Language acquisition and Earnings Differential among Immigrants in Canada

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Major paper Presented to the Department of Economics of the University of Ottawa

In partial fulfillment of the requirements of the M.A. Degree

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Ottawa, Ontario

Date August 01, 2011

Acknowledgements

This dissertation would not have been possible without the guidance and the help of several individuals who in one way or another contributed and extended their valuable assistance in the preparation and completion of this study.

First and foremost I want to thank my advisor Miles Corak. He has taught me, both consciously and un-consciously, how good economic analysis is done. I appreciate all his contributions of time, and ideas, to make my major paper experience productive and stimulating. The joy and enthusiasm he has for research was contagious and motivational for me, even during tough times in the master pursuit. I am also thankful for the excellent example he has provided as a successful economic man and professor.

In my attempted measurements the instrumental variables, I thank Professor Hoyt Bleakley from the University of Chicago for his comments and support.

Lastly, I would like to thank my family and friends for all their love and encouragement. For my loving, supportive, encouraging, and patient husband Alberto Vargas whose faithful support during the final stages of this master is so appreciated. For the support of my children Jacob, Sofia and Gabriela which share with me a love of science and supported me in all my pursuits during these school years. Also I would like to thank my parents Eduardo and Isabel Escobar and my brother and sister Carlos and Viviana who had been a constant source of support, emotional and moral during my postgraduate years. Thank you

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August 2011

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Abstract

This study of the determination of earnings among the adult foreign-born population using the 2006 Canada Census of population recognizes that younger children learn a second language more easily than older children and adults. Based on this psycho-biological phenomenon, an instrumental variable is constructed in an earnings regressions for language proficiency based upon age at arrival to the country. This research uses both Two-stage Least Square estimation and Ordinary Least Square. It is found that there is an association between immigrants' ages at arrival and language skills. The results indicate that there is a significant positive effect of English and French proficiency on earnings among adults who immigrate to Canada at early ages. These results show that least square understates rather than overstates the two stages least squares results.

I. Introduction

The size and rapid growth of the immigrant population in Canada has generated a large body of literature, particularly in the last two decades. The economic literature on immigration focuses primarily on the macro-economic impact of immigrants, and on their labour market performance relative to native born Canadians. The 2006 Census shows that 19.8 percent of the Canadian population is foreign born. Most of these immigrants are from non-English speaking countries. In fact, the Census shows that 70.2% of the foreign-born population has a mother tongue other than English or French, and this ratio is up from 67.5% in 2001. The linguistic profile of these immigrants reflects the leading source countries of immigrants to Canada. Of the foreign-born who reported a mother tongue other than English or French, the largest proportion (18.6%) reported is Chinese. It was followed by Italian (6.6%), Punjabi (5.9%), Spanish (5.8%), German (5.4%), Tagalong (4.8%) and Arabic (4.7%).[1] Only 43 % of the foreign-born population spoke a non-official language most often at home.

Language skills are central to the evolution of immigrant integration into the labour market, and the association between language and earnings has been the subject of considerable research. However, measuring the causal effect of language proficiency on earnings is complicated by the reality that immigrants with advanced language proficiency may earn more for reasons other than these proficiencies. Studies to date have relied mainly on straightforward regression strategies that assume language skills are exogenous to control for those factors.

The analysis in this paper uses the 2006 Canadian census and follows previous work by Bleakley and Chin (B & C) (2004, 2010) for the United States. They summarize the literature on

[1] The 2006 Census shows that: (1) the proportion of Canada's population born outside the country has reached its highest level in 75 years; (2) there are about 6. 2 million foreign-born in Canada in 2006; (3) Canada's total population increased by 1.6 million between 2001 and 2006, an increase of 5.4%. Statistics Canada, Census, 2006. Analysis series Profile of languages in Canada. Retrieved from: http://www12.statcan.ca/census-recensement/2006/as-sa/97-557/p2-eng.cfm

language acquisition by noting that "young children learn languages more easily than older children and adults" (B & C 2010, page 166). B & C (2004, 2010) review the language acquisition literature and note that the critical period to learn a language appears to be linked to physiological changes in the brain: "with maturational changes initiating immediately before puberty, it decrease a child's capability to obtain second languages. If an introduction to the language starts throughout the critical period, achievement of the language up to native-like ability is almost assured. If an introduction to the second language starts at older ages, the individual's ability in that language is less certain" B & C (2008, page 6). This observation induces B & C (2004) to use an instrumental variable derived from immigrants' age at arrival to their country of destination. This instrumental variable is used in an earnings regression. However, age at arrival probably affects immigrants' earnings through channels other than language. For example, immigrants who arrive earlier may adapt better to Canadian institutions than those who arrived to Canada at older ages. Therefore, in my analysis, immigrants from English or French speaking countries of birth are used to control for non-language effects of age at arrival. Following, B & C (2004), the result is an instrumental variable (IV) strategy using age at arrival interacted with a dummy for non-English or French speaking country of origin as the identifying instrument. The working hypothesis is that younger child immigrants are more likely to become fluent speakers of one of the country's official languages, and in this way age at immigration will also influence adult earnings. This attempt to replicate the empirical work of B & C (2004) finds, by and large, results that are largely comparable. In particularly, there is a significant positive effect of Official Language skills on earnings among individuals from 2006 Canadian Census who immigrate to Canada as children.

Using individual-level data from the public use files of the 2006 Canadian Census, the research shows that there is a significant positive effect of English and French language skills on earnings among adults who immigrated to Canada as children. Immigrants who arrived before 10 years old will have significantly higher earnings than those who come to Canada at older ages (Table 6).

The paper is organized as follows. Section II discusses the literature on the returns to language skills on the one hand and on language acquisition on the other. Section III describes the data and methodology based on the original work by Bleakley and Chin (2004) and the econometric model used in their analysis. Section IV describes the methodology and data used in the Canadian replication. Section V presents the results obtained and Section VI concludes.

II. Previous Literature on Language Skills and Earnings

Studies on immigration and earnings differences have several antecedents in the economic literature. All studies reach broadly the same conclusions: language proficiency influences wage differentials. The literature uses cross-sectional, longitudinal, and quasi- longitudinal data, and analyzes the effects of language proficiency on earning differentials using data from different periods of time. The Census is an important source of data in many of the Canadian and U.S studies, but other data sources are used elsewhere. In the UK, for example, the Fourth National Survey of Ethnic Minorities is sometimes used. Earlier studies tend to regress log earnings on some measure of language skills and interpret the Least Squares coefficient for the language variable as the labour market return to language skills. More recent studies have attempted to address the problem of endogeneity in the relationship between language and earnings (Chiswick and Miller, 2001; Dustmann and van Soest, 2002).

