THE IMPACTS OF LITERACY AND NUMERACY ON EARNINGS:

DO ADMISSION CATEGORIES MATTER?

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Abstract

We explore differences in literacy and numeracy skills, and the economic returns to these skills for immigrants to Canada in different admission classes, and their Canadian-born counterparts. Respondents are categorized into nine subpopulations: adult economic immigrants, adult refugees, adult family reunification, other adult immigrants, adult temporary residents, young refugees, young non-refugee immigrants, second- and third-generation Canadians. With some exceptions, the results suggest that both adult and young immigrants (those who arrived in Canada at age 13 or younger) do not perform as well on literacy and numeracy tests as those born in Canada, although young immigrants have higher test scores than adult immigrants. Similar results are found for wages, our metric for success in the labour market. Generally, we find that economic immigrants tend to have the highest test scores and hourly wages, with refugees having the lowest, amongst all immigration categories. A one-standard deviation increase in literacy attracts a wage premium of eight percent for men and nine percent for women. Those of numeracy scores are associated with 10 percent wage premium for both males and females. Though literacy and numeracy tests in PIAAC 2012 are used to capture basic everyday life and workplace proficiency, the returns to these basic skills are economically significant across different quantiles of earnings.

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1. Introduction

Canada is a major immigrant-receiving nation with individuals coming from different countries, economic backgrounds, and under various immigration policies. There are numerous studies focused on the labour market performance of immigrants compared to the Canadian born (e.g., Sweetman and Schaafsma 2001; Aydemir and Skuterud 2005; Sweetman and Warman 2013; Warman et al. 2018). However, there is little research studying differences in basic skills (e.g., literacy and numeracy) and the labour market remuneration among immigrant and Canadian-born subgroups. This paper utilizes Statistics Canada's 2012 Survey of Adult Skills, part of the OECD's Programme for the International Assessment of Adult Competencies (PIAAC) to compare immigrants' performance on basic literacy and numeracy tests by admission category to those of second- and third-generation Canadians. We also examine the impact of literacy and numeracy on earnings and rates of return to education among these subgroups of the population, controlling for key variables affecting labour market outcomes.

While immigrants' characteristics (e.g., countries of origin, language skills, and other socioeconomic variables) have changed over the past 50 years, the broad admissions categories of economic class, family reunification, refugees, and other immigration categories, have remained intact. Although there have been appreciable changes to the economic class over the period relevant for our sample, it does comprise a mix of sub-categories with the common goals of selecting individuals (principal applicants) who are expected to be successful in the labour market and/or fill a labour market niche, along with their spouses and dependents. The family reunification category allows current Canadian citizens and permanent residents to sponsor family members to immigrate to Canada. Refugees, who could be privately sponsored or sponsored by the government, are admitted on humanitarian grounds. In this paper, the refugee category cannot be separated into different subgroups of refugees and does not include refugee claimants as their applications have yet been accepted. In 2015, the economic class (both principal applicants and spouses and dependents) accounted for 62.7 percent of all permanent

immigrants, up from about 35 percent in 1980. Between 1980 and 2015, approximately 12 percent of the annual immigrant flow were refugees (Sweetman and Truong 2018; Sweetman 2017).

[Insert Figure 1 Here]

Amongst all immigrants, economic immigrants (at least the principal applicants) are expected to perform well in the Canadian labour market because they are mainly assessed on essential determinants of labour market success, such as education and employment history.[1] In this paper, we define economic immigrant categories to include points-based immigrants, business investors, entrepreneurs, and self-employed using self-reports to the survey questions asked in the PIAAC 2012. In 2010, Citizenship and Immigration Canada (CIC), the predecessor to the current Immigration, Refugee, and Citizenship Canada (IRCC), introduced mandatory language testing for points-based immigrants.[2] Immigrants from the other two classes (i.e., family reunification and refugees) are not admitted on employability factors, and thus they are likely to have lower basic literacy and numeracy skills compared to those of economic immigrants and the Canadian-born.

Despite coming from various socioeconomic backgrounds and having different motives for migrating, immigrants are treated as one homogenous group in many studies, due to the paucity of data on immigration categories. There are a few studies considering immigrants by specific category, particularly focusing on refugees. These studies are able to identify refugees based on their year of arrival and specific refugee events provided in the survey of interest (e.g., the Mariel Boatlift Cuban refugees in the U.S. in Card (1990) and Borjas and Monras (2017); Vietnamese refugees in Canada in Hou (2017)).

[1] A small subclass of economics class immigrants are business investors, entrepreneurs and self-employed individuals who are assessed on their ability to establish businesses and otherwise invest in the Canadian economy. They are a small percentage of total immigration, comprising approximately two percent of the total flow in 2015 (IRCC 2016). However, we are not able to separate the points-based immigrants, business investors, live-in caregivers, and Provincial Nominee Programs using our data. Furthermore, there are other immigration subcategories under the economic class which have been introduced, such as the provincial/territorial nominee program in the late 1990's and the Canadian experience class in 2009, and we are not able to separate them out using out data.

[2] Under the current skilled-based system, language ability in one or both official languages is mandatory for all individuals who have applied through the Express Entry program. Unfortunately, our data do not capture the changes in the immigration program that were implemented from 2011 onward.

Furthermore, studies comparing the education and labour market performance of immigrants in various admission categories to those of the native born mostly use data from Canada and Australia.[3] In Canada, Sweetman and Warman (2013) find that immigrants who arrived in Canada under the economic immigrant class do have earnings advantages compared to those in other categories in the long term. Their results also suggest that in the short run privately sponsored refugees have "relatively good" labour market outcomes compared to economic immigrants. They find that economic immigrants have earnings advantages compared to other categories in the long-term, approximately four years after landing. However, Aydemir (2011) finds that even though economic immigrants are selected for their high skills and education, on average they do not have superior earnings and labour force participation rates compared to other immigration categories in the short term, around two years after landing.

Furthermore, Truong and Sweetman (2018) document that refugees tend to have lower educational attainment compared to those in other immigrant classes as well as those born in Canada. Hou and Bonikowska (2016) use the 2011 National Household Survey linked with the Immigrant Landing File to assess the labour market performance of childhood immigrants who arrived at age 17 or younger. They find that children whose parents arrived in the economic class have the highest earnings while those whose parents arrived as refugees had the lowest, and that this outcome is transmitted in part through differences in education and the official language ability of parents. Warman et al. (2018) use two linked datasets, the Immigration Master Data Base (IMDB) along with individual income tax records, and find that points-based immigrants have higher earnings compared to those who arrived under the family or refugee classes, and that this advantage also extends to their children.

We extend the rising literature which shows the importance of general basic skills for earnings. Green and Riddell (2003), using the 1994 International Adult Literacy Survey (IALS), find that literacy

[3] Refer to Bauer, Lofstrom, Zimmerman (2001) for an overview of general differences of immigration policies in Canada and Australia, and Mahboubi (2017) for differences in the points-based systems in Canada and Australia. For studies examining labour market performance of different immigration classes in Australia, refer to Miller (1999), Cobb-Clark (2000), Hugo (2002), Chiswick, Lee, and Miller (2006) as examples.

has a large positive impact on earnings and reduces the schooling coefficient by about 30 percent. Green and Riddell (2013) combine the IALS with the 2003 International Adult Literacy and Life Skills Survey (IALSS) to examine the impacts of ageing on literacy skills across birth cohorts for Canada, the U.S., and Norway. They find a weak negative relationship between age and literacy skills in the cross-sectional analysis, and the age effect on skills is less evident in the bottom of this skills distribution but much stronger at the top. In an international comparison, Hanushek et al. (2015) employ the PIAAC to study the return to numeracy skills in 23 countries for workers between the ages of 35 and 54 who work at least 30 hours per week. They find that a one-standard-deviation increase in numeracy skills is on average associated with approximately an 18 percent increase in earnings, and different labour and product market regulations (e.g., unionization) play a role in determining differences in returns to skill in the sampled countries.

In term of studies on socioeconomic outcomes of immigrants in Canada, Ferrer et al. (2006) also use the IALS along with the 1998 Ontario Immigrant Literacy Survey (OILS) and show that differences in measured literacy scores explain about two-thirds of the earnings gap between university-educated immigrants and those born in Canada. Furthermore, Mahboubi (2017) employ the immigration category in PIAAC 2012 and find that immigrants on average score below the Canadian born individuals, which are not separated into the second- and third-generation Canadian-born individuals. She also provides policy recommendations placing the emphasis on more rigid official language testing, international students as a source of immigrants, and high-quality language programs for immigrants after arrival.

The literature also points to the importance of language skills on labour market outcomes (e.g., Chiswick and Miller 1995, 2002, 2005; Bleakley and Chin 2004, 2010; de Coulon and Wolf 2007; and Dustmann and van Soest 2001, 2002). Goldmann et al. (2015) note that host-country language proficiency is highly rewarded in the Canadian labour market. Similarly, Sweetman and Warman (2010) cite poor language ability as a deficiency that makes immigrant human capital less productive. Warman

et al. (2018) find that the wage premium in Canada for immigrants with either French or English as a mother tongue is substantial, even when knowledge of one or both official languages (measured as yes/no, with no measure of actual skills) at the time of arrival is controlled for statistically. Also, of relevance is the literature studying the earning differences among immigration generations (surveyed by Sweetman and van Ours 2014) and the impacts of age at arrival on the earnings of immigrants. Sweetman and Schaafsma (2001) show that young immigrants perform better in the labour market because they obtain their education in Canada and more easily integrate economically because they arrive at a young age.

We contribute the current literature in two ways. First, we contrast literacy and numeracy proficiency between immigrants, and Canadian-born individuals, by category. Secondly, we extend the current literature studying the labour market outcomes of immigrants in the host country to gain a deeper understanding of how basic literacy and numeracy skills are valued across population subgroups. We follow Sweetman and Truong (2018) to define subpopulation groups in the PIAAC, except Canadians at birth who were born abroad who are excluded from this study. Subgroups are based on self-reported immigration status, place of birth, parents' place of birth, and age at arrival for immigrants.

We explore differences in foundational skills and earnings among population subgroups using different homogenous subsamples (e.g., among university graduates) to attempt to account for the heterogeneity in skills among immigrants and the Canadian-born. We also employ the unconditional quantile method proposed by Firpo et al. (2009) to examine these differences along each respective outcome distribution. As a result, this research informs policies to help current immigrants to boost their skills, to better assimilate in the Canadian labour market, and to attract more talented and highly-skilled immigrants to Canada.

We find that both adult and young immigrants (those who arrived in Canada at age 13 or younger) have lower literacy and numeracy scores compared to those born in Canada, although young immigrants

do have higher test scores than adult counterparts. As these tests are conducted in English (and French in some parts of the country), domestic language fluency does play a moderating role. Similar results are found for wages. Generally, we find that those admitted under the economic class tend to have the highest test scores and hourly wages with refugees having the lowest between immigration categories. In unconditional quantile regressions, test scores gaps between immigrants and the Canadians are smaller in the upper 75^{th} percentile of the distribution of these outcomes. In the earnings regressions, economic immigrants have similar earnings compared to the third generation within the 25^{th}, 50^{th}, and 75^{th} quantiles of earnings. Even though literacy and numeracy tests in PIAAC 2012 are used to capture basic everyday life and workplace proficiency, the returns to a one-standard-deviation increase in each test is associated with eight to ten percent increase in hourly wages. These returns are statistically significant at every earnings quantile examined. Furthermore, the Canadian labour market rewards all immigrants, regardless of immigration categories, and Canadian-born individuals similarly at the same level of literacy or numeracy proficiency.

Section 2 discusses the PIACC data set used in the subsequent empirical models which are explained in Section 3. Section 4 presents the results of the empirical estimation. The final section concludes.

2. Data and Summary Statistics

We employ Statistics Canada's Survey of Adult Skills, a component of the OECD's 2012 Programme for the International Assessment of Adult Competencies (PIAAC). Our sample includes all individuals aged 25 to 65, excluding members of Canada's Indigenous population, those with unknown immigration generation categories or missing immigration information, and Canadians at birth who are

born outside of Canada.[4] One disadvantage of PIAAC 2012 is that it does not allow us to identify and separate principal applicants from their spouses and dependents under any admission category.

We separate young immigrants – defined as those who arrived in Canada at age 13 or younger – into two groups, young refugees and young non-refugees. Adult immigrants are grouped into five different categories, based on their self-reported admission categories, including economic immigrants (those admitted under the points system, business investors, and entrepreneurs), refugees, family reunification class, temporary residents and other immigration classes (not clearly defined by Statistics Canada). Unfortunately, we are not able to identify the provincial/territorial nominee programs and the Canadian Experience Class immigrants, even though these programs began in 1999 (in some provinces) and 2009, respectively.[5] In this paper, these individuals are possibly included in the economic class. Canadian-born individuals are categorized by their parents' place of birth, with the second generation comprising the domestic born with at least one foreign-born parent, and the third (or higher) generation being those where both parents are Canadian-born.

Besides providing abundant demographic and labour market information, PIAAC 2012 evaluates individuals on three cognitive skills: literacy, numeracy, and problem-solving in technology-rich environments. In this paper, we focus our analysis on literacy and numeracy proficiency and their impacts on the labour market performance of our disaggregated groups of immigrants and Canadian-born individuals. These skills are described as "foundational" skills, or "key information-processing competencies," that are used to build other complex skills. Literacy and numeracy scores range from zero

[4] These individuals are born outside of Canada to at least one Canadian-born parent. In the conventional definition of immigrants based on place of birth, this group would have been included in the immigrant group. Even though it is interesting to study this group of individuals, they are excluded due to insufficient sample size. And, we are interested in studying differences between the "usual" Canadian born and immigrants. Sweetman and Truong (2018) look at this group of individuals. They are different because they were born outside of Canada to at least one Canadian-born parent. However, in term of their socioeconomic characteristics, they are similar to those who were born in Canada. Thus, we exclude them to obtain a more homogenous comparison group.

[5] In a recent change, immigrants in the provincial/territorial nominee programs and the Canadian Experience Class started to be assessed under the Comprehensive Ranking System (a point system separate from the Skilled Worker point system) as part of the Express Entry. However, this change launched after PIAAC 2012 was released.

to 500. Each observation has ten plausible values for each test, which are calculated using multiple item response theory.[6] To account for the sample stratification characteristics, 80 replicated weights are provided by Statistics Canada to compute variance estimates using the delete-one jackknife method.

The final sample contains 17,891 individuals, 3,944 of whom fall into one of the immigrant categories and the remaining 13,947 are classified as second- or third-generation Canadians. Table 1 presents summary statistics for the sample, divided into the aggregate immigrant and Canadian-born groups. For both males and females who were born in Canada, 80 per cent of the sample was born to two Canadian-born parents. Within the immigrant group, 38 per cent of male immigrants are economic immigrants, and 34 percent are family reunification class. Other categories make up the remainder. On the other hand, the family reunification class accounts for 41 percent of all female immigrants, with economic immigrants accounting for 31 percent. The proportion of male refugees is almost double that of females.

[Insert Table 1 Here]

Regarding numeracy and literacy, immigrants are likely to have lower scores compared to those born in Canada. Immigrants' scores also have higher variances for both genders. Within the two groups, average test scores seems to suggest that males seem to perform slightly better than female on both tests, although the difference is smaller in the Canadian-born group, and practically nil in the case of literacy scores. Male Canadian-born individuals have higher average hourly wages than both female Canadians and female immigrants. Hourly wages (for the subsample with positive self-reported earnings) are statistically similar between male Canadians and immigrants. Regarding education, both male and female immigrants have a larger proportion of individuals who hold at least a bachelor's degree. Furthermore, a

[6] For this reason, these test scores do not represent each individual proficiency level in literacy and numeracy, but a spectrum of proficiency levels for the population of interest.

higher proportion of Canadians hold college or trade credentials (i.e., post-secondary non-university education) compared to their immigrant counterparts.

Immigrants tend to be concentrated in Canada's large urban areas, with about 90 percent of all immigrants in these locations, compared to only about 50 percent of those born in Canada. Male immigrants are about two percentage points *more* likely to earn strictly positive hourly wages than Canadian-born males, while immigrant females are five percentage points *less* likely to self-report positive earnings compared to Canadian-born females.[7]

[Insert Table 2 Here]

Table 2 presents average characteristics of nine population subgroups. It is not surprising that economic immigrants generally have the highest average literacy and numeracy scores among all the immigrant groups, the exception is for females in the other immigration class who have marginally higher scores on both tests compared to females in the economic class. Refugees, have the lowest average numeracy and literacy scores among the five immigrant groups. On average, second-generation Canadians have higher scores on both tests compared to the third-generation. Test score variances tend to be higher for the immigrant groups.[8]

Considering that economic immigrants are admitted based on their favourable labour market characteristics, it is unsurprising that their average hourly wages are the highest among all immigrant groups. These individuals also have average hourly wages similar to those of third-generation Canadians. Second generation immigrants have the highest hourly wages among all individuals in the sample. Our analysis allows us to examine whether this relationship holds when controlling for other demographic

[7] While not directly, comparable, at least for females, this statistic does broadly reflect the findings of Cross (2015) who shows that immigrants have labour force participation rates about five percentage points less than the Canadian-born, although this gape does tend to shrink with time spent in Canada.

[8] This pattern of literacy scores by immigration category is similar to results of Mahboubi (2017) who also uses the PIAAC data.

characteristics and test scores. Refugees of either gender have the lowest average hourly wages among all immigrant categories. This wage pattern is comparable to the annual earnings pattern in Hou and Bonikowska (2016). The average ages of immigrants and the Canadian-born are similar, hovering between 43 and 48. The exception is temporary residents who average about 38.5 years of age. Economic immigrants arrived in Canada at an older age with smaller percentages of both males and females arriving in Canada under the age of 14. Refugees enter at an average age of 25 years, with about 20 percent arriving before age 14.

The percentage of economic immigrants, other immigration categories, and temporary residents holding a bachelor's degree exceed those in the refugee and family reunification categories as well as both Canadian-born groups. The low proportion of refugees having at least a bachelor's degree is compensated by this group having the highest rates of post-secondary education attainment below a university degree among immigrant categories, with about 40 percent having obtained this credential, a figure comparable to both second and third-generation Canadians. The pattern of individuals holding a university degree is similar to the university completion rate pattern in Hou and Bonikowska (2016). Fewer refugees obtained their degrees outside of Canada compared to those in the points-based category, perhaps not surprising given that they were younger on average at the time of arrival. The final panel of this table shows the unweighted sample size and the proportion of individuals who have valid positive self-reported earnings. These individuals exclude those with no self-reported wages and any self-employment earnings. Males within each group have probabilities of working of greater than 60 percent; the exception is the other immigration class where only 57 percent are employed. Females have probabilities of employment of between 53 and 64 percent, with female refugees having the lowest probability of employment.

3. Regression framework

This section outlines our approach to answer the research questions outlined above. We begin by exploring the mean differences in literacy and numeracy scores among the three broad categories of immigrants and the Canadian-born in a regression context. Second, we examine average differences in earnings among these groups using a Mincer-type model and seek to understand how these differences change when we control for literacy or numeracy scores. We also study these gaps across subsamples of individuals with and without a university degree, and across the quantiles of the distributions of dependent variables to address the heterogeneous relationships with the independent variables. We repeat these exercises for the nine subpopulation groups.

In the initial regression analysis for each gender, we estimate the following model using ordinary least squares (OLS):[9]

$$Score_i = \alpha_1 + \mathbf{Category_i}\alpha_2 + X_i\alpha_3 + \epsilon_i \quad (1).$$

where $Score_i$ is our measure of individual i's literacy or numeracy. These scores have been standardized to have a mean of zero and a standard deviation of one. X_i is a vector of covariates which changes across specifications, including a cubic polynomial in age , the highest level of educational attainment (i.e., below high school, high school graduates (the reference group), post-secondary education below university, bachelor's degree and above), a dummy variable if the education was obtained abroad, a rural/urban indicator (e.g., rural, small urban, medium urban, and large urban (the reference group)),[10] and an indicator for province of residence (i.e., Ontario (the reference group), Alberta, British Columbia, the Prairies, the Atlantic provinces, Quebec, and the Territories). **Category** is a vector which includes three broad subpopulation groups (adult immigrants, young immigrants, and the Canadian-born), and then the nine immigration categories: refugees, economic immigrants, family reunification, other

[9] We also included the number of years in Canada as a control variable in separate regressions (not reported here) and the coefficients remain quantitatively unchanged.

