Skills Research Initiative
Initiative de recherche sur les compétences

**Migration, Human Capital, and Skills Redistribution
across the Canadian Provinces**

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Jean-François Tremblay (University of Ottawa)

Working Paper 2006 D-07

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In the context of the federal government's innovation strategy, Human Resources and Social Development Canada (HRSDC), Industry Canada (IC) and the Social Sciences and Humanities Research Council Initiative on the New Economy (SSHRC-INE) are partnering to design and fund a multi-year skill-related research program–the HRSDC-IC-SSHRC Skills Research Initiative (HISSRI).   The research is grouped into four themes:

A.   Labour Market and Skills Implications of Population Aging;
B.   Employer-Supported Training;
C.   Adjustments in Markets for Skilled Workers;
D.   International Mobility of Skilled Workers.

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A.   les incidences du vieillissement de la population sur le marché du travail et la main-d'oeuvre spécialisée;
B.   la formation en entreprise;
C.   l'adaptation du marché du travail aux travailleurs spécialisés;
D.   la mobilité des travailleurs spécialisés dans le monde.

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Acknowledgements

Abstract

We provide provincial and national perspectives on the skill intensity and schooling of the international immigrant (foreign-born), interprovincial migrant, and Canadian-born populations using data constructed from the 2003 International Adult Literacy and Skills Survey (IALSS). On average, international immigrants to Canada have more years of schooling but a lower skill level than the Canadian-born population. Evaluated at the mean years of schooling, the measured skill deficiency of the foreign-born population (the skill-schooling gap) corresponds to 3 years of formal education in Canada. The skill-schooling gap decreases to 2.1 years of schooling in the case of international immigrants with English or French as first language. There is no skills-schooling gap for the second-generation immigrant population in Canada. These results suggest that the quality of education, in terms of skills acquired, received by international immigrants to Canada in their home country is typically lower than in Canada. Interprovincial migrants typically have a higher skill intensity than the Canadian-born non-migrant population. Overall, the two migration channels have opposite effects on skill disparities across the 10 Canadian provinces. International immigration tends to reduce provincial disparities whereas interprovincial migration tends to increase them. However, the net effect of the two channels on provincial disparities is clearly negative since in absolute value, the alleviating effect of international migration is more than twice as great as the effect of interprovincial migration.

Résumé

Nous présentons, dans une perspective provinciale et nationale, les niveaux de compétences spécialisées et de scolarité des immigrants internationaux (nés à l'étranger), des migrants d'autres provinces et des personnes nées au Canada à l'aide de données tirées de l'Enquête internationale sur l'alphabétisation et les compétences des adultes (EIACA) de 2003. En moyenne, les immigrants internationaux au Canada ont un plus grand nombre d'années de scolarité mais un niveau de compétences moins élevé que la population née au Canada. Évalué selon le nombre moyen d'années de scolarité, l'écart de compétences de la population née à l'étranger (l'écart compétences-scolarité) correspond à trois années de scolarité au Canada. L'écart compétences-scolarité passe à 2,1 années de scolarité dans le cas des immigrants internationaux dont la langue maternelle est le français ou l'anglais. Il n'y a pas d'écart compétences-scolarité chez les immigrants de deuxième génération au Canada. Ces résultats laissent supposer que, sur le plan des compétences acquises, la qualité des études faites par les immigrants internationaux au Canada dans leur pays d'origine est habituellement moins grande que la qualité des études faites au Canada. Les migrants interprovinciaux possèdent habituellement un degré de compétences plus élevé que les non-migrants nés au Canada. Dans l'ensemble, les deux voies de migration ont des effets opposés sur les écarts de compétences entre les dix provinces canadiennes. L'immigration internationale tend à réduire les écarts entre les provinces, tandis que la migration interprovinciale tend à les creuser. Toutefois, l'effet net des deux voies sur les écarts provinciaux est clairement négatif puisque, en valeur absolue, l'effet atténuant de la migration internationale est deux fois plus important que l'effet de la migration interprovinciale.

1. Introduction

With the "neoclassical revival in growth economics,"[1] the focus of a large body of the growth and development literature has shifted in the last decade to the accumulation of human capital. Following Mankiw, Romer, and Weil (1992), empirical research has used human capital intensity as one of the key determinants of various labour productivity indicators in cross-country studies.[2] On theoretical grounds, the role of human capital is potentially important. According to Mankiw (1995), the share of human capital in national income, around 50 percent, is greater than the share for physical capital that is about 33 percent in most developed economies. Moreover, when physical capital is allowed to be perfectly mobile, as in the open economy growth model of Barro, Mankiw, and Sala-i-Martin (1995), the dynamics of human capital intensity is the driving force for physical capital and labour productivity. This approach to economic growth is particularly attractive in understanding long-run economic developments in small open economies such as the Canadian provinces. Recent empirical evidence (Coulombe and Tremblay 2001, 2006; Coulombe 2003) indicates that the neoclassical framework can account reasonably well for the evolution of per capita provincial income disparities toward their long-run equilibrium distribution across the 10 Canadian provinces since the 1950s.

In this paper, we focus on the relative skill intensity of the international immigration and interprovincial migration processes in Canada. We measure the relative human capital intensity of the migrant and Canadian-born populations, using a direct measure of human capital based on test results. Our goal is to quantify the contribution of the migration process to the skill intensity across the Canadian provinces and in overall Canadian economy. To this end, we use new data on the skill component of interprovincial migrants and international immigrants in Canada, data extracted and aggregated from the 2003 International Adult Literacy and Skills Survey (IALSS) released by Statistics Canada in 2005.

In a neoclassical growth model with migration (Barro and Sala-i-Martin 2004), the long-run effect of migration on labour productivity in the receiving country is ambiguous and depends on the relative

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[1] From the title of Klenow and Rodriguez-Clare (1997).

[2] See, for example, Benhabib and Spiegel (1994) and Islam (1995) and the more recent works of Temple (2000), Bassanini and Scarpetta (2001), Krueger and Lindahl (2001), Pritchett (2001), de la Fuente and Doménech (2002), Barro and Sala-i-Martin (2004), and Coulombe, Tremblay, and Marchand (2004).

capital intensity (physical and human) of the migrant and the non-migrant populations. If physical capital is perfectly mobile across economies, as can be assumed for the 10 Canadian provinces, the long-run effect of migration on labour productivity is determined by the relative skill intensity of the migrant and non-migrant populations.

Human capital, being the invention of economists rather than engineers, is a very difficult concept to measure. Not surprisingly, measurement error is one of the biggest problems encountered in cross-country studies (Krueger and Lindahl 2001). Human capital intensity in cross-country studies is traditionally measured by schooling data, following the Mincerian approach in labour economics. This may be a good first approximation for microeconomic studies dealing with individuals of the same countries if the quality of schooling is relatively homogenous across schools. However, the quality of the educational system, as with other important social and economic institutions, is likely to differ greatly across countries. This is especially true between developed and developing countries.

The relative human capital intensity of the foreign-born population is a critical aspect to consider for an economy such as Canada's. Canada, along with the United States, Australia, and New Zealand, has for some time been considered one of the traditional immigration countries (Bauer, Haisken-DeNew, and Schmidt 2005). The measurement of human capital is particularly important in order to evaluate the contribution of international migration to the economy since the foreign-born population comes from many different countries, developed and developing.

International migration can also affect the distribution of human capital intensity across the provinces as international immigrants are concentrated mainly in the provinces with large urban centres.[3] The relative human capital intensity across provinces can also be affected by interprovincial migration if the skill intensity of interprovincial migrants differs from the non-migrant population. As documented in Coulombe (2006), interprovincial migration has always been a powerful mechanism of population redistribution in the Canadian federation.

Using a direct measure of human capital will prove particularly important for international migration because, as we will show, the skill level is substantially higher in the Canadian-born population than in

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[3] Ontario, Quebec, British Columbia, and Alberta. Manitoba is also an important province for international immigration.

the foreign-born, at any level of schooling. For the overall international immigrant population, the skill gap evaluated at the mean corresponds to 3 years of formal education in Canada. This number—referred to as the skill-schooling gap—is the difference, evaluated at the mean, in the years of schooling reported by the foreign-born and Canadian-born populations at the same skill level. The skill-schooling gap is reduced to 2.1 years for international immigrants with English or French as first language, but remains substantial. Consequently, measuring the contribution of international migration to human capital intensity by using schooling data or skills matters substantially. The international migration process appears to generate a brain drain that benefits the Canadian economy when using schooling data. But the picture is reversed when the IALSS skills test data are used: international migration tends to dilute the skill intensity in the Canadian economy. We believe this to be the most important contribution of the paper.

The lower skill intensity of the foreign-born population in Canada has been documented recently in the study of Ferrer, Green, and Riddell (2004). Their microeconometric analysis is based on immigrant literacy data taken from the 1998 Ontario Immigrant Literacy Survey (OILS) that covers six census metropolitan areas in Southern Ontario. Ferrer et al. (2004) compare these literacy data with a sample of the Canadian-born population from urban areas around Canada taken from the 1994 International Adult Literacy Survey (IALS). Ferrer et al.'s (2004) main finding is that the relatively low literacy of international immigrants is an important factor in explaining the earnings differential between foreign- and Canadian-born. Sweetman (2004) recently has also related the return to schooling of international immigrants in the Canadian labour market to the cross-country school quality index constructed by Hanushek and Kimko (2000). Since Chiswick (1978), a large body of the Mincerian literature on migration in Canada and the United States has focused on the earnings differential, after accounting for schooling, of foreign- vs. native-born. We believe that the new findings emerging from literacy studies are likely to alter the orientation of future research in this direction.

Our analysis complements Ferrer et al. (2004) and Sweetman (2004) by looking at the effect of migration on the skill intensity at the aggregate provincial level. The provincial dimension of our analysis will also prove useful since our findings clearly indicate that Ontario's international immigrants may be a biased sample of the total foreign-born population in Canada regarding the skill-schooling relationship. Results show that in Ontario, especially among international immigrants with French or

English as a mother tongue, skill intensity at a comparable level of schooling is by far the lowest across the 10 Canadian provinces.

We will follow Borjas (1987) and the related recent studies on development accounting in linking the skill intensity of international immigrants in Canada to the quality of schooling in the country of origin. In his study, Borjas suggested that the wages of international immigrants in the U.S. labour market might be a proxy for the quality of the educational system in their country of origin. In doing so, Borjas (1987) associates wages with skill, which is common in labour studies. He found that the return to schooling differs greatly across countries of origin and that immigrants' earnings in the United States are correlated with political and economic characteristics of the countries of origin. In their growth-accounting study, Klenow and Rodriguez-Clare (1997) recognized the merit of this approach. They adjusted the years of schooling used as a proxy for human capital across countries to account for the negative relationship between wages and per capita income found in Borjas (1987). Hendricks (2002) has also used the earnings of international immigrants in the United States to adjust the years of schooling for human capital measurement in a cross-country, growth-accounting study. In a recent theoretical and empirical study, Manuelli and Seshadri (2005) allow the quality of schooling to vary with the level of development across countries. This adjustment helps to increase considerably the capacity of human capital to account for cross-country income differences. They conclude that the difference in the quality of schooling is one of the most important determinants of productivity differences across developed and underdeveloped countries.

In our study, it appears that the skill-schooling gap of international immigrants in Canada is negatively correlated with the per capita income of the country of origin. The difference in the skill outcomes of schooling between the foreign-born and Canadian-born population is much larger for immigrants coming from poor countries. Along the line of Borjas (1987) and Manuelli and Seshadri (2005), we interpret this as indicating that the quality of education of Canadian international immigrants varies considerably across the countries of origin and is typically lower than in Canada. This interpretation is also supported by another of our findings that shows the skill-schooling gap vanishing for the second-generation immigrant population in Canada.

Recently, however, the association between skill and wages in the case of international immigrant populations has been often criticized because it is possible that foreign credentials might not be recognized at their full value due to discrimination in labour markets. Li (2001) provides a recent Canadian analysis of this view. The results of our analysis and that of Ferrer et al. (2004) tend to support Borjas' (1987) methodology, rather than the discrimination hypothesis. The value of foreign credentials is lower in the Canadian labour market at least in part because they are associated with lower skill intensity.

