

b. Geographic location and language issue

This rule was utilized for African countries, which are categorized by language, French or English.

c. Geographic location and economic development level

Australia and New Zealand, and Other Oceania are separated as two individual groups since the first group is much more economically developed than the second group. The same rule is utilized for the two Southeast Asia groups, Arabic countries in Asia, and countries in South America.

d. Geography and social structures

The concept of East Europe and West Europe is employed to define East Europe group.

³⁷ Table 3.2 provides the detailed country-group information.

Appendix II Calculating the skill-schooling gap

The concept of the skill-schooling gap is to provide quantity estimates of the skill deficiency of international immigrants relative to the Canadian-born population (Coulombe and Tremblay 2009a). The main idea is to convert the international immigrants' skill scores into years of education taken by Canadian-born population who hold the same level of scores.

First of all, the relationship between schooling and skill for the Canadian-born population has to be defined. As displayed in Figure 4.1.1, instead of having a linear relationship, skills increase over years of schooling but at a decreasing growth rate, especially for the years of education beyond 16. The following quadratic function is defined to explain the relationship between the skill and schooling of the Canadian-born population:

$$H_i = c + \beta_1 * S_i + \beta_2 * S_i^2 + \varepsilon_i \quad (\text{AII.1})$$

where H_i denotes skill proficiency, S_i represents the formal years of education for the Canadian-born population, and i denotes each cross-sectional unit. The β_1 and β_2 are the coefficients of S_i and S_i^2 . The ε_i is the error term to capture the measurement errors and missing factors. The OLS estimation yields the results as below:

$$H = 102.014 + 19.548 * S_i - 0.424 * S_i^2 \quad (\text{AII.2})$$

(5.7017) (0.9236) (0.0337)
R-squared 0.9948 S.E of regression 3.4282

Standard errors are presented in parentheses. Figure 4.1.2 indicates that the model, represented by the fitted curve, fits very well to the actual curve.

Then, based on the assumption that immigrants and the Canadian-born population have the same quantitative relationship between skill and schooling as displayed in equation (AII.2), the international immigrants' skill proficiency, H_i , is converted into years of education, S_i . Once the values of H_i , constant term and coefficients of S_i and S_i^2 , are known, then standardize equation (AII.2) into $a*s^2 + b*s + m = 0$ formula (where $a = -\beta_2$, $b = -\beta_1$ and $m = H_i - c$). The value of S_i (which is the solution of $ax^2 + bx + m = 0$) is obtained by the following equation:

$$\frac{-b - (b^2 - 4*a*m)^{1/2}}{2*a} \quad (\text{AII.3})$$

To measure how the solution from equation AII.2 fits, the data of the Canadian-born population are utilized, and it is found that the calculated solution is around 0.38 of a year less than the actual 13.25 years of education of the Canadian-born population.³⁸ Thus all the calculated results for the country/country-group of origin will be adjusted by 0.38.

The last step is to replace the H_i of the 50 countries/country-groups into equation (AII.3) to get S_i . The 0.38 years of schooling is subtracted from each solution of S in order to get the objective variable of the skill-schooling gap as shown in Table 4.1.2.

The figures in Table 1.1.2 indicate that most of the source countries/country-groups have a positive skill-schooling gap while a couple have a negative skill schooling gap. They also indicate that the well-developed countries have negative or smaller

³⁸ The solution should be adjusted by -0.38 in order to map the years of education of immigrants to the fitted line displayed in Figure 4.2.

positive gaps while most of the developing countries have large and positive gaps relative to the Canadian-born population.

Appendix III Linguistic information in IALSS (2003)

Questions in Section B of IALSS

- B1: What is the language that you first learned at home in childhood and still understand?
- B2: What language do you speak most often at home?
- B4: What is the language you spoke most often at home when you were elementary school age?
- B5: How would you rate your current reading skills in French (if province of interview is Quebec) or English (if province of interview is other than Quebec)?
- B6: How would you rate your current writing skills in French (if province of interview is Quebec) or English (if province of interview is other than Quebec)?
- B7: How would you rate your current ability to speak French (if province of interview is Quebec) or English (if province of interview is other than Quebec)?

Appendix IV Regressions on skills with logarithmic income per capita

Dependent variable: Skill proficiency		
Explanatory variables	(1)	(2)
c	16.20 (0.63)	350.34 *** (3.41)
log(income)	9.49 *** (3.85)	9.91 *** (3.96)
Language proficiency	19.09 ** (2.75)	21.12 *** (3.14)
Years of education	10.25 *** (8.90)	9.22 *** (7.80)
Mean age		-14.88 *** (-3.31)
Mean age2		0.17 *** (3.23)
Adjusted R ²	0.706	0.756
Observations	50	50

Note: Standard errors are in the parentheses. *** indicates that the coefficient is significant at 1% significance level; ** implies that the coefficient is significant at 5% significance level; and * means that the coefficient is significant at 10% significance level.