[10] A small urban population centre has 1,000 to 29,999 inhabitants, a medium urban area has 30,000 to 99,999, and a large urban population center has 100,000 or greater.

immigrants, temporary residents, young refugees, young non-refugee immigrants (young immigrants who arrived under other categories), and second-generation Canadians (third-generation Canadians are omitted). Including those two above-mentioned young immigrant groups allows us to indirectly control for the age at arrival. Finally, ϵ_i is a possibly heteoskedastic error term.

In the second stage of the regression analysis, we estimate a Mincer-type model using OLS to understand the earnings gaps among these population/immigrant subgroups by estimating:[11]

$$\log(hourlywage_i) = \beta_1 + X_i\beta_2 + \mathbf{Category_i}\beta_3 + \theta Score_i + \mu_i \qquad (2).$$

where $\log(hourlywage_i)$ is the natural logarithm of the hourly wage rate for individual i, $Score_i$ is the standardized literacy or numeracy score for the individual which are added separately and jointly into the earnings equation, and μ_i is a possibly heteroskedastic error term.

As suggested by both the OECD and Statistics Canada, all plausible values and replicated weights are used to calculate point estimates and compute delete-one jackknife standard errors.[12] Let γ_t denote the coefficient of interest from either regression above, and $\widehat{\gamma_t}$ be the OLS estimate of γ_t. Indexing plausible values by t, and using the final sample weight and all 80 replicate weights, $\hat{\gamma}$ is the equally weighted average of all $\widehat{\gamma_t}$. The variance is imputed using the delete-one jackknife method, as follows:

$$Var(\hat{\gamma}) = \sum_{t=1}^{10} \frac{Var(\widehat{\gamma_t})}{10} + \left[1 + \frac{1}{10}\right] \times \sum_{t=1}^{10} \frac{(\widehat{\gamma_t} - \hat{\gamma})^2}{9} \qquad (3).$$

Furthermore, we employ the unconditional quantile method proposed in Firpo et al. (2009) to look at changes in coefficients on immigrant and Canadian-born categories at the 25th, 50th, and 75th quantiles of literacy scores, numeracy scores, and hourly wages. We examine how immigrants and the Canadian-born are different along the distribution of dependent variables of interest. We explore how

[11] We have also controlled for years in Canada in separate regressions (not reported here) and the coefficients remain quantitatively unchanged.

[12] Other methods are sometimes used to deal with plausible values, such as Hanushek et al. (2015) who use only the first plausible value of numeracy scores (of all ten plausible values), and Green and Riddell (2003, 2013) who take a log of an equally weighted average of all five plausible values in IALS 1994 and IALSS 2003. However, these approaches do not take the design of the survey fully into account and inference may be affected.

differences in test scores and earnings change using more defined subsamples (e.g., among university graduates) and across quantiles of respective outcomes. The unconditional quantile regression method is chosen over the conditional quantile regression, which was proposed by Koenker and Bassett (1978), because the latter method cannot be used to estimate the impact of a change in an explanatory variable on the quantile of the unconditional distribution of the outcome variable (Firpo et al. 2009). We estimate the RIF-OLS regression model:

$$RIF_i(\tau) = \mathbf{Category_i}\delta_1 + \mathrm{X_i}\delta_2 + \mathrm{e_i} \quad (4)$$

where $RIF_i(\tau)$ is the recentered influence function of the τ^{th} quantile and is estimated by the ordinary least squares method. The coefficient δ_1 can be interpreted, similarly to the OLS regression coefficient, as the standard deviation difference in test scores (in the case of test scores as dependent variables) and percentage differences in wages (in the case of log hourly wages as dependent variables) between the immigration and Canadian-born categories, but at the τ^{th} quantile of the respective dependent variables conditional on X_i. In the case where log hourly wage is the dependent variable, standardized literacy and numeracy scores are also introduced sequentially as explanatory variables. We seek to understand how economic returns to literacy and numeracy change across the distribution of the earnings and how their presence influences the return to education.

4. Results

4.1.Literacy and numeracy scores gaps

Tables 3 shows, separately for males and females, regression results using OLS with literacy scores as the dependent variable and the population subgroups aggregated into immigrants and the Canadian-born. Estimated coefficients are interpreted as the number of standard deviations away from the average score of the non-immigrant group, which is omitted.

[Insert Table 3 here]

Columns 1 and 4 of Table 3 show that, controlling only for age, male and female adult immigrants score on average about 0.61 and 0.86 standard deviations less than their counterparts who are born in Canada. Adding controls for the highest level of educational attainment (columns 2 and 5) results in a larger negative coefficient on for immigrants: -0.83 for males and -0.91 for females. Accounting for whether individuals obtained their education in countries other than Canada helps explain some of the differences in test scores and reduces the size of the coefficient to -0.69 and -0.66 for males and females, respectively.

Coming to Canada at young age allows immigrants to participate in the Canadian education system and have a better knowledge, compared to their parents, of one or both official languages in Canada. When controlling for education, there are statistically significant differences in scores for male young immigrants, and the differences for female young immigrants are closer to zero. These individuals were born abroad and not all would have the same ability and chance to learn English or French before coming to Canada. The result is quite encouraging for female young immigrants, and it is unsurprising to see that those who arrive in Canada at a young age do have higher scores on average compared to those who arrived in Canada over the age of 13.

Not unexpectedly, those with higher levels of education (above high school) tend to have higher literacy scores. However, individuals who obtained their education abroad on average do worse on literacy tests compared to those who obtained their highest education in Canada. The result also suggests that there are no statistical differences in test scores by urban size. Nor does region of residence matter, except for those who live in Atlantic Canada and Quebec where the average literacy score is lower than those who live in Ontario.

[Insert Table 4 here]

We examine differences in literacy scores between nine subpopulation groups and show regression results in Table 4. The comparator group is third-generation Canadians. Columns 1 and 4 in Table 4 show that both male and female second-generation Canadians outscore their third-generation counterparts. However, these differences are accounted for when controlling for individuals' highest level of educational attainment (columns 2 and 5) and all covariates (columns 3 and 6). All adult immigrant groups have literacy scores that are statistically below those of third-generation Canadians (the omitted category). Refugees tend to have the lowest literacy scores, around one standard deviation less than third-generation Canadians for both males and females in all specifications. Controlling for education increases the differences in literacy scores for adult economic immigrants, other categories immigrants, and male adult temporary residents. One noticeable result is that the coefficient on male adult economic immigrants increases approximately four times, when controlling for the highest educational attainment, and around three times when controlling for all covariates. These differences for male adult economic immigrants are smaller compared to their counterparts in other population subgroups, except for those who came under other immigration categories.

Literacy scores gaps are statistically significant for both female young refugees and male young non-refugees. This suggests that the disadvantages in language proficiency for those arriving through refugee programs may persist through an intergenerational channel, particularly in the case of females. Unfortunately, it is hard to draw any conclusion that young immigrants are at disadvantage in literacy scores compared to their third-generation counterparts, as the standard errors are substantial, possibly due to the small sample sizes. Furthermore, obtaining education abroad tends to have a negative influence on the language proficiency in Canada

[Insert Table 5 here]

The above regressions are repeated in Tables 5 and 6 for numeracy scores. The results are similar, but magnitudes are smaller than those seen in Tables 3 and 4 for literacy scores. In columns 3 and 6 of

Table 5, adult immigrants of either gender average about one-half standard deviations less on numeracy scores compared to their Canadian-born counterparts. Male young immigrants score 0.3 standard deviations less than those of their Canadian-born counterparts, but the difference is not statistically different from zero for females.

[Insert Table 6 here]

When the immigrant groups are disaggregated in Table 6, we observe that the second-generation does not have any numeracy scores gaps, except for second-generation males who score 0.12 standard deviations higher, but only in the most parsimonious specification (column 1). This difference is mitigated when the highest level of educational attainment is accounted for in the full specification regressions. Refugees have the lowest numeracy scores, and they are joined by both genders in the family reunification class and females who are temporary residents in all specifications. All the coefficients on adult refugee immigrants are negative and significant, ranging from -0.8 to -1.1 standard deviations. Estimated coefficients are larger for female adult economic immigrants and adult temporary residents than those for male respective categories. While higher levels of education are associated with higher numeracy scores, obtaining a foreign education reduces this benefit.

In sum, for both males and females, immigrants have test scores disadvantages in literacy and numeracy scores compared to their Canadina-born counterparts. The results hold true even when we disaggregate immigrants and Canadian-born individuals into nine subpopulation groups.

4.2. More defined subsamples by educational level

By gender, we explore differences in test scores between these individuals across different subsamples that include individuals without university education (below a bachelor's degree) and individuals with at least a bachelor's degree. Differences in test scores are also evaluated among these groups of individuals at the 25^{th}, 50^{th}, and 75^{th} quantiles of literacy and numeracy scores, respectively.

[Insert Table 7 here]

The top panel in Table 7 shows differences in literacy test scores and the bottom panel shows differences in numeracy test scores between adult and young immigrants, and the Canadian-born. Within each panel and for each gender, OLS estimates are in the left two columns and obtained by separating individuals with and without university education. Moving from low to high educational attainment and across quantiles of literacy and numeracy scores, differences in both literacy and numeracy scores between adult immigrants and the Canadian born decrease in absolute values, except for female adult immigrants. Adult female immigrants with a university degree have larger disadvantages in test scores, compared to the Canadian born with a degree and this is larger than the gap between adult female immigrants and the Canadian born when the level of education is less than a bachelor's degree.

Disadvantages in literacy and numeracy scores are less evident in the case of female young immigrants where test scores are statistically indistinguishable from those of the Canadian born. For male young immigrants, there are some disavantages depending on model specification. In cases where coefficients on young immigrants are not statistically significant and standard errors are large, it is hard to draw any conclusion because we cannot distinguish the effects of small sample sizes and measurement errors in test scores.

For both genders' literacy and numeracy tests, as we move from the 25^{th} percentile to the 75^{th} percentiles, scores gaps for individuals without high school diploma, compared to those with a high school diploma, decrease in absolute value, while the advantage in test scores increases for those with at least a bachelor's degree. There is no clear pattern for individuals with a college or trade certification across the distribution of test scores. It is interesting to note that obtaining a university degree outside of Canada is disadvantageous among individuals at the 75^{th} percentiles, and the magnitude of differences is larger for females. This pattern is less evident in the case of numeracy scores for males. On the other

hand, obtaining a high school diploma abroad is detrimental for individuals at the lowest quantiles in both literacy and numeracy for both genders.

[Insert Table 8]

We repeat the exercise with the more disaggregated definition of immigrants and Canadian-born individuals in Table 8. There are mixed effects across subsamples of levels of education and skills. Looking at the OLS results for different subsamples with and without university education, and for both genders, we observe that adult immigrants from various admission classes scores less on both tests than their third-generation counterparts. There is no definite pattern in score gaps when comparing the groups with at least a bachelor's degree to those without. There are some exceptions for adult economic and family reunification immigrants. The test scores gap between them and the third generation is higher in the subsample of individuals with at least a bachelor's degree, compared to those with a postsecondary non-university degree. Young immigrants in either group (i.e., refugees and non-refugees) tend to outperform those who arrived as adults, although the statistical significance of these results continue to be hampered by the small number of observations.

The quantile regression results show more of a pattern with coefficients on the immigrant and second-generation variables tending to decrease in absolute value as we move up through the quantiles. In other words, literacy and numeracy scores for both males and females by different immigration categories are closer to third-generation Canadians as one moves right in the skills distribution. Male adult economic immigrants are the exception, with coefficients higher in absolute magnitude at the higher quantiles. Once again, the result suggests that conditional on possessing similar "ability," which is measured by the quantiles of each test score, immigrants across categories appear to have better language skills and thus lower test scores gaps. The results from the unconditional quantiles point to the importance of analyzing differences in test scores at different quantiles of the distribution. The results obtained using

the unconditional quantile regressions are similar to the conclusion of Green and Riddell (2013) who use only the Canadian-born sample in the International Adult Life Skills Survey (2003).

4.3.The earnings gap

The results presented in this section demonstrate the effects of literacy and numeracy on differences in earnings between immigration categories. Estimated coefficients are derived using Equation 2 for both aggregated and disaggregated population subgroups of immigrants and the Canadian-born. Literacy and numeracy scores are introduced to the model to examine their individual impact on earnings gaps among these groups of individuals, with separate models estimated for males and females.[13] Table 9 addresses the earnings gap between young and adult immigrants, and the Canadian-born, while Table 10 repeats the exercise with more disaggregated groups of immigrants. The estimated coefficients on immigration categories approximate the average percentage gap in the hourly wage of the respective immigration category compared to the Canadian-born. The coefficients on literacy or numeracy scores can be interpreted as the approximate percentage change in hourly wages as literacy or numeracy scores increase by one standard deviation.

[Insert Table 9 here]

In Table 9, columns 1 and 6 show that age-adjusted earnings penalty for adult immigrants are lower for males (approximately 16 percent) than for females (around 20 percent). The earnings gap increases for male adult immigrants and decreases for females when education is added to the model; both show that adult immigrants earn 18 percent less than the Canadian born. Except for those who did not complete high school diploma oversea or obtained a post-secondary non-university education

[13] Test scores are specified linearly and could miss an important non-linearity. However, we have experimented with various specifications and find that being specified linearly is a compact approach that does not affect coefficients of interest markedly. The results from these regressions can be found in Appendix Tables 1, 2, 3, and 4.

overseas, other adult immigrants earn significantly less than those who obtain high school diplomas in Canada, for both genders, and the penalty is larger for females.

In subsequent columns in which literacy and numeracy scores are controlled, either separately or together, differences in earnings across educational levels become smaller, and even statistically insignificant for males who did not obtain a high school diploma. It is striking, though unsurprising, that obtaining a bachelor's degree abroad on average is disadvantageous compared to those who obtained a similar degree in Canada.

Literacy and numeracy scores are rewarded highly in the Canadian labour market, even after controlling for levels of education. The return to a one-standard-deviation increase in literacy is equivalent to 8 percent for men and 9 percent for women, while the return a one-standard-deviation increase in numeracy is approximately 10 percent for both genders. Compared to the results in columns 2 and 7, the immigrant earnings gap is reduced by about one-third for both males and females when either score is added to the model (columns 3 and 4 for males and columns 8 and 9 for females). Furthermore, controlling for literacy and/or numeracy scores reduce coefficients for individuals with a university degree, compared to those with a high school diploma, from 0.46 log points to 0.36 log points for males, and from 0.53 to around 0.45 log points for females. Conditioning on these test scores also decreases the earnings gap from -0.17 to -0.16 log points for males and from -0.29 to -0.25 log points for females who obtain a bachelor's degree abroad.

Previous research using the PIAAC data by Mueller et al. (2018) and Truong and Sweetman (2018) has shown that all three domains of test scores in the PIAAC are highly and positively correlated and that only the numeracy score has an independent effect on earnings when also controlling for scores literacy and problem-solving in technology-rich environment. We also control for both test scores jointly

in the final regression for each gender. We observe that the returns to numeracy scores are statistically significant at 10 percent for males and seven percent for females.

The coefficients on the young-immigrant variable being statistically indistinguishable from zero suggests that arriving in Canada at young age may help mitigate earnings disadvantages for immigrants compared to Canadian-born individuals. That could be because these individuals are educated mostly in the Canadian education system, would be more familiar with the Canadian labour market, and may have established networks that could potentially be helpful to gain employment, even though they have lower literacy and numeracy scores than the Canadian-born as shown above.

[Insert Table 10 here]

We extend the analysis in Table 9 to examine differences in earnings for our nine population subgroups. Across the columns, as controls are added, we see that second-generation Canadians have wages that are about the same as third-generation Canadians. Female second-generation Canadians have an earnings advantage in column 6. However, the advantage is accounted for when controlling for differences in education levels and location of residence (column 7). For both genders, adult refugee and family reunification immigrants, as well as female temporary resident immigrants, experience lower earnings across all specifications. Coefficients on adult economic immigrants are also negative but the earnings gap is accounted for when controlling for literacy or numeracy skills scores. On the other hand, both male and female adult family reunification immigrants, and female adult temporary residents have statistically lower earnings compared to those of the third generation.

Estimated coefficients on young refugees for both males and females are negative, but high standard errors render most of them statistically insignificant. The wage disadvantages for female young refugee immigrants are from about 34 percent (in the age-adjusted model) to 20 percent in the full specification without test scores and are not statistically different from zero when literacy or numeracy

scores are taken into account. This result suggests that despite receiving a Canadian education and any other benefits of arriving to Canada at an early age, these individuals' outcomes in the labour market are not as good, perhaps due to low socioeconomic status of previous generations, but they can do very well if given the same opportunities to improve to their literacy or numeracy proficiency. The returns to literacy and numeracy scores are similar to those in the case of more general definitions of immigrants and the Canadian-born.[14]

4.4. Examining the earnings gap using different subsamples and across (unconditional) quantiles

In this section we study differences in earnings between immigrants and the Canadian-born using more defined subsamples of those with and without a university degree and across unconditional quantiles of hourly wages.

[Insert Table 11 here]

By gender, literacy and numeracy scores are indirectly controlled by grouping individuals into three subsamples: individuals with similar literacy and numeracy scores, with literacy scores higher than numeracy scores, and with numeracy scores higher than literacy scores. To determine the sample of interest, we begin by calculating an equally weighted average literacy and numeracy scores using all ten plausible values for everyone. Then, we rank these averages into ten weighted deciles of literacy and numeracy scores, respectively. We restrict the thresholds for each decile of each test to be the same for

[14] We also interact the literacy and numeracy scores individually with the aggregated adult and young immigrant groups and the disaggregated group of immigrants. This exercise is done to answer the question of whether there are differential effects of literacy and numeracy on wages of immigrant groups versus the Canadian born, given that they have similar test scores. The hypothesis tests that coefficients on interaction terms (derived separately for different definitions of population subgroups) are jointly equally to zero cannot be rejected. We also find no statistically significant results in any of the model specification estimated. The impacts of literacy and numeracy proficiency on wages are similar for both Canadian-born individuals and immigrant. The results remain the same when we look at differences in earnings among nine population subgroups. Stated differently, the effects of literacy and numeracy on wages are the same for immigrants and the Canadian-born of either generation.

both males and females. The subsample of individuals with equal literacy and numeracy scores indicates that the ranking (decile) of literacy scores is identical to that of numeracy scores. The second subsample includes individuals whose literacy score is in a higher-ranking decile than the numeracy score, and the reverse selection is for the third subsample. We are interested in exploring if literacy or numeracy proficiency plays a more significant role in helping us understand earnings gaps between immigrants and the Canadian-born. The top panel of Table 11 shows earnings gaps between immigrants and Canadians using more general definitions of immigrants and the Canadian-born, and the bottom panel shows the results for the nine population subgroups. In all regressions, all covariates in equation 2, except for test scores, are controlled.

In the top panel, for men, the earnings gap is more substantial for adult immigrants when they have better literacy skills than numeracy skills compared to when they have balanced literacy and numeracy scores. The trend is reversed for adult female immigrants. Numeracy matters more than literacy for immigrants relative to the Canadian born. Both genders experience statistically insignificant earnings gaps compared to all Canadians, on average, as they have better numeracy than literacy skills. These results suggest that numeracy skills are perhaps more critical and individuals of either gender with higher numeracy skills are better rewarded in the Canadian labour market than they are for literacy skills. This result supports the claim we made in the previous section that numeracy scores have an independent effect on earnings and the return to these scores are higher than that of the literacy scores. On the other hand, across these subsamples, immigrants who migrated to Canada at a young age do not have any earnings disadvantages compared to the Canadian-born.