Chiswick and Miller (2001) study how country of birth influence languages abilities on immigrants based on the 1991 Canadian Census. Language attainments are based on the assumption that language abilities are an investment in human capital. This human capital could be obtained before or after arriving to Canada. The results show that human capital, age at immigration and time living in Canada are important determinants of language preparation. How much a person invests in language acquisition depends on how much he or she is able to sacrifice. That is, in order to invest in language skills an immigrant needs to sacrifice time out of the labour market which has an opportunity cost in foregone wages. At the same time, investing in language acquisition represents an economic benefit to immigrants. Immigrants with professional qualifications who invest in language acquisition can improve their job opportunities as well as their income compared to those professionals lacking language skills. Additionally, the authors argue that immigrants who decide to invest in acquisition of the host country language will benefit economically by getting better paying jobs, and also they will have the opportunity to participate in the cultural, social and political life of the host country. People who came to Canada at an older age have poorer language skills. However, they improve their languages skills with time spent living in Canada and with educational attainment. The results also show that the farther the "linguistic distance" between the immigrant's birth country and Canada, the higher the probability that an immigrant will learn at least one of Canada's official languages and also speak the languages at home.[2] The study also found that, the bigger the linguistic distance between an official language and the immigrant's mother tongue, the higher the cost to learn the language. This means the greater the distance between English or French and the language spoken in the person's country of origin, the less likely the person will see the

[2]Chiswick and Miller (2001, page 393) explain the efficiency effect as "the extent of improvement in destination-language skills per unit of exposure. They also argue that the economic effect for destination-language proficiency depends on the increment in wages due to becoming proficient and on the expected duration of employment or duration of stay in the destination".

necessity of learning an official language (Chiswick and Miller, 2001, page 405). Their results also show that immigrants concentrate in a specific region in the host country, and they use their mother tongue as a medium to communicate. It is easier for them avoid use of the official languages but it will also increase the probability that even though a person is able to speak one of the official languages he chooses to speak his mother tongue at home.[3]

Chiswick and Miller (2002) study the wage differential between immigrants from non-English speaking countries and native born in United States using the 1990 census. The study focuses on the effects of immigrant languages abilities, place of residence and language spoken in it, and the business cycle at the moment of immigrants' entry into the labour force (Chiswick and Miller, 2002, page 48). Their results highlight the importance of being fluent in English in order to attain higher earnings. They find that those immigrants from non-English speaking countries who are fluent in English have 14 percent higher salaries than those immigrants who lack English language skills. The results also show that language abilities decrease for those immigrants from non-English speaking countries who live in communities where their original language is spoken (Chiswick and Miller, 2002, page 49). The opposite effect is also true, that immigrants from non-English speaking countries who live in neighbourhoods where the majority of residents are native born, increase their language abilities. The authors conclude that immigrants from non-English speaking countries who lack English abilities have comparative

[3] Chiswick and Miller (2001, page 393) define the exposure effect as the acquisition of the destination country language that can occur before or after immigration. They argue that "the model is trivial if immigrants come from an origin country in which the primary language is the same as the primary language used in the destination. Yet even for immigrants from countries in which the destination language is not the dominant language, there may be various levels of exposure in the origin before immigration. Thus the characteristics of the country of origin may matter."

advantages in finding high earning opportunities inside their areas of residence than other locations.[4]

The authors found that the longer the immigrants live in the United States the greater the possibility that their wage discrepancies decrease with time. For those immigrants from non-English speaking countries who have very poor English skills, the state of the business cycle at the moment of the entry into the labour market does not have an effect, while for those immigrants with languages abilities, wages discrepancies will continue through time and will be accelerated in times of recession.[5]

Dustmann and Van Soest (2002) distinguish among three different types of endogeneity that are likely to affect parameter estimates: correlated unobserved heterogeneity in speaking fluency and earnings, time-varying measurement errors, and time-persistent measurement errors. Their results indicate that time-varying measurement errors lead to a large downward bias on the effect of speaking fluency on earnings, which dominates the potential positive bias due to unobserved heterogeneity (Dustmann and Soest, 2002, page 480). The emerging picture suggests that the effect of language on earnings is underestimated in ordinary least square (OLS) regressions. The authors also find that the downward bias in the language variable leads to upward-biased estimates of the years of residence variable. Their results yield evidence that the

[4] Chiswick and Miller (2002, page 49) claim that "their findings have important implications for public policy, they emphasize the value to be had from including English language fluency, or the correlates of English language fluency, in the criteria for allocating immigration visas. The authors also point to the value of encouraging immigrants to participate in English as a-second-language programs either prior to or after arrival in the United States".

[5] Chiswick and Miller (2002, page 49) argue that "among the foreign born, the state of the business cycle on entry into the U.S. labour market does influence current earnings overall and among those who are fluent in English, and earnings are lower for those who enter during a period of high unemployment. Yet this effect is not permanent as the adverse effect of a high unemployment rate at entry diminishes with duration in the U.S. Among those who are not fluent, however, the stage of the business cycle at entry has no effect on earnings".

latter bias tends to be much larger than the former, implying that language proficiency is far more important than suggested by the existing literature (Dustmann and Soest, 2002, page 487).

Shield and Price (2002) analyze the function that English language proficiency and other human capital skills play in United Kingdom occupational success. The results show that English language skills are strongly associated with age at immigration as well as the number of years that the person has been living in the UK. The study uses the Fourth National Survey of Ethnic Minorities from 1994 and divides all electoral wards in England and Wales into three groups according to the percentage of the population with a visible minority status. They ran a set of different regressions with and without language variables to test to what extent language skills affect wages.[6]

The authors find that there is ordinary least square estimations are biased. Classifying language skills according to speaking fluency alone is likely to overestimate the true level of language ability because employers not only measure the immigrants' speaking ability but also the immigrants' writing and reading skills. This results in downwardly biased ordinary least squared estimators (Shield and Price, 2002, page 142). They use an instrumental variable method to account for this potential problem and to measure in a more accurate way the true impact of language fluency in occupational success.

The authors find that immigrants married to a native person from the UK do not experience an improvement in the ability to speak English fluently, since the UK born partner may acts as a translator, rather than as an informal teacher of English. English language skills improve for immigrants with dependent children, but they are lower for immigrants who do not

[6] The first model Shields and Price (2002) estimate includes variables such as age of immigration, years since immigration and country of birth. Unfortunately, as in many other studies of English language skills and wages, they do not observe an individual-specific expected wage premium from fluency or whether the individual has received any formal language training. In the second regression they add variables to capture the impact of other members of the household on language fluency such a number of children or spouse origin.

have kids. The study also analyzed English language abilities as human capital (Shield and Price, 2002, page 145). The results show that English language skills are the second most important determinant of immigrant occupational success in the United Kingdom after immigrants have acquired some level of education. They also find that fluency is associated with significantly higher mean hourly occupational wages.

Dustmann and Fabbri (2003) also study the United Kingdom to investigate the determinants of language proficiency and the effect of language on earnings and employment probabilities of non-white immigrants. Their findings suggest that skills in the official language of the host country are correlated with higher employment possibilities and with higher wages. The study uses data from two UK surveys on ethnic minorities: the Fourth National Survey on Ethnic Minorities (FNSEM), which was collected between 1993 and 1994, and the Family and Working Lives Survey (FWLS) which was collected between 1994 and 1995. They concentrate their effort on analysing language as human capital which they consider important to study immigrants' labour market performance and immigrants' cultural assimilation in the UK. The study is divided in two parts: first, they look at the factors that can affect immigrants' acquisition of the language from the destination country (for example age at immigration, year of immigration and education attainments from the country of birth as well as from the host country). Second, they examine the level at which language skills influence immigrant labour market effects.

Immigrants who have better language skills have the opportunity to find better paying jobs than those who have poorer language skills. Male immigrants have a higher chance to be fluent in the official language of the host country, because usually they are engaged in the labour market while their partners stay at home (Dustmann and Fabbri, 2003, page 704). Age at

immigration has the expected negative impact: it is negatively correlated with language skills with older immigrants having more difficulty in the acquisition of new language resulting in relatively lower wages. Additionally, the authors find that year of immigration is significant statistically and has a positive effect which diminishes with time of residence in the destination country.[7]

Their results also indicate that controls for the presence of children are negatively correlated with language skills, since parents who have school-aged or older children usually use them as translators. This effect will decrease the incentives for parents to improve their languages skills (Dustmann and Fabbri, 2003, page 706). However, at the same time, young children will force the parents to have more contact with the community, increasing exposure to English through school meetings, and meeting with parents of English speaking friends.