Direct measures of human capital based on test scores have been used successfully in recent cross-country growth studies (Hanushek and Kimko 2000; Barro 2001). Coulombe, Tremblay, and Marchand's (2004) study of 14 OECD countries uses human capital indicators based on literacy skills from the IALS 1994 survey. Their findings indicate that literacy data capture the effect of human capital on aggregate productivity better than data based on years of schooling. Using literacy data from the same IALSS 2003 survey that is used in this paper, Coulombe and Tremblay (2006) show that literacy data do not outperformed schooling data in their empirical analysis of per capita income differences across the Canadian provinces. This paper might provide an answer to support the superiority of literacy data over schooling data in cross-country studies only: the quality of educational systems varies considerably across countries and the flow of international migration (coming from a wide variety of countries) in Canada is not evenly distributed across the provinces.

Information on the data and the underlying theoretical and empirical motivations are provided in Sections 2 and 3. Section 4 describes two key stylized facts regarding the skill-schooling relationship for international immigrants to Canada and for the net skills effect of the interprovincial migration process. We introduce the concept of the skill-schooling gap in Section 5. This gap is designed to measure in a single number (years of schooling) the differences in the mean return to schooling in terms of skills acquired among various subgroups of foreign- and Canadian-born populations. In Sections 6 and 7, we analyze the effect of international immigration and interprovincial migration processes on aggregate indicators of skills and human capital stock across the Canadian provinces and the overall Canadian economy. We come back to the skill-schooling gap of international immigrants in Section 8 with an analysis based on the countries of origin and on second-generation immigrants. We briefly compare the

evolution of literacy scores between the 1994 and the 2003 literacy surveys for Canadian- and foreign-born populations in Section 9. We focus on policy considerations in the conclusion.

2. The data

The International Adult Literacy and Skills Survey (IALSS) is designed to provide skill measures that are comparable in level across countries and over time. The questionnaire was designed by an international group of experts to provide relevant measures of literacy performances for people coming from various cultural backgrounds. International skill data using the same methodology were collected in various countries in 1994, 1996, 1998, and 2003. Canada participated to the international assessment of adult literacy in 1994 and 2003. According to Kirsch (2005, 91), the IALSS is also designed to provide data that can be used to compare skill levels across major subgroups of the population in a given country.[4]

Consequently, it is important to bear in mind that the IALSS has not been designed to capture "Canada-specific" skills. If it had been the case, our indicator would not have been better than earlier ones, based on immigrant earnings for example, to capture differences in the quality of education across countries. The central merit of the IALSS for the purpose of this study is that it has been precisely designed to capture skill differences across countries and across subgroups of the population with different cultural backgrounds.

The target population in the Canadian sample includes all non-institutionalized residents over the age of 16, excluding members of the armed forces and individuals living on First Nations Reserves. The data in this study were constructed from the sample that excludes residents from the Northwest Territory, Yukon, and Nunavut. For the data derived from the 2003 survey, we use a sample of 20 019 responding units with 16 559 Canadian-born and 3460 foreign-born. We also use the comparable sample from the 1994 survey to analyze the change in prose and document literacy between 1994 and 2003. The Canadian sample in 1994, however, is much smaller that the one in 2003, consisting of 4175 Canadian-born individuals and 325 international immigrants (foreign-born).

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[4] For more information on IALSS, refer to Murray, Clermont, and Binkley (2005).

The IALSS sample is a stratified multi-stage sample that uses the 1991 Census as a frame. Each record on the data file is accompanied by two types of weights: a population weight and 30 jackknife replicate weights. The population weights adjust for non-response and post-stratification and were used to create population estimates. The post-stratification adjustment uses a set of geographical and demographic variables. The jackknife weights were used to compute correct standard errors for the comparison of prose and document literacy between the 1994 and 2003 samples. We used a SAS macro provided by Statistics Canada to carry out these computations.

Finally, in our analysis, a respondent is considered to be an international immigrant if she/he was born outside Canada.

3. Theoretical and empirical motivations

Our focus on comparing the skill and the schooling measures extracted from the IALSS 2003 data is motivated by theoretical and empirical considerations. Following Mankiw, Romer, and Weil (1992), the augmented neoclassical production function for an economy i at time t can be written in labour intensive form as:

$$y_{i,t} = F(k_{i,t}, h_{i,t}, A_{i,t})$$

where $y_{i,t}$ is labour productivity; $k_{i,t}$ is the physical capital intensity (the capital/labour ratio); $A_{i,t}$ is the level of technology; and $h_{i,t}$ is the human capital/labour ratio, or the skill intensity of the labour force. In an open economy with perfect capital mobility such as described in Barro, Mankiw, and Sala-i-Martin (1995), the ratio of physical capital to output can be assumed to be constant. Consequently, in logarithm form, the production function can be rewritten as:

$$\ln y_{i,t} = \beta \ln h_{i,t} + c_i + \ln \overline{A}_{i,t}, \quad (1)$$

where c_i is a time-invariant parameter as long as the world interest rate is constant, and $\overline{A}_{i,t}$ is a normalization of $A_{i,t}$. According to this neoclassical approach, the human capital intensity is one of the

few important determinants of labour productivity differences across economies. Coulombe and Tremblay (2006) use various time-series and cross-sectional empirical models based on (1) to analyze the relationship between the human capital intensity and per capita income, excluding government transfers to individuals, across the Canadian provinces in the 1951–2001 period.

The standard approach in empirical macroeconomics is to use the mean years of schooling $s_{i,t}$ in the labour force as a proxy for skill intensity. This approach is based on the microeconomic Mincerian empirical literature that has related earnings at the individual level to a limited number of key parameters such as years of schooling, experience, and sex. From a conceptual point of view, the limits and dangers of measuring skill intensity across economies by comparing years of schooling can be illustrated using the following "human capital production function":

$$h_{i,t} = S_{i,t}(s_{i,t}, z_{i,t}, z_{i,t-1}, ...,) \qquad (2)$$

In country i at time $t,$ the mean skill intensity is the result (output) of a production process. The inputs entering the skill production function $S_{i,t}$ are the mean years of schooling $s_{i,t}$ and a set z of country-specific characteristics. These include such attributes as the quality of the educational system, job-related training, and other socioeconomic factors, given that skills are also acquired within the family and social circles outside the educational system and the labour market. The past values of the z are also likely to affect the present skill intensity. If the present and past $z_{i,t}$ are quite comparable across a set of economies, as can be assumed as a first approximation for the 10 Canadian provinces, one can approximate the mean skill intensity at the aggregate level adequately by the mean years of schooling of the labour force. This provides an estimation of the skill intensity based on an *input measure*. But if the purpose of the exercise is to compare the skill intensity across countries with large variations in the present and past values of the z, focusing on an input measure such as schooling might be misleading. For example, after controlling for schooling, Borjas (1987) finds that the earnings of international immigrants to the United States are positively correlated with the per capita income level of the country of origin. In the human capital function (2), Borjas' (1987) findings might be interpreted in the following way: earnings are a good proxy for the skill intensity, and the per capita income level is a proxy of the $z_{i,t}$.

The central merit of measuring human capital intensity by using literacy scores data is that it provides a direct measure, or an *output measure*, of the skill intensity. To this end, the test scores should be designed to be comparable across countries, which is precisely the situation with the IALS 1994 and the IALSS 2003 literacy tests. The results of Coulombe, Tremblay, and Marchand's (2004) empirical analysis based on the IALS 1994 data indicate that literacy indicators are preferable to schooling data for comparing the human capital intensity across a subset of 14 OECD countries. The output approach to measuring the skill intensity should be even more useful when comparing the skill intensity of the international immigrant population in Canada, since the immigrants come from a variety of countries, developed and developing, with a larger variance in the $z_{i,t}$.

4.   Skills and schooling of Canadian migrants: two stylized facts

This section focuses on the main aggregates of human capital intensity of international immigrants, interprovincial migrants, and non-migrants, extracted from the IALSS 2003 data bank. These data come from the aggregated literacy scores (output measure) and the reported years of schooling (input measure) of respondents. For comparison purposes, we use four subgroups of the Canadian population: Canadian-born non-migrants; Canadian-born interprovincial migrants; the total international immigrant population to Canada; and a subset of the previous subgroup, international immigrants with English or French as first language[5]. It is important to note that, in all figures comparing schooling and skills, interprovincial migrants are individuals born in Canada who were interviewed in 2003 in a different province from the province of birth, and international immigrants are the foreign-born population in Canada.

The mean years of completed formal education from IALSS 2003 for the four subgroups of the Canadian population are shown in figure 1. A clear pattern emerges from this figure: the typical Canadian migrant (interprovincial migrant and international immigrant) is better educated than the typical Canadian non-migrant. In terms of mean years of schooling, the difference is close to one year of schooling between the Canadian-born interprovincial migrants (13.5) and the Canadian-born non-migrant (12.7). The mean years of schooling of the total international immigrant population in Canada

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[5] Throughout the paper, this means immigrants whose mother tongue is English or French **and** for whom this is the language used most frequently at home. In the figures, this is abbreviated as "International Immigrants English/French".

falls in the middle (13) of these two numbers; the international immigrant population with English or French as first language has the largest mean years (14) of formal education.

Next, we examine whether this picture of population subgroups that is based on the input measure of human capital holds for output measures such as the literacy scores. The overall mean literacy scores for the four subgroups of the Canadian population are shown in figure 2. The picture regarding the relative skill level of Canadian-born non-migrants and interprovincial migrants is consistent with the one displayed in figure 1: the skill level of the interprovincial migrants is greater than the non-migrant population. The difference between the numbers (13 in the IALSS 2003 scale) is roughly consistent with the difference of one year of schooling observed between these two subgroups in figure 1. As a first approximation, to convert the ALL (2003) scale into years of schooling, OECD (2000, xiv) specifies that an additional year of schooling increases the literacy score of an individual on average by 10 points in the 0–500 scale used for literacy tests. However, the literacy numbers for the international immigrants contrast sharply with the schooling numbers. Even if the total international immigrant population has more years of formal education than the Canadian-born non-migrant population, their mean skill level is about 30 points lower. The same pattern is observed for the international immigrants with English or French as first language . Despite reporting more years of schooling on average (1.5 years) than Canadian-born non-migrants, their mean skill level is 6 points lower on the IALSS 2003 scale.

This initial investigation of the skills and schooling levels of Canadian-born and international immigrant populations has highlighted two important stylized facts:

1. *The international immigrant skill-gap*: Compared with the Canadian-born population, international immigrants in Canada have a lower average skill level, but have reported more years of schooling.
2. *The interprovincial skill redistribution*: The typical interprovincial migrant in Canada has a skill level higher than the non-migrant. Given that net interprovincial migration flows are typically from the seven traditional "have-not" provinces to Ontario, Alberta, and British Columbia, interprovincial migration results in a skill redistribution process from the poorer to the richer Canadian provinces.

Figure 1. Mean years of formal education - Canada
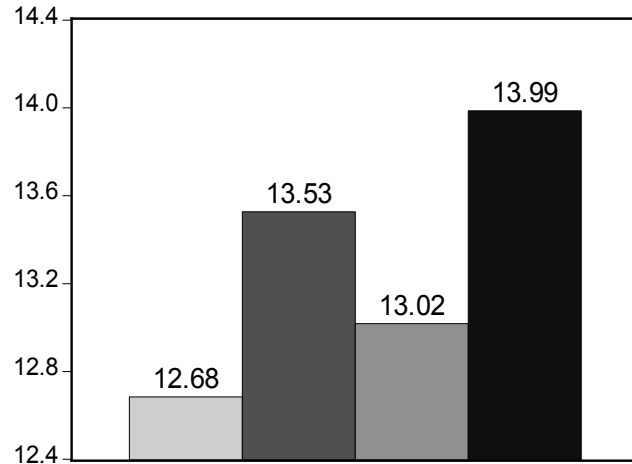
Figure 2. Literacy mean overall score - Canada

- Canadian-born non- migrants
- Canadian-born interprovincial migrants
- International immigrants Total
- International immigrant English/French
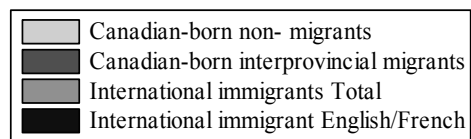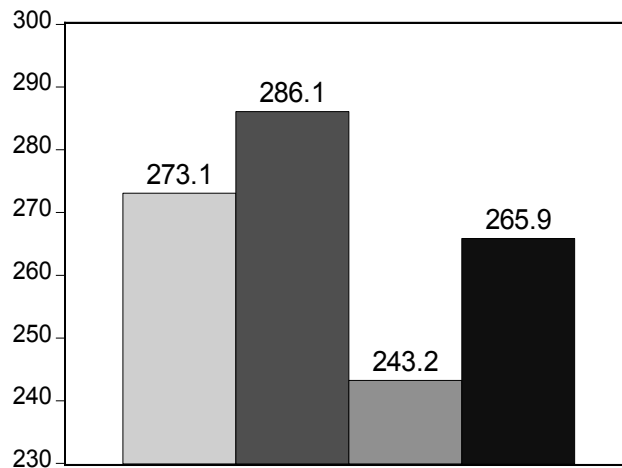
Notes to figures 1 and 2: Computed by the authors from IALSS 2003.
An interprovincial migrant is an individual who was interviewed in a different
province from the province of birth. International immigrants English/French
have either English or French as the mother tongue and the language
most often spoken at home.