When we examine earnings gaps using disaggregated groups of immigrants (the lower panel of Table 11), adult refugee immigrants experience 30 percent and 40 percent lower wages compared to the third generation for males and females, respectively, among individuals who have similar proficiency in numeracy and literacy. However, estimated coefficients on this category are not statistically different

from zero in the other two subsamples, perhaps due to small sample size. For both males and females, adult economic immigrants exhibit no earnings disadvantages compared to the third generation across these homogenous subsamples, except for female adult economic immigrants with balanced literacy and numeracy scores. These women average a 20.5 percent earnings gap compared to female third-generation Canadians. This is likely because these individuals, while having both literacy and numeracy scores in the same decile, have these scores at a lower decile than third-generation Canadians. Unfortunately, due to the small sample size when categorizing immigrants and Canadians into more disaggregated groups, estimated coefficients are negative and not statistically significant for most immigration groups. Young non-refugee immigrants and second-generation Canadians have statistically zero earnings gaps compared to the third generation.

[Insert Table 12 here]

Table 12 shows the earnings gap of adult and young immigrants compared to all Canadian counterparts across quantiles of earnings. Accounting for literacy or numeracy scores in the 25^{th} and 75^{th} quantiles helps to eliminate earnings disadvantages of adult male immigrants. Coefficients on female adult immigrants are almost all statistically significant across quantiles of earnings, even after controlling for literacy or numeracy scores. The impact of being an adult immigrant is different for men and women across the distribution. Immigrants who arrive in Canada at a young age do not have any disadvantages in wages compared to the Canadian-born. The remuneration of obtaining at least a bachelor's degree increases from the bottom 25^{th} to the top 75^{th} quantile pointing to the importance of education in wage determination. We also observe the earnings gap of obtaining a university degree abroad is statistically significant at the bottom and top 25^{th} quantiles for men, and across all quantiles for women. Even though literacy and numeracy tests are meant to capture adults' basic everyday life and workplace skills, they matter in wage determination across all earnings quantiles.

[Insert Table 13 here]

In Table 13, second-generation Canadians and young non-refugees, both males and females, experience no earnings gaps across wage quantiles compared to the third geneartion of respective gender. On the other hand, male young refugee immigrants suffer considerable earnings disadvantages at the 25^{th} quantile of earnings, and female young refugee immigrants experience the most substantial earning gap at the 50^{th} quantile. We see the highest earnings gaps for adult male refugee immigrants are at the 50^{th} quantile and controlling for literacy or numeracy scores helps explain only a small portion the total earnings gaps. Similarly, controlling for these test scores helps explain the earnings gap of female adult refugees at the bottom 25^{th} quantile and these gaps remain statistically significant at higher quantiles. Coefficients on male and female adult family reunification immigrants are statistically significant at the 25^{th} and 50^{th} quantiles. Controlling for literacy and numeracy scores helps mitigate these differences at the 75^{th} quantile. Within a quantile of earnings, male and female adult economic immigrants do not have earnings disadvantages compared to those of the third generation, especially after accounting for literacy and numeracy. It is again evident in this table that literacy and numeracy scores are important factors in determining wages in the Canadian labour market.

5. **Conclusion**

The purpose of this research is to investigate differences in basic skills (measured by literacy and numeracy scores) between aggregated and disaggregated groups of adult and young immigrants and the Canadian-born. We also examine how these skills are individually valued in the Canadian labour market and how these skills help to explain earnings gaps among subpopulation groups. We find that immigrants of either gender who arrived in Canada older than age 13 have literacy and numeracy scores that are up to two-thirds of a standard deviation less than those of the Canadian-born when controlling for various factors such as age and education. By contrast, immigrants who arrived at the age of 13 or earlier tend to fare better on these tests compared to adult immigrants and have test scores similar to those of the

Canadian-born, arguably reflecting the difference in education systems from the origin countries and perhaps parental characteristics. These test score gaps can be seen when immigrants and the Canadian-born are disaggregated into nine subpopulation groups, pointing to the heterogeneity in abilities between individuals arriving in Canada under different immigration classes. Once all factors are controlled for, these gaps can be as high as one standard deviation depending on admissions class, with refugees having the largest gaps and economic immigrants the lowest among the three major immigration entry classes. It is difficult to disentangle between the effects of small sample sizes and measurement errors in test scores in interpreting the coefficients for young immigrant groups, although the estimates suggest that they do perform better on these tests than those who arrive in Canada at an older age. Having a higher level of education is positively correlated with test scores, but the effect for immigrants tends to be less, and in some cases even reversed, if that education was obtained outside of Canada.

We examine differences in test scores by carrying out analyses using more defined subsamples. In the case of aggregated immigrants and the Canadian-born groups, literacy and numeracy scores gaps are smaller among the individuals with at least a bachelor's degree compared to those with less than a bachelor's degree, and among individuals at the upper distribution of each test score respectively. When separating immigrants and the Canadian-born into nine subgroups, immigrant test scores gaps are sometimes smaller and other times larger among individuals with higher levels of education; there is no clear pattern. Differences do tend to become smaller as we move up the quantiles and are generally smallest at the 75^{th} quantile of each test score for both genders. These results point to the importance of addressing the heterogeneity in ability and other observable characteristics by disaggregating them into separate groups by category of admission and gender and carrying out the analyses along the distribution of literacy and numeracy scores.

Both literacy and numeracy scores increase hourly wages by up to 10 percent when viewed separately in different regressions. While adult immigrants earn of either gender earn 12 percent less than

those born in Canada once all covariates accounted for in the model, young immigrants have earnings that are statistically the same as those born in Canada. Disaggregating the data into several immigration categories shows that adult economic immigrants seem to have similar earnings compared to both second-and third-generation Canadians, and those adults in the refugee and family reunification classes receive about 14-18 percent less than the comparator group of third-generation Canadians.

Numeracy scores can be independently rewarded in the Canadian labour market, when both test scores are controlled for in the earnings regression. In fact, once we include these scores in the hourly wage model, the coefficients on the immigrant variables decreases, sometimes dramatically, suggesting that these skills are important determinants of compensation in Canada. As we move across the distribution of earnings, literacy and numeracy scores are important factors in determining wages in the Canadian labour market, for both genders, and there are only minor differences across quantiles.

It is important to note that for both genders, the second generation, adult economic immigrants, and young non-refugee immigrants do not have any earnings gaps when all covariates, including literacy and numeracy scores, are added individually to the models. Adult economic immigrants could fully capture their potential when they are given the opportunities to work and improve their language skills (recall that economic immigrants' numeracy scores are already similar to those of the Canadian-born, at least among males). In fact, improving both numeracy and literacy skills would assist all immigrant groups in the labour market and help them overcome other factors – such as a having obtained a foreign education – which are penalized in the Canadian labour market. With few exceptions, the children of immigrants are doing very well in the Canadian labour market, in part because they do have the highest average numeracy and literacy scores among the nine subgroups examined.

Overall the results presented here also underline the importance of immigration class as well as immigrating to Canada at a young age. While in general no immigrant group does as well on the two

tests or regarding hourly wages as the Canadian-born, there are still differences between immigrant admission categories that are worthy of note, namely that those admitted under the points system tend to perform better in Canada, regardless of which metric we use. Mahboubi (2017) recently wrote that Canada should toughen the language requirements for new immigrants – much the way that Australia has done – by allowing fewer points for poor language skills. Our results support this suggestion and further suggest that numeracy skills might be the better indicator of labour market success, along with immigration class and whether higher education is obtained in Canada or abroad.

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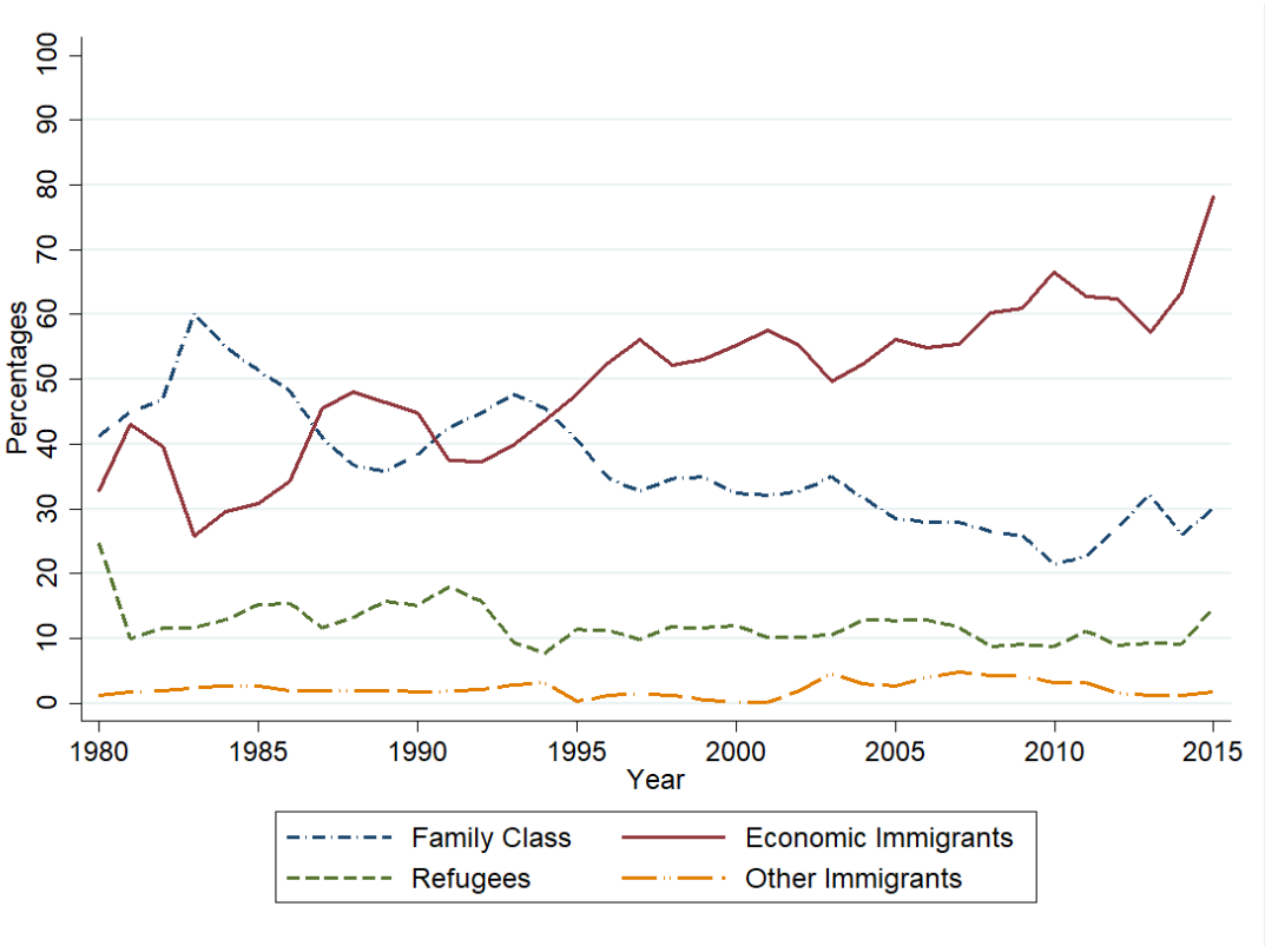
Figure 1. Permanent Residents by Category (% Distribution)



Sources: Immigration, Refugee and Citizenship Canada (IRCC, multiple years): Facts and Figures.

Table 1. Sample Characteristics, Immigrants and the Canadian born

	Immigrant		Canadian-born	
	Male	Female	Male	Female
Weighted shares of				
- Third-generation Canadians	--	--	0.81	0.80
- Second-generation Canadians	--	--	0.20	0.20
- Refugee	0.11	0.06	--	--
- Economic immigrants	0.38	0.31	--	--
- Family reunification category	0.34	0.41	--	--
- Other immigration classes	0.11	0.13	--	--
- Temporary residents	0.07	0.09	--	--
Average literacy score	257.67	250.01	281.24	280.62
s.d.	56.84	55.87	48.31	45.58
s.e.	(2.06)	(1.97)	(1.14)	(1.02)
Average numeracy score	258.84	236.88	278.50	265.69
s.d.	63.13	60.86	53.20	49.09
s.e.	(2.48)	(2.06)	(1.08)	(1.17)
Average age	45.22	44.43	44.93	45.31
Average age at immigration	25.30	24.60	--	--
Proportion of young immigrants (arrived at age 13 or younger)	0.20	0.20	--	--
Average hourly wage	$29.46	$22.75	$31.90	$25.85
s.d.	21.52	13.16	23.82	16.91
s.e.	(0.91)	(0.52)	(0.63)	(0.32)
Educational characteristics				
- Below high school	0.10	0.12	0.13	0.10
- High school	0.16	0.18	0.22	0.21
- Post-secondary - below university	0.30	0.29	0.41	0.41
- Post-secondary - bachelor's degree or above	0.45	0.42	0.24	0.27
Proportion of individuals who obtained degree abroad	0.61	0.63	0.02	0.01
Proportions of individuals living in urban areas	0.91	0.89	0.49	0.53
Sample size (N)	1,816	2,128	6,485	7,462
Sample size with positive self-reported hourly wages	1,197	1,206	4,132	4,650
Unweighted proportion owith positive hourly wages	0.66	0.57	0.64	0.62

Source: PIAAC 2012. Authors' calculations.

Note: The sample includes 17,891 individuals, aged 25 to 65. Estimates are weighted using the final sample weight provided in PIAAC 2012, by group of individuals. Average literacy and numeracy scores are calculated using all plausible test scores and replicate weights in the survey. Average hourly wages, including bonuses, are calculated for individuals with positive self-reported wages.

Table 2. Sample Characteristics, Immigrants by Admission Class, and Second- and Third-Generation Canadians

	Refugee		Economic Immigrants		Family Reunification		Other Immigration Class		Temporary Residents		Second Generation		Third Generation	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Average literacy score	235.87	232.40	272.33	259.62	243.28	240.86	273.02	271.92	258.18	238.73	288.98	288.41	279.36	278.70
s.d.	59.60	48.29	49.13	52.62	58.63	55.70	51.07	50.31	62.04	63.95	43.82	45.58	49.15	45.37
s.e.	(6.89)	(6.01)	(2.72)	(2.95)	(4.07)	(3.49)	(5.62)	(5.99)	(11.42)	(8.64)	(2.24)	(2.62)	(1.17)	(1.02)
Average numeracy score	233.30	222.68	282.00	252.12	237.79	223.94	269.60	254.53	257.77	227.25	284.91	270.17	276.95	264.59
s.d.	61.77	53.12	53.64	56.70	63.09	60.97	58.19	53.76	70.60	69.77	48.88	51.42	54.08	48.43
s.e.	(6.87)	(6.50)	(3.29)	(3.31)	(4.09)	(3.70)	(6.69)	(5.80)	(13.42)	(9.35)	(2.65)	(2.97)	(1.14)	(1.08)
Average age	46.27	43.03	45.81	44.55	45.18	44.48	46.19	48.48	38.56	38.71	43.13	43.65	45.37	45.72
Average age at immigration	24.69	25.69	30.58	28.83	21.08	22.81	18.39	19.38	28.36	24.82	--	--	--	--
Proportion of young immigrants (arrived at age 13 or younger)	0.20	0.21	0.10	0.09	0.27	0.21	0.42	0.40	0.12	0.22	--	--	--	--
Average hourly wage	$24.47	$19.49	$32.24	$24.51	$27.87	$22.02	$30.63	$24.17	$27.76	$19.72	$32.65	$28.11	$31.72	$25.31
s.d.	17.66	17.08	24.75	12.96	20.08	12.82	13.19	11.43	20.03	13.54	21.63	17.11	24.32	16.82
s.e.	(2.09)	(3.06)	(1.32)	(1.00)	(1.85)	(0.86)	(2.17)	(1.12)	(2.99)	(1.89)	(1.28)	(0.96)	(0.72	(0.34)
Educational characteristics														
- Below high school	0.13	0.10	0.02	0.06	0.18	0.18	0.12	0.07	0.08	0.14	0.09	0.06	0.14	0.11
- High school	0.26	0.24	0.08	0.10	0.19	0.24	0.17	0.15	0.25	0.16	0.18	0.21	0.23	0.21
- Post-secondary - below university	0.41	0.40	0.22	0.29	0.35	0.26	0.34	0.34	0.21	0.27	0.44	0.40	0.41	0.42
- Post-secondary - bachelor's degree or above	0.20	0.27	0.68	0.56	0.29	0.32	0.38	0.44	0.46	0.42	0.29	0.34	0.22	0.26
Proportion obtained degree abroad	0.52	0.57	0.71	0.70	0.53	0.63	0.43	0.46	0.82	0.73	0.02	0.03	0.02	0.01
Proportion living in urban areas	0.91	0.95	0.93	0.88	0.92	0.93	0.78	0.78	0.90	0.86	0.64	0.67	0.46	0.49
Sample size (N)	174	131	829	823	471	744	231	274	111	156	796	888	5,689	6,574

Sample size with positive self-reported hourly wages	108	69	562	463	319	411	131	174	77	89	508	534	3,624	4,116
Unweighted proportion with positive hourly wages	0.62	0.53	0.68	0.56	0.68	0.55	0.57	0.64	0.69	0.57	0.64	0.60	0.64	0.63

Source: PIAAC 2012. Authors' calculations.

Note: The sample includes 17,891 individuals, aged 25 to 65. Estimates are weighted using the final sample weight provided in PIAAC 2012, by group of individuals. Average literacy and numeracy scores are calculated using all plausible test scores and replicate weights in the survey. Average hourly wages ,including bonuses, are calculated for individuals with positive self-reported wages.

Table 3. Determinants of literacy scores among immigrants and Canadian-born, OLS

	Dependent variable: standardized literacy scores (with mean of 0 and variance of 1)					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Adult immigrants	-0.610***	-0.834***	-0.686***	-0.858***	-0.912***	-0.659***
	(0.059)	(0.053)	(0.081)	(0.048)	(0.043)	(0.080)
Young immigrants (migrated at <14 years)	-0.143	-0.255*	-0.293**	-0.018	-0.126	-0.162
	(0.103)	(0.100)	(0.100)	(0.100)	(0.092)	(0.090)
Education (Omitted group: HS graduates)						
- Below HS		-0.834***	-0.793***		-0.852***	-0.825***
		(0.069)	(0.070)		(0.082)	(0.075)
- College/trade		0.251***	0.217***		0.226***	0.223***
		(0.050)	(0.054)		(0.049)	(0.048)
- Bachelor's degree and above		0.977***	0.923***		0.836***	0.849***
		(0.050)	(0.054)		(0.050)	(0.054)
Foreign education x below HS			-0.512**			-0.376*
			(0.188)			(0.180)
Foreign education x HS			-0.461*			-0.408**
			(0.180)			(0.140)
Foreign education x college/trade			-0.222			-0.420***
			(0.146)			(0.108)
Foreign education x ≥ bachelor's degree			-0.193*			-0.428***
			(0.090)			(0.093)
Rural/urban and provinces (Omitted group: Large urban in Ontario)						
Rural			-0.098			0.029
			(0.056)			(0.045)
Small urban			-0.096			-0.049
			(0.061)			(0.051)
Medium urban			0.059			-0.028
			(0.061)			(0.050)
Alberta			0.009			-0.011
			(0.069)			(0.053)
British Columbia			-0.004			0.037
			(0.083)			(0.061)
Prairie provinces			-0.071			-0.030
			(0.056)			(0.053)
Atlantic provinces			-0.172***			-0.187***
			(0.052)			(0.046)
Territories			0.154			0.123
			(0.129)			(0.179)
Quebec			-0.191***			-0.271***
			(0.046)			(0.039)
Age	0.211*	0.130	0.175*	0.203*	0.088	0.082
	(0.095)	(0.081)	(0.080)	(0.091)	(0.083)	(0.083)
$Age^2/100$	-0.510*	-0.332	-0.434*	-0.486*	-0.219	-0.207
	(0.219)	(0.184)	(0.183)	(0.208)	(0.190)	(0.191)
$Age^3/10000$	0.366*	0.250	0.325*	0.338*	0.155	0.147

	(0.161)	(0.135)	(0.134)	(0.152)	(0.140)	(0.140)
Constant	-2.490	-1.626	-2.143	-2.353	-1.164	-0.971
	(1.314)	(1.135)	(1.126)	(1.281)	(1.166)	(1.168)
N	8301	8301	8301	9590	9590	9590
R^2	0.079	0.314	0.327	0.149	0.343	0.361
Adjusted R^2	0.078	0.313	0.325	0.149	0.342	0.360

Note: * p<0.05, ** p<0.01, *** p<0.001
Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for literacy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females.