Joseph Schaafsma and Arthur Sweetman (2001) argue that there is a correlation between age at immigration and earnings, using the 1986, 1991 and 1996 Canadian census data. They argue that age at immigration is crucial to determine how well an immigrant will do in the labour market of the host country. Their results show that age of immigration is important. People who immigrate at an early age can assimilate to the Canadian culture, attend Canadian school and integrate in the Canadian job market, at the same level which is similar to Canadian born individuals. On the other hand, for those people who immigrate at older ages, the results are quite different.

Immigrants who come to Canada and already have finished their education will face difficulties in finding a job and earning the same wages as their Canadian-born counterparts with the same years of education or less (Schaafsma and Sweetman, 2001 , page 1,069). The reason is that many of the credentials that an immigrant has are not recognized in Canada, and therefore he

[7] All these results are consistent with findings for other countries.

or she attracts lower wages compared to his or her Canadian-born counterpart (Schaafsma and Sweetman, 2001, page 1067). Similar outcomes were obtained with immigrants' labour market experience. Additionally, the authors found that older immigrants face problems assimilating cultural and have language ability deficiencies. According to the research results, all of these elements indicate that age at immigration is a crucial factor in determining labour market assimilation and language proficiency. Schaafsma and Sweetman conclude that those immigrants who arrived at early ages, on average, will have higher returns than those who arrived later. Additionally, they show some evidence that immigrants who belong to visible minorities groups and who landed before the teen years do not have an earnings deficit relative to the Canadian born. However, visible minority immigrants who landed at older age have an earnings deficit compared to a Canadian born, and this shortfall grows with age at migration (Schaafsma and Sweetman, 2001, page 1094-1095)

III. Data and Methodology used by Bleakley and Chin

A. Language Acquisition Theory and the Estimation Strategy

Hoyt Bleakley and Aimee Chin (2004) implement their empirical strategy using microdata from the 1990 U.S. Census, specifically the Integrated Public Use Micro sample Series (IPUMS) files. They combine the 5 percent State sample with the 1 percent Metro sample. These samples contain information on each individual's age at arrival to the U.S., educational attainment, labour earnings and English-language proficiency (B & C, 2004, page 483). The English language proficiency variable used in their research was constructed from the Census question "how well does this person speak English?" with the four possible responses: "very well;" "well;" "not well;" and not at all." This question was only asked of individuals who responded affirmatively

to "does this person speak a language other than English at home?'. They have coded immigrants who do not answer "yes" to speaking another language as speaking English "very well" (B C, 2004, footnote page 483).

The contribution of their paper is the implementation of an identification strategy for the causal effect of language skill that is motivated by research on language acquisition (B & C, 2004, page 481).Young children tend to learn languages easily, whereas adolescents and adults do not. There is a theory that there is a biologically based critical period for second language acquisition that prevents older learners from achieving native levels. The "Critical period hypothesis" states that compared to adults, children are more successful second language learners. After settling in another language community, children seem to pick up the language without much effort, whereas their parents experience greater difficulty in achieving high levels of proficiency. On the basis of the "critical period hypothesis", Bleakley and Chin emphasize that the identifying instrument is not age at arrival itself, because those arriving young probably will differ from older individuals along non-language dimensions that also affect earnings. For example, in addition of acquiring an early contact to English, younger children attended the U.S. educational system at an early age. So the human capital gained in U.S. schools is better matched to the U.S. labour market. Younger immigrants will have an advantage over older immigrants that need not reflect language skills B & C, 2004, page 484).

B & C (2004) use a straightforward statistical technique to illustrate how the IV strategy based on age at arrival can identify the effect of English-language skills on wages. In addition to the regressors listed below, all specifications also include age-at-arrival, country-of-birth, age, race, Hispanic, and sex dummies.

$$y_{ija} = \alpha + \beta X_{ija} + \delta A_a + \gamma N_j + \xi_{ija} \quad (1)$$

for individual i born in country j arriving in the United States at age a. Where y_{ija} is log earnings, X_{ija} is a measure of English-language skills, A_a is a dummy for having arrived young (age at arrival ≤ 11), and N_j is a dummy for having been born in a non-English-speaking country. They let Z_{ija} be the binary instrument, the interaction between having arrived young and having been born in a non-English-speaking country, that is, $Z_{iia} = A_a N_j$ (B & C, 2004, page 483). The IV estimate of β in their equation is:

$$\beta_{iv} = [(y_{1,1} - y_{0,1}) - (y_{1,0} - y_{0,0})] / [(X_{1,1} - X_{0,1}) - (X_{1,0} - X_{0,0})] \quad (2)$$

where $Y_{1,0}$ is the mean of y_{ija} for those observations with $A_a = 1$ and $N_j = 0$; similar definitions are given for the other terms. The numerator is the reduced-form relationship between y_{ija} and Z_{ija}: the difference in difference of mean log earnings. The denominator is the reduced-form relationship between X_{ija} and Z_{ija}: the difference in difference of mean English ability.[8]

The identifying instrument is an interaction of age at arrival with country of birth. Immigrants from English-speaking countries are included into the analysis to partial out the non-language effects of age at arrival. This is due to the fact that, following their arrival in the United States, immigrants from English-speaking countries confront the same things that immigrants from non-English-speaking countries experience, except a new language. Thus, any difference in wages between young and old arrivals in non-English-speaking countries, which is over and above the difference in English-speaking countries, can plausibly be attributed to language.

In their first estimations, B & C restrict their interest to childhood immigrants, which they define as those immigrants who were under age 18 upon arrival in the United States. For the final estimations, they use a parameterization that admits degradation in language-learning

[8] Bleakley, Hoyt, and Aimee Chin,. ""Language Skills and Earnings: Evidence from Chilhood Immigratns,"." The Review of Economics 86:2 ((2004),): 481.496.

ability that starts at age 12 and grows linearly. Year of arrival in the United States is reported in multiyear intervals, with more detailed intervals for the recent past. Their definition of age at arrival is (current age) – [1990 – (maximum year of arrival)][9], in that way they can use the maximum possible age at arrival (B& C, 2004, page 483). They do this because the 1990 US Census files report age at arrival in categories, for example (0-4, 5-9) rather than offering the exact age at arrival.

The definition of age at arrival is crucial. It permits them to exclude adult immigrants, and to focus on the role of the critical period hypothesis. As a result of this definition, they find that over 35% of the foreign-born population in the United States are childhood immigrants. Additionally, they restrict their sample to persons who have been living in the United States for 16 to 30 years. The last restriction is based on an individual's age, that is, individuals that are between ages 25 and 38 in 1990. These age-at-arrival and year-of-arrival restrictions alone would limit the age range to 16-47.[10]

Additionally, B & C (2004) divided their sample into three mutually restricted language categories: non-English-speaking countries of birth (the treatment group); countries of birth with English as an official language or that have English as the predominant language (the control group); and other countries of birth with English as an official language (B & C , 2004, page 483) (this category is omitted from the main study because it is not clear how much exposure to the English language immigrants from these countries would have had before immigrating).[11]

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[9] As years of arrival in U.S. are reported in multiyear intervals, the maximum year of arrival is chosen as follows: if it is reported between 1970 and 1975 the maximum year of arrival is 1975.

[10] Bleakley, Hoyt, and Aimee Chin, "Language Skills and Earnings: Evidence from Childhood Immigrants, "Population Research Center, University of Chicago, discussion paper no. 2002-17 (2002) (http:// www.src.uchicago.edu/prc

[11] Bleakley Hoyt and Aimee Chin Appendix Table Al display the categorization of countries, as well as the composition of the sample by national origin. Table 1 provides the descriptive statistics for the treatment and control groups, with decompositions by age at arrival.