5.   Documenting the foreign-born skill-gap

## 5.1   The skill-schooling gap

In order to understand the different relationships between schooling and skills of the international immigrant and Canadian-born populations that emerged from figures 1 and 2, we computed the mean skill level at all schooling levels from the IALSS 2003 data. The correspondence between skills and schooling for the Canadian-born and international immigrant populations is shown in figure 3. Given the small number of respondents who reported years of schooling below 5 and over 22, their mean skill level was not computed accurately and the numbers are not reported.

The striking point that emerges from figure 3 is that the skill-schooling curve for international immigrants stands remarkably and relatively steadily below the skill-schooling curve for the Canadian-born population. This indicates that the mean return to schooling, in terms of acquired skills, is less for the foreign-born than the Canadian-born population at any level of schooling. We believe this to be the most important finding of this study.

Our first task is to provide a quantitative assessment of the gap. A simple measure such as the ratio between the mean skill level and years of schooling might be misleading when used for comparison purposes: the skill-schooling relationship appears non-linear since both skill-schooling curves display similar decreasing-return shapes. Since the skill level generally increases with the years of schooling but at a declining rate, the mean skill-to-schooling ratio will also be declining with years of schooling as we move along the same skill-schooling curve. Such a non-linear relationship is consistent with the recent cross-country evidence on the macroeconomic return (from earnings) to schooling (Psacharopoulos 1994). If earnings and skills are closely related, as suggested by Green and Riddell (2001), the marginal and the mean return to schooling in terms of acquired skills should also be decreasing with the numbers of years at the aggregate level.

One can quantify the differential return to schooling by measuring the vertical distance between the two schooling curves at the mean of the foreign-born curve. Skill differences, however, cannot be interpreted in a straightforward fashion from a quantitative point of view since they are measured on an arbitrary scale from 0 to 500. Furthermore, the 10-point benchmark for the average increase in literacy produced

Figure 3. Literacy score and years of formal education - Canada
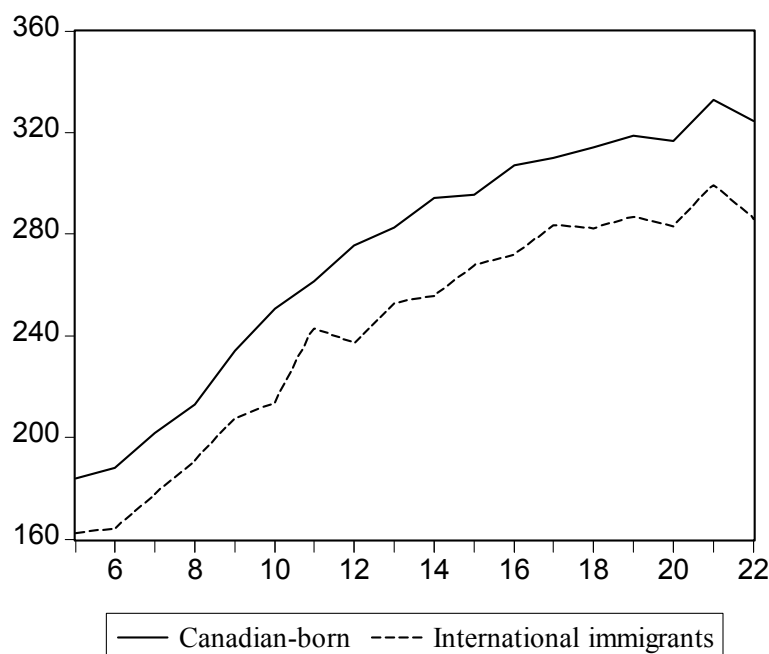
Note: Computed by the authors from IALSS 2003. Vertical axis: mean literacy score.
Horizontal axis: years of formal education

by an additional year of schooling, as reported in OECD (2000), has to be used carefully since the relationship between skills and schooling is non-linear.

All these considerations lead us to interpret quantitatively the differences in the skill/schooling relationship between the two populations: we measure the horizontal distance between the curves in figure 3 at the mean skill level of the foreign-born population. First we estimate the skill-schooling curve for the Canadian-born population. This skill-schooling curve will then be used to convert the mean skill level of international immigrants into the equivalent years of schooling in the Canadian-born population. Second, we will compute the difference between the mean years of schooling of the international immigrants and the years of schooling equivalent in the Canadian-born population. Finally, this difference will be adjusted to take into account that the skill-schooling function is a concave function. The result will provide a single number in years of schooling, the skill-schooling gap, which will be used to compare the skill intensity of a variety of subgroups of the foreign-born and Canadian-born populations.

We have estimated the decreasing returns relationship between the skill level *h* and years of schooling *s* of the Canadian-born population using the 18 grade-level observations shown in figure 3. We found that the following second-order polynomial best described the skill-schooling relationship in the data:

$$h_i = c + \alpha s_i - \beta s_i^2 + \varepsilon_i .$$

In this simple set-up, h_i is the mean skill level of the subgroup of the Canadian-born population that has attained s_i years of schooling; ε_i is an additive error term that might capture, among other things, measurement errors. An OLS estimation of this equation yields the following results:

$$A = 75.8 \quad + \quad 22.16s \quad - \quad 0.49s^2$$
$$(9.12) \qquad (16.5) \qquad (-10.0) \qquad \text{R1}$$
$$\text{R-squared .99 \quad S.E. of regression 4.99}$$

with the *t-statistics* shown in parentheses. The actual-fitted-residual graph is shown in figure 4. The fit is very good, particularly in the range between 5 and 14 years. All the comparisons between the skill return of the non-migrant and migrant populations will be done in this range.

The fitted line shown in figure 4 is the Canadian-born skill-schooling curve. This curve is used to convert the international immigrant mean skill level in terms of years of education in the Canadian-born population. The merit of using the fitted rather than the observed skill curve for the non-migrant population is that the residual depicted in figure 4 is treated as white noise generated by, among other things, measurement error.

The mean skill level of 243.2 and the corresponding years of formal education of 13 (point A in figure 4) obtained for the total international immigrant population corresponds to 9.6 years of formal education in the Canadian-born skill-schooling curve (point B). The s*kill-schooling gap* is the difference between 13 and 9.6 years, adjusted for the curvature of the skill-schooling curve. Because the skill-schooling relationship is described by a concave function, the point corresponding to the mean values of years of schooling and skills lies necessarily slightly on the right side of the curve. The point corresponding to the mean skill and schooling levels of the Canadian-born population is 0.43 years of

Figure 4. The skill-schooling curve of Canadian-born population
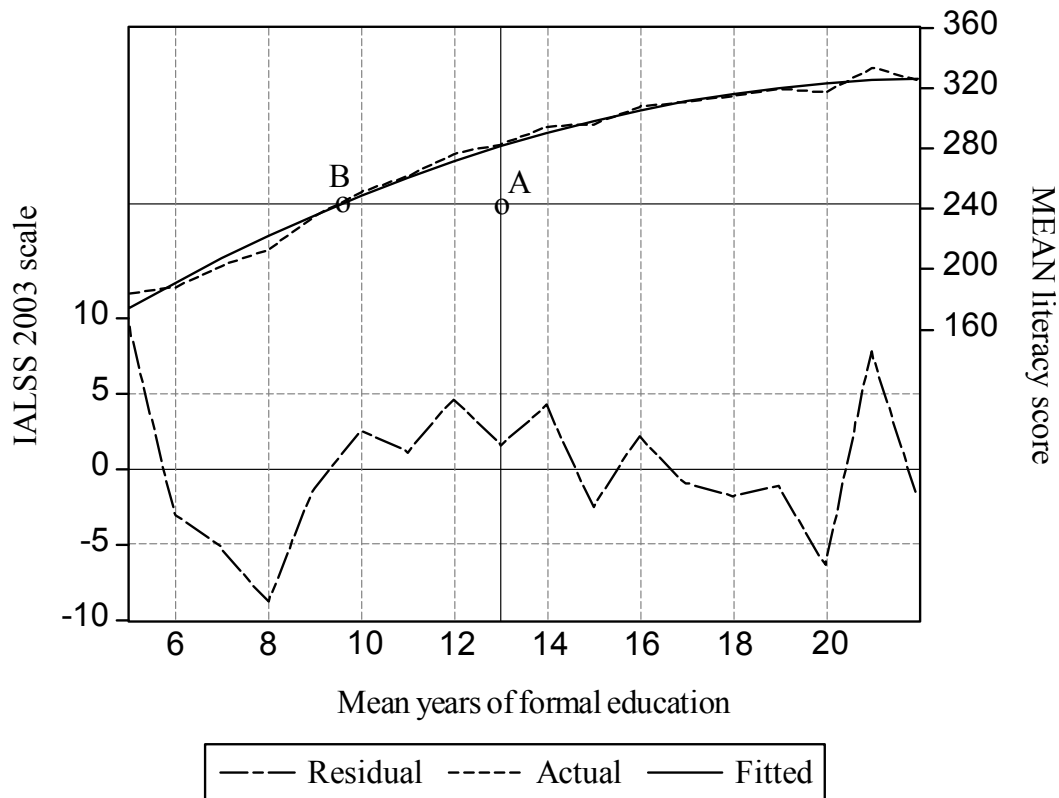
schooling to the right of the Canadian-born skill-schooling curve. This number was used to adjust the horizontal distance between the points corresponding to the mean skill and schooling of all international immigrant groups and the Canadian-born skill-schooling curve. For the total foreign-born population, the skill-schooling gap is 3 years of formal education. The skill-schooling gap is used in the rest of the paper as a synthetic measure of the differences in the mean skill return to schooling between various international immigrant subgroups and the Canadian-born population. In figure 4, the skill-schooling gap for the total international immigrant population is the horizontal distance between points A and B, minus 0.43 year. One could view the adjustment for the curvature of the skill-schooling curve as a horizontal shift, by 0.43 years, to the right. With this shift, the adjusted skill-schooling curve is constrained to pass through the point corresponding to the mean skill and schooling levels of the Canadian-born population. As long as the point corresponding to the mean skill level and years of schooling of an international immigrant subgroup lies on the right of this adjusted Canadian-born skill-schooling curve, the skill-schooling gap for this subgroup is positive. For the international immigrants with English or French as first language, the point in the skill-schooling plan corresponds to 265.9 in the

ALL scale and 14 years of schooling. This corresponds to 11.5 years of education in the Canadian-born skill-schooling curve and the skill-schooling gap for this subgroup of international immigrants is 2.1 years.

These results suggest that language problems (limited understanding of English or French) might account for some part of the international immigrant skill-schooling gap. This interpretation, however, has to be made with great care since it is possible that the immigrant population with English or French as first language comes from a different socioeconomic background, on average, than the other international immigrant population. The current exercise is primarily designed to provide a quantitative idea of the gap between the reported years of schooling and the mean literacy score between international immigrant and Canadian-born population. The skill-schooling gaps, 3 years' schooling for the total international immigrant population and 2.1 years for the international immigrants with English or French as first language, appear very substantial indeed.

## 5.2   Literacy domains, highest schooling level obtained, and age

Another point of interest is to verify if the relative performance of the foreign-born varies across literacy domains that are related to communication skills and quantitative skills. To this end, we have computed the mean score for the four literacy domains tested in IALSS 2003: prose, document, numeracy, and problem solving. For each of these four domains, the ratio between the mean score of the total international immigrant and Canadian-born populations is shown in figure 5. The relative performance of the international immigrants does not differ much across the four domains: it is a little better in numeracy than in prose but not significantly better in problem solving than in prose and document. The key point that emerges from this figure is that the skill-gap of international immigrants is not smaller in quantitative domains such as problem solving and numeracy than in domains that capture reading capacities such as prose and document. It is important to point out, however, that the numeracy and problem-solving scores of international immigrants with poor reading skills in French or English might have been driven down because they have problems understanding the questions in those languages.