Table 4. Determinants of literacy scores among 9 population subgroups, OLS

	Dependent variable: standardized literacy scores (with mean of 0 and variance of 1)					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Second generation Canadian	0.172***	0.071	0.012	0.164**	0.083	0.015
	(0.049)	(0.046)	(0.048)	(0.058)	(0.050)	(0.050)
Adult refugees	-1.079***	-1.074***	-0.948***	-1.152***	-1.197***	-0.966***
	(0.182)	(0.163)	(0.172)	(0.156)	(0.150)	(0.182)
Adult economic immigrants	-0.155*	-0.661***	-0.530***	-0.518***	-0.750***	-0.523***
	(0.068)	(0.065)	(0.098)	(0.065)	(0.063)	(0.094)
Adult family reunification immigrants	-1.005***	-0.982***	-0.847***	-1.047***	-0.966***	-0.759***
	(0.105)	(0.092)	(0.110)	(0.079)	(0.070)	(0.099)
Adult other categories	-0.337*	-0.507***	-0.353**	-0.404**	-0.613***	-0.371*
	(0.133)	(0.119)	(0.134)	(0.140)	(0.135)	(0.145)
Adult temporary residents	-0.725**	-0.886***	-0.690***	-1.305***	-1.263***	-0.992***
	(0.246)	(0.220)	(0.210)	(0.189)	(0.166)	(0.170)
Young refugee immigrants	-0.346	-0.315	-0.366	-0.734*	-0.530*	-0.577*
	(0.330)	(0.318)	(0.318)	(0.311)	(0.265)	(0.263)
Young non-refugee immigrants	-0.080	-0.227*	-0.281*	0.062	-0.080	-0.133
	(0.111)	(0.110)	(0.111)	(0.102)	(0.096)	(0.095)
Education						
(Omitted group: HS graduates)						
- Below HS		-0.826***	-0.792***		-0.838***	-0.822***
		(0.067)	(0.069)		(0.081)	(0.076)
- College/trade		0.241***	0.219***		0.212***	0.217***
		(0.051)	(0.054)		(0.050)	(0.048)
- Bachelor's degree and above		0.936***	0.911***		0.809***	0.834***
		(0.052)	(0.054)		(0.050)	(0.054)
Foreign education x below HS			-0.417*			-0.304
			(0.188)			(0.182)
Foreign education x HS			-0.405*			-0.359**
			(0.173)			(0.138)
Foreign education x college/trade			-0.236			-0.427***
			(0.143)			(0.110)
Foreign education x ≥ bachelor's degree			-0.253**			-0.432***
			(0.094)			(0.093)
Rural/urban and provinces						
(Omitted group: Large urban in Ontario)						
Rural			-0.100			0.023
			(0.056)			(0.045)
Small urban			-0.095			-0.053
			(0.061)			(0.051)
Medium urban			0.058			-0.033
			(0.062)			(0.050)
Alberta			0.001			-0.019
			(0.069)			(0.054)
British Columbia			-0.019			0.025
			(0.082)			(0.062)
Prairie provinces			-0.082			-0.033

			(0.057)			(0.052)
Atlantic provinces			-0.179***			-0.188***
			(0.053)			(0.045)
Territories			0.138			0.108
			(0.128)			(0.167)
Quebec			-0.200***			-0.272***
			(0.047)			(0.038)
Age	0.164	0.109	0.157	0.174	0.077	0.074
	(0.093)	(0.081)	(0.080)	(0.089)	(0.083)	(0.083)
$Age^2/100$	-0.401	-0.282	-0.390*	-0.426*	-0.199	-0.194
	(0.213)	(0.186)	(0.183)	(0.203)	(0.189)	(0.190)
$Age^3/10000$	0.286	0.212	0.290*	0.299*	0.142	0.139
	(0.157)	(0.136)	(0.134)	(0.149)	(0.139)	(0.140)
Constant	-1.865	-1.336	-1.894	-1.920	-0.983	-0.826
	(1.291)	(1.147)	(1.129)	(1.258)	(1.162)	(1.168)
N	8301	8301	8301	9590	9590	9590
R^2	0.110	0.320	0.332	0.171	0.35	0.368
Adjusted R^2	0.109	0.319	0.330	0.17	0.349	0.366

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for literacy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females.

Table 5. Determinants of numeracy scores between immigrants and Canadian-born, OLS

	Dependent variable: standardized numeracy scores (with mean of 0 and variance of 1)					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Adult immigrants	-0.463***	-0.691***	-0.548***	-0.739***	-0.796***	-0.504***
	(0.061)	(0.053)	(0.076)	(0.047)	(0.040)	(0.075)
Young immigrants (migrated at <14 years)	-0.160	-0.280**	-0.302**	-0.058	-0.169	-0.167
	(0.112)	(0.104)	(0.106)	(0.098)	(0.088)	(0.087)
Education						
(Omitted group: HS graduates)						
- Below HS		-0.805***	-0.799***		-0.837***	-0.848***
		(0.079)	(0.082)		(0.082)	(0.078)
- College/trade		0.360***	0.300***		0.239***	0.218***
		(0.052)	(0.056)		(0.052)	(0.049)
- Bachelor's degree and above		1.068***	0.991***		0.872***	0.873***
		(0.052)	(0.056)		(0.048)	(0.046)
Foreign education x below HS			-0.442*			-0.340
			(0.188)			(0.174)
Foreign education x HS			-0.576**			-0.459**
			(0.195)			(0.140)
Foreign education x college/trade			-0.135			-0.427***
			(0.144)			(0.112)
Foreign education x ≥ bachelor's degree			-0.140			-0.428***
			(0.087)			(0.092)
Rural/urban and provinces						
(Omitted group: Large urban in Ontario)						
Rural			-0.058			0.083
			(0.056)			(0.046)
Small urban			-0.069			-0.033
			(0.060)			(0.049)
Medium urban			0.076			-0.027
			(0.062)			(0.055)
Alberta			0.028			0.002
			(0.073)			(0.067)
British Columbia			-0.004			0.044
			(0.075)			(0.060)
Prairie provinces			-0.059			0.014
			(0.059)			(0.055)
Atlantic provinces			-0.224***			-0.209***
			(0.056)			(0.044)
Territories			0.029			0.070
			(0.106)			(0.172)
Quebec			-0.114*			-0.092*
			(0.046)			(0.037)
Age	0.248*	0.166	0.202*	0.150	0.031	0.034
	(0.105)	(0.090)	(0.092)	(0.091)	(0.082)	(0.081)
$Age^2/100$	-0.576*	-0.399*	-0.479*	-0.345	-0.069	-0.078
	(0.238)	(0.201)	(0.205)	(0.206)	(0.185)	(0.184)
$Age^3/10000$	0.403*	0.289*	0.348*	0.223	0.034	0.041

	(0.173)	(0.145)	(0.148)	(0.150)	(0.135)	(0.135)
Constant	-3.077*	-2.276	-2.671*	-1.955	-0.744	-0.725
	(1.483)	(1.299)	(1.323)	(1.292)	(1.152)	(1.146)
N	8301	8301	8301	9590	9590	9590
R^2	0.053	0.303	0.313	0.118	0.322	0.334
Adjusted R^2	0.053	0.302	0.312	0.118	0.321	0.332

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The omitted group is the Canadian-born whose the highest level of educational attainment is a high school diploma in Canada, and who live in large urban areas in Ontairo at the time of survey.

Table 6. Determinants of numeracy scores between population subgroups, OLS

	Dependent variable: standardized numeracy scores (with mean of 0 and variance of 1)					
	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Second generation	0.124*	0.017	-0.026	0.067	-0.015	-0.047
	(0.057)	(0.055)	(0.057)	(0.057)	(0.050)	(0.050)
Adult refugees	-0.939***	-0.930***	-0.805***	-1.004***	-1.050***	-0.789***
	(0.167)	(0.147)	(0.151)	(0.157)	(0.148)	(0.183)
Adult economic immigrants	0.105	-0.408***	-0.279**	-0.335***	-0.575***	-0.308***
	(0.078)	(0.075)	(0.101)	(0.065)	(0.062)	(0.084)
Adult family reunification immigrants	-0.997***	-0.970***	-0.840***	-1.015***	-0.935***	-0.685***
	(0.098)	(0.084)	(0.109)	(0.079)	(0.072)	(0.099)
Adult other categories	-0.309*	-0.483***	-0.341**	-0.408**	-0.621***	-0.349*
	(0.133)	(0.118)	(0.125)	(0.138)	(0.138)	(0.147)
Adult temporary residents	-0.643*	-0.794***	-0.590**	-1.147***	-1.108***	-0.801***
	(0.269)	(0.232)	(0.218)	(0.195)	(0.176)	(0.181)
Young refugee immigrants	-0.602	-0.577	-0.618	-0.499	-0.286	-0.308
	(0.398)	(0.407)	(0.407)	(0.356)	(0.320)	(0.321)
Young non-refugee immigrants	-0.080	-0.234*	-0.272*	-0.017	-0.163	-0.173
	(0.119)	(0.111)	(0.115)	(0.101)	(0.094)	(0.094)
Age	0.194	0.141	0.182*	0.122	0.022	0.028
	(0.103)	(0.090)	(0.091)	(0.090)	(0.082)	(0.082)
$Age^2/100$	-0.454	-0.342	-0.432*	-0.287	-0.053	-0.066
	(0.232)	(0.201)	(0.202)	(0.204)	(0.187)	(0.186)
$Age^3/10000$	0.315	0.247	0.312*	0.185	0.024	0.034
	(0.169)	(0.145)	(0.146)	(0.149)	(0.136)	(0.136)
Education						
(Omitted group: HS graduates)						
- Below HS		-0.789***	-0.795***		-0.827***	-0.845***
		(0.077)	(0.081)		(0.081)	(0.078)
- College/trade		0.349***	0.306***		0.221***	0.213***
		(0.053)	(0.057)		(0.052)	(0.050)
- Bachelor's degree and above		1.007***	0.974***		0.842***	0.859***
		(0.053)	(0.056)		(0.047)	(0.046)
Foreign education x below HS			-0.275			-0.245
			(0.194)			(0.174)
Foreign education x HS			-0.484*			-0.389**
			(0.193)			(0.137)
Foreign education x college/trade			-0.153			-0.438***
			(0.138)			(0.114)
Foreign education x ≥ bachelor's degree			-0.243**			-0.437***
			(0.090)			(0.093)
Rural/urban and provinces						
(Omitted group: Large urban in Ontario)						
Rural			-0.063			0.072
			(0.056)			(0.046)
Small urban			-0.072			-0.043
			(0.060)			(0.050)
Medium urban			0.070			-0.036

			(0.063)			(0.055)
Alberta			0.015			-0.009
			(0.073)			(0.067)
British Columbia			-0.020			0.035
			(0.073)			(0.061)
Prairie provinces			-0.073			0.007
			(0.059)			(0.054)
Atlantic provinces			-0.238***			-0.221***
			(0.056)			(0.045)
Territories			0.018			0.055
			(0.104)			(0.160)
Quebec			-0.130**			-0.103**
			(0.047)			(0.036)
Constant	-3.077*	-2.276	-2.671*	-1.955	-0.744	-0.725
	(1.483)	(1.299)	(1.323)	(1.292)	(1.152)	(1.146)
N	8301	8301	8301	9590	9590	9590
R^2	0.053	0.303	0.313	0.118	0.322	0.334
Adjusted R^2	0.053	0.302	0.312	0.118	0.321	0.332

Note: * p<0.05, ** p<0.01, *** p<0.001
Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The omitted group is the Canadian-born whose the highest level of educational attainment is a high school diploma in Canada, and who live in large urban areas in Ontairo at the time of survey.

Table 7. Determinants of literacy scores at different levels of ability for aggregated population subgroups

	Dependent variable: Standardized Literacy Score (with mean of 0 and variance of 1)									
	Male					Female				
	Subsamples by educ. attainment (OLS)		Unconditional Quantiles			Subsamples by educ. attainment (OLS)		Unconditional Quantiles		
	< Bachelor's	≥ Bachelor's	25th	50th	75th	< Bachelor's	≥ Bachelor's	25th	50th	75th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Adult Immigrants	-0.915***	-0.825***	-0.764***	-0.765***	-0.628***	-0.854***	-0.965***	-0.753***	-0.675***	-0.556***
	(0.104)	(0.074)	(0.171)	(0.140)	(0.134)	(0.090)	(0.074)	(0.158)	(0.136)	(0.133)
Young immigrants (migrated at <14 years)	-0.258*	-0.391*	-0.317	-0.285	-0.290	-0.184	-0.192	-0.185	-0.171	-0.104
	(0.123)	(0.169)	(0.185)	(0.171)	(0.171)	(0.121)	(0.111)	(0.154)	(0.121)	(0.180)
Education										
Below HS	-0.747***		-1.282***	-0.630***	-0.300***	-0.774***		-1.178***	-0.796***	-0.342***
	(0.071)		(0.209)	(0.113)	(0.087)	(0.077)		(0.180)	(0.104)	(0.060)
College/trade	0.260***		0.197*	0.320***	0.255*	0.276***		0.247**	0.263**	0.239**
	(0.051)		(0.092)	(0.094)	(0.103)	(0.050)		(0.087)	(0.081)	(0.082)
≥ Bachelor's degree			0.771***	1.072***	1.140***			0.677***	1.006***	1.108***
			(0.108)	(0.139)	(0.146)			(0.103)	(0.105)	(0.137)
Above a bachelor's degree		0.291***					0.305***			
		(0.083)					(0.078)			
Foreign education x below HS	-0.322		-0.513	0.182	0.356**	-0.203		-0.345	0.316*	0.372**
	(0.192)		(0.381)	(0.208)	(0.129)	(0.172)		(0.264)	(0.148)	(0.132)
Foreign education x HS	-0.039		-0.843**	-0.174	0.081	-0.255*		-0.796**	-0.224	0.094
	(0.164)		(0.297)	(0.205)	(0.144)	(0.101)		(0.282)	(0.156)	(0.140)
Foreign education x college/trade			-0.386	-0.115	-0.023			-0.704**	-0.430*	-0.152
			(0.255)	(0.198)	(0.149)			(0.244)	(0.167)	(0.124)
Foreign education x ≥ Bachelor's			-0.067	-0.223	-0.351*			-0.286	-0.582***	-0.648***
			(0.142)	(0.143)	(0.164)			(0.176)	(0.152)	(0.151)
Foreign education x > Bachelor's		0.031					-0.143			
		(0.133)					(0.132)			
N	5925	2376	8301	8301	8301	6574	3016	9590	9590	9590
R^2	0.262	0.184	0.210	0.204	0.166	0.299	0.229	0.230	0.232	0.187
Adjusted R^2	0.260	0.179	0.208	0.202	0.164	0.297	0.225	0.229	0.231	0.185

	Dependent variable: Standardized Numeracy Score (with mean of 0 and variance of 1)									
Adult immigrants	-0.882***	-0.603***	-0.729***	-0.576***	-0.409**	-0.739***	-0.793***	-0.652***	-0.540***	-0.392***
	(0.101)	(0.075)	(0.164)	(0.134)	(0.138)	(0.081)	(0.081)	(0.152)	(0.134)	(0.115)
Young immigrants (migrated at <14 years)	-0.321*	-0.288	-0.432*	-0.242	-0.299*	-0.196	-0.191	-0.191	-0.154	-0.177
	(0.137)	(0.156)	(0.204)	(0.158)	(0.143)	(0.116)	(0.116)	(0.143)	(0.138)	(0.148)
Education										
Below HS	-0.756***		-1.256***	-0.604***	-0.239**	-0.795***		-1.283***	-0.801***	-0.343***
	(0.082)		(0.239)	(0.118)	(0.085)	(0.078)		(0.207)	(0.111)	(0.080)
College/trade	0.347***		0.349**	0.383***	0.293**	0.272***		0.264**	0.252*	0.227*
	(0.052)		(0.126)	(0.108)	(0.093)	(0.050)		(0.089)	(0.101)	(0.092)
At least a bachelor's degree			0.886***	1.105***	1.150***			0.746***	1.027***	1.101***
			(0.138)	(0.124)	(0.136)			(0.112)	(0.142)	(0.125)
Above a bachelor's degree		0.215*					0.273***			
		(0.088)					(0.082)			
Foreign education x below HS	-0.144		-0.359	0.046	0.186	-0.125		-0.163	0.251	0.260*
	(0.188)		(0.327)	(0.137)	(0.141)	(0.168)		(0.286)	(0.183)	(0.110)
Foreign education x HS	0.143		-1.041**	-0.293	0.018	-0.224*		-0.741*	-0.296	-0.032
	(0.162)		(0.372)	(0.227)	(0.189)	(0.104)		(0.292)	(0.169)	(0.141)
Foreign education x College/Trade			-0.192	-0.125	0.017			-0.643*	-0.371*	-0.194
			(0.272)	(0.218)	(0.190)			(0.256)	(0.166)	(0.137)
Foreign education x ≥ Bachelor's			0.086	-0.171	-0.326			-0.243	-0.568***	-0.609***
			(0.138)	(0.142)	(0.167)			(0.170)	(0.161)	(0.136)
Foreign education x > Bachelor's		0.064					-0.161			
		(0.121)					(0.142)			
N	5925	2376	8301	8301	8301	6574	3016	9590	9590	9590
R^2	0.249	0.105	0.208	0.196	0.156	0.268	0.160	0.224	0.219	0.167
Adjusted R^2	0.246	0.099	0.206	0.194	0.154	0.266	0.155	0.222	0.218	0.165

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) and unconditional quantile regression methods were used to calculate point estimates using all 10 plausible values for literacy and numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. All regressions include age and its polynomials, rural and urban indicators, and provinces.