Their results on the relationship between age at arrival and English-language skills are consistent with the research on language acquisition, which indicates that children who experience their first contact to English at an earlier age reach a higher level of English-language proficiency than those who received it later. In fact, immigrants from non-English-speaking countries who come to the host country very young (up until age 8 or 9) accomplish English-language skills comparable to those of immigrants from English-speaking countries (B & C, 2004, page 484). However, for later ages at arrival, their English- language skills are lower.[12] For example, the authors found that for earlier arrivers the ordinal measure of English-speaking ability is 31% higher than for older arrivers.

In their final estimation B & C (2004) use Two-Stage Least-Squares Estimation (2SLS) dropping the assumption that age at arrival is binary, and proceed to use a parameterization that admits a linear degradation in language-learning ability. They do this in order to better capture the pattern of second-language acquisition in children. They assume that language ability starts to deteriorate at age 12 and falls linearly afterward. Their variable is defined as max $(0, a_i - 11)$, in which a_i continues to be the individual's age at arrival. The key prediction is that the immigrants from English- and non- English-speaking countries have increasingly divergent language and wage outcomes starting at age at arrival 12. As a result, the instrument excluded from the second stage is k_{ija}= (max $(0, a_i-11)$* N_j (B & C, 2004, page 487). This variable allows the difference between the control and treatment groups to grow starting just before the onset of teenage years. B & C summarize this procedure in the second-stage equation which relates the outcome of interest, wages, to the endogenous regressor, English language skills. This is equation (1) modified by the inclusion of a vector of exogenous explanatory variables w_{ija}:

[12] Bleakley, Hoyt, and Aimee Chin, "Language Skills and Earnings: Evidence from Childhood Immigrants, "Population Research Center, University of Chicago, discussion paper no. 2002-17 (2002) (http:// www.src.uchicago.edu/prc

$$y_{ija} = \alpha + \beta X_{ija} + \delta A_a + \gamma_j + w'_{ija}\lambda + \xi_{ija} \quad (3)$$

The first-stage equation relates the endogenous regressor to the instrument k_{ija}:

$$X_{ija} = \alpha_1 + \beta_1 k_{ija} + \delta_{1a} + \gamma_{1j} + w'_{ija}\lambda_1 + \xi_{1ija} \quad (4)$$

δ_a is a full set of age at arrival fixed effects, which control for non-language age at arrival effects in a better way than having a dummy for arriving young. The γ_j are a full set of country of birth fixed effects, which control for cross-country differences better than a single dummy for non-English speaking origin (B & C, 2004, page 487).

B & C also use the reduced form effect of the binary instrument Z_{ija} on language proficiency and earnings to construct an IV estimate of the returns on language. Substituting this into equation 3 they obtained an indirect least squares estimate of the return in language, in which a 1-unit increase in English speaking ability will raise earnings by 39%.

As B & C (2004) suggest, there is a strong, negative relationship between the instrument and English-speaking ability meaning that immigrants who arrived from non-English-speaking countries have progressively poorer English skills for each year of arrival past age 11. Their results imply that on average, improving English-speaking ability by 1 unit increases log wages by 34%. Compared to a person who speaks English poorly ($x_{ija} = 1$), a person who speaks English well ($x_{ija} = 2$) earns 33% more, and a person who speaks English very well ($x_{ija} = 3$) earns 67% more (B & C, 2004, pages 481, 496).

It has been recognized that acquiring a level of education equivalent to that of the domestic population is one of the key elements that determines how immigrants and their children integrate into the economic and social structures of the host country. B & C (2004) found that because teaching in U.S. classrooms is conducted in English, English-language skills

can be expected to affect not only the quality of learning at each stage of schooling but also the probability that immigrants from non-English speaking country will progress to the next stage of schooling. By using the exogenous variation provided by language-learning theory, they obtain a consistent estimate of the effect of English-language skills on educational attainment, which indicate that increasing English-speaking ability by 1 unit increases years of completed schooling by 4 years.[13]

B. Bleakley and Chin's Results

As mentioned, the Census question from which the English-ability measures in their paper was constructed as "How well does this person speak English?" with the four possible responses: "very well (with a value of 3)," "well (with a value of 2)," "not well (with a value of 1)," and "not at all (with a value of 0)." This question was only asked of individuals responding affirmatively to "Does this person speak a language other than English at home?" and they have coded immigrants who do not answer "yes" to speaking another language as speaking English "very well.

Year of arrival to the U.S. data was reported in intervals: before 1950, 1950-1959, 1960-1964, 1965-1969, 1970-1974, 1975-1979, 1980-1981, 1982-1984, 1985-1986, and 1987-1990. They used The World Almanac and Book of Facts, 1999, to determine whether English was an official language of each country. Recent adult immigrants from the 1980 Census were used to provide empirical evidence of the prevalence of English in countries with English as an official language.

[13] Bleakley, Hoyt, and Aimee Chin,. ""Language Skills and Earnings: Evidence from Chilhood Immigratns,"." The Review of Economics 86:2 ((2004),): 481.496.

The first estimation procedure was as follows. First, they show the reduced form results to illustrate the relationship between English-language skills and wages. Then the IV estimate of β was estimated. Finally, in this way they obtain an indirect least square estimate of the returns to language that implies that a one unit increases in English Speaking ability raises earnings by thirty nine percent.[14]

The first-stage regression results illustrate a strong, negative relationship between the instrument and English-speaking ability. That is, immigrants who arrived from non-English-speaking countries have progressively poorer English skills for each year of arrival past age 11. This result is consistent with the theory that the acquisition of a second language is more difficult for those who are exposed to the second language after 12 years of age. The effects of language skills on earnings are obtained from estimating the second stage equation. This suggests that, on average, improving English-speaking ability by one unit increases wages by 33%.

Bleakley and Chin (2004) conclude that there is a significant positive effect of English-language skills on wages among individuals from the 1990 Census who immigrated to the United States as children. The estimated effect using the IV strategy is greater in magnitude than that suggested by regression strategies that do not address endogeneity and measurement error (B & C, 2004, page 493). They also find evidence of substantial downward bias in the OLS estimate due to measurement error and somewhat smaller upward bias due to endogeneity. They also suggest that much of the effect of English-language skills appears to be diminished as school years in the host country increase. Better English-language skills induce immigrants who would otherwise drop out with the equivalent of junior high or some high school education to at least complete their high school degree (Bleakley and Chin, 2004, page 493).

[14] Numerator is from column 5: 0.1221. Denominator is from column 4: 0.3124 (B & C, .Table 2 page 485).

C. Complications in the Model

Even though, B & C (2004) offer an exhaustive study they find that their model faces some complications. By design the IV estimate uses only the variation in language skills that is induced by the instrument whereas the OLS estimate uses all the variation (B & C, 2004, page 491). They argue that "if the marginal return to language skills for individuals affected by the instrument differs systematically from that of the population then there is heterogeneity in the return to languages. The coefficient estimated using OLS certainly differs from that using IV" (B & C, 2004, page491). The authors also suggest that "the return to moving from speaking English "not at all" to speaking "not well" is different from the return from moving from "well" to "very well." (B & C, 2004, page 491).

Second, measurement error in the language skills variable may affect the OLS and IV estimates differently. The language measure used in their paper is an ordinal measure with four categories (0 to 3), which they denote as x. It is likely measured with error because it is based on each individual's self-assessment of his or her English-speaking ability, and measured in only a few discrete categories (B & C, 2004, page 492, 493). In analyzing the effect on language skills on earnings, the OLS estimate appears to be downward biased due to measurement error. These results are robust to the exclusion of immigrants from Canada, who account for the largest share (40%) of immigrants from English-speaking countries (B & C, 2004, page 487).The concern is that immigrants from Canada are poor controls for the non-language age-at-arrival effects experienced by immigrants from non-English-speaking countries because of Canada's cultural and institutional similarity to the United States. However, an important fact is that the IV estimate of the effect of language on earnings does not differ when they exclude Canadian

immigrants from the analysis which, we can see by comparing panels A and B of their table 4 (B & C, 2004, page 488).