The skill gap is also observed when skill levels are related to the highest level of schooling obtained (figure 6). If, for example, foreign diplomas were not recognized in the Canadian labour market, international immigrants might have the incentive to acquire a comparable diploma in a Canadian

school. This phenomenon might account for the skill-schooling gap if the years of schooling are counted twice when they report their years of schooling in the IALSS 2003 test. This hypothesis is clearly rejected by the data presented in figure 6 since for any schooling degree, the difference in skills (between 30 and 40 points on the literacy scale) is consistent with the skill-schooling gap of 3 years measured for the foreign-born population.[6]

Finally, the relationship between the mean literacy score and age is shown in figure 7 for the Canadian-born and foreign-born populations. In both cases, the score starts to increase with age, up to 30–34 years of age for the Canadian-born population and to 25–29 years for the international immigrants. After the peak, the skill level decreases with age. More importantly, the skill-age curve of international immigrants stands steadily and considerably below the skill-age curve of the Canadian-born population. Therefore, differences in the age structure of Canadian-born and foreign-born populations cannot account for the skill-schooling gap.

Figure 5. Skill ratios of mean test score of total international immigrants and Canadian-born population in four literacy domains
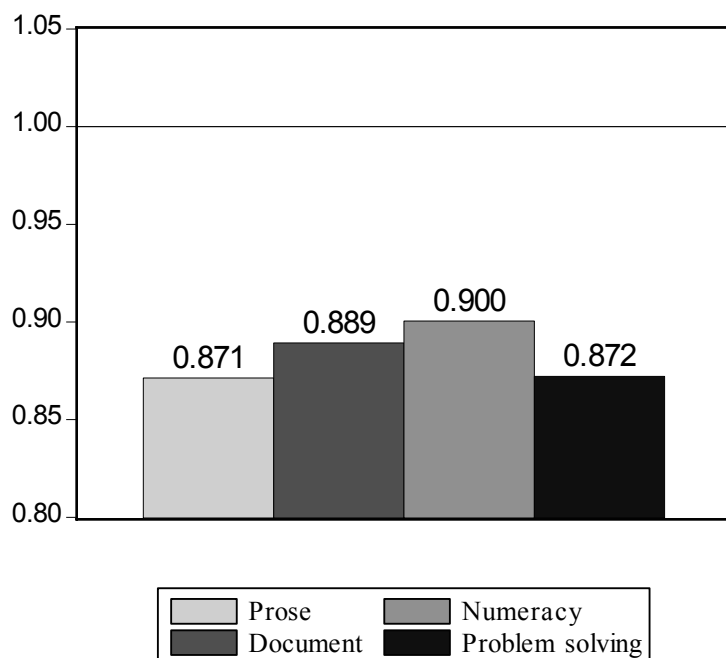
Note: Computed by the authors from IALSS 2003.

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[6] In figure 6, we follow the degree ordering used in the IALSS 2003 questionnaire. As is evident from this figure, this ordering does not always correspond to an ordering based on the skill intensity.

Figure 6. Skill per highest level of schooling – Canada
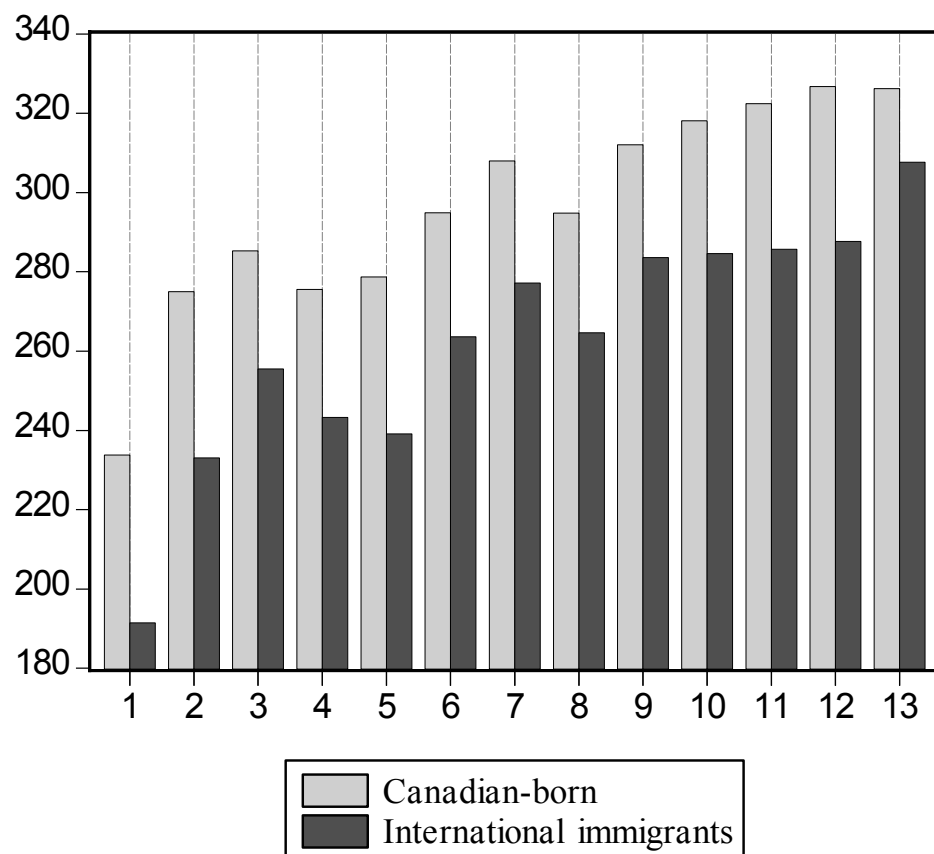
Note: Computed by the authors from IALSS 2003 - mean literacy score
1) Less than high school
2) High school
3) Some trade
4) Trade
5) Apprenticeship
6) Non-university
7) Trans university*
8) Below bachelor degree
9) Bachelor degree
10) Above bachelor degree
11) Professional
12) Masters degree
13) PhD degree
An * indicates that the number of respondents is smaller than 30.

Figure 7. Mean literacy score and age

Note: Mean literacy score by age groups computed by the authors from IALSS 2003

5.3   A provincial perspective

The international migration flow is not spread evenly across the 10 Canadian provinces. As shown in figure 8, the proportion of international immigrants in t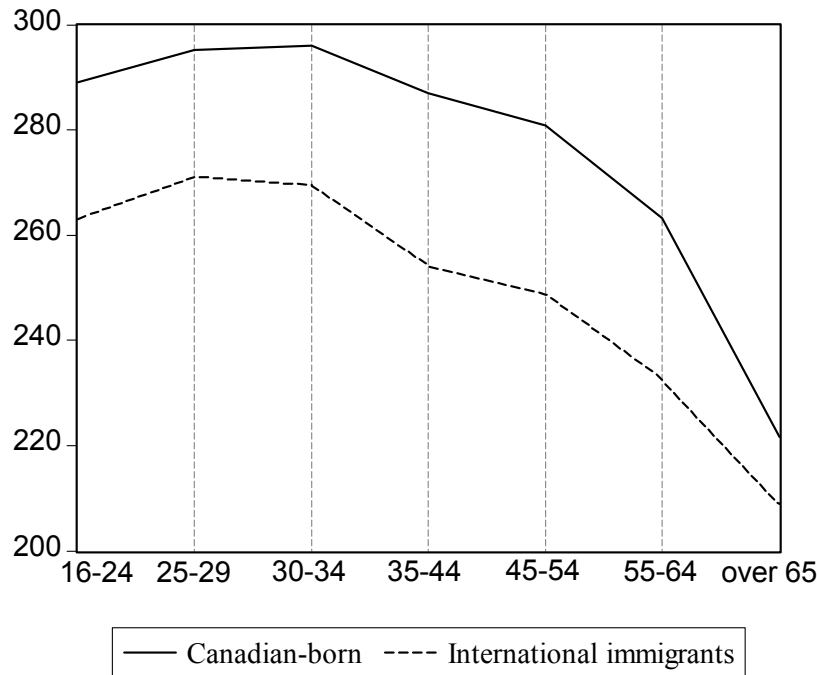he population in the IALSS 2003 sample (16 years and over) varies considerably across provinces. Only two provinces, Ontario (0.33) and BC (0.32), have migration rates greater than the Canadian average (0.23). Three other provinces, Alberta (0.19), Manitoba (0.16), and Quebec (0.12) also attract relatively substantial numbers of international immigrants. International migration rates are considerably smaller in the four Atlantic provinces (ranging from 0.02 to 0.06) and in Saskatchewan (0.05).

Analysis of the IALSS 2003 data reveals a surprising fact regarding the skill intensity of the international immigrant flows across provinces. As shown in figure 9, the mean skill level of international immigrants varies considerably across provinces. More specifically, the skill intensity is relatively very high in Newfoundland, Prince Edward Island, and Nova Scotia. In these three Atlantic provinces, the mean skill level is even greater for international immigrants than for the Canadian-born

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Figure 8. Proportion of international immigrants in the population, 10 provinces

Canadian mean

BC 0.32 AB 0.19 SK 0.05 MB 0.16 ON 0.33 QC 0.12 NB 0.04 NS 0.06 PE* 0.03 NF 0.02
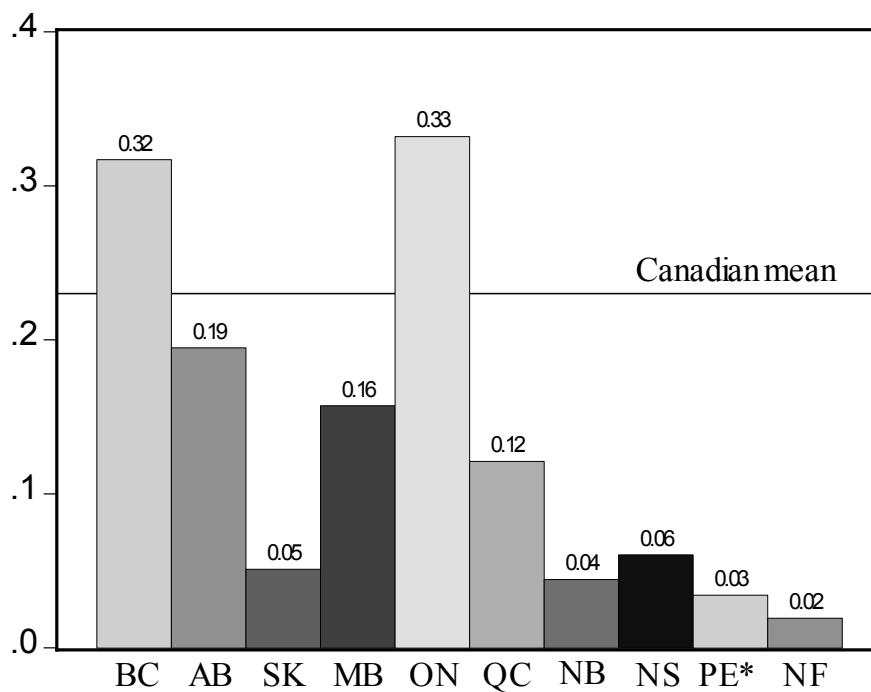
Figure 9. Literacy mean overall score for international immigrants, per province

BC 250.9 AB 248.6 SK 246.0 MB 234.5 ON 238.2 QC 249.8 NB 250.7 NS 272.0 PE* 278.0 NF 281.1
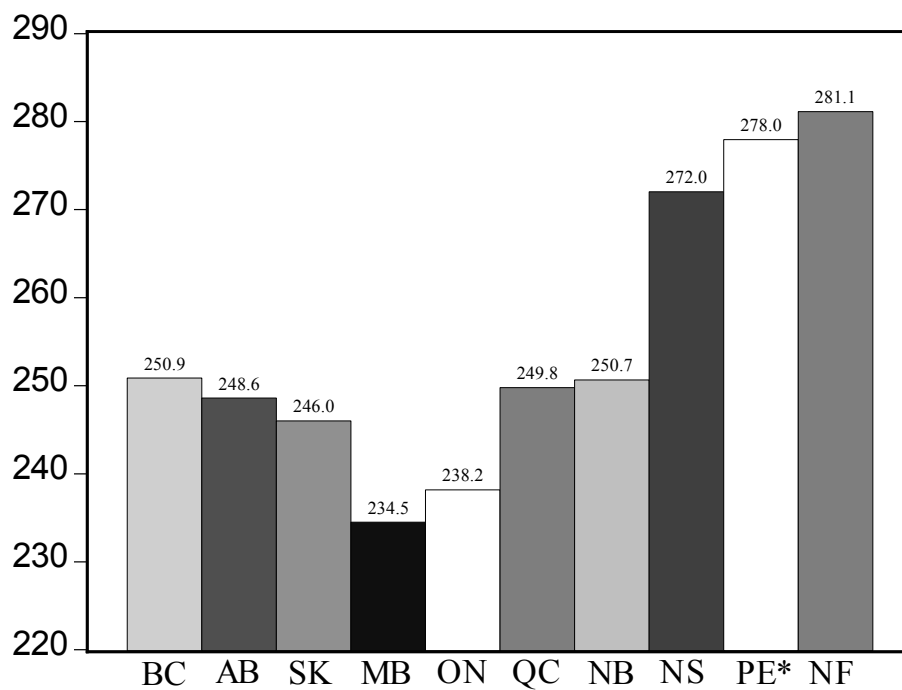
Note: Computed by the authors from IALSS 2003 sample.
An * indicates that the number of respondants is smaller than 30.