Table 8. Determinants of literacy scores at different levels of ability for nine population subgroups

	Dependent variable: Standardized Literacy Score (with mean of 0 and variance of 1)									
	Male					Female				
	Subsamples by educ. attainment (OLS)		Unconditional Quantiles			Subsamples by educ. attainment (OLS)		Unconditional Quantiles		
	< Bachelor's	≥ Bachelor's	25th	50th	75th	< Bachelor's	≥ Bachelor's	25th	50th	75th
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Second generation	0.027	-0.064	0.069	-0.024	-0.043	0.024	-0.042	-0.009	0.020	0.066
	(0.053)	(0.096)	(0.093)	(0.082)	(0.094)	(0.062)	(0.081)	(0.087)	(0.086)	(0.100)
Adult refugees	-1.184***	-0.837**	-1.209***	-0.942***	-0.608***	-1.092***	-1.265***	-1.209**	-0.953***	-0.724***
	(0.198)	(0.316)	(0.359)	(0.182)	(0.163)	(0.197)	(0.326)	(0.424)	(0.269)	(0.155)
Adult economic immigrants	-0.582***	-0.808***	-0.450**	-0.645***	-0.643***	-0.653***	-0.880***	-0.563**	-0.543***	-0.468**
	(0.154)	(0.089)	(0.174)	(0.172)	(0.172)	(0.136)	(0.098)	(0.186)	(0.147)	(0.150)
Adult family reunification immigrants	-0.986***	-1.066***	-1.011***	-0.923***	-0.724***	-0.907***	-1.132***	-0.910***	-0.789***	-0.601***
	(0.123)	(0.145)	(0.231)	(0.176)	(0.141)	(0.102)	(0.117)	(0.190)	(0.165)	(0.139)
Adult other categories	-0.538**	-0.519**	-0.455	-0.538**	-0.381	-0.511*	-0.704***	-0.384	-0.415*	-0.349
	(0.183)	(0.177)	(0.277)	(0.184)	(0.224)	(0.209)	(0.154)	(0.263)	(0.207)	(0.190)
Adult temporary residents	-0.987**	-0.856***	-0.648	-0.750**	-0.625**	-1.335***	-1.155***	-1.202***	-0.823***	-0.658***
	(0.373)	(0.248)	(0.369)	(0.242)	(0.234)	(0.264)	(0.230)	(0.286)	(0.190)	(0.181)
Young refugee immigrants	-0.323	-0.662	-0.043	-0.348	-0.308	-0.629*	0.095	-0.413	-0.652	-0.531
	(0.386)	(0.425)	(0.395)	(0.486)	(0.386)	(0.281)	(0.745)	(0.552)	(0.522)	(0.346)
Young non-refugee immigrants	-0.241	-0.397*	-0.328	-0.285	-0.302	-0.134	-0.213	-0.176	-0.135	-0.057
	(0.136)	(0.180)	(0.207)	(0.183)	(0.189)	(0.132)	(0.115)	(0.166)	(0.128)	(0.190)
Education										
Below HS	-0.746***		-1.281***	-0.628***	-0.299***	-0.776***		-1.173***	-0.793***	-0.339***
	(0.070)		(0.208)	(0.112)	(0.087)	(0.077)		(0.179)	(0.104)	(0.060)
College/trade	0.259***		0.199*	0.324***	0.257*	0.263***		0.241**	0.257**	0.235**
	(0.052)		(0.093)	(0.095)	(0.103)	(0.050)		(0.087)	(0.081)	(0.082)
At least a bachelor's degree			0.750***	1.064***	1.142***			0.660***	0.991***	1.096***
			(0.106)	(0.139)	(0.147)			(0.105)	(0.106)	(0.136)
Above a bachelor's degree		0.290***					0.291***			
		(0.083)					(0.079)			
Foreign education x below HS	-0.287		-0.345	0.265	0.380**	-0.153		-0.240	0.375*	0.404**
	(0.191)		(0.378)	(0.208)	(0.123)	(0.176)		(0.266)	(0.157)	(0.135)
Foreign education x HS	-0.133		-0.755**	-0.130	0.091	-0.295**		-0.722**	-0.185	0.113

	(0.167)		(0.291)	(0.206)	(0.143)	(0.108)		(0.278)	(0.158)	(0.142)
Foreign education x college/trade			-0.407	-0.127	-0.027			-0.712**	-0.444**	-0.161
			(0.254)	(0.197)	(0.150)			(0.246)	(0.168)	(0.126)
Foreign education x ≥ Bachelor's			-0.183	-0.274	-0.355*			-0.292	-0.592***	-0.654***
			(0.143)	(0.156)	(0.172)			(0.173)	(0.153)	(0.152)
Foreign education x > Bachelor's		0.002					-0.127			
		(0.135)					(0.133)			
N	5925	2376	8301	8301	8301	6574	3016	9590	9590	9590
R^2	0.269	0.192	0.217	0.207	0.167	0.308	0.238	0.237	0.236	$0.190
Adjusted R^2	0.266	0.184	0.215	0.204	0.164	0.305	0.232	0.234	0.234	0.187
	Dependent variable: Standardized Numeracy Score (with mean 0 and variance 1)									
Second generation	0.017	-0.160	0.014	-0.037	-0.071	-0.056	-0.062	-0.061	-0.044	-0.020
	(0.068)	(0.092)	(0.115)	(0.101)	(0.103)	(0.066)	(0.082)	(0.088)	(0.075)	(0.090)
Adult refugees	-1.011***	-0.943**	-1.084**	-0.893***	-0.512**	-0.919***	-1.135***	-1.021**	-0.866***	-0.615***
	(0.178)	(0.299)	(0.340)	(0.185)	(0.158)	(0.192)	(0.330)	(0.369)	(0.262)	(0.161)
Adult economic immigrants	-0.416*	-0.537***	-0.303	-0.329*	-0.296	-0.474***	-0.634***	-0.413*	-0.363*	-0.282*
	(0.171)	(0.082)	(0.168)	(0.150)	(0.172)	(0.124)	(0.105)	(0.176)	(0.156)	(0.127)
Adult family reunification immigrants	-1.063***	-0.972***	-1.143***	-0.815***	-0.581***	-0.874***	-1.010***	-0.853***	-0.702***	-0.505***
	(0.119)	(0.152)	(0.248)	(0.171)	(0.152)	(0.103)	(0.140)	(0.194)	(0.161)	(0.135)
Adult other categories	-0.553**	-0.506*	-0.527	-0.463*	-0.380	-0.457*	-0.747***	-0.532	-0.422*	-0.262
	(0.190)	(0.197)	(0.273)	(0.192)	(0.202)	(0.188)	(0.181)	(0.282)	(0.183)	(0.196)
Adult temporary residents	-1.048**	-0.620*	-0.747	-0.526*	-0.365	-1.131***	-0.994***	-1.032**	-0.705***	-0.466**
	(0.371)	(0.257)	(0.428)	(0.258)	(0.261)	(0.281)	(0.236)	(0.328)	(0.211)	(0.173)
Young refugee immigrants	-0.582	-0.844*	-0.793	-0.406	-0.277	-0.398	0.648	-0.376	-0.312	-0.267
	(0.499)	(0.425)	(0.697)	(0.469)	(0.379)	(0.342)	(1.154)	(0.556)	(0.530)	(0.447)
Young non-refugee immigrants	-0.278	-0.303	-0.385	-0.233	-0.323*	-0.193	-0.226	-0.199	-0.158	-0.178
	(0.148)	(0.159)	(0.220)	(0.166)	(0.158)	(0.125)	(0.122)	(0.154)	(0.145)	(0.160)
Education										
Below HS	-0.754***		-1.251***	-0.602***	-0.237**	-0.799***		-1.280***	-0.799***	-0.341***
	(0.081)		(0.238)	(0.118)	(0.085)	(0.078)		(0.205)	(0.112)	(0.080)
College/trade	0.347***		0.356**	0.389***	0.299**	0.259***		0.259**	0.248*	0.224*
	(0.053)		(0.127)	(0.108)	(0.093)	(0.051)		(0.089)	(0.101)	(0.091)
At least a bachelor's degree			0.860***	1.090***	1.147***			0.730***	1.015***	1.093***
			(0.136)	(0.123)	(0.137)			(0.113)	(0.140)	(0.125)

Above a bachelor's degree		0.213*					0.253**			
		(0.086)					(0.081)			
Foreign education x below HS	-0.063		-0.109	0.192	0.274	-0.069		-0.054	0.325	0.308**
	(0.190)		(0.344)	(0.144)	(0.140)	(0.169)		(0.291)	(0.194)	(0.116)
Foreign education x HS	0.025		-0.909*	-0.218	0.058	-0.290**		-0.657*	-0.239	0.004
	(0.162)		(0.362)	(0.230)	(0.198)	(0.111)		(0.288)	(0.169)	(0.144)
Foreign education x college/trade			-0.216	-0.144	0.008			-0.653*	-0.383*	-0.204
			(0.266)	(0.214)	(0.192)			(0.257)	(0.166)	(0.137)
Foreign education x ≥ Bachelor's			-0.070	-0.270	-0.378*			-0.254	-0.582***	-0.619***
			(0.139)	(0.143)	(0.177)			(0.169)	(0.161)	(0.136)
Foreign education x > Bachelor's		0.018					-0.145			
		(0.121)					(0.140)			
N	5925	2376	8301	8301	8301	6574	3016	9590	9590	9590
R^2	0.259	0.122	0.218	0.202	0.158	0.277	0.173	0.229	0.223	0.169
Adjusted R^2	0.256	0.114	0.216	0.199	0.156	0.274	0.166	0.227	0.221	0.167

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) and unconditional quantile regression methods were used to calculate point estimates using all 10 plausible values for literacy and numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. All regressions include age and its polynomials, rural and urban indicators, and provinces.

Table 9. Determinants of log hourly wages for aggregated groups of immigrants and the Canadian-born

	Dependent variable: log hourly wages									
	Male					Female				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Literacy			0.084***		-0.006			0.090***		0.036
			(0.013)		(0.022)			(0.011)		(0.023)
Numeracy				0.103***	0.108***				0.095***	0.067**
				(0.012)	(0.021)				(0.011)	(0.023)
Adult immigrants	-0.163***	-0.176***	-0.119**	-0.119**	-0.120**	-0.203***	-0.183***	-0.118**	-0.130**	-0.120**
	(0.024)	(0.039)	(0.041)	(0.040)	(0.041)	(0.023)	(0.043)	(0.042)	(0.043)	(0.043)
Young immigrants	0.102	0.048	0.069	0.078	0.078	0.033	-0.023	0.001	0.002	0.004
	(0.061)	(0.062)	(0.060)	(0.059)	(0.059)	(0.046)	(0.043)	(0.043)	(0.042)	(0.043)
Age	0.683*	0.506	0.470	0.435	0.434	0.191	0.176	0.104	0.133	0.120
	(0.294)	(0.294)	(0.294)	(0.296)	(0.297)	(0.271)	(0.248)	(0.246)	(0.244)	(0.243)
$Age^2/100$	-2.241*	-1.604	-1.489	-1.375	-1.369	-0.422	-0.418	-0.171	-0.270	-0.224
	(1.032)	(1.018)	(1.017)	(1.024)	(1.027)	(0.963)	(0.873)	(0.866)	(0.859)	(0.856)
$Age^3/10000$	3.297*	2.314	2.160	1.994	1.985	0.374	0.460	0.095	0.243	0.174
	(1.572)	(1.531)	(1.526)	(1.537)	(1.543)	(1.484)	(1.335)	(1.323)	(1.313)	(1.309)
$Age^4/1000000$	-1.826*	-1.269	-1.194	-1.104	-1.099	-0.113	-0.207	-0.010	-0.088	-0.052
	(0.878)	(0.845)	(0.840)	(0.847)	(0.850)	(0.838)	(0.749)	(0.741)	(0.736)	(0.734)
Education										
(Omitted group: HS graduates)										
- Below HS		-0.107*	-0.043	-0.031	-0.032		-0.195***	-0.135**	-0.136**	-0.129**
		(0.044)	(0.045)	(0.046)	(0.046)		(0.042)	(0.043)	(0.044)	(0.043)
- College/trade		0.161***	0.140***	0.126***	0.126***		0.193***	0.172***	0.172***	0.169***
		(0.030)	(0.031)	(0.032)	(0.032)		(0.024)	(0.024)	(0.024)	(0.024)
- Bachelor's degree and above		0.462***	0.380***	0.355***	0.356***		0.530***	0.451***	0.448***	0.441***
		(0.037)	(0.040)	(0.040)	(0.040)		(0.028)	(0.031)	(0.030)	(0.030)
Foreign education x below HS		-0.067	-0.004	-0.005	-0.007		0.032	0.063	0.069	0.070
		(0.101)	(0.099)	(0.100)	(0.100)		(0.077)	(0.084)	(0.084)	(0.084)
Foreign education x HS		-0.218**	-0.151*	-0.127	-0.128		-0.045	-0.014	-0.008	-0.006
		(0.071)	(0.070)	(0.071)	(0.071)		(0.069)	(0.071)	(0.073)	(0.072)
Foreign education x college/trade		-0.100	-0.084	-0.089	-0.090		-0.156*	-0.128	-0.119	-0.118
		(0.065)	(0.064)	(0.063)	(0.063)		(0.068)	(0.066)	(0.069)	(0.068)
Foreign education x ≥ Bachelor's		-0.171***	-0.155***	-0.158***	-0.158***		-0.290***	-0.258***	-0.253***	-0.251***
		(0.046)	(0.047)	(0.046)	(0.046)		(0.059)	(0.058)	(0.058)	(0.058)

Rural/urban and provinces (Omitted group: Large urban in Ontario)										
Rural		-0.011	0.003	0.000	-0.000		-0.057**	-0.051*	-0.055**	-0.053**
		(0.027)	(0.028)	(0.028)	(0.028)		(0.021)	(0.020)	(0.020)	(0.020)
Small urban		-0.005	0.005	0.002	0.002		-0.097***	-0.089***	-0.089***	-0.088***
		(0.030)	(0.030)	(0.030)	(0.030)		(0.027)	(0.026)	(0.026)	(0.025)
Medium urban		-0.048	-0.050	-0.049	-0.049		-0.050	-0.044	-0.044	-0.043
		(0.039)	(0.040)	(0.039)	(0.039)		(0.036)	(0.037)	(0.036)	(0.036)
Alberta		0.223***	0.214***	0.213***	0.213***		0.104**	0.101**	0.102**	0.101**
		(0.039)	(0.040)	(0.039)	(0.039)		(0.038)	(0.037)	(0.037)	(0.037)
British Columbia		-0.009	-0.004	0.000	0.001		0.035	0.027	0.028	0.027
		(0.036)	(0.036)	(0.036)	(0.036)		(0.028)	(0.028)	(0.028)	(0.028)
Prairie provinces		-0.002	0.004	0.006	0.005		-0.056*	-0.056*	-0.057*	-0.057*
		(0.026)	(0.025)	(0.025)	(0.025)		(0.024)	(0.024)	(0.024)	(0.024)
Atlantic provinces		-0.215***	-0.205***	-0.198***	-0.198***		-0.166***	-0.156***	-0.151***	-0.152***
		(0.026)	(0.026)	(0.026)	(0.026)		(0.020)	(0.020)	(0.020)	(0.020)
Territories		0.201***	0.187***	0.200***	0.201***		0.372***	0.356***	0.361***	0.357***
		(0.039)	(0.043)	(0.044)	(0.044)		(0.088)	(0.075)	(0.072)	(0.071)
Quebec		-0.107***	-0.097***	-0.098***	-0.099***		-0.089***	-0.072***	-0.084***	-0.079***
		(0.024)	(0.024)	(0.024)	(0.024)		(0.018)	(0.018)	(0.018)	(0.018)
Constant	-4.544	-2.911	-2.512	-2.136	-2.118	0.208	0.226	0.984	0.716	0.847
	(3.056)	(3.089)	(3.101)	(3.119)	(3.130)	(2.794)	(2.572)	(2.556)	(2.532)	(2.525)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R^2	0.05	0.215	0.235	0.246	0.246	0.049	0.267	0.291	0.294	0.296
Adjusted R^2	0.049	0.212	0.232	0.243	0.243	0.048	0.264	0.288	0.291	0.293

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the Canadian-born who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

Table 10. Determinants of log hourly wages for nine population subgroups

	Dependent variable: log hourly wages									
	Male					Female				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Literacy			0.083***		-0.004			0.087***		0.034
			(0.013)		(0.022)			(0.011)		(0.023)
Numeracy				0.101***	0.104***				0.092***	0.066**
				(0.013)	(0.021)				(0.011)	(0.023)
Second generation	0.056	-0.021	-0.021	-0.017	-0.016	0.103***	0.016	0.011	0.015	0.013
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.030)	(0.027)	(0.027)	(0.027)	(0.027)
Adult refugees	-0.316***	-0.238**	-0.159*	-0.155*	-0.157*	-0.270*	-0.265**	-0.184*	-0.194*	-0.183
	(0.075)	(0.074)	(0.071)	(0.068)	(0.069)	(0.110)	(0.089)	(0.093)	(0.094)	(0.094)
Adult economic immigrants	-0.000	-0.110**	-0.067	-0.078	-0.079	-0.064	-0.120*	-0.071	-0.089	-0.079
	(0.034)	(0.041)	(0.041)	(0.041)	(0.042)	(0.039)	(0.051)	(0.049)	(0.050)	(0.050)
Adult family reunification immigrants	-0.283***	-0.234***	-0.161**	-0.147**	-0.148**	-0.266***	-0.224***	-0.147**	-0.151**	-0.142**
	(0.042)	(0.054)	(0.056)	(0.054)	(0.055)	(0.041)	(0.051)	(0.051)	(0.052)	(0.052)
Adult other categories	-0.189	-0.235	-0.212	-0.202	-0.203	-0.104*	-0.112	-0.072	-0.072	-0.068
	(0.125)	(0.142)	(0.137)	(0.139)	(0.139)	(0.047)	(0.061)	(0.060)	(0.060)	(0.060)
Adult temporary residents	-0.203	-0.173	-0.123	-0.117	-0.117	-0.365***	-0.331***	-0.252**	-0.263**	-0.252**
	(0.131)	(0.129)	(0.123)	(0.117)	(0.118)	(0.067)	(0.092)	(0.087)	(0.085)	(0.085)
Young refugee immigrants	-0.183	-0.208	-0.173	-0.124	-0.123	-0.344**	-0.203*	-0.151	-0.170	-0.159
	(0.262)	(0.250)	(0.231)	(0.207)	(0.206)	(0.109)	(0.081)	(0.087)	(0.101)	(0.098)
Young non-refugee immigrants	0.142*	0.069	0.088	0.094	0.094	0.081	-0.007	0.013	0.017	0.018
	(0.065)	(0.065)	(0.064)	(0.064)	(0.064)	(0.049)	(0.046)	(0.046)	(0.045)	(0.046)
Age	0.670*	0.501	0.469	0.436	0.435	0.217	0.199	0.124	0.147	0.135
	(0.296)	(0.293)	(0.294)	(0.296)	(0.297)	(0.263)	(0.246)	(0.244)	(0.241)	(0.240)
$Age^2/100$	-2.205*	-1.592	-1.491	-1.380	-1.374	-0.535	-0.506	-0.244	-0.327	-0.285
	(1.044)	(1.017)	(1.017)	(1.025)	(1.028)	(0.936)	(0.867)	(0.858)	(0.849)	(0.847)
$Age^3/10000$	3.258*	2.301	2.166	2.002	1.994	0.572	0.603	0.213	0.335	0.273
	(1.594)	(1.531)	(1.528)	(1.540)	(1.545)	(1.447)	(1.327)	(1.311)	(1.299)	(1.296)
$Age^4/1000000$	-1.810*	-1.264	-1.198	-1.109	-1.105	-0.235	-0.291	-0.078	-0.142	-0.109
	(0.892)	(0.846)	(0.842)	(0.849)	(0.852)	(0.821)	(0.746)	(0.735)	(0.730)	(0.728)
Education										
(Omitted group: HS graduates)										
- Below HS		-0.109*	-0.045	-0.033	-0.034		-0.194***	-0.136**	-0.137**	-0.131**
		(0.044)	(0.045)	(0.046)	(0.046)		(0.042)	(0.043)	(0.044)	(0.043)