IV. Methodology and Data for the Replicated Work

A. Methodology

The objective of the analysis is to replicate the empirical work of B & C (2004) using the 2006 Canadian Census. The first step in doing this is the estimation of a model using a simple binary treatment variable, based in B & C (2004) equation (1). In my analysis, y_{ija} is the natural logarithm of earnings for individual *i* born in a country *j* arriving In Canada at age *a*, as in B & C (2004), X_{ija} is a measure of English or French-language skills (the endogenous regressor), A_a is a dummy variable for having arrived young: (age at arrival ≤ 9). This variable is constructed using reported information on age and age at immigration. The range age at arrival ≤ 9 that was chosen for the creation of this variable is different from the age range chosen by B & C (2004), who define the arriving young variable as (age at arrival ≤ 11). This is because in the Canadian Census the variable age at immigration is grouped in a different way than in the 1990 United States Census. N_j is a dummy for having been born in a non- English speaking country and ξ_{ija} is the stochastic error term. I also allow the variable Z_{ija} be the binary instrument, the interaction between having arrived young and having been born in a non-English-speaking country, that is, $Z_{iia} = A_a * N_j$

Once again, the identifying instrument is not age at arrival by itself; the identifying instrument Z_{ija} captures the effect of language skills achievement on earnings for those immigrants who not only come at early ages, before age of 10, but who also come from a non-English or French speaking country of birth. This interaction term is meant to rule out the non-

language effect of age at arrival. All types of immigrants, with or without official language skills, will face similar difficulties when arriving to a new host country. But those arriving from a non English – non French speaking country will have the additional challenge of having to learn a new language. As such, the interaction term will capture in a clearer way the role of language skills

Following B & C (2004), the analysis drops the assumption that age at arrival is binary, and an identifying instrument: max (0, age at arrival –9) ×Non-English or French speaking country of birth, that grows linearly is created in order to use age at arrival in a way that better captures the pattern of second language acquisition in children. The objective of this variable is that, instead of estimating twenty differences in means (for each age at arrival, 0 to 19); the analysis will estimate a parameterized difference that is allowed to vary by age at arrival. In particular, it will impose a restriction that allows a difference of zero between childhood immigrants from non-English or French-speaking countries and childhood immigrants from English or French-speaking countries, up through age at arrival nine, but that has a linear relationship with age at arrival thereafter.

Then, the analysis proceeds with the estimation of the relationship between English proficiency and age at arrival in the first-stage equation that relates the endogenous regressor to the instrument k_{ija}; this is just the first stage equation of B & C (2004) ($X_{ija} = \alpha_1 + \beta k_{ija} + \delta_{1a} + \gamma_{1j} + w'_{ija}\lambda_1 + \xi_{1ija}$ (4)).

Since it may be more appealing to have a direct interpretation as an effect of English or French proficiency, for example, instead of answering what is the change in outcome associated with coming one year past age at arrival nine; the analysis will answer what is the effect of a

unit-change in the English or French speaking ability. I proceed with the estimation of the second stage equation, ($y_{ija} = \alpha + \beta X_{ija} + \delta A_a + \gamma_j + w'_{ija}\lambda + \xi_{ija}$ (3)) where the instrument Z_{ija} is excluded.

Because English or French language skills are endogenous, the analysis cannot obtain unbiased estimates of Equation (3) using ordinary least squares (OLS). Instead, following B & C (2004) I use max (0, age at arrival -9)* Non-English or French speaking country of birth, denoted as k_{ija} , the excess age at-arrival effect for non-English-origin immigrants, as an instrumental variable to identify the effect of English-language skills.

B. Data

Microdata from the 2006 Canadian Census, specifically the Public Use Microdata File (PUMF), are used in the analysis. The data contain 844,476 records and a number of restrictions were used to develop an analysis file of 16,078 individuals. These are described in Table 1.

The table illustrates that the analysis focuses on adults who are immigrants between the ages 30 to 54 in 2006, and who were under age 20 upon arrival in Canada. This age range is chosen to focus upon individuals at a similar part of the experience-earnings profile. After implementing these restrictions, the sample size is reduced to 21,773 observations. Then observations with earnings recorded as being negative or zero were deleted. Also any observations with invalid or missing data for the variables of interest in this econometric model are removed from the sample. Thus, the sample for this study contains a total of 16,078 observations.

Census questions 15A and 15B are used to construct the language ability variables used in this paper. The former asks respondents the following question: "What language does this person speak most often at home?" The possible answers are: (1) English; (2) French; or (3) Other. The latter question asks: "Does this person speak any other languages on a regular basis at

home?" It has four possible responses: (1) No; (2) Yes English; (3) Yes French; and (4) Yes Other. If the person answers "Other" in any of the questions he or she needs to specify which language he or she speaks. The Canadian Census does not pose a question on self-reported language ability of the type used by B & C (2004).[15]

Therefore the analysis is not a direct replication of B & C (2004), but it follows them in creating a four point scale of language ability. The English or French-speaking ability measure refers to the use of one of the official languages as the language used at home. Table 2 describes the derivation. If the respondent did not speak English or French at home, then he or she would be asked whether other languages were regularly spoken at home. A score of zero means that the respondent did not report speaking English or French in both parts A and B of Question 15. When respondents did not report English or French in part A, but spoke English or French in part B, they are assigned a score of one. In order to receive a score of two, the respondent would have to have spoken English or French in part A with other language being reported in part B. If respondents answer yes to speaking English or French in part A and did not report speaking another language in part B, they are assigned a score of three. Most of the observations receive a score of 2.

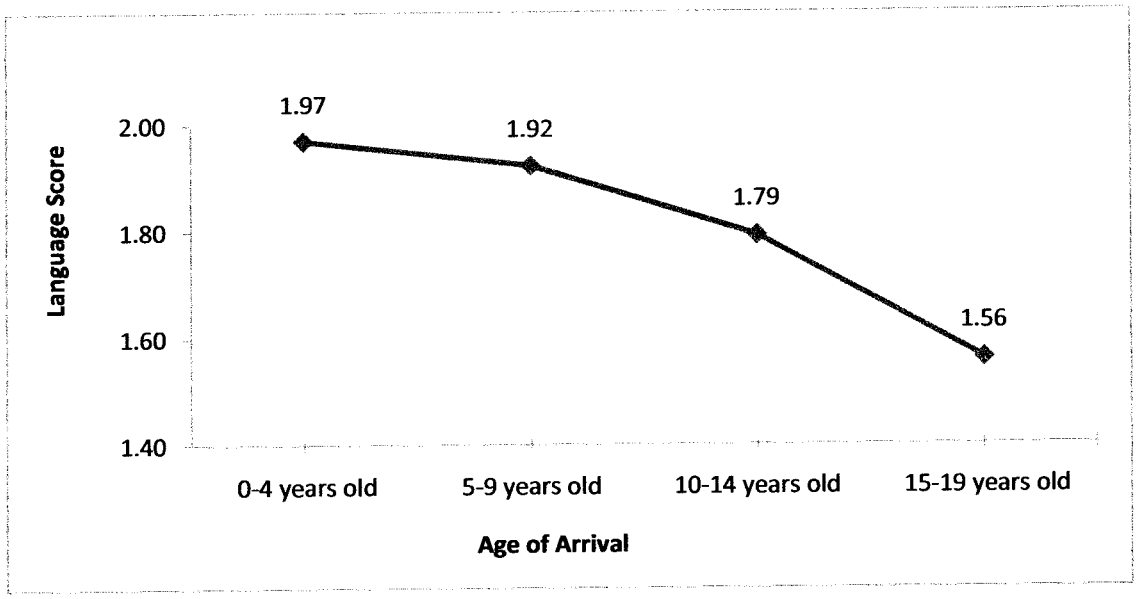
Table 3 provides the descriptive statistics of the variables that are used in the analysis. The natural logarithm of annual earnings in 2005 is the dependent variable of interest, and five age categories are used to control for the life cycle patterns in earnings. The series of indicators for Age at Arrival are based upon the age an immigrant reported landing in Canada. This plays a