(see table A.3 in the data appendix). On the other side of the spectrum, the skill intensity of the foreign-born population is the lowest in Manitoba and Ontario. In the other five provinces, the skill intensity of international immigrants is relatively constant and falls between these two extremes.

The portrait of international immigration per province is completed with figures 10 and 11 where we report the skill-schooling gap of total international immigrants and international immigrants with English or French as first language. Interestingly, in figure 10, the five provinces with the larger skill-schooling gap are also the five provinces with the largest international migration rates (as reported in figure 8). Ontario has the highest skill-schooling gap among the 10 provinces for both total immigrants and immigrants with English or French as first language. The data for Prince Edward Island, Saskatchewan, and Newfoundland are not reported in figure 11 due to the very small number of respondents in the international immigrant population with English or French as first language in these provinces. The skill-schooling gap is smaller in all provinces for the immigrant population with English or French as first language. Interestingly, in two traditional immigration provinces, Alberta and British Columbia, the skill-schooling gap of the immigrants with English or French as first language is around 0.4 years. This is remarkably smaller than the 2.8 years observed for the same subgroup in Ontario.

Figure 10. The skill-schooling gap of international immigrants,
10 provinces and Canada
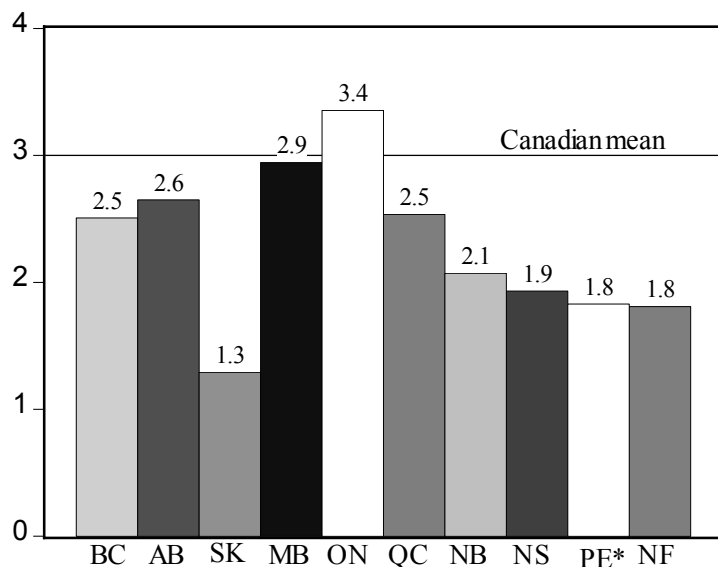
Figure 11: The skill-schooling gap of international immigrants with English
or French as first language, 7 provinces and Canada
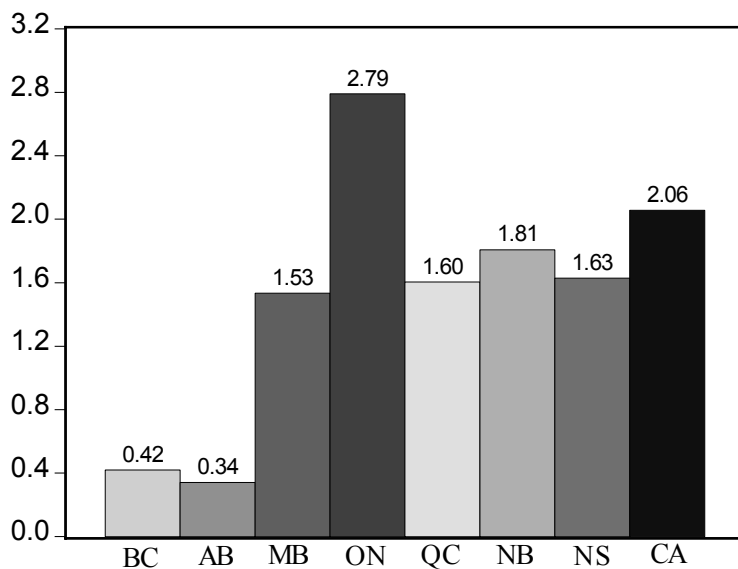
Note: Estimated by the authors from IALSS 2003. The skill-schooling gap
for an international immigrant subgroup is the horizontal distance between
the point corresponding to its mean skill level and schooling in table 4
and the adjusted Canadian-born skill-schooling curve. It corresponds
to the difference in the number of years of schooling between the mean
international immigrant of the subgroup. In figure 11, excluding SK, PE,
and NL (insufficent number of onservations).

6. The effect of migration flows on provincial mean skill levels

The empirical analysis of Coulombe and Tremblay (2006) indicates that differences in skill intensity of labour market entrants, measured by the same literacy data as used in this study, are an important determinant of Canadian provincial disparity in per capita income.[7] Coulombe and Tremblay's (2006) empirical methodology is based on a time-series and cross-sectional analysis of the 10 provinces between 1951 and 2001. The essence of their results is illustrated in figure 12 in a scatter with a cross-sectional regression that relates per capita income disparities to skill disparities in 2003 across the 10 provinces.

Figure 12: Skill and income disparities

> slope ols 2.20
> p-value .017
> R-squared .48
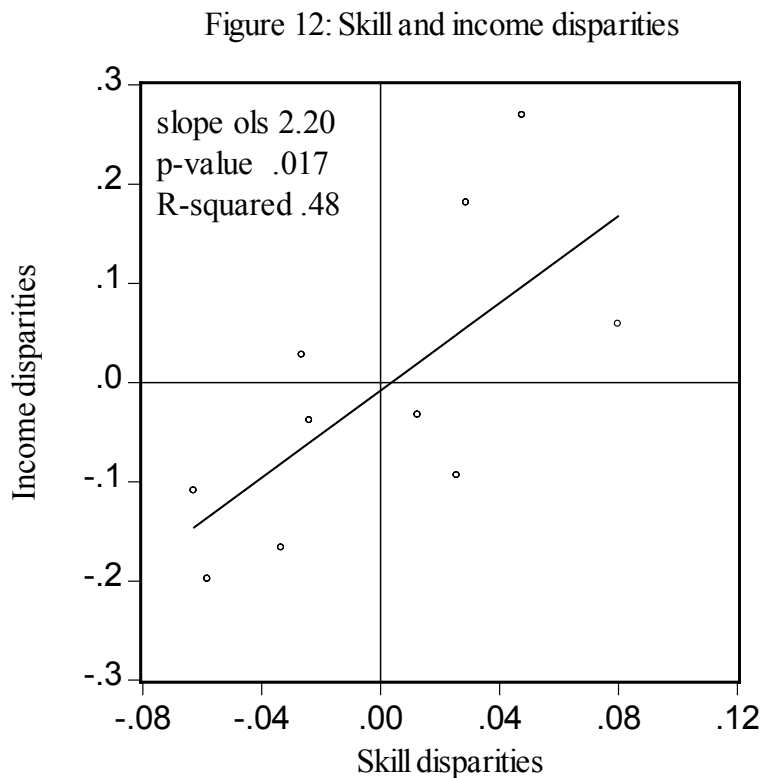
Note: Figure taken from Coulombe and Tremblay (2006). Skills of non-migrants and personal income minus transfers to individuals; 10 provinces, 2003. Logarithm deviations from the cross-sectional sample mean

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[7] As in Coulombe and Tremblay (2005), the per capita income concept used in this study excludes government transfers to individuals.

Since both variables are expressed as (logarithm) deviation from their sample mean, the constant term is eliminated from the regression. The fit between the two variables is striking. In simple OLS with just 10 observations, skill disparities "explain" close to 50 percent of the observed income disparities across provinces. The slope parameter of 2.2 implies that a 1 percent increase in skill (in the IALSS 2003 scale) translates into a 2.2 percent increase in per capita income. The close relationship between skill and per capita income suggests that migration flows are likely to affect disparities in per capita income if they change the skill intensity across the provinces. Along this line, we construct in this section a quantitative assessment of the accounting effect of migration flows on the skill intensity of the 10 Canadian provinces. This accounting exercise is not intended to capture a causal relationship between migration flows and provincial disparities. It is designed to estimate, from a quantitative point of view, whether the "dilution" effect of international migration and the redistribution effect of interprovincial migration on the skill intensity are substantial.

6.1   The effect of international migration

Given the variability in migration rates and the differences in skill intensities observed in Section 5.3, the effect of international migration on skill intensity is likely to vary considerably across provinces. It should be remembered that the five provinces with the higher (lower) migration rates also have the higher (lower) skill-schooling gaps. This net effect of international immigration on the mean skill intensity can be directly measured from our aggregate data bank presented in the data appendix by taking the difference in the mean skill levels of the total population and the Canadian-born portion of the population. The result is shown in figure 13 for the 10 provinces and for Canada as a whole.

For Canada, the addition of international immigrants to the Canadian-born population translates into a decrease of the mean skill intensity by 7.5 points in the IALSS 2003 scale. This number corresponds to a decrease of 0.72 years of schooling in the Canadian-born skill-schooling curve around its mean.

As expected, the differences across provinces are indeed striking. Only two provinces stand below the national average: Ontario, with a decrease of 14 points and British Columbia with a decrease of 12.1 points. In years of schooling around the mean in the Canadian-born skill-schooling curve, these two

Figure 13: Net contribution of international migration on the mean skill level per province
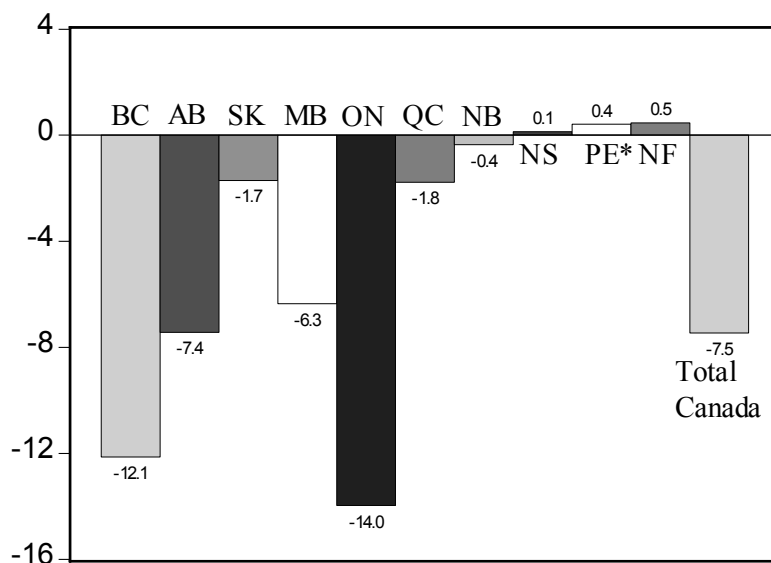
Note: Computed by the authors from IALSS 2003 - Differences between the mean skill levels of the total and the Canadian-born populations. An * indicates that the number of repondants is smaller than 30.

numbers correspond to a decrease of 1.31 and 1.15 years of schooling respectively. The negative effect is also substantial and just below the national average for Alberta, with a drop of 7.4 points, and for Manitoba with 6.3 points. For the other six provinces, the net effect of international immigration on skill intensity is not that substantial. The effect is negative but very small for Saskatchewan, Quebec, and New Brunswick. Interestingly, the net effect is positive but very small in Nova Scotia, Prince Edward Island, and Newfoundland.