- College/trade		0.162***	0.142***	0.128***	0.128***		0.191***	0.171***	0.170***	0.168***
		(0.031)	(0.031)	(0.032)	(0.032)		(0.024)	(0.024)	(0.024)	(0.024)
- Bachelor's degree and above		0.458***	0.379***	0.355***	0.356***		0.522***	0.447***	0.443***	0.437***
		(0.037)	(0.040)	(0.040)	(0.040)		(0.028)	(0.031)	(0.030)	(0.031)
Foreign education x below HS		-0.026	0.025	0.016	0.014		0.065	0.088	0.090	0.091
		(0.108)	(0.107)	(0.107)	(0.107)		(0.084)	(0.090)	(0.090)	(0.090)
Foreign education x HS		-0.189*	-0.133	-0.116	-0.117		-0.026	0.000	0.002	0.005
		(0.079)	(0.075)	(0.075)	(0.075)		(0.068)	(0.070)	(0.072)	(0.072)
Foreign education x college/trade		-0.111	-0.093	-0.096	-0.097		-0.159*	-0.130*	-0.122	-0.121
		(0.066)	(0.065)	(0.064)	(0.064)		(0.067)	(0.065)	(0.068)	(0.067)
Foreign education x ≥ Bachelor's		-0.198***	-0.177***	-0.176***	-0.176***		-0.290***	-0.259***	-0.253***	-0.251***
		(0.049)	(0.050)	(0.049)	(0.049)		(0.060)	(0.059)	(0.059)	(0.059)
Rural/urban and provinces (Omitted group: Large urban in Ontario)										
Rural		-0.014	-0.000	-0.002	-0.002		-0.058**	-0.052*	-0.057**	-0.055**
		(0.028)	(0.029)	(0.029)	(0.029)		(0.021)	(0.020)	(0.021)	(0.021)
Small urban		-0.008	0.002	-0.000	-0.000		-0.100***	-0.092***	-0.090***	-0.090***
		(0.030)	(0.030)	(0.030)	(0.030)		(0.027)	(0.026)	(0.026)	(0.026)
Medium urban		-0.050	-0.052	-0.051	-0.051		-0.054	-0.047	-0.046	-0.045
		(0.039)	(0.040)	(0.040)	(0.040)		(0.036)	(0.036)	(0.035)	(0.036)
Alberta		0.218***	0.211***	0.211***	0.211***		0.104**	0.101**	0.103**	0.102**
		(0.040)	(0.040)	(0.040)	(0.040)		(0.038)	(0.037)	(0.037)	(0.037)
British Columbia		-0.013	-0.007	-0.001	-0.001		0.031	0.024	0.025	0.024
		(0.037)	(0.038)	(0.037)	(0.037)		(0.028)	(0.028)	(0.028)	(0.028)
Prairie provinces		-0.006	0.001	0.003	0.003		-0.056*	-0.055*	-0.057*	-0.056*
		(0.027)	(0.026)	(0.026)	(0.026)		(0.025)	(0.024)	(0.024)	(0.024)
Atlantic provinces		-0.219***	-0.209***	-0.201***	-0.201***		-0.165***	-0.155***	-0.150***	-0.151***
		(0.027)	(0.027)	(0.027)	(0.027)		(0.022)	(0.022)	(0.021)	(0.021)
Territories		0.203***	0.192***	0.204***	0.205***		0.369***	0.355***	0.360***	0.356***
		(0.039)	(0.043)	(0.044)	(0.044)		(0.082)	(0.071)	(0.069)	(0.068)
Quebec		-0.111***	-0.100***	-0.101***	-0.101***		-0.087***	-0.072***	-0.082***	-0.078***
		(0.026)	(0.025)	(0.026)	(0.026)		(0.020)	(0.019)	(0.019)	(0.019)
Constant	-4.370	-2.835	-2.489	-2.129	-2.112	-0.004	0.028	0.814	0.594	0.712
	(3.075)	(3.079)	(3.095)	(3.119)	(3.129)	(2.698)	(2.550)	(2.529)	(2.500)	(2.495)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R^2	0.066	0.218	0.238	0.248	0.248	0.066	0.271	0.294	0.297	0.298

Adjusted R^2	0.064	0.214	0.233	0.244	0.244	0.065	0.268	0.29	0.293	0.295

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate point estimates using all 10 plausible values for numeracy scores. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourlywages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

Table 11. Earnings gaps between immigrants and the Canadian-born using different subsamples

	Dependent variable: log hourly wages					
	Male			Female		
	Lit=Num	Lit>Num	Lit<Num	Lit=Num	Lit>Num	Lit<Num
	(1)	(2)	(3)	(4)	(5)	(6)
	Aggregated groups of immigrants and the Canadian-born					
Adult Immigrants	-0.171*	-0.279***	-0.128	-0.267***	-0.158*	-0.125
	(0.069)	(0.079)	(0.083)	(0.065)	(0.071)	(0.085)
Young immigrants (migrated at <14 years)	0.063	-0.022	0.118	-0.029	-0.034	0.035
	(0.077)	(0.104)	(0.122)	(0.058)	(0.069)	(0.147)
Education						
(Omitted group: HS graduates)						
- Below HS	-0.190**	-0.084	0.012	-0.194**	-0.257***	-0.102
	(0.071)	(0.100)	(0.084)	(0.068)	(0.074)	(0.094)
- College/trade	0.131*	0.145*	0.205***	0.180***	0.203***	0.206***
	(0.059)	(0.070)	(0.052)	(0.042)	(0.039)	(0.044)
- Bachelor's degree and above	0.459***	0.360***	0.517***	0.560***	0.504***	0.516***
	(0.065)	(0.066)	(0.062)	(0.052)	(0.040)	(0.059)
Foreign education x below HS	0.004	0.209	-0.360	0.101	0.173	-0.123
	(0.130)	(0.147)	(0.211)	(0.112)	(0.142)	(0.216)
Foreign education x HS	-0.280**	-0.055	-0.198	-0.015	0.187	-0.146
	(0.103)	(0.115)	(0.120)	(0.091)	(0.212)	(0.121)
Foreign education x college/trade	-0.126	-0.039	-0.148	-0.107	-0.177	-0.136
	(0.100)	(0.208)	(0.096)	(0.077)	(0.109)	(0.170)
Foreign education x ≥ Bachelor's	-0.209*	0.042	-0.245**	-0.245***	-0.333***	-0.262*
	(0.082)	(0.120)	(0.082)	(0.074)	(0.094)	(0.104)
N	2093	1133	2101	2157	2438	1261
R^2	0.283	0.172	0.203	0.326	0.258	0.238
Adjusted R^2	0.276	0.156	0.195	0.319	0.251	0.224
	Disaggregated groups of immigrants and the Canadian-born					
Second generation	0.041	-0.088	-0.013	-0.004	0.054	-0.081
	(0.056)	(0.081)	(0.052)	(0.045)	(0.039)	(0.084)
Adult refugee	-0.299**	-0.388	-0.135	-0.400***	-0.137	-0.248
	(0.108)	(0.208)	(0.127)	(0.110)	(0.089)	(0.283)
Adult economic immigrant	-0.093	-0.185	-0.080	-0.205*	-0.084	-0.096
	(0.079)	(0.110)	(0.083)	(0.082)	(0.081)	(0.094)
Adult family reunification immigrant	-0.224*	-0.429***	-0.132	-0.301***	-0.187	-0.201*
	(0.093)	(0.120)	(0.093)	(0.073)	(0.104)	(0.095)
Adult other categories	-0.147	-0.073	-0.474	-0.157	-0.097	-0.048
	(0.226)	(0.107)	(0.285)	(0.093)	(0.086)	(0.149)
Adult temporary residents	-0.229	-0.425*	0.003	-0.362*	-0.351*	-0.272
	(0.227)	(0.168)	(0.174)	(0.157)	(0.158)	(0.181)
Young refugee immigrants	0.028	-0.320	0.403	-0.190*	-0.123	-0.326
	(0.554)	(0.221)	(1.502)	(0.087)	(0.074)	(0.244)
Young non-refugee immigrants	0.074	0.022	0.107	-0.018	-0.014	0.060

	(0.083)	(0.117)	(0.125)	(0.064)	(0.072)	(0.155)
Education						
(Omitted group: HS graduates)						
- Below HS	-0.195**	-0.081	0.012	-0.190**	-0.257***	-0.111
	(0.071)	(0.098)	(0.084)	(0.067)	(0.073)	(0.094)
- College/trade	0.125*	0.148*	0.208***	0.181***	0.202***	0.198***
	(0.059)	(0.071)	(0.051)	(0.042)	(0.039)	(0.043)
- Bachelor's degree and above	0.448***	0.357***	0.515***	0.556***	0.499***	0.507***
	(0.066)	(0.067)	(0.063)	(0.053)	(0.040)	(0.058)
Foreign education x below HS	0.062	0.316	-0.368	0.136	0.245	-0.154
	(0.142)	(0.164)	(0.211)	(0.115)	(0.182)	(0.224)
Foreign education x HS	-0.218	-0.010	-0.222	-0.015	0.194	-0.094
	(0.116)	(0.129)	(0.118)	(0.091)	(0.219)	(0.147)
Foreign education x college/trade	-0.110	0.008	-0.171	-0.120	-0.161	-0.145
	(0.107)	(0.203)	(0.091)	(0.074)	(0.110)	(0.182)
Foreign education x ≥ Bachelor's	-0.214*	0.013	-0.283***	-0.262***	-0.328***	-0.249*
	(0.087)	(0.124)	(0.081)	(0.076)	(0.096)	(0.113)
N	2093	1133	2101	2157	2438	1261
R^2	0.287	0.187	0.209	0.331	0.263	0.247
Adjusted R^2	0.277	0.166	0.199	0.322	0.254	0.23

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate point estimates. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positive wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey. We calculate equally weighted average literacy and numeracy scores using all ten plausible values for everyone. Then, we rank these averages into ten weighted deciles of literacy and numeracy scores, respectively. We restrict the thresholds for each decile of each test to be similar for both males and females. The subsample of individuals with equal literacy and numeracy scores indicates that the ranking (decile) of literacy scores is identical to that of numeracy scores. The second subsample includes individuals whose literacy score has a higher ranking than the numeracy score, and the reverse selection is for the third subsample.

Table 12. Unconditional quantile wage regressions for aggregated groups of individuals

	Dependent variable: log hourly wage								
	25th quantile			50th quantile			75th quantile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Male								
Literacy		0.108***			0.088***			0.086***	
		(0.020)			(0.019)			(0.018)	
Numeracy			0.126***			0.113***			0.095***
			(0.021)			(0.019)			(0.017)
Adult immigrants	-0.136**	-0.064	-0.066	-0.252**	-0.193*	-0.189*	-0.164**	-0.107	-0.111
	(0.047)	(0.048)	(0.046)	(0.079)	(0.076)	(0.083)	(0.060)	(0.059)	(0.062)
Young immigrants	0.013	0.040	0.049	-0.008	0.014	0.024	0.120	0.141	0.147
	(0.065)	(0.063)	(0.063)	(0.092)	(0.089)	(0.092)	(0.081)	(0.080)	(0.079)
Education									
(Omitted group: HS graduates)									
- Below HS	-0.160*	-0.079	-0.067	-0.102	-0.035	-0.018	-0.113*	-0.048	-0.043
	(0.071)	(0.071)	(0.070)	(0.053)	(0.051)	(0.053)	(0.046)	(0.049)	(0.048)
- College/trade	0.167***	0.141***	0.125**	0.224***	0.203***	0.187***	0.137**	0.116**	0.105*
	(0.039)	(0.040)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)
- Bachelor's degree and above	0.381***	0.278***	0.251***	0.511***	0.427***	0.395***	0.572***	0.489***	0.474***
	(0.053)	(0.050)	(0.050)	(0.083)	(0.078)	(0.091)	(0.058)	(0.058)	(0.058)
Foreign education x below HS	-0.166	-0.086	-0.090	0.040	0.104	0.107	0.117	0.180	0.174
	(0.153)	(0.151)	(0.155)	(0.120)	(0.120)	(0.121)	(0.105)	(0.107)	(0.106)
Foreign education x HS	-0.494***	-0.409**	-0.384**	-0.198**	-0.129	-0.100	-0.081	-0.014	0.002
	(0.135)	(0.126)	(0.126)	(0.072)	(0.077)	(0.076)	(0.074)	(0.079)	(0.079)
Foreign education x college/trade	-0.226*	-0.206*	-0.213*	-0.042	-0.026	-0.030	-0.014	0.002	-0.004
	(0.095)	(0.093)	(0.091)	(0.083)	(0.082)	(0.081)	(0.082)	(0.080)	(0.080)
Foreign education x ≥ Bachelor's	-0.211***	-0.192**	-0.196**	-0.067	-0.051	-0.053	-0.176*	-0.160*	-0.164*
	(0.061)	(0.060)	(0.060)	(0.060)	(0.062)	(0.062)	(0.079)	(0.079)	(0.079)
N	5327	5327	5327	5327	5327	5327	5327	5327	5327
R^2	0.139	0.16	0.17	0.182	0.198	0.209	0.189	0.202	0.206
Adjusted R^2	0.136	0.157	0.166	0.178	0.194	0.206	0.185	0.199	0.203
	Female								

Literacy		0.110***			0.099***			0.099***	
		(0.020)			(0.016)			(0.016)	
Numeracy			0.105***			0.103***			0.106***
			(0.020)			(0.015)			(0.018)
Adult immigrants	-0.294***	-0.215***	-0.235***	-0.187***	-0.116*	-0.130**	-0.209**	-0.138	-0.150*
	(0.065)	(0.065)	(0.064)	(0.048)	(0.048)	(0.048)	(0.075)	(0.073)	(0.072)
Young immigrants	-0.032	-0.003	-0.004	0.064	0.090	0.091	-0.077	-0.051	-0.049
	(0.065)	(0.066)	(0.066)	(0.059)	(0.060)	(0.059)	(0.071)	(0.071)	(0.070)
Education									
(Omitted group: HS graduates)									
- Below HS	-0.335***	-0.263**	-0.270**	-0.207***	-0.142**	-0.143**	-0.070	-0.004	-0.004
	(0.087)	(0.090)	(0.090)	(0.051)	(0.052)	(0.053)	(0.048)	(0.049)	(0.050)
- College/trade	0.297***	0.272***	0.274***	0.235***	0.212***	0.212***	0.163***	0.140***	0.139***
	(0.059)	(0.057)	(0.057)	(0.038)	(0.037)	(0.037)	(0.032)	(0.032)	(0.033)
- Bachelor's degree and above	0.526***	0.432***	0.436***	0.632***	0.546***	0.542***	0.685***	0.599***	0.594***
	(0.063)	(0.061)	(0.060)	(0.045)	(0.043)	(0.043)	(0.049)	(0.054)	(0.053)
Foreign education x below HS	0.032	0.069	0.073	-0.037	-0.003	0.003	0.104	0.138	0.146
	(0.178)	(0.179)	(0.179)	(0.075)	(0.081)	(0.082)	(0.087)	(0.092)	(0.092)
Foreign education x HS	-0.078	-0.040	-0.037	-0.063	-0.029	-0.022	0.076	0.110	0.117
	(0.132)	(0.134)	(0.136)	(0.093)	(0.092)	(0.094)	(0.106)	(0.107)	(0.110)
Foreign education x college/trade	-0.179	-0.145	-0.138	-0.192	-0.161	-0.151	-0.036	-0.005	0.006
	(0.121)	(0.120)	(0.123)	(0.099)	(0.098)	(0.100)	(0.088)	(0.086)	(0.087)
Foreign education x ≥ Bachelor's	-0.244***	-0.206**	-0.203**	-0.349***	-0.315***	-0.309***	-0.295**	-0.261*	-0.254*
	(0.067)	(0.066)	(0.066)	(0.062)	(0.062)	(0.062)	(0.113)	(0.112)	(0.112)
N	5856	5856	5856	5856	5856	5856	5856	5856	5856
R^2	0.179	0.196	0.196	0.225	0.242	0.245	0.205	0.222	0.225
Adjusted R^2	0.176	0.193	0.192	0.222	0.239	0.242	0.202	0.219	0.222

Note: * p<0.05, ** p<0.01, *** p<0.001

The Firpo et al. (2009) method of unconditional quantile regressions was used to derive estimated coefficients. All 10 plausible value of each test scores are used. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

Table 13. Unconditional quantile regressions of wages for disaggregated groups of immigrants and the Canadian-born

	Dependent variable: log hourly wage								
	25th quantile			50th quantile			75th quantile		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Male								
Literacy		0.104***			0.087***			0.085***	
		(0.020)			(0.019)			(0.019)	
Numeracy			0.120***			0.112***			0.096***
			(0.021)			(0.019)			(0.017)
Second generation	-0.020	-0.020	-0.014	-0.006	-0.006	-0.001	0.001	0.001	0.005
	(0.044)	(0.045)	(0.046)	(0.064)	(0.065)	(0.066)	(0.050)	(0.049)	(0.049)
Adult refugee	-0.169	-0.071	-0.072	-0.333**	-0.251*	-0.242*	-0.186*	-0.106	-0.109
	(0.096)	(0.088)	(0.086)	(0.113)	(0.105)	(0.114)	(0.085)	(0.084)	(0.084)
Adult economic immigrant	-0.006	0.046	0.031	-0.189*	-0.145	-0.154	-0.148	-0.105	-0.119
	(0.063)	(0.062)	(0.062)	(0.094)	(0.091)	(0.097)	(0.077)	(0.076)	(0.077)
Adult family reunification immigrant	-0.305***	-0.215**	-0.202**	-0.310**	-0.234*	-0.214	-0.212**	-0.137	-0.130
	(0.069)	(0.069)	(0.067)	(0.118)	(0.112)	(0.123)	(0.074)	(0.073)	(0.073)
Adult other categories	-0.125	-0.097	-0.087	-0.272	-0.248	-0.236	-0.063	-0.040	-0.032
	(0.133)	(0.127)	(0.129)	(0.173)	(0.170)	(0.174)	(0.252)	(0.248)	(0.249)
Adult temporary residents	-0.140	-0.078	-0.074	-0.160	-0.108	-0.098	-0.113	-0.063	-0.061
	(0.170)	(0.166)	(0.160)	(0.199)	(0.200)	(0.191)	(0.111)	(0.107)	(0.104)
Young refugee immigrants	-0.552*	-0.509*	-0.453*	-0.079	-0.044	0.013	0.288	0.323	0.367
	(0.262)	(0.241)	(0.216)	(0.203)	(0.185)	(0.169)	(0.226)	(0.208)	(0.189)
Young non-refugee immigrants	0.065	0.089	0.094	-0.002	0.018	0.026	0.103	0.122	0.126
	(0.066)	(0.066)	(0.067)	(0.106)	(0.103)	(0.105)	(0.088)	(0.087)	(0.086)
Education									
(Omitted group: HS graduates)									
- Below HS	-0.162*	-0.083	-0.073	-0.103	-0.037	-0.020	-0.113*	-0.048	-0.042
	(0.071)	(0.071)	(0.070)	(0.053)	(0.051)	(0.053)	(0.046)	(0.049)	(0.048)
- College/trade	0.169***	0.144***	0.129**	0.225***	0.204***	0.187***	0.138**	0.117**	0.105*
	(0.039)	(0.040)	(0.041)	(0.042)	(0.042)	(0.043)	(0.042)	(0.042)	(0.043)
- Bachelor's degree and above	0.374***	0.276***	0.252***	0.507***	0.425***	0.394***	0.571***	0.490***	0.474***
	(0.053)	(0.050)	(0.050)	(0.085)	(0.080)	(0.094)	(0.058)	(0.057)	(0.058)
Foreign education x below HS	-0.063	0.001	-0.014	0.078	0.130	0.123	0.140	0.192	0.179
	(0.152)	(0.149)	(0.152)	(0.127)	(0.127)	(0.128)	(0.112)	(0.114)	(0.114)