[15] It is the case that Question 13 of the Canadian Census asks: "Can this person speak English or French well enough to conduct a conversation?" with the possible responses of English only, French only, both, or neither. The answer is binary, as opposed to a gradation like in the U.S. data. There are also other questions associated with language, including Question 14 which asks whether a person can speak other languages than English and French, and Questions 16 on mother tongue. As such my focus is on language used at home, which I take to be an important indicator of ability.

central role in the analysis and is based upon four categories: (a) age at arrival 0 to 4; (b) age at arrival 5 to 9; (c) age at arrival 10 to 14; and (d) age at arrival 15 to 19.

The relation between English or French language skills and age at arrival is show in Figure 1. Consistent with the "critical period" hypothesis, children who immigrate to Canada at early ages have a higher indicator of using of English or French at home than those arriving after the age of nine.

Figure 1. English or French Speaking Ability by Age at Arrival



Note: Data from 2006 Canadian Census. Sample size is 16,078 for individuals who arrived to Canada under 19 year old and ages are 30 to 54. See table 2 and associated text for the definition of the language score, which ranges from 0 to 3 and indicates the degree to which an official language is used in the home.

Using the place of birth variable the sample is divided into two mutually restricted language categories: (a) English or French speaking countries of birth[16] and (b) Non-English or

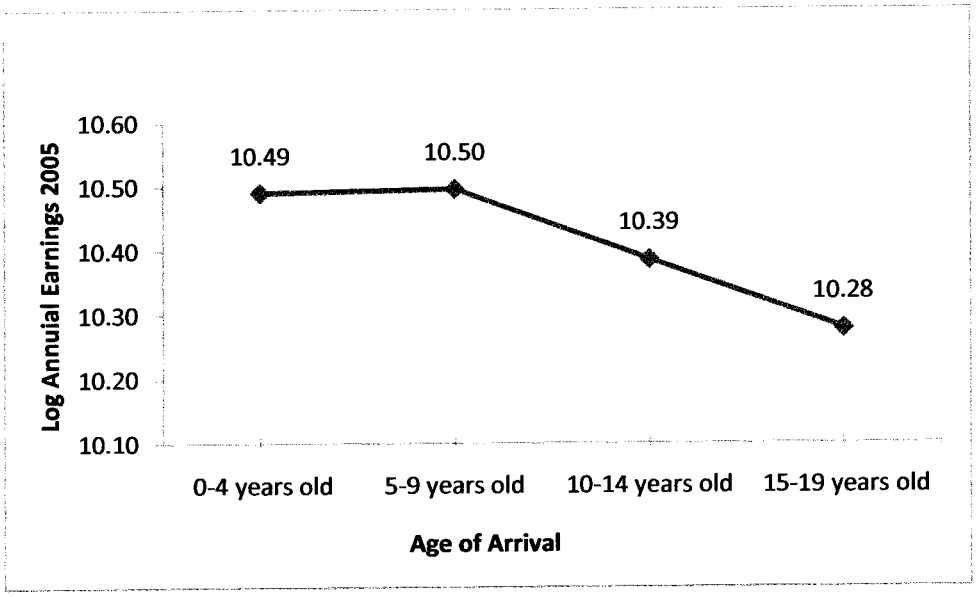
[16] These are: the United States, Jamaica, other Caribbean and Bermuda, United Kingdom, Eastern Africa, Hong Kong, Philippines, India, Pakistan, and Oceania.

French speaking country of birth.[17] Tables 1a and 1b in the appendix offer more information, but it should be noted that the public use files do not allow a clear distinction between these categories.

Other variables are used as controls for other influences on earnings. These include a dummy variable set to one for visible minorities and zero otherwise. This is intended to control for other labour market challenges that members of a visible minority status may experience in the Canadian labour market. B& C (2004) use a similar control. The analysis also follows them in using controls for gender, marital status, and region of residence.

Figure 2 illustrates the relationship between age at arrival and earnings. As in Figure 1, immigrants who arrive at early ages, whether they are from English or French or non-English or French speaking countries will not be significant difference in their earnings. However, for those immigrants who come to Canada at older ages, earning will be lower.

Figure 2. Log of Annual Earnings by Age at Arrival



[17] These consist of the following regions and countries: Central America, South America, Germany, Other Northern and Western Europe, Poland, Other Easter Europe, Italy, Portugal, other Southern Europe, Northern Africa, Other Africa, West Central Asia and the Middle East, China, Other Eastern Asia, other Southern Asia, other Southeast Asia.

V. Results of the Replicated Work

The results using a binary treatment indicator are offered first for illustrative purposes. The results from estimating the first stage equation, presented in the first column of Table 4, indicate that immigrants who arrive young, before 10 years old, are more likely to be speaking English and French at home, having a score that is 0.16 points higher, on a four point scale ranging from 0 to 3. Additionally, the results indicate that those immigrants who come to Canada from non-English or French speaking countries of birth have a score that is 0.30 points lower compared to those from English or French speaking countries. The variable of interest is the interaction term. The first-stage results indicate that the binary instrument (Arriving young×non-English or French speaking country of birth), has a positive coefficient of 0.039. Immigrants arriving at early ages from non-English or French speaking countries of birth are more likely to be speaking English or French as their home language than their counterparts who arrived after the age of nine. These results are similar in kind to those of B & C (2004, table 2).

The results of the reduced form equation in the second column of Table 4 indicate that immigrants who arrived at a young age have 12% higher earnings than those immigrants who came at older ages. They also show that while the interaction term is estimated to be positive, it is not found to be statistically significant at the 95% confidence level. These results are similar to those obtained by B & C (2004, table 2).

Following B & C (2004), the analysis drops the assumption that age at arrival is binary and uses the variable that permits a linear degradation in language acquisition ability starting at age of 10: max (0, age at arrival –9). The instrument that is excluded from the second stage (equation 3) is: max (0, age at arrival – 9) × Non-English or French speaking country of birth.

The first stage regression results (from estimating equation 2) are presented in Table 5. Columns 1 and 2 show how English or French speaking ability is related to the instrument max (0, age at arrival -9) × (Non-English or French speaking country of birth). The results indicate that there is a negative relationship between speaking English or French at home and the instrument; for each year of arrival after the age of 9, the language score falls for immigrants who arrived from a non English speaking country

The results from estimating the second-stage equation are displayed in the last four columns of Table 5. Columns III and IV show the results using ordinary least square (OLS) and column V and VI show the results using the two-stage least square estimation (2SLS). The results in Column III indicate that a one unit increase in the language score is associated with 15% higher earnings. Similar results are obtained in column IV of table 5 when the analysis controls for each age at arrival.

These results should be contrasted with the 2SLS results in columns V and VI of the table, which report a return of 40% without the age at arrival fixed effects and 53% when they are included. Like B & C (2004), these results show that least square understates rather than overstates the 2SLS results.