The net effect of international migration displayed in figure 13 is strongly negatively correlated (correlation coefficient of –0.76) with per capita income disparities (in logarithm deviations from the mean) among the 10 observations. A bivariate OLS regression with the same income variable regressed on a constant and the effect of international immigration yields a negative slope parameter with a p-value around 0.01. This substantial and significant negative relation implies that the dispersion of skill intensity of the total population across the 10 provinces (including international immigrants) is much smaller than for the Canadian-born population. In the IALSS 2003 scale, the standard deviation of the skill intensity across the provinces measured with the Canadian-born population is 11.11; it falls to 7.66

when the international immigrant population is included in the population. The dispersion of skill intensity, evaluated around the dispersion measured using the total population, is reduced by 45 percent when international immigration is accounted for.[8]

In the neoclassical empirical model of Coulombe and Tremblay (2006), per capita income disparity across the Canadian provinces is positively correlated with, and determined by, the skill intensity of the total population. Interpreted in this framework, international immigration might be viewed as alleviating income disparity across the Canadian provinces. The diluting effect is driven mainly by the fact that the skill intensity is most diluted in the three richest provinces and the net effect is even slightly positive in three "have-not" provinces.

The alleviating effect on disparities is first imputed to the fact that the skill intensity of international immigrants, relative to the Canadian-born population in a given province, is typically lower in rich provinces than in poor. This follows from two facts: (1) as documented in figure 12, the skill level of the Canadian-born population is positively correlated with income disparity; (2), as shown in figure 9, the skill intensity of international immigrants moving into the rich provinces of Ontario, Alberta, and British Columbia is lower than those migrating to the poor provinces of Newfoundland, Nova Scotia, and Prince Edward Island. But on quantitative grounds, the alleviating effect of the international immigration process on Canadian disparity is driven primarily by the fact that the large majority of the international immigrant population chooses to go to the three rich provinces of Ontario, Alberta, and British Columbia.

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[8] We measure the percentage change from the total population number here for comparison purposes with the same number estimated for the net effect of interprovincial migration in the next subsection.

6.2   The effect of interprovincial migration

The net accounting effect of interprovincial migration on the mean skill level of a province ($NetP_i$) is computed from the following equation:

$$NetP_i = A(TP)_i - \left(\frac{A(TP)_i \cdot N(TP)_i - A(MI)_i \cdot N(MI)_i + A(MO)_i \cdot N(MO)_i}{N(TP)_i - N(MI)_i + N(MO)_i} \right)$$

using the data displayed in the Appendix for the mean skill level A; the number of people N in province i for the total population (TP); the interprovincial in-migrant population MI, and the interprovincial out-migrant population (MO). Of course, for Canada as a whole, the effect of interprovincial migration on the mean skill level is null.

The results of the exercise are shown in figure 14. The first important point that emerges from this figure is that, overall across the 10 provinces, the quantitative impact of interprovincial migration on the distribution of the skill intensity is much smaller than for international immigration. The standard deviation of the net effect of interprovincial migration, which is 2.6 on the IALSS 2003 scale, is around half what it is for international migration (5.4). Not surprisingly, Newfoundland, the province that had the largest rate of negative net migration in the last 30 years (see Coulombe [2005]) is the one that is characterized by the largest brain drain. The brain drain is also relatively substantial in New Brunswick and Manitoba but is much smaller in Quebec. The brain gain is minimal in the two rich provinces of Ontario and Alberta and the net effect is virtually null in British Columbia. The most interesting finding, however, is that interprovincial migration translates into a small but positive brain gain for Saskatchewan, Nova Scotia, and Prince Edward Island.

The correlation coefficient between our per capita income variable and the net effect of interprovincial migration is 0.42. In a bivariate OLS regression with the income variable as independent variable, the slope parameter of the interprovincial migration variable is positive but not significant. This positive relationship implies, however, that from a purely accounting point of view, interprovincial migration helps to increase the dispersion in the skill intensity across the provinces. The standard deviation of the hypothetical skill intensity distribution where all interprovincial migrants are assigned to their province of birth is 1.6 point smaller on the ALL (2003) scale than for the distribution based on the total population. Again, evaluated at the standard deviation of the total population, interprovincial migration

accounts for an increase of 21 percent of the dispersion of the skill intensity across the Canadian provinces.

Overall, the two migration channels have opposite effects on the skill disparities across the 10 Canadian provinces. International immigration tends to reduce provincial disparities whereas interprovincial migration tends to increase them. The net effect of the two channels on provincial disparities, however, is clearly negative since in absolute value, the negative effect of international migration is more than twice as great as the positive effect of interprovincial migration.

Figure 14. Net contribution of interprovincial migration on the mean skill level per province
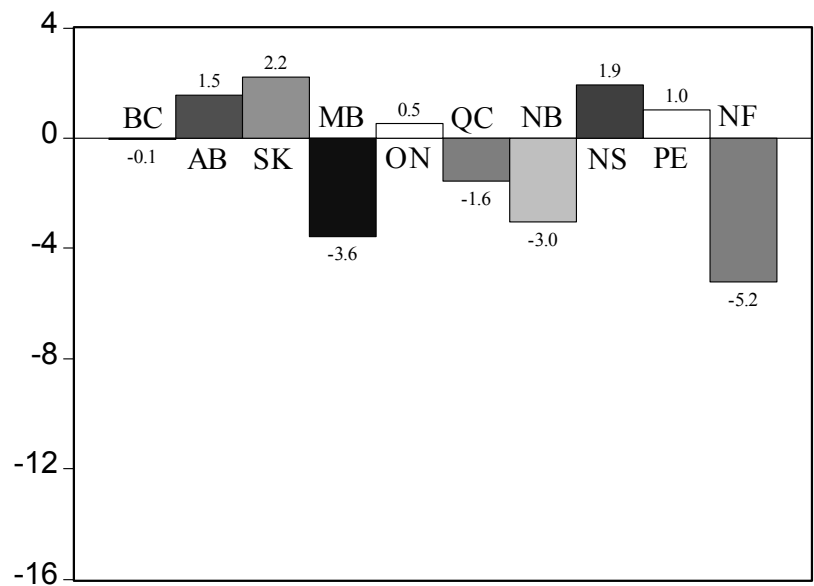
Note: Computed by the authors from IALSS 2003 using
gross migration data displayed in Appendix.

7. Interprovincial redistribution of human capital stock and regional disparity

In this section we provide a quantitative assessment of the direct effect of interprovincial migration on the total human capital stock among the provinces. It is important to note at this point that, in order to link migration data to public investment in education, we change the definition of both migrants and non-migrants. An interprovincial migrant is now defined as an individual who was interviewed in a different province from the one where the last year of high school was completed (including foreign-born). Similarly, a non-migrant is an individual who was interviewed in the same province as the one of schooling. Our aggregate measure of the human capital stock gained or lost through interprovincial migration in province i is the stock of net skill gains $NetH_i$. It is defined as a percentage of the human capital stock of the non-migrant population:

$$NetH_i = \left(\frac{A(MI)_i \cdot N(MI)_i - A(MO)_i \cdot N(MO)_i}{A(NM)_i \cdot N(NM)_i} \right).$$

The stock of net skill gains is measured from the data displayed in table A.2 from the skill level A and number N of the in-migrants MI, out-migrants MO, and non-migrants NM. The results of the computation are shown in figure 15. The net human capital loss is very substantial in four provinces: Saskatchewan (–0.54), Prince Edward Island (–0.46), Newfoundland (–0.31), and Manitoba (–0.27). The number for Saskatchewan implies that the net skills loss, measured on the IALSS 2003 scale, corresponds to 54 percent of the skill stock of the non-migrant population in this province. The loss is also substantial in New Brunswick (–0.13) but much less significant in Quebec and Nova Scotia. The net skill gain is not substantial for Ontario, and only the two Western provinces of Alberta (0.26) and British Columbia (0.21) show substantial gains.

As shown in figure 16, the stock of net skill gains is highly and positively correlated with per capita income disparities. Migration therefore tends to redistribute skills toward the relatively rich provinces, which potentially raises equity issues. Note, however, that the welfare implications of this redistribution process are partly mitigated by the federal equalization program in which the federal government

Figure 15. Stock of net skills gains from interprovincial migration, 10 provinces
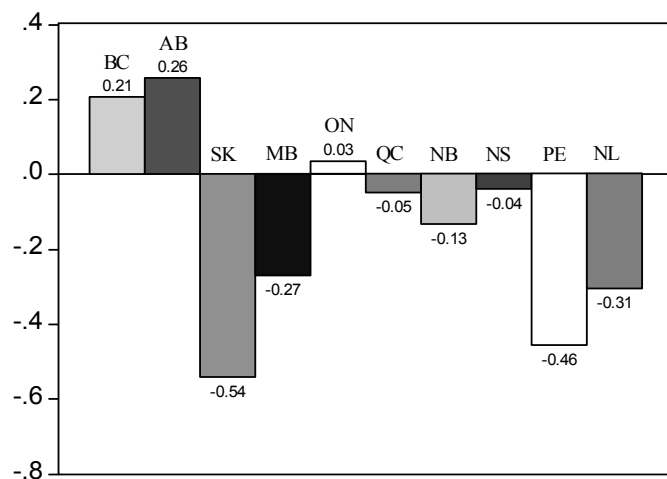
Note: Computed by the authors from IALSS 2003. Stock of net skills gains as a proportion of the non-migrant skill stock. An interprovincial migrant is an individual who was interviewed in a different province from the one where the last year of high school was completed. Non-migrants were interviewed in the same province in which they were schooled.

Figure 16. Stock of net skills gains from interprovincial migration and income disparities, 10 provinces, 2003

slope ols 0.37
p-value 0.008
R-squared .55

Income disparities
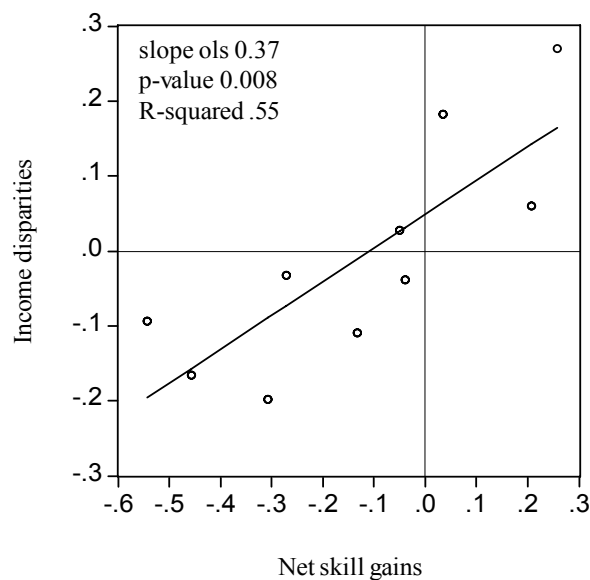
Net skill gains

Note: See note to figure 15 for net skills gains. Per capita income minus government transfers to individuals measured as the logarithm deviations from the cross-sectional sample mean.

transfers revenues to provinces with relatively small per capita tax bases. Hence, equalization partly compensates the have-not provinces for their public investment in skills that is lost to the have provinces.

Perhaps more important, however, over and above these redistributive implications, is that the migration of skills will tend to have substantial adverse efficiency effects, given that public investment in education is largely carried out and financed by provincial governments. With interprovincial migration, part of the skills produced by the provincial government investment in education benefits other provinces, both from the external benefits of human capital and from the taxation of the labour market returns on skills. This will generally lead provincial governments to underestimate the full return of education funding and to underinvest in schooling.

To get an idea of the quantitative importance of this distortion in the decisions of provincial governments to invest in education, we computed the gross skills loss, $OutH_i$, of each province as follows:

$$OutH_i = \left(\frac{A(MO)_i \cdot N(MO)_i}{A(NM)_i \cdot N(NM)_i + A(MO)_i \cdot N(MO)_i} \right).$$

It corresponds to the gross skills loss of each province as a ratio of the total skills produced in that province, abstracting from the skills of international emigrants. Results are shown in figure 17. Saskatchewan is again leading with respect to gross skill loss with 39 percent of the total skill produced in this province having left for other provinces. Prince Edward Island follows closely with a 0.38 ratio. The ratio of skills loss is also very substantial in New Brunswick, Nova Scotia, and Manitoba. The size of these ratios suggests that the incentives for provincial governments to invest in education may be substantially weakened by migration.