Foreign education x HS	-0.426**	-0.356**	-0.340*	-0.174*	-0.117	-0.094	-0.063	-0.007	0.005
	(0.144)	(0.135)	(0.134)	(0.082)	(0.082)	(0.084)	(0.074)	(0.076)	(0.077)
Foreign education x college/trade	-0.245**	-0.223*	-0.228*	-0.058	-0.040	-0.042	-0.019	-0.002	-0.006
	(0.093)	(0.093)	(0.091)	(0.082)	(0.081)	(0.081)	(0.083)	(0.081)	(0.081)
Foreign education x ≥ Bachelor's	-0.257***	-0.232***	-0.231***	-0.095	-0.074	-0.071	-0.182*	-0.162*	-0.162*
	(0.063)	(0.062)	(0.062)	(0.059)	(0.061)	(0.062)	(0.080)	(0.080)	(0.080)
N	5327	5327	5327	5327	5327	5327	5327	5327	5327
R^2	0.149	0.168	0.176	0.184	0.199	0.21	0.19	0.203	0.207
Adjusted R^2	0.145	0.164	0.172	0.179	0.194	0.206	0.185	0.198	0.203
				Female					
Literacy		0.104***			0.095***			0.100***	
		(0.020)			(0.016)			(0.016)	
Numeracy			0.099***			0.100***			0.106***
			(0.021)			(0.015)			(0.017)
Second generation	-0.005	-0.012	-0.007	-0.037	-0.043	-0.039	-0.005	-0.011	-0.007
	(0.045)	(0.045)	(0.045)	(0.038)	(0.037)	(0.037)	(0.041)	(0.041)	(0.040)
Adult refugee	-0.439*	-0.345	-0.364	-0.351***	-0.265*	-0.275*	-0.329*	-0.238*	-0.248*
	(0.217)	(0.222)	(0.221)	(0.097)	(0.112)	(0.113)	(0.128)	(0.119)	(0.117)
Adult economic immigrant	-0.188*	-0.130	-0.155*	-0.118*	-0.065	-0.085	-0.143*	-0.087	-0.108
	(0.079)	(0.076)	(0.077)	(0.057)	(0.056)	(0.055)	(0.069)	(0.066)	(0.066)
Adult family reunification immigrant	-0.399***	-0.309***	-0.321***	-0.252***	-0.170**	-0.174**	-0.208*	-0.122	-0.125
	(0.083)	(0.084)	(0.084)	(0.062)	(0.062)	(0.062)	(0.092)	(0.090)	(0.090)
Adult other categories	-0.075	-0.029	-0.033	-0.092	-0.049	-0.050	-0.377***	-0.332***	-0.332***
	(0.108)	(0.108)	(0.108)	(0.099)	(0.100)	(0.102)	(0.085)	(0.084)	(0.082)
Adult temporary residents	-0.661***	-0.569***	-0.589***	-0.391***	-0.306***	-0.318***	-0.276**	-0.187*	-0.199*
	(0.173)	(0.173)	(0.173)	(0.089)	(0.090)	(0.090)	(0.098)	(0.092)	(0.090)
Young refugee immigrants	-0.227	-0.166	-0.192	-0.331***	-0.274**	-0.295***	-0.079	-0.020	-0.041
	(0.325)	(0.321)	(0.334)	(0.091)	(0.091)	(0.079)	(0.063)	(0.062)	(0.052)
Young non-refugee immigrants	-0.022	0.001	0.002	0.080	0.102	0.105	-0.078	-0.055	-0.051
	(0.066)	(0.068)	(0.067)	(0.064)	(0.065)	(0.064)	(0.077)	(0.076)	(0.075)
Education									
(Omitted group: HS graduates)									
- Below HS	-0.332***	-0.264**	-0.271**	-0.210***	-0.147**	-0.148**	-0.072	-0.006	-0.006
	(0.087)	(0.089)	(0.089)	(0.051)	(0.052)	(0.053)	(0.048)	(0.049)	(0.050)
- College/trade	0.295***	0.271***	0.273***	0.232***	0.210***	0.210***	0.163***	0.140***	0.139***

	(0.059)	(0.058)	(0.057)	(0.038)	(0.037)	(0.037)	(0.032)	(0.032)	(0.033)
- Bachelor's degree and above	0.515***	0.427***	0.431***	0.621***	0.541***	0.537***	0.685***	0.600***	0.595***
	(0.062)	(0.061)	(0.060)	(0.045)	(0.044)	(0.044)	(0.049)	(0.054)	(0.053)
Foreign education x below HS	0.109	0.136	0.135	0.009	0.034	0.036	0.125	0.151	0.153
	(0.185)	(0.187)	(0.186)	(0.080)	(0.085)	(0.086)	(0.095)	(0.098)	(0.098)
Foreign education x HS	-0.032	-0.002	-0.002	-0.041	-0.013	-0.011	0.088	0.117	0.119
	(0.130)	(0.133)	(0.135)	(0.091)	(0.090)	(0.092)	(0.110)	(0.112)	(0.114)
Foreign education x college/trade	-0.187	-0.153	-0.147	-0.198*	-0.167	-0.158	-0.023	0.009	0.019
	(0.120)	(0.118)	(0.121)	(0.097)	(0.096)	(0.098)	(0.088)	(0.086)	(0.087)
Foreign education x ≥ Bachelor's	-0.241***	-0.204**	-0.201**	-0.351***	-0.317***	-0.311***	-0.296**	-0.260*	-0.253*
	(0.066)	(0.065)	(0.066)	(0.063)	(0.064)	(0.064)	(0.111)	(0.111)	(0.110)
N	5856	5856	5856	5856	5856	5856	5856	5856	5856
R^2	0.189	0.204	0.204	0.231	0.247	0.25	0.208	0.224	0.227
Adjusted R^2	0.185	0.2	0.2	0.228	0.243	0.246	0.204	0.221	0.223

Note: * p<0.05, ** p<0.01, *** p<0.001

The Firpo et al. (2009) method of unconditional quantile regressions was used to derive estimated coefficients. All 10 plausible value of each test scores are used. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

Appendix Table 1. Different functional forms of literacy and numeracy in earnings regressions for aggregated groups of immigrants and the Canadian-born

	Dependent variable: Log(hourly wage)									
	Male					Female				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Literacy									
Literacy	0.085***	0.082***	0.100***	0.093***		0.091***	0.092***	0.109***	0.118***	
	(0.013)	(0.014)	(0.017)	(0.021)		(0.011)	(0.012)	(0.014)	(0.017)	
Literacy^2		-0.006	-0.014	-0.019			0.003	-0.004	0.006	
		(0.006)	(0.009)	(0.012)			(0.007)	(0.008)	(0.012)	
Literacy^3			-0.005	-0.002				-0.006	-0.009*	
			(0.003)	(0.005)				(0.003)	(0.005)	
Literacy^4				0.001					-0.002	
				(0.001)					(0.002)	
Level of literacy										
(Omitted: above 325 points)										
- Below 226					-0.378***					-0.270***
					(0.042)					(0.039)
- 226 to below 276					-0.177***					-0.216***
					(0.035)					(0.035)
- 276 to below 326					-0.081**					-0.073*
					(0.027)					(0.029)
Adult Immigrants	-0.119**	-0.120**	-0.116**	-0.117**	-0.110**	-0.118**	-0.118**	-0.117**	-0.117**	-0.120**
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Young Immigrants	0.069	0.068	0.069	0.069	0.069	0.001	0.001	0.001	0.001	-0.001
	(0.060)	(0.060)	(0.060)	(0.061)	(0.060)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Constant	-2.518	-2.597	-2.534	-2.522	-2.557	0.977	0.927	0.804	0.803	0.576
	(3.101)	(3.114)	(3.112)	(3.102)	(3.043)	(2.556)	(2.557)	(2.559)	(2.569)	(2.576)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R2	0.235	0.235	0.237	0.237	0.243	0.291	0.291	0.292	0.293	0.291
Adjusted R2	0.232	0.232	0.233	0.233	0.239	0.288	0.288	0.289	0.289	0.288
Log-likelikhood	-3616.401	-3614.911	-3610.466	-3609.434	-3588.421	-3149.637	-3148.652	-3144.029	-3142.047	-3150.308

RMSE	0.478	0.478	0.478	0.478	0.476	0.415	0.415	0.415	0.415	0.415
	Numeracy									
Numeracy	0.104***	0.104***	0.118***	0.114***		0.095***	0.102***	0.111***	0.115***	
	(0.012)	(0.013)	(0.016)	(0.019)		(0.011)	(0.013)	(0.015)	(0.019)	
$Numeracy^2$		-0.001	-0.007	-0.011			0.009	0.003	0.005	
		(0.005)	(0.007)	(0.012)			(0.007)	(0.010)	(0.013)	
$Numeracy^3$			-0.004	-0.002				-0.004	-0.005	
			(0.003)	(0.004)				(0.003)	(0.006)	
$Numeracy^4$				0.001					-0.000	
				(0.001)					(0.002)	
Level of Numeracy (Omitted: above 325 points)										
- Below 226					-0.419***					-0.353***
					(0.042)					(0.042)
- 226 to below 276					-0.237***					-0.248***
					(0.035)					(0.040)
- 276 to below 326					-0.116***					-0.122***
					(0.033)					(0.036)
Adult Immigrants	-0.119**	-0.119**	-0.115**	-0.115**	-0.105**	-0.130**	-0.131**	-0.131**	-0.131**	-0.130**
	(0.040)	(0.040)	(0.040)	(0.040)	(0.040)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Young Immigrants	0.078	0.078	0.081	0.080	0.083	0.002	0.001	0.002	0.002	-0.000
	(0.059)	(0.059)	(0.060)	(0.060)	(0.058)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Constant	-2.142	-2.148	-2.067	-2.063	-1.778	0.710	0.594	0.469	0.470	0.717
	(3.119)	(3.121)	(3.120)	(3.118)	(3.060)	(2.532)	(2.528)	(2.532)	(2.538)	(2.575)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R2	0.246	0.246	0.247	0.247	0.255	0.294	0.295	0.296	0.296	0.3
Adjusted R2	0.243	0.243	0.244	0.244	0.252	0.291	0.292	0.293	0.293	0.297
Log-likelikhood	-3576.807	-3576.559	-3573.59	-3573.027	-3545.426	-3135.442	-3131.922	-3129.838	-3128.939	-3112.551
RMSE	0.475	0.475	0.474	0.474	0.472	0.414	0.414	0.414	0.414	0.413

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate coefficients. All 10 plausible values for each respective test are employed. The delete-one jackknife method and

all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positive wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

The level of literacy and numeracy is calculated as follows: (1) calculate an equally weighted averge of all 10 plausible values, and (2) use the thresholds in OECD (2013) to assign level to each individuals with a slight modification. There are four groups of individuals: (a) those with average test scores below 226, (b) those with average test scores from 226 to below 276, (c) those with average test scores from 276 to 326, and (d) those with average test scores above 325.

Appendix Table 2. Different specifications of literacy and numeracy scores in the earnings regressions for aggregated groups of immigrants and the Canadian-born

	Dependent variable: Log(hourly wage)															
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Male															
Literacy	-0.006	-0.006	-0.007	-0.007	-0.007	-0.008	0.010	0.010	0.005				-0.005	-0.009	-0.010	-0.082
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.026)	(0.026)	(0.028)				(0.021)	(0.022)	(0.027)	(0.066)
Literacy^2				-0.004	-0.006	-0.008	-0.011	-0.012	-0.011					-0.007	-0.007	0.016
				(0.006)	(0.011)	(0.011)	(0.008)	(0.012)	(0.013)					(0.008)	(0.011)	(0.054)
Literacy^3							-0.005	-0.005	-0.004						0.000	0.001
							(0.003)	(0.003)	(0.004)						(0.004)	(0.036)
Level of literacy (Omitted: above 325 points)																
- Below 226										-0.182**	-0.181**	-0.172*				
										(0.068)	(0.068)	(0.069)				
- 226 to below 276										-0.055	-0.047	-0.042				
										(0.050)	(0.054)	(0.055)				
- 276 to below 326										-0.024	-0.017	-0.020				
										(0.032)	(0.035)	(0.035)				
Numeracy	0.109***	0.109***	0.124***	0.108***	0.108***	0.124***	0.108***	0.108***	0.115***	0.073***	0.075***	0.085***				
	(0.022)	(0.022)	(0.024)	(0.022)	(0.022)	(0.024)	(0.021)	(0.021)	(0.027)	(0.020)	(0.021)	(0.025)				
Numeracy^2		-0.001	-0.007		0.003	-0.001		0.002	0.000		0.004	0.001				
		(0.005)	(0.007)		(0.010)	(0.011)		(0.010)	(0.012)		(0.007)	(0.009)				
Numeracy^3			-0.004			-0.004			-0.002			-0.002				
			(0.003)			(0.003)			(0.004)			(0.003)				
Level of Numeracy (Omitted: above 325 points)																
- Below 226													-0.431***	-0.432***	-0.433***	-0.374***
													(0.068)	(0.068)	(0.070)	(0.067)
- 226 to below 276													-0.244***	-0.258***	-0.258***	-0.243***
													(0.048)	(0.054)	(0.054)	(0.053)
- 276 to below 326													-0.120**	-0.131**	-0.131**	-0.119**
													(0.037)	(0.042)	(0.043)	(0.042)
Adult Immigrants	-0.120**	-0.120**	-0.117**	-0.120**	-0.121**	-0.117**	-0.117**	-0.117**	-0.116**	-0.107**	-0.107**	-0.106**	-0.106*	-0.107**	-0.107*	-0.104*
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)
Young Immigrants	0.078	0.078	0.080	0.077	0.077	0.079	0.078	0.078	0.079	0.077	0.077	0.078	0.083	0.082	0.081	0.080
	(0.059)	(0.059)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)	(0.059)	(0.059)	(0.060)	(0.058)	(0.059)	(0.059)	(0.059)
Constant	-2.124	-2.131	-2.048	-2.179	-2.175	-2.098	-2.120	-2.112	-2.094	-2.330	-2.324	-2.268	-1.774	-1.865	-1.868	-2.008
	(3.130)	(3.132)	(3.131)	(3.139)	(3.148)	(3.148)	(3.141)	(3.148)	(3.150)	(3.071)	(3.073)	(3.076)	(3.073)	(3.099)	(3.099)	(3.066)

N	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327
R2	0.246	0.246	0.247	0.247	0.247	0.248	0.248	0.248	0.248	0.25	0.251	0.251	0.255	0.256	0.256	-3539.471
Adjusted R2	0.243	0.243	0.244	0.243	0.243	0.244	0.244	0.244	0.244	0.247	0.247	0.247	0.252	0.252	0.252	0.253
Log-likelikhood	-3576.495	-3576.239	-3573.245	-3575.731	-3574.997	-3571.665	-3571.495	-3570.905	-3570.217	-3562.444	-3561.8	-3560.723	-3544.829	-3543.002	-3542.595	0.257
RMSE	0.475	0.475	0.474	0.475	0.475	0.474	0.474	0.474	0.474	0.473	0.473	0.473	0.472	0.472	0.472	0.472
	Female															
Literacy	0.036	0.038	0.038	0.038	0.036	0.036	0.054*	0.052*	0.050				0.032	0.029	0.041*	-0.055
	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)	(0.026)				(0.017)	(0.018)	(0.021)	(0.052)
Literacy^2				0.004	-0.006	-0.008	-0.003	-0.012	-0.011					-0.004	-0.008	-0.052
				(0.007)	(0.010)	(0.010)	(0.008)	(0.011)	(0.011)					(0.008)	(0.010)	(0.044)
Literacy^3							-0.005	-0.005	-0.004						-0.003	0.010
							(0.003)	(0.004)	(0.005)						(0.004)	(0.032)
Level of literacy (Omitted: above 325 points)																
- Below 226										-0.097	-0.096	-0.095				
										(0.057)	(0.056)	(0.057)				
- 226 to below 276										-0.104*	-0.089*	-0.088				
										(0.043)	(0.045)	(0.045)				
- 276 to below 326										-0.021	-0.008	-0.009				
										(0.030)	(0.033)	(0.033)				
Numeracy	0.067**	0.073**	0.082**	0.067**	0.075**	0.085***	0.067**	0.074**	0.077**	0.069***	0.075***	0.078***				
	(0.023)	(0.024)	(0.025)	(0.023)	(0.024)	(0.025)	(0.023)	(0.024)	(0.026)	(0.017)	(0.019)	(0.021)				
Numeracy^2		0.010	0.004		0.015	0.009		0.013	0.012		0.008	0.007				
		(0.007)	(0.010)		(0.010)	(0.012)		(0.010)	(0.012)		(0.008)	(0.011)				
Numeracy^3			-0.004			-0.004			-0.001			-0.001				
			(0.003)			(0.003)			(0.005)			(0.003)				
Level of Numeracy (Omitted: above 325 points)																
- Below 226													-0.278***	-0.283***	-0.278***	-0.304***
													(0.060)	(0.061)	(0.060)	(0.055)
- 226 to below 276													-0.202***	-0.212***	-0.213***	-0.222***
													(0.048)	(0.052)	(0.052)	(0.049)
- 276 to below 326													-0.100*	-0.107*	-0.114**	-0.125**
													(0.039)	(0.042)	(0.043)	(0.041)
Adult Immigrants	-0.120**	-0.121**	-0.120**	-0.120**	-0.121**	-0.120**	-0.119**	-0.120**	-0.120**	-0.118**	-0.119**	-0.119**	-0.119**	-0.119**	-0.119**	-0.123**
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)
Young Immigrants	0.004	0.004	0.004	0.004	0.003	0.004	0.004	0.003	0.003	0.003	0.003	0.003	0.004	0.003	0.003	0.001
	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.043)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)
Constant	0.841	0.723	0.600	0.773	0.788	0.667	0.653	0.674	0.658	0.666	0.605	0.569	0.880	0.963	0.918	0.760

	(2.526)	(2.521)	(2.526)	(2.528)	(2.533)	(2.537)	(2.529)	(2.535)	(2.537)	(2.557)	(2.553)	(2.555)	(2.564)	(2.586)	(2.585)	(2.604)
N	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856
R2	0.296	0.297	0.297	0.296	0.297	0.298	0.297	0.298	0.298	0.298	0.299	0.299	0.301	0.302	0.302	-3105.538
Adjusted R2	0.293	0.294	0.294	0.293	0.294	0.294	0.294	0.295	0.295	0.295	0.295	0.295	0.298	0.298	0.299	0.298
Log-likelikhood	-3129.102	-3125.09	-3123.112	-3127.856	-3123.917	-3121.631	-3123.393	-3120.02	-3119.541	-3119.813	-3117.2	-3116.82	-3106.091	-3104.843	-3103.322	0.301
RMSE	0.414	0.414	0.413	0.414	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.412	0.412	0.412	0.412

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate coefficients. All 10 plausible values for each respective test are employed. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

The level of literacy and numeracy is calculated as follows: (1) caclculate an equally weighted averge of all 10 plausible values, and (2) use the thresholds in OECD (2013) to assign level to each individuals with a slight modification. There are four groups of individuals: (a) those with average test scores below 226, (b) those with average test scores from 226 to below 276, (c) those with average test scores from 276 to 326, and (d) those with average test scores above 325.

All regressions control for age and its polynomial, the highest educational attainment and its interaction with an indicator if an individual obtains the degree abroad, rural/urban indicators, and province of residence indicators.