One of the concerns in the analysis is that immigrants from United States and United Kingdom for example, can be weak controls for the non-language age at arrival effects experienced by immigrants from non-English speaking countries of birth. As B & C (2004) argue, the reason can be attributed to similarities in culture and educational systems between English or French speaking countries and the host country. In order to observe if United States and United Kingdom are poor controls, the analysis proceeds with the exclusion of those two countries.

Comparing panels A and B in Table 6, column 1 shows that the OLS estimates of the effect of language on earnings does not differ when the United States and United Kingdom are excluded from the analysis. A one unit of improvement in English or French home language usages with all countries will increase earnings by 14.8%. On the other hand, when the United States and United Kingdom are excluded, earnings will increase also by 14.7%. In addition, after also excluding immigrants from Oceania and Hong Kong , because those countries have some cultural similarities with Canada, the OLS earnings effects is basically the same, at 14.8%, as shown in panel C. Finally, similar results are obtained in the analysis even when it is restricted to immigrants from Jamaica and the Caribbean region; panel C shows that earnings will increase by 13.6% for one unit of improvement in English or French language skills.

Furthermore, comparable results are found when the two-stage least square estimates are obtained. In Table 6, column II, the 2SLS estimates of the effects of one unit improvement in English or French language ability on earnings do not vary substantively with the sample definition. The estimate is 0.51 when the US and the UK are excluded, compared to 0.53 in the original sample; it is also 0.50 with the further exclusion of Oceania, and 0.56 when only Caribbean countries are used. All of these estimates are within one standard error of the original estimates reported in the first panel.

VI. Conclusions

Language proficiency is an important aspect of immigrant assimilation process. Language skills, particularly language spoken at home, provide important information on the immigrant's socioeconomic status and on the extent of integration into the social, political, cultural, and economic life of the majority population in the host country. Guided by the existing literature based upon the phenomenon that younger children acquire language skills more easily than older

children and adults, known in psychology as the "critical period of language acquisition", the research reported in this paper uses instrumental variables to estimate the causal impact of language proficiency on adult earnings. The identification strategy uses age at arrival to estimate the causal effect of English or French proficiency on earnings.

The analysis indicates that there is a significant positive effect of English and French language skills on earnings among adults from the 2006 Canadian Census who immigrated to Canada as children. These results indicate that English or French language skills have an important role in the process of immigrants' economic assimilation. Results obtained from the two-stage least square estimates indicated that on average earnings increase by 52% for a one unit increase in the language proficiency score used in this paper. This measure is derived from Census information on the language spoken at home. These results are robust to the definition of the sample. On the other hand, the analysis also finds that, even if some of the countries in the analysis have similar cultural and educational systems to those of Canada, the IV estimate of the effect of language on earnings does not differ when the analysis excludes these countries from the analysis.

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Table 1
Sample selection rules used to create the analytical file from the Public Use Census File

	Sample Size (un-weighted)	Sample Size (weighted)
Total sample, all individuals	844,476	31,241,030
Only immigrants	166,881	6,173,692
Only immigrants 30 to 54 years of age in 2006	74,468	2,754,911
Immigrants arriving before age 20	21,773	805,483
No negative and zero earnings	18,708	692,094
No missing values for variables	16,078	594,798
Total Sample after restrictions	16,078	594,798

Table 2
Distribution of sample according to English or French speaking ability, based on languages spoken at home

Answers to Question 15A	English or French		Other	
Answers to Question 15B	No other languages	Other languages	English or French	Other languages
Derived Language score	3	2	1	0
Number of observations	529	13,017	1,391	1,141

Table 3

Descriptive Statistics

	Mean (Standard Deviation)	Minimum	Maximum
Earnings	52,196 (65,180)	1,000	1,202,476
Log of Annual Earnings	10.5 (0.95)	6.9	13.9
English or French speaking ability	1.80 (0.60)	0	3
Arriving young	0.49	0	1
Arriving young* Non-English or French speaking country of birth	0.24	0	1
Max (0, age at arrival -9)	3.92	0	10
Max (0, age at arrival -9)*Non-English or French speaking country of birth	1.99	0	10
Age 30 to 34	0.20	0	1
Age 35 to 39	0.21	0	1
Age 40 to 44	0.22	0	1
Age 45 to 49	0.18	0	1
Age 50 to 54	0.16	0	1
Age at arrival 0 to 4	0.25	0	1
Age at arrival 5 to 9	0.23	0	1
Age at arrival 10 to 14	0.22	0	1
Age at arrival 15 to 19	028	0	1
Male	0.50	0	1
Married	0.63	0	1
Visible minority	0.43	0	1
Atlantic	0.01	0	1
Quebec	0.11	0	1
Ontario	0.55	0	1
Manitoba; Saskatchewan; and Alberta	0.12	0	1
British Columbia	0.18	0	1
Northern Canada	0.001	0	1
English or French speaking country of birth	0.50	0	1
United States	0.06	0	1
United Kingdom	0.17	0	1
Jamaica	0.03	0	1
Other Caribbean countries	0.04	0	1
Eastern Africa	0.02	0	1
Hong Kong	0.04	0	1
Philippines	0.03	0	1
India	0.04	0	1
Pakistan	0.007	0	1
Oceania	0.01	0	1
Non-English or French speaking country of birth	0.49	0	1

Central America	0.01	0	1
South America	0.05	0	1
Germany	0.03	0	1
Other Northern and Western Europe	0.05	0	1
Poland	0.02	0	1
Other Eastern Europe	0.02	0	1
Italy	0.06	0	1
Portugal	0.04	0	1
Other Southern Europe	0.03	0	1
Northern Africa	0.01	0	1
Other Africa	0.01	0	1
West Central Asia and the Middle East	0.03	0	1
China	0.01	0	1
Other Eastern Asia	0.01	0	1
Other Southeast Asia	0.05	0	1
Other Southern Asia	0.007	0	1

Note: Standard deviation in parenthesis.

Source: Statistics, Canada 2006 Canada Census derivations by the author according to selection rules described in Table 1.

Table 4
Difference in Differences With Binary Treatment Variable

Dependent Variable:	English or French speaking ability	Log of Annual Earnings
(Arriving young)×(Non-English/French speaking country of birth)	0.0394* (0.0181)	0.0077 (0.0309)
Arriving young	0.1596* (0.0128)	0.1224* (0 .0220)
Non-English/French- speaking country of birth	-0.3021* (0.6221)	-0.0615 (0.1062)
Adjusted R^2	0.2141	0.0791

Note: Arriving young is defined as a binary indicator equal to one if the individual arrived in the country before the age of 10, and zero otherwise. Single asterisks denote statistically significant results at a marginal significance level of 95%. The number of observations is 16,078 for each column. In addition to the repressors listed above, all specifications also include age, sex, and visible minority, region of residence and Place of birth dummies. Standard errors are reported in parentheses.
See Table A.1 in the appendix for full regression results.

Table 5
Effects on Log Annual Earnings – Base Results

Dependent Variable:	English or French speaking ability		Log of Annual Earnings			
	OLS	OLS	OLS	OLS	2SLS	2SLS
	(I)	(II)	(III)	(IV)	(V)	(VI)
Endogenous Repressor:						
English or French speaking ability			0.1490* (0.0135)	0.1487* (0.0135)	0.4051 (0.7985)	0.5281* (0.2352)
Identifying Instrument:						
max(0, age at arrival -9)*Non-English/French Speaking country of birth	-0.0043* (0.002)	-0.0042* (0.0021)				
Controls:						
max(0, age at arrival -9)	-0.0232* (0.001)		- 0.0138* (0.0018)		-0.0058 (0.0201)	
Non- English or French speaking country of birth	-0.2338* (0.0626)	-0.2312* (0.0625)	-0.0002 (0.1052)	0.0010 (0.1052)	0.0616 (0.2353)	0.0933 (0.1322)
Age at arrived dummies	No	Yes	No	Yes	No	Yes
Country of birth dummies	Yes	yes	Yes	yes	Yes	Yes
Adjusted R^2	0.2223	0.2228	0.0875	0.0874		

Notes: single asterisks denote statistically significant level of 95% of confidence. The number of observations is 16,078 for each column. In addition to the repressors listed above, all specifications also include indicators for age, sex, visible minority status. See Table A.2 in the appendix for full regression results.