Appendix V Income per capita of country of origin

Source country	1956	1966	1976	1986	1996
China	0 07	0 06	0 05	0 08	0 13
El Salvador	0 34	0 31	0 28	0 17	0 18
Yugoslavia	--	0 29	0 34	0 34	--
Russia	--	0 36	0 41	0 45	0 31
France	0 67	0 82	0 84	0 84	0 88
Guyana	0 21	0 20	0 22	0 13	0 12
Germany	0 73	0 91	0 82	0 84	0 91
Hong Kong	--	0 39	0 56	0 81	1 13
India	0 08	0 07	0 06	0 07	0 09
Iran	0 15	0 20	0 43	0 22	0 23
Italy	0 54	0 71	0 74	0 80	0 89
Jamaica	0 18	0 22	0 20	0 14	0 16
Lebanon	--	--	--	--	0 21
Mexico	0 35	0 39	0 39	0 35	0 32
Netherlands	0 83	0 88	0 91	0 84	0 93
Pakistan	0 09	0 08	0 07	0 07	0 08
Philippines	0 19	0 17	0 16	0 13	0 14
Poland	--	--	0 41	0 32	0 33
Portugal	0 28	0 35	0 43	0 45	0 59
Romania	--	0 13	0 23	0 25	0 22
South Korea	0 14	0 15	0 23	0 36	0 62
Sri Lanka	0 14	0 12	0 10	0 12	0 14
Taiwan	0 12	0 17	0 26	0 42	0 68
United Kingdom	0 85	0 87	0 76	0 78	0 87
United States	1 18	1 24	1 12	1 16	1 26
Vietnam	--	--	--	--	0 07
Algeria	--	0 20	0 28	0 30	0 20
Argentina	0 67	0 64	0 56	0 43	0 46
Bangladesh	--	0 09	0 05	0 05	0 07
Barbados	--	0 54	0 63	0 77	0 63
Congo, Republic of	--	0 09	0 07	0 09	0 07
Belgium	0 71	0 79	0 86	0 82	0 91

Source country	1956	1966	1976	1986	1996
Brazil	0 20	0 23	0 33	0 32	0 30
Hungary	--	--	0 43	0 44	0 38
Bulgaria	--	--	--	0 39	0 26
Cambodia	--	--	--	--	0 05
Chile	0 35	0 40	0 25	0 24	0 39
Colombia	0 24	0 21	0 22	0 22	0 24
Egypt	0 15	0 15	0 13	0 15	0 16
Laos	--	--	--	0 08	0 06
Fiji	--	0 19	0 24	0 19	0 23
Ghana	0 16	0 12	0 08	0 06	0 06
Greece	0 34	0 49	0 60	0 53	0 55
Haiti	--	0 10	0 06	0 05	0 08
Indonesia	--	0 05	0 07	0 11	0 17
Iraq	0 30	0 40	0 43	0 20	--
Ireland	0 45	0 49	0 50	0 55	0 80
Israel	0 51	0 55	0 56	0 57	0 71
Kenya	0 08	0 08	0 06	0 06	0 05
Japan	0 34	0 61	0 79	0 88	1 04
Malaysia	0 21	0 20	0 22	0 24	0 40
Morocco	0 12	0 15	0 15	0 16	0 16
Peru	0 31	0 35	0 30	0 23	0 19
South Africa	0 44	0 43	0 43	0 38	0 32
Somalia	--	0 11	0 06	0 05	--
Swaziland	--	0 20	0 19	0 14	0 22
Syria	--	0 18	0 31	0 23	0 17
Trinidad & Tobago	0 30	0 40	0 54	0 50	0 41
Turkey	0 24	0 26	0 27	0 25	0 28

Source Penn World Table 6 2 and IALSS (2003)

Appendix VI List of variables for micro studies

Variable	Definition	Source
Skill proficiency	The mean score from the four domains prose, document, numeracy and problem solving	IALSS
Constant relative GDP per capita of country of origin	Real gross domestic income per capita of country of origin relative to Canada's. The real gross domestic income is adjusted in terms of trade changes in 1996 of the country of origin and is measured in U S dollars at 1996 constant prices. Every immigrant from the same country will share the same value of this variable.	Penn World Table 6 2
Landing time adjusted relative income of country of origin	Real gross domestic income per capita of country of origin relative to Canada's. The real gross domestic income is adjusted in terms of trade changes in 1966, 1976, 1986 or 1996 of the country of origin and is measured in U S dollars at 1996 constant prices. The year of migration for each individual determines the year of income per capita data of his/her source country.	Penn World Table 6 2
Landing time and landing age adjusted relative income of country of origin	Real gross domestic income per capita of country of origin relative to Canada's. The real gross domestic income is adjusted in terms of trade changes in 1966, 1976, 1986 or 1996 of the country of origin and is measured in U S dollars at 1996 constant prices. Landing year and landing age are used to determine the year and the country of income per capita data.	
Public expenditures on education as percentage of GDP of country of origin	Total public expenditures on education expressed as a percentage of the GDP in 1999 of each country of origin.	UNESCO
Years of formal education	Self-reported number of years of formal education.	IALSS
Years of education abroad	Self-reported number of years of education outside Canada.	IALSS
Years of education in Canada	Derived from total years of education and education outside Canada.	IALSS
Education degree	It is composed by a group of dummy variables, which are employed to indicate the educational degree, such as university degree or higher, high school degree, trade level degree, or less than high school level.	IALSS
Years of work experience	Self-reported number of years of work experience.	IALSS
Years of work experience in Canada	Self-reported number of years of work experience in Canada.	IALSS
Years of work experience abroad	Derived from total and Canadian work experience.	IALSS
Mother tongue	Whether the language first learned and skill known is English or French.	IALSS
Language spoken at home	Whether the most often spoken language at home is English or French.	IALSS
Language spoken at work	Whether the language used at workplace is English or French.	IALSS

Official language of source country	Official language of the source country is English or French	UNESCO
Age	Age at interview	IALSS
Age of landing	Age at migration	IALSS
Year since migration	Derived according to age of landing	IALSS
Parents' education	Whether parents have post-secondary education	IALSS