Appendix Table 3. Different functional forms of literacy and numeracy in earnings regressions for 9 population subgroups

	Dependent variable: Log(hourly wage)									
	Male					Female				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Literacy									
Literacy	0.084***	0.081***	0.098***	0.091***		0.088***	0.090***	0.107***	0.115***	
	(0.013)	(0.014)	(0.017)	(0.021)		(0.011)	(0.012)	(0.014)	(0.017)	
$Literacy^2$		-0.006	-0.013	-0.019			0.004	-0.003	0.006	
		(0.006)	(0.009)	(0.012)			(0.007)	(0.008)	(0.012)	
$Literacy^3$			-0.005	-0.002				-0.006	-0.009*	
			(0.003)	(0.005)				(0.003)	(0.004)	
$Literacy^4$				0.001					-0.002	
				(0.001)					(0.002)	
Level of literacy (Omitted: above 325 points)										
- Below 226					-0.374***					-0.260***
					(0.044)					(0.040)
- 226 to below 276					-0.176***					-0.213***
					(0.035)					(0.036)
- 276 to below 326					-0.083**					-0.073*
					(0.027)					(0.029)
Second generation	-0.021	-0.022	-0.023	-0.022	-0.024	0.011	0.010	0.011	0.010	0.011
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
Adult refugees	-0.159*	-0.156*	-0.150*	-0.149*	-0.141*	-0.184*	-0.184*	-0.180	-0.180	-0.191*
	(0.071)	(0.071)	(0.071)	(0.071)	(0.069)	(0.093)	(0.093)	(0.093)	(0.093)	(0.093)
Adult economic immigrants	-0.067	-0.069	-0.066	-0.067	-0.066	-0.071	-0.070	-0.070	-0.070	-0.068
	(0.041)	(0.042)	(0.042)	(0.042)	(0.041)	(0.049)	(0.049)	(0.049)	(0.049)	(0.048)
Adult family reunification immigrants	-0.161**	-0.161**	-0.158**	-0.159**	-0.146*	-0.147**	-0.148**	-0.148**	-0.148**	-0.155**
	(0.056)	(0.056)	(0.056)	(0.056)	(0.057)	(0.051)	(0.052)	(0.052)	(0.052)	(0.051)
Adult other categories	-0.212	-0.215	-0.211	-0.211	-0.208	-0.072	-0.072	-0.069	-0.069	-0.066
	(0.137)	(0.137)	(0.138)	(0.138)	(0.137)	(0.060)	(0.060)	(0.060)	(0.060)	(0.061)
Adult temporary residents	-0.123	-0.122	-0.123	-0.124	-0.123	-0.252**	-0.255**	-0.255**	-0.254**	-0.263**
	(0.123)	(0.122)	(0.122)	(0.122)	(0.124)	(0.087)	(0.088)	(0.089)	(0.088)	(0.090)
Young refugee immigrants	-0.173	-0.174	-0.171	-0.173	-0.168	-0.151	-0.150	-0.146	-0.145	-0.128

	(0.231)	(0.233)	(0.232)	(0.233)	(0.229)	(0.087)	(0.087)	(0.088)	(0.088)	(0.078)
Young non-refugee immigrants	0.088	0.087	0.087	0.087	0.086	0.013	0.013	0.013	0.013	0.010
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)
Constant	-2.496	-2.572	-2.516	-2.506	-2.550	0.807	0.736	0.609	0.608	0.376
	(3.096)	(3.110)	(3.110)	(3.100)	(3.040)	(2.529)	(2.530)	(2.535)	(2.544)	(2.560)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R2	0.238	0.238	0.239	0.24	0.245	0.294	0.294	0.295	0.295	0.294
Adjusted R2	0.233	0.234	0.235	0.235	0.241	0.29	0.29	0.291	0.292	0.29
Log-likelikhood	-3607.381	-3605.962	-3601.656	-3600.657	-3580.416	-3138.034	-3136.829	-3132.109	-3130.277	-3137.299
RMSE	0.478	0.478	0.477	0.477	0.475	0.415	0.415	0.414	0.414	0.415
					Numeracy					
Numeracy	0.102***	0.102***	0.116***	0.112***		0.093***	0.100***	0.110***	0.113***	
	(0.013)	(0.013)	(0.017)	(0.019)		(0.012)	(0.013)	(0.015)	(0.019)	
$Numeracy^2$		-0.001	-0.006	-0.010			0.010	0.004	0.005	
		(0.005)	(0.007)	(0.012)			(0.007)	(0.010)	(0.013)	
$Numeracy^3$			-0.004	-0.002				-0.004	-0.005	
			(0.003)	(0.004)				(0.003)	(0.006)	
$Numeracy^4$				0.001					-0.000	
				(0.001)					(0.002)	
Level of Numeracy (Omitted: above 325 points)										
- Below 226					-0.412***					-0.346***
					(0.043)					(0.043)
- 226 to below 276					-0.234***					-0.247***
					(0.036)					(0.041)
- 276 to below 326					-0.116***					-0.122***
					(0.033)					(0.037)
Second generation	-0.017	-0.017	-0.017	-0.017	-0.018	0.015	0.014	0.014	0.014	0.013
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.027)	(0.027)	(0.027)	(0.027)	(0.026)
Adult refugees	-0.155*	-0.155*	-0.149*	-0.148*	-0.143*	-0.194*	-0.194*	-0.191*	-0.191*	-0.185*
	(0.068)	(0.069)	(0.069)	(0.069)	(0.069)	(0.094)	(0.093)	(0.094)	(0.094)	(0.092)
Adult economic immigrants	-0.078	-0.078	-0.075	-0.075	-0.068	-0.089	-0.089	-0.088	-0.088	-0.091
	(0.041)	(0.041)	(0.041)	(0.041)	(0.041)	(0.050)	(0.049)	(0.049)	(0.049)	(0.049)
Adult family reunification immigrants	-0.147**	-0.147**	-0.144**	-0.143**	-0.129*	-0.151**	-0.155**	-0.155**	-0.155**	-0.151**
	(0.054)	(0.054)	(0.054)	(0.054)	(0.053)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)

Adult other categories	-0.202	-0.203	-0.199	-0.200	-0.182	-0.072	-0.072	-0.070	-0.070	-0.067
	(0.139)	(0.138)	(0.140)	(0.140)	(0.145)	(0.060)	(0.060)	(0.060)	(0.060)	(0.060)
Adult temporary residents	-0.117	-0.116	-0.119	-0.119	-0.122	-0.263**	-0.271**	-0.270**	-0.268**	-0.267**
	(0.117)	(0.117)	(0.119)	(0.120)	(0.120)	(0.085)	(0.085)	(0.086)	(0.086)	(0.086)
Young refugee immigrants	-0.124	-0.124	-0.116	-0.116	-0.096	-0.170	-0.169	-0.168	-0.168	-0.178
	(0.207)	(0.207)	(0.204)	(0.204)	(0.183)	(0.101)	(0.100)	(0.102)	(0.103)	(0.111)
Young non-refugee immigrants	0.094	0.094	0.095	0.095	0.096	0.017	0.016	0.016	0.016	0.015
	(0.064)	(0.064)	(0.064)	(0.064)	(0.063)	(0.045)	(0.045)	(0.045)	(0.045)	(0.045)
Constant	-2.135	-2.139	-2.070	-2.070	-1.798	0.588	0.449	0.324	0.327	0.601
	(3.119)	(3.120)	(3.121)	(3.120)	(3.064)	(2.500)	(2.498)	(2.503)	(2.508)	(2.548)
N	5327	5327	5327	5327	5327	5856	5856	5856	5856	5856
R2	0.248	0.248	0.249	0.249	0.257	0.297	0.298	0.298	0.299	0.302
Adjusted R2	0.244	0.244	0.244	0.244	0.252	0.293	0.294	0.295	0.295	0.299
Log-likelikhood	-3570.755	-3570.495	-3567.715	-3567.196	-3540.3	-3123.923	-3119.763	-3117.669	-3116.89	-3100.888
RMSE	0.474	0.474	0.474	0.474	0.472	0.414	0.413	0.413	0.413	0.412

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate coefficients. All 10 plausible values for each respective test are employed. The delete-one jackknife method and all replicate weights were employed to calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positive wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

The level of literacy and numeracy is calculated as follows: (1) calculate an equally weighted averge of all 10 plausible values, and (2) use the thresholds in OECD (2013) to assign level to each individuals with a slight modification. There are four groups of individuals: (a) those with average test scores below

Appendix Table 4. Different functional forms of literacy and numeracy in earnings regressions for 9 population subgroups

	Dependent variable: Log(hourly wage)															
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
	Male															
Literacy	-0.004	-0.005	0.012	-0.004	-0.005	0.012	-0.005	-0.006	0.007				-0.004	-0.007	-0.008	
	(0.023)	(0.023)	(0.026)	(0.023)	(0.023)	(0.026)	(0.023)	(0.023)	(0.028)				(0.021)	(0.022)	(0.027)	
Literacy^2		-0.004	-0.011		-0.006	-0.012		-0.008	-0.011					-0.007	-0.007	
		(0.006)	(0.009)		(0.011)	(0.013)		(0.011)	(0.013)					(0.008)	(0.011)	
Literacy^3			-0.005			-0.005			-0.004						0.000	
			(0.003)			(0.003)			(0.004)						(0.004)	
Level of literacy (Omitted: above 325 points)																
- Below 226										-0.186**	-0.185**	-0.177**				-0.088
										(0.067)	(0.067)	(0.068)				(0.065)
- 226 to below 276										-0.058	-0.050	-0.046				0.013
										(0.050)	(0.054)	(0.054)				(0.054)
- 276 to below 326										-0.027	-0.021	-0.024				-0.002
										(0.031)	(0.035)	(0.035)				(0.036)
Numeracy	0.105***	0.104***	0.104***	0.105***	0.104***	0.104***	0.119***	0.120***	0.110***	0.070***	0.072***	0.082***				
	(0.022)	(0.021)	(0.021)	(0.022)	(0.021)	(0.021)	(0.024)	(0.024)	(0.027)	(0.020)	(0.020)	(0.025)				
Numeracy^2				-0.001	0.003	0.002	-0.006	-0.001	0.000		0.004	0.001				
				(0.005)	(0.010)	(0.010)	(0.007)	(0.011)	(0.012)		(0.007)	(0.009)				
Numeracy^3							-0.004	-0.004	-0.002			-0.002				
							(0.003)	(0.003)	(0.004)			(0.003)				
Level of Numeracy (Omitted: above 325 points)																
- Below 226													-0.421***	-0.423***	-0.423***	-0.364***
													(0.067)	(0.067)	(0.069)	(0.065)
- 226 to below 276													-0.240***	-0.254***	-0.254***	-0.239***
													(0.048)	(0.054)	(0.054)	(0.053)
- 276 to below 326													-0.118**	-0.130**	-0.130**	-0.117**
													(0.037)	(0.042)	(0.043)	(0.042)
Second generation	-0.016	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017	-0.017	-0.020	-0.019	-0.020	-0.018	-0.019	-0.019	-0.020
	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)	(0.038)
Adult refugees	-0.157*	-0.155*	-0.149*	-0.156*	-0.154*	-0.149*	-0.150*	-0.147*	-0.147*	-0.133	-0.132	-0.130	-0.145*	-0.143*	-0.143*	-0.131
	(0.069)	(0.069)	(0.069)	(0.070)	(0.069)	(0.069)	(0.070)	(0.069)	(0.069)	(0.068)	(0.068)	(0.068)	(0.070)	(0.070)	(0.070)	(0.069)
Adult economic immigrants	-0.079	-0.080	-0.077	-0.079	-0.080	-0.077	-0.076	-0.077	-0.077	-0.070	-0.070	-0.069	-0.068	-0.071	-0.070	-0.069

	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.042)	(0.041)	(0.041)	(0.041)	(0.042)	(0.042)	(0.043)	(0.042)
Adult family reunification immigrants	-0.148**	-0.148**	-0.145**	-0.148**	-0.149**	-0.146**	-0.145**	-0.146**	-0.145**	-0.133*	-0.134*	-0.133*	-0.129*	-0.130*	-0.130*	-0.128*
	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.055)	(0.056)	(0.056)	(0.056)	(0.054)	(0.054)	(0.054)	(0.056)
Adult other categories	-0.203	-0.205	-0.201	-0.204	-0.205	-0.201	-0.200	-0.202	-0.201	-0.202	-0.201	-0.200	-0.182	-0.186	-0.186	-0.189
	(0.139)	(0.138)	(0.140)	(0.139)	(0.138)	(0.140)	(0.140)	(0.140)	(0.140)	(0.138)	(0.139)	(0.140)	(0.145)	(0.145)	(0.145)	(0.146)
Adult temporary residents	-0.117	-0.117	-0.118	-0.116	-0.118	-0.119	-0.119	-0.122	-0.120	-0.112	-0.114	-0.116	-0.123	-0.123	-0.122	-0.122
	(0.118)	(0.117)	(0.118)	(0.117)	(0.118)	(0.118)	(0.120)	(0.120)	(0.119)	(0.118)	(0.119)	(0.120)	(0.120)	(0.119)	(0.118)	(0.119)
Young refugee immigrants	-0.123	-0.124	-0.121	-0.123	-0.126	-0.122	-0.115	-0.118	-0.120	-0.135	-0.137	-0.133	-0.095	-0.099	-0.099	-0.115
	(0.206)	(0.207)	(0.206)	(0.206)	(0.209)	(0.207)	(0.203)	(0.206)	(0.207)	(0.214)	(0.215)	(0.214)	(0.182)	(0.186)	(0.185)	(0.198)
Young non-refugee immigrants	0.094	0.093	0.093	0.094	0.093	0.093	0.095	0.094	0.094	0.093	0.093	0.094	0.096	0.094	0.094	0.094
	(0.064)	(0.064)	(0.064)	(0.064)	(0.064)	(0.065)	(0.064)	(0.064)	(0.065)	(0.064)	(0.064)	(0.064)	(0.063)	(0.063)	(0.064)	(0.063)
Constant	-2.118	-2.172	-2.121	-2.123	-2.170	-2.113	-2.053	-2.106	-2.099	-2.334	-2.332	-2.282	-1.796	-1.887	-1.888	-2.037
	(3.129)	(3.139)	(3.141)	(3.130)	(3.147)	(3.148)	(3.131)	(3.149)	(3.150)	(3.071)	(3.073)	(3.076)	(3.077)	(3.104)	(3.105)	(3.070)
N	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327	5327
R2	0.248	0.248	0.249	0.248	0.248	0.25	0.249	0.249	0.25	0.252	0.252	0.253	0.257	0.257	0.257	0.258
Adjusted R2	0.244	0.244	0.245	0.244	0.244	0.245	0.244	0.245	0.245	0.248	0.248	0.248	0.252	0.253	0.253	0.254
Log-likelikhood	-3570.5	-3569.74	-3565.64	-3570.24	-3568.98	-3565.01	-3567.44	-3565.85	-3564.4	-3556.24	-3555.58	-3554.59	-3539.73	-3537.91	-3537.48	-3534.1
RMSE	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.474	0.473	0.473	0.473	0.472	0.472	0.472	0.471
							Female									
Literacy	0.034	0.036	0.053*	0.036	0.035	0.050*	0.036	0.034	0.048				0.030	0.028	0.040*	
	(0.023)	(0.023)	(0.024)	(0.023)	(0.023)	(0.024)	(0.023)	(0.023)	(0.026)				(0.017)	(0.018)	(0.020)	
Literacy^2		0.005	-0.002		-0.006	-0.011		-0.007	-0.011					-0.003	-0.008	
		(0.007)	(0.008)		(0.010)	(0.010)		(0.010)	(0.011)					(0.008)	(0.010)	
Literacy^3			-0.006			-0.005			-0.004						-0.003	
			(0.003)			(0.003)			(0.005)						(0.004)	
Level of literacy (Omitted: above 325 points)																
- Below 226										-0.092	-0.092	-0.090				-0.049
										(0.056)	(0.056)	(0.057)				(0.052)
- 226 to below 276										-0.104*	-0.088	-0.087				-0.051
										(0.043)	(0.046)	(0.046)				(0.044)
- 276 to below 326										-0.022	-0.007	-0.009				0.011
										(0.030)	(0.033)	(0.033)				(0.031)
Numeracy	0.066**	0.067**	0.066**	0.072**	0.074**	0.073**	0.082**	0.085***	0.076**	0.067***	0.074***	0.078***				
	(0.023)	(0.023)	(0.023)	(0.024)	(0.024)	(0.024)	(0.025)	(0.025)	(0.027)	(0.017)	(0.019)	(0.021)				
Numeracy^2				0.011	0.015	0.014	0.005	0.009	0.013		0.009	0.007				

				(0.007)	(0.010)	(0.010)	(0.010)	(0.011)	(0.012)		(0.008)	(0.011)				
Numeracy[3]							-0.004	-0.004	-0.001			-0.001				
							(0.003)	(0.003)	(0.005)			(0.003)				
Level of Numeracy (Omitted: above 325 points)																
- Below 226													-0.276***	-0.280***	-0.275***	-0.300***
													(0.060)	(0.061)	(0.060)	(0.055)
- 226 to below 276													-0.204***	-0.212***	-0.213***	-0.221***
													(0.048)	(0.052)	(0.052)	(0.049)
- 276 to below 326													-0.102**	-0.108*	-0.115**	-0.126**
													(0.040)	(0.042)	(0.044)	(0.041)
Second generation	0.013	0.013	0.013	0.012	0.012	0.013	0.012	0.013	0.013	0.013	0.013	0.013	0.012	0.012	0.012	0.012
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)	(0.026)	(0.026)	(0.026)	(0.027)
Adult refugees	-0.183	-0.182	-0.178	-0.182	-0.182	-0.178	-0.179	-0.179	-0.178	-0.186*	-0.184	-0.184	-0.174	-0.174	-0.173	-0.182
	(0.094)	(0.094)	(0.095)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)	(0.094)	(0.095)	(0.093)	(0.093)	(0.093)	(0.094)
Adult economic immigrants	-0.079	-0.078	-0.078	-0.078	-0.078	-0.078	-0.078	-0.078	-0.078	-0.076	-0.076	-0.076	-0.081	-0.081	-0.081	-0.084
	(0.050)	(0.050)	(0.050)	(0.050)	(0.050)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)	(0.049)
Adult family reunification immigrants	-0.142**	-0.144**	-0.144**	-0.146**	-0.146**	-0.146**	-0.146**	-0.145**	-0.146**	-0.142**	-0.145**	-0.145**	-0.141**	-0.141**	-0.142**	-0.147**
	(0.052)	(0.053)	(0.053)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.052)	(0.053)	(0.052)	(0.052)
Adult other categories	-0.068	-0.068	-0.065	-0.068	-0.069	-0.066	-0.066	-0.066	-0.066	-0.060	-0.061	-0.060	-0.064	-0.065	-0.064	-0.061
	(0.060)	(0.060)	(0.061)	(0.060)	(0.060)	(0.061)	(0.060)	(0.060)	(0.061)	(0.061)	(0.061)	(0.061)	(0.060)	(0.060)	(0.060)	(0.061)
Adult temporary residents	-0.252**	-0.255**	-0.256**	-0.259**	-0.258**	-0.258**	-0.259**	-0.257**	-0.258**	-0.255**	-0.260**	-0.260**	-0.255**	-0.254**	-0.255**	-0.263**
	(0.085)	(0.086)	(0.087)	(0.086)	(0.086)	(0.087)	(0.087)	(0.088)	(0.087)	(0.087)	(0.088)	(0.088)	(0.086)	(0.086)	(0.087)	(0.088)
Young refugee immigrants	-0.159	-0.157	-0.154	-0.157	-0.157	-0.154	-0.156	-0.157	-0.154	-0.140	-0.140	-0.141	-0.165	-0.166	-0.163	-0.155
	(0.098)	(0.098)	(0.098)	(0.097)	(0.097)	(0.097)	(0.099)	(0.099)	(0.097)	(0.094)	(0.094)	(0.094)	(0.107)	(0.108)	(0.107)	(0.103)
Young non-refugee immigrants	0.018	0.018	0.017	0.017	0.017	0.016	0.017	0.017	0.016	0.016	0.015	0.015	0.017	0.017	0.017	0.014
	(0.046)	(0.045)	(0.045)	(0.045)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.046)	(0.045)	(0.046)	(0.045)	(0.045)	(0.045)	(0.045)
Constant	0.706	0.618	0.493	0.564	0.627	0.509	0.442	0.506	0.496	0.515	0.440	0.404	0.752	0.825	0.773	0.623
	(2.495)	(2.498)	(2.501)	(2.493)	(2.505)	(2.508)	(2.499)	(2.510)	(2.510)	(2.534)	(2.531)	(2.533)	(2.537)	(2.558)	(2.559)	(2.582)
N	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856	5856
R2	0.298	0.299	0.3	0.299	0.3	0.301	0.3	0.3	0.301	0.301	0.301	0.301	0.304	0.304	0.305	0.304
Adjusted R2	0.295	0.295	0.296	0.296	0.296	0.297	0.296	0.296	0.297	0.297	0.297	0.297	0.3	0.3	0.3	0.3
Log-likelikhood	-3118.16	-3116.68	-3112.13	-3113.48	-3112.5	-3108.55	-3111.5	-3110.21	-3108.1	-3108.42	-3105.39	-3105.03	-3095.1	-3094.03	-3092.38	-3094
RMSE	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.413	0.412	0.412	0.412	0.412	0.412	0.412

Note: * p<0.05, ** p<0.01, *** p<0.001

Ordinary least squares (OLS) was used to calculate coefficients. All 10 plausible values for each respective test are employed. The delete-one jackknife method and all replicate weights were employed to

calculate standard errors. All analyses were done separately for males and females. The sample includes individuals aged 25 to 65 with positive self-reported hourly wages for all wage earners. The top and bottom 1% of wage earners are set to equal the hourly wages of the nearest percentiles. The cut-off for each percentile is the weighted cut-off of hourly wages of everyone with positve wages in the sample. The omitted group includes the third generation who obtain a high school diploma in Canada, and live in a large urban population centre in Ontario at the time of survey.

The level of literacy and numeracy is calculated as follows: (1) caclculate an equally weighted averge of all 10 plausible values, and (2) use the thresholds in OECD (2013) to assign level to each individuals with a slight modification. There are four groups of individuals: (a) those with average test scores below 226, (b) those with average test scores from 226 to below 276, (c) those with average test scores from 276 to 326, and (d) those with average test scores above 325.

All regressions control for age and its polynomial, the highest educational attainment and its interaction with an indicator if an individual obtains the degree abroad, rural/urban indicators, and province of residence indicators.