In this context, there may be an efficiency role for federal transfers to provincial governments that are conditional on the level of provincial expenditures on education. Both the Canada Social Transfer (CST) and the equalization program are intended to contribute partly to the financing of provincial expenditures on education. These transfer programs are, however, effectively unconditional. The CST is the federal transfer program to provincial governments designed to support postsecondary education,

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social assistance, and social services. Before 2004, the CST was lumped together with the Canada Health Transfer in the Canada Health and Social Transfer (CHST). Since 1999, the CHST (and subsequently the CST) transfers are provided on an equal per capita basis. Therefore, even if the size of the CST transfers was increased substantially, the incentives for provincial governments to invest in education would remain largely unchanged. To address the potential problem of underinvestment in education, transfers may need to be somehow related to levels of education expenditures of provincial governments, or alternatively, to enrolment rates at different levels of education.[9]

Figure 17. Stock of gross skills loss from interprovincial migration, 10 provinces
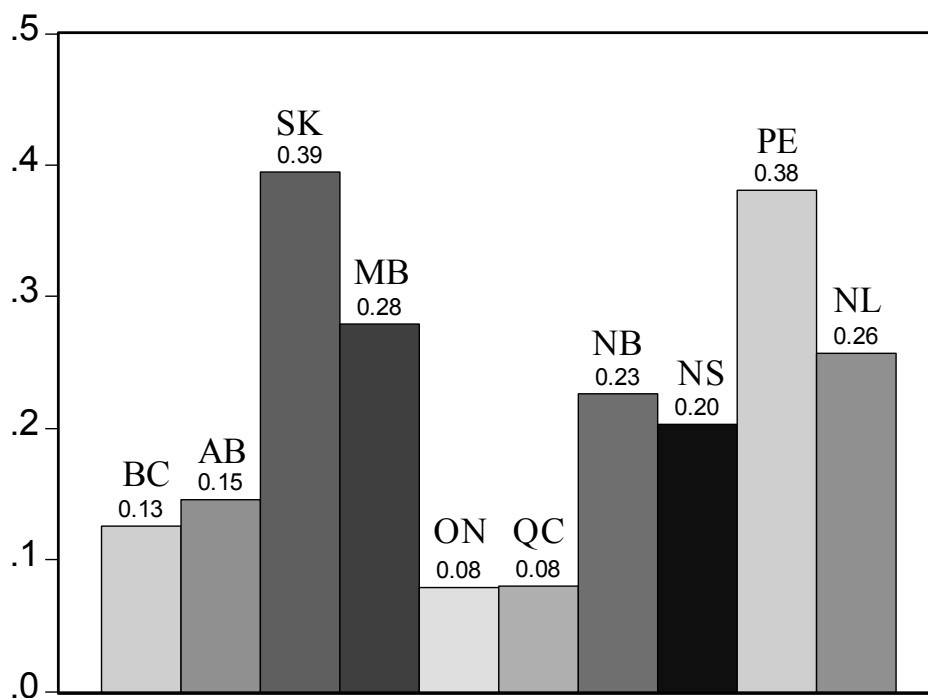
Note: Computed by the authors from IALSS 2003. Stock of gross skills loss as a proportion to the total skills produced in this province. See note to figure 15 for definition of an interprovincial migrant.

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[9] In this vein, Coulombe and Mérette (2000) argue that the per capita allocation rule might not be equitable if expenditure needs for health, education, and social services are not distributed equally across provinces.

8.   More on the skill-schooling gap

In this section, we discuss two aspects that contribute to our understanding of the skill-schooling gap observed for the foreign-born population in Canada. First, we show that the skill-schooling gap varies considerably across countries of origin. It is typically larger (smaller) in countries with low (high) per capita income. Second, the skill-schooling gap is completely eliminated for international immigrants' children who are born in Canada. These two findings suggest that the skill-schooling gap is related to differences in the quality of the educational systems across the countries of origin.

8.1   Country of origin

Along the line of Borjas (1987), we have computed the skill-schooling gap of the foreign-born population of Canada per country of origin. The data are shown in table 1 with the 1995 per capita income (in U.S. dollars at 1996 constant prices) for the 26 countries for which both sets of data are available.

The skill-schooling gap varies considerably across countries. This suggests that the value of schooling, in terms of acquired skills, also varies considerably across countries. The correlation coefficient between the skill-schooling gap and per capita income in the immigrants' home country is –0.64. This finding first indicates that there is considerable information contained in our synthetic measure of the quality of schooling. The high correlation is consistent with Borjas' (1987) results regarding the positive correlation between the value of schooling of U.S. immigrants in terms of earnings in the U.S. labour market and the per capita income in the immigrants' home country. In our analysis, the correlation is negative since the skill-schooling gap might be viewed as an attempt at capturing the difference in the return to schooling between Canada and other countries. The higher the skill-schooling gap, the lower is the quality of education.

Results of a simple bivariate OLS regression where the skill-schooling gap is regressed on the per capita income and a constant across the 26 countries are shown with the scatter in figure 18. The slope parameter of per capita income is highly significant with a p-value of .0004 and the R-squared of the simple cross-section regression at 0.41. The –0.10 point estimate of the slope coefficient indicates that the skill-schooling gap is one year smaller in countries with a higher per capita income of $10 000.

Table 1. The skill-schooling gap of international immigrants by country of origin and per capita income (Y)

	Skill-schooling gap	Per capita income		Skill-schooling gap	Per capita income
United States	0.9	28 381	Vietnam	3.2	1498
Portugal	0.9	13 134	Mexico	3.2	7159
Netherlands	1.3	20 965	Other countries	3.2	-
Italy	1.4	20 147	China	3.3	2800
Russia	1.4	719 2	Philippines	3.7	3021
United Kingdom	1.5	19 543	Jamaica	4.2	3810
France	2.2	20 142	El Salvador	4.2	4206
Germany	2.4	21 048	Sri Lanka	4.3	3038
Hong Kong	2.4	25 168	Poland	4.4	7338
Romania	2.5	4780	India	4.4	1978
Taiwan	2.8	14 583	South Korea	4.9	13 767
Guyana	3.0	2651	Pakistan	5.0	1909
Iran	3.0	5302	Ukraine	6.5	4787
Lebanon	3.2	4495			

Note: The skill-schooling gap for an international immigrant subgroup is the horizontal distance between the point corresponding to its mean skill level and schooling in the skill-schooling plan and the Canadian-born skill schooling curve in table 4. It corresponds to the difference between the mean years of schooling of the immigrant subgroup and the typical Canadian-born with the same skill level. The larger the skill-schooling gap, the smaller is the value of education in terms of acquired skills. Per capita income is the real Gross Domestic Income adjusted for Terms of Trade changes in 1995 measured in U.S. dollars at 1996 constant prices. The income data was extracted from Penn World Table.

Figure 18. The skill-schooling gap and per capita income per origin country, 26 countries

slope ols = -0.11 (p-value .00)
constant = 4.17 (p-value .00)
R-squared .41

skill-schooling gap

per capita income
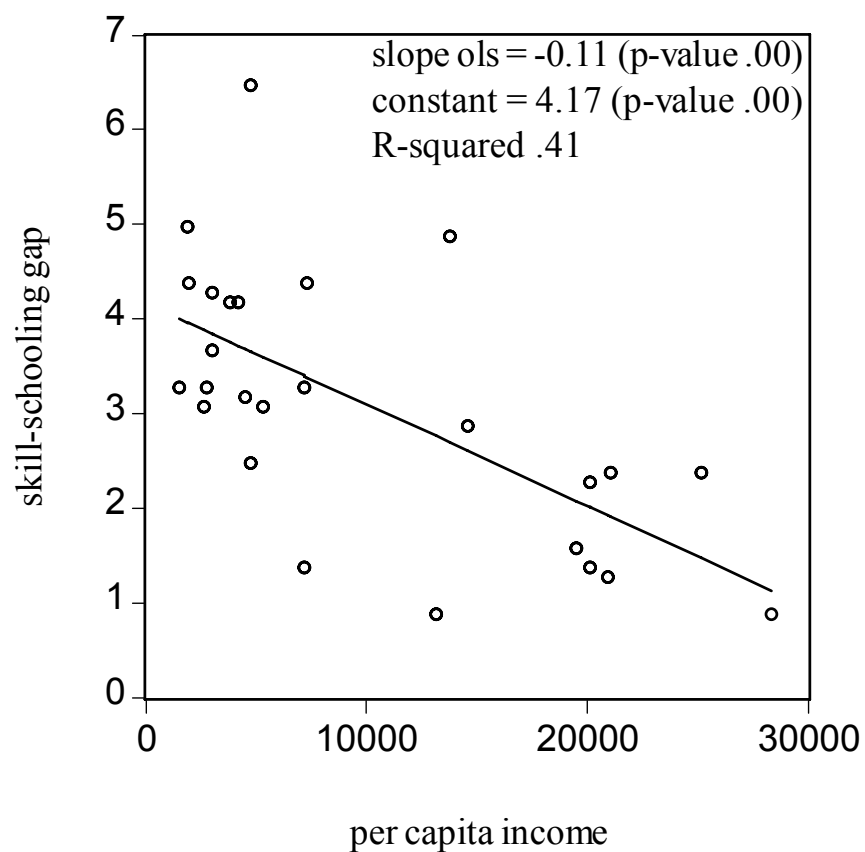
Note: See note to table 1 for data definition and sources.
The reported coefficient for the slope parameter is in U.S. thousand dollars.
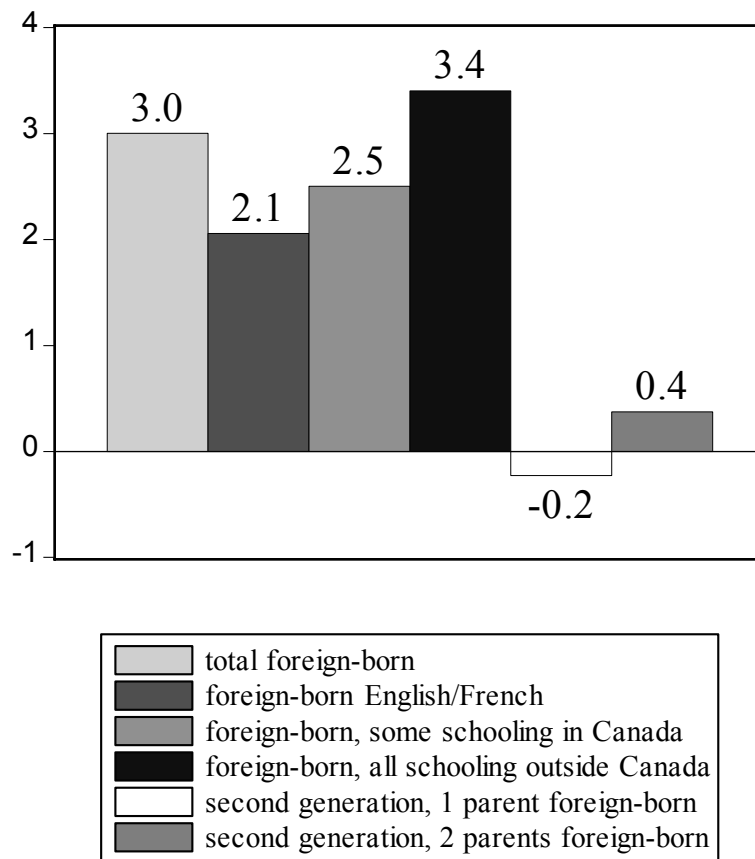
8.2   Source of education and second-generation immigrants

The results of computing the skill-schooling gap for six subgroups of international immigrants and second-generation immigrants are shown in figure 19. The first two subgroups, 3 years for the total immigrants and 2.1 for the foreign-born with English or French as first language, have been mentioned previously and are used as benchmark measures.

We are able to provide separate measures of the mean skill and schooling levels for the foreign-born who have completed all their formal education abroad. Their mean skill level of 226.6 on the IALSS 2003 scale, coupled with a mean education level of 12.1 years, translates into a skill-schooling gap of 3.4 years. The rest of the foreign-born population has received on average about half of their formal education in Canada. The mean skill level of this population is 267.31 and the mean of their reported years of schooling is 14.51. This corresponds to a skill-schooling gap of 2.5 years. For the first generation of immigrants, having some schooling in Canada decreases the skill-schooling gap by almost to one year. The remaining gap, however, is very substantial and larger even than the gap of the foreign-born with English or French as first language.

The last two numbers of figure 19 indicate that the skill-schooling gap vanishes for the second generation of immigrants. Second-generation immigrants (Canadian-born) with both parents born outside the country have a skill-schooling relationship relatively similar to the overall Canadian-born. Their mean skill level of 277.7 in the IALSS 2003 scale and mean years of schooling of 13.45 correspond to a skill-schooling gap of only 0.4 years. With a mean skill level of 282.4 and 13.33 years of formal education, the skill-schooling gap of the Canadian-born population with one parent born outside the country is even negative at -0.2 year. Since, as reported above in regression R1, the standard error of regression of the skill-schooling curve for the Canadian-born is 5 points on the IALSS 2003 scale, skill-schooling gaps of less than half a year of schooling cannot be considered different from zero. These findings indicate that cross-country differences in the quality of education and in other socio-economic factors might be largely responsible for the differential skill–return of schooling.

Figure 19: The skill-schooling gap of international immigrants and second generation
Canada - various sub-groups

total foreign-born	
foreign-born English/French	
foreign-born, some schooling in Canada	
foreign-born, all schooling outside Canada	
second generation, 1 parent foreign-born	
second generation, 2 parents foreign-born	

Note: Computed by the authors from IALSS 2003.

9.   Evolution of literacy levels between the 1994 and the 2003 surveys

Statistics Canada (2005) reports little change in the mean literacy proficiency of the Canadian population between the 1994 and the 2003 surveys. The two surveys contain similar questions and were designed to be comparable over time. In this section, we want to verify whether the lack of significant progress is also observed in the Canadian-born population. In the 1994 survey, skill data were provided for three literacy domains: prose, document, and quantitative. For the 2003 survey, the quantitative domain was broken down in two domains: numeracy and problem solving. Consequently, comparison between the 1994 and the 2003 data can be done only for the prose and the document domains.

The mean scores for the prose and document domains are presented in table 2 for the overall, the Canadian-born, and the foreign-born populations. With one important exception, all changes between the 1994 and the 2003 surveys are not significant. It is important to point out that the low significance of the changes between the 1994 and the 2003 data is partly attributable to the small number of respondents in the 1994 survey.

For the overall population (table 2a), both the prose and document mean scores increase from 1994 to 2003 but the increase is far from significant. In the Canadian-born population (table 2b), the increase of 3.6 points in the IALSS scale is significant at the 10 percent level. The one-side p-value associated with the z-statistics of 1.561 for prose data is 0.057. The improvement between the 1994 and the 2003 data is close to being significant at the 5 percent level. However, the small improvement in the Canadian-born population in the document score is far from being significant. Finally, all changes between 1994 and 2003 in the mean scores of international immigrants (table 2c) are not close to being significant.

The key point emerging from this exercise is that, contrary to the case of the overall population, the progress observed between 1994 and 2003 in the prose score of the Canadian-born population is significant from a statistical point of view. This result illustrates the fact that if one wants to evaluate the progress in the quality of the Canadian educational system from literacy surveys, it is important to focus on the evolution of the scores of the Canadian-born population only.

Table 2. Evolution of literacy scores between the 1994 and the 2003 surveys

2a. Overall population, 16–65 years old

	Mean prose score	Mean document score
1994	278.84	279.33
2003	280.75	280.61
z-statistic	0.596	0.426

2b. Canadian-born population, 16–65 years old

	Mean prose score	Mean document score
1994	284.98	286.16
2003	288.55	287.30
z-statistic	1.561*	0.506

2c. Foreign-born population, 16–65 years old

	Mean prose score	Mean document score
1994	255.30	253.15
2003	252.81	256.63
z-statistic	-0.203	0.262

Note: The z-statistic measures if the change in the mean scores between 1994 and 2003 is significant. * significant at the 10% level

10.   Conclusion: policy considerations

The skill intensity of the labour force is one of the key determinants of productivity and competitiveness across developed countries. In Canada in recent years, policy makers and public policy analysts have devoted a great deal of attention to the brain drain of highly skilled Canadian workers to the United States. One of the limitations of our study, which pertains to the analysis of IALSS respondents living in Canada, is that we are unable to measure the skill intensity of the labour force that is leaving Canada for the United States. Our analysis, however, can contribute to the brain drain debate from another perspective. One of the arguments often used in the debate is that the loss of skilled workers to the United States is more than compensated by the brain gain of university graduates coming from our international immigrant population.[10] But our analysis suggests that the international immigration process cannot compensate for the brain drain of Canadians to the United States because international immigration reduces the skill intensity of the Canadian labour force. International immigrants might be more educated on average than the Canadian-born population but their mean skill intensity is lower. We attribute this fact to the wide variance in the quality of education across countries. This factor has been noted and is analyzed in a number of recent papers in the economic growth literature. The quality of the educational system, along with the quality of all other social and public institutions, appears to be lower in poor countries than in rich.

The variance in the quality of educational systems around the world also puts into question the pertinence of using educational attainment, instead of a more direct measure of skills, in the points system employed in Canada to select international immigrants.[11] In our view, the number of years of schooling is a good proxy for skills when comparing individuals coming from the same country or from countries with comparable levels of development. However, schooling is a biased indicator of skills when it is used to compare individuals coming from countries with big differences in their levels of development. The points system, therefore, may not be maximizing the skill intensity of our international immigrant population.

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[10] See, for example, Zhao, Drew, and Murray (2000).

[11] Educational attainment accounts for 25 percent of the total score in the points system. Only economic immigrants are selected on the basis of their skills, but economic immigrants were 43% of principal applicants admitted in 2004. (Citizenship and Immigration Canada, 2005). It should be noted that our IALSS results refer to all international immigrants, as the data do not identify the basis for admission.

Three alternative modifications to the selection system could be considered in order to improve its efficiency from a skill-intensity perspective. Our discussion applies only to the skilled worker immigration program, not to potential immigrants who may be admitted under other programs such as the family class immigration program.

First, schooling across countries could be weighted by a quality index in an attempt to account for the variance in the quality of education across countries. The weights could be based on skills assessment surveys, such as the IALSS, or simply on the per capita income of the origin countries. Of course, as illustrated in figure 18, such weights would necessarily capture the variance in the quality of education with a measurement error (the error component in figure 18). Nonetheless, it would potentially improve the skill intensity of our international immigrant population. An obvious drawback of this approach is that it is not very transparent and may not be palatable from a political point of view. Among other things, evaluating otherwise identical candidates for immigration differently, based on their countries of origin, may be considered by some as discrimination.[12]

Second, the selection of immigrants could be based partly on direct skills tests, although implementing such tests may be quite costly. However, the size of returns on skills and the external benefits of human capital suggest that the benefits of selecting immigrants more efficiently may largely outweigh these costs.[13]

Third, an alternative, market-based approach to the evaluation of skills would consist in letting employers evaluate the skills of potential migrants, as it is done to some extent in the United States. Such an approach can be implemented relatively easily by admitting as immigrants those individuals who are offered employment. This approach allows the country to benefit from the (possibly superior) information of employers about the skills that are economically valuable. Moreover, it may also allow an increase in the absolute level of immigration flows by improving the process of integrating immigrants into the labour market. A potential drawback to this approach is that employers may recruit

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[12] By definition, it would be statistical discrimination, which among other drawbacks could lead to excluding high skills applicants from countries with low quality schooling systems.
[13] Australia currently requires successful completions of tests in English competency as a requirement for skilled immigrants, see http://www.immi.gov.au/migrate/skilled.htm.

immigrants in response to short-term skill needs, but that once admitted immigrants are permanent residents. Note that the points system used to evaluate immigration candidates in the skilled worker program already gives ten points (out of a maximum score of 100) to candidates who have received a permanent job offer in Canada. One option would be to increase the number of points accorded for pre-arranged employment.

Although modifications to the immigrant selection system may improve the skill intensity of immigrants, our results suggest that doing so would be relevant only for first-generation immigrants. One of the most important facts shown in this study is that the skill-schooling gap vanishes completely for second-generation immigrants. Therefore, the relative inability of the current system to maximize the skill intensity of immigrants has potentially adverse effects only in the short run.

We conclude by briefly returning to an important policy implication of the interprovincial mobility of skills documented in our study. The information contained in the IALSS allowed us to construct estimates of the share of the total skills produced in each province that migrated to other provinces over time. Our estimates indicate that these shares are substantial and suggest that provincial governments, who are responsible for public investment in education, are likely to underestimate to a significant extent the full social return on education. As a result, there may be a strong efficiency rationale for introducing some form of conditionality in federal transfers to provinces that are intended to finance education. In particular, defining the allocation formula of the Canada Social Transfer (CST) as a function of provincial governments' expenditures on education or as a function of schooling enrolment rates, may be worth considering.

Data appendix

Table A.1. Interprovincial migration (based on province of birth)

Literacy (mean overall score)				Education (mean years of formal education)			
Province	**In-movers**	**Out-movers**	**Non-movers**	**Province**	**In-movers**	**Out-movers**	**Non-movers**
NL	291.3	279.1	255.2	NL	13.3	13.3	11.6
PE	279.6	269.6	261.6	PE	13.4	12.3	12.1
NS	289.7	277.0	264.1	NS	13.7	13.2	12.1
NB	279.3	286.8	254.0	NB	12.8	13.7	11.8
QC	286.2	291.2	263.4	QC	14.3	13.9	12.3
ON	286.5	293.1	278.4	ON	13.8	14.2	13.2
MB	280.6	282.6	273.9	MB	12.9	13.1	12.5
SK	289.8	275.3	277.5	SK	13.1	12.7	12.4
AB	289.0	289.5	283.7	AB	13.5	13.4	12.8
BC	283.7	295.5	293.0	BC	13.3	14.2	13.2
Total	**286.1**	**286.1**	**273.1**	**Total**	**13.5**	**13.5**	**12.7**

Notes: An interprovincial mover is an individual who was interviewed in a different province from the province of birth. In-movers were born in another province; out-movers left province at birth; non-movers were interviewed in the same province as that of birth.

Table A.2. Interprovincial migration (based on province of schooling)

Literacy (mean overall score)				Education (mean years of formal education)			
Province	**In-migrants**	**Out-migrants**	**Non-migrants**	**Province**	**In-migrants**	**Out-migrants**	**Non-migrants**
NL	285.9	276.5	262.3	NL	13.4	13.6	12.1
PE	280.1	271.0	267.6	PE	13.7	12.2	12.5
NS	290.4	275.4	269.3	NS	13.9	14.0	12.5
NB	280.5	287.8	259.7	NB	12.9	13.9	12.3
QC	295.8	288.9	269.4	QC	15.5	14.3	12.9
ON	282.5	295.5	280.1	ON	14.0	14.8	13.5
MB	278.6	270.8	276.2	MB	13.4	12.6	12.7
SK	285.8	278.5	281.4	SK	13.3	13.2	12.6
AB	288.4	283.8	286.0	AB	13.7	14.0	13.0
BC	282.3	295.5	291.7	BC	13.8	14.2	13.2
Total	**285.0**	**285.0**	**277.3**	**Total**	**13.9**	**13.9**	**13.1**

Notes: An interprovincial mover is an individual who was interviewed in a different province from the one where the last year of high school was completed. In-migrants had schooling in another province; out-migrants left province where schooling was done; non-migrants were interviewed in the same province as that of schooling.

Table A.3: International Immigrants and the Canadian-born

	Literacy (mean overall score)					Education (mean years of formal education)			
Province	Immigrants			Canadian-born	Province	Immigrants			Canadian-born
	English/ French	Other	Total immigrants			English/ French	Other	Total immigrants	
NL	296.6	240.5	281.1	256.9	NL	15.9	13.6	15.2	11.7
PE	269.3	291.7	278.0	265.8	PE	14.4	15.7	14.9	12.4
NS	277.7	258.2	272.0	269.8	NS	14.7	13.8	14.4	12.5
NB	253.8	244.4	250.7	258.8	NB	12.7	12.7	12.7	12.0
QC	277.2	237.1	249.8	264.4	QC	14.6	12.4	13.1	12.4
ON	254.1	231.9	238.2	279.8	ON	13.7	12.7	13.0	13.3
MB	267.3	220.5	234.5	275.0	MB	13.6	11.7	12.3	12.6
SK	272.2	233.5	246.0	279.4	SK	13.5	10.6	11.5	12.5
AB	284.9	237.4	248.6	285.8	AB	14.2	12.8	13.1	13.1
BC	285.9	239.1	250.9	289.2	BC	14.4	12.7	13.1	13.2
Total	**265.9**	**234.3**	**243.2**	**275.5**	**Total**	**14.0**	**12.6**	**13.0**	**12.8**

Notes: International immigrants are those born outside of Canada. With English or French as first language: had either English or French as the mother tongue and the language most often spoken at home. Other: did not have either English or French as the mother tongue and the language most often spoken at home.

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