Table 6.
Effect on Earnings and Schooling –Alternative Countries in Sample

Dependent Variable:	Log of Annual Earnings	
	OLS (I)	2SLS (II)
Panel A. All countries (base)		
English or French speaking ability	0.1487* (0.0135)	0.5281* (0.2352)
Panel B. Excluding immigrants from United States and United Kingdom		
English or French speaking ability	0.1478* (0.0139)	0.5193* (0.2352)
Panel C. Excluding immigrants from United States, United Kingdom, and Oceania		
English or French speaking ability	0.1481* (0.0135)	0.4995* (0.2357)
Pane D. Caribbean countries only		
English or French speaking ability	0.1367* (0.130)	0.5630* (0.2360)

Notes: single asterisks denotes statistically significant of 95% confidence interval. The official Canada language speaking score is defined as: 0 for those who do not speak English or French at home at all; 1 for those who speak other language most often at home but also speak English or French; 2 for those who speak English or French most often at home but also speak other language at home; and 3 for those who speak only English or French at home. The number of observations is 16,078 for each column. In addition to the repressors listed above, all specifications also include age, sex, visible minority, Canadian regions: (Newfoundland and Labrador, PEI, Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia, Northern Canada, and Place of birth dummies. The 2SLS estimate is obtained using the variable max (0, age at arrival -9)* (Non-English/French speaking country of birth) to instrument for the endogenous repressor, the official Canada language speaking score. See Table A.3 in the appendix for full regression results.

Appendix

Immigrants by Country of Birth

Panel A. Countries with English/French as an official language

1. English/French countries (= Control group)

Rank by N	Country	N	Share of total N
1	United Kingdom (Northern and Western Europe)	2,787	34.30%
2	United States of America	1,122	13.81%
3	India	777	9.56%
4	Other Caribbean and Bermuda	695	8.55%
5	Hong Kong, Special Administrative Region	766	9.43%
6	Jamaica	631	7.76%
7	Philippines	546	6.72%
8	Eastern Africa	375	3.81%
9	Oceania and others	310	3.07%
10	Pakistan	114	1.40%
	Total English/French Observations	8,123	100.0%

Panel B. Countries with Non-English/French as an official language

2. Non-English/French-Speaking Countries (= Control group)

Rank by N	Country	N	Share of total N
1	Italy (Northern and Western Europe)	1,008	12.57%
2	Other Southeast Asia	888	11.07%
3	Portugal (Other Northern and Western Europe)	739	9.21%
4	Other Northern and Western Europe	923	11.51%
5	South America	842	10.50%
6	Other Southern Europe	579	7.22%
7	West Central Asia and the Middle East	544	6.78%
8	Germany (north and Western Europe)	539	6.72%
9	China, People's Republic of	319	3.97%
10	Central America	237	2.95%
11	Poland	337	4.20%
12	Other Eastern Europe	322	4.01%
13	Other Eastern Asia	252	3.14%
14	Other Africa	198	2.46%
15	Northern Africa	178	2.22%
16	Other Southern Asia	113	1.40%
	Total English/French Observations	8,018	100%

Table A.1
Difference in Differences With Binary Treatment Variable

Dependent Variable:	English or French speaking ability	Log of Annual Earnings
Arriving young)×(Non-English/French speaking country of birth	0.0394*	0.0077
	(0.0181)	(0.0309)
Arriving young	0.1596*	0.1224*
	(0.0128)	(0 .0220)
Non-English/French- speaking country of birth	-0.3021*	-0.0615
	(0.6221)	(0.1062)
Age 30- 34	-0.1207*	-0.2460*
	(0.0151)	(0.0258)
Age 35- 39	-0.0137	-0.1304*
	(0.0146)	(0.0249)
Age 40- 44	-0.0145	-0.0458*
	(0.0139)	(0.0238)
Age 45- 49	-0.0028	-0.0002
	(0.0144)	(0.0246)
Male	-0.0161*	0.3923*
	(0.0084)	(0.0144)
Married	-0.0151*	0.1454*
	(0.0089)	(0.0153)
Visible minority	-0.0493*	-0.0373
	(0.0168)	(0.0288)
Newfoundland	0.0385	-0.1760
	(0.1161)	(0.1984)
Quebec	-0.0073	-0.02582
	(0.1126)	(0.1924)
Ontario	-0.0676	0.0088
	(0.1120)	(0.1914)
Manitoba	-0.0745	-0.0520
	(0.1124)	(0.1922)
British Columbia	-0.0625	-0.1408
	(0.1122)	(0.1919)
United States	0.1481*	0.0156
	(0.0387)	(0.0661)
United Kingdom	0.0964*	0.1077*
	(0.0365)	(0.0624)
Jamaica	0.2190*	-0.0434
	(0.0415)	(0.0709)
Other Caribbean Countries	0.2098*	0.0829
	(0.0409)	(0.0699)
Eastern Africa	0.0460	0.2282*
	(0.0445)	(0.0761)
Hong Kong	-0.4831*	0.2324*
	(0.0401)	(0.0686)
Philippines	-0.0023	0.1279*
	(0.0421)	(0.0720)

India	-0.3885*	0.0418
	(0.0400)	(0.0685)
Pakistan	-0.2140*	0.0160
	(0.0615)	(0.1052)
Central America	0.0319	-0.0972
	(0.0614)	(0.1050)
South America	0.3177*	0.1291
	(0.0540)	(0.0923)
Germany	0.3535*	0.1023
	(0.0582)	(0.0996)
Other Northern and western Europe	0.4036*	0.0982
	(0.0563)	(0.0962)
Poland	0.0570	0.0384
	(0.0605)	(0.1034)
Other Eastern Europe	0.2635*	0.2286*
	(0.0608)	(0.1041)
Italy	0.3010*	0.0776
	(0.0562)	(0.0961)
Portugal	0.2806*	0.0933
	(0.0567)	(0.0970)
Other Southern Europe	0.1480*	0.1111
	(0.0577)	(0.0987)
Northern Africa	0.4999*	0.3098*
	(0.0660)	(0.1128)
Other Africa	0.4014*	0.1448
	(0.0641)	(0.1097)
West Central Asia and Middle East	0.1060*	0.1262
	(0.0562)	(0.0961)
China	-0.3349*	0.1029
	(0.0588)	(0.1006)
Other Easter Asia	0.0538	0.2753*
	(0.0608)	(0.1039)
Other Southeast Asia	-0.1237*	0.1499
	(0.0536)	(0.0917)
Adjusted R^2	0.2141	0.0791

Note: Arriving young is defined as a binary indicator equal to one if the individual arrived in the country before the age of 10, and zero otherwise. Single asterisks denote statistically significant results at a marginal significance level of 95%. The number of observations is 16,078 for each column..

Table A.2

Effects on Log Annual Earnings – Base Results

Dependent Variable:	English or French speaking ability		Log of Annual Earnings			
	OLS	OLS	OLS	OLS	2SLS	2SLS
	(I)	(II)	(III)	(IV)	(V)	(VI)
Endogenous Repressor						
English or French speaking ability			0.1490*	0.1487*	0.4051	0.5282*
			(0.0135)	(0.0135)	(0.7985)	(0.2352)
Identifying Instrument: max(0, age at arrival -9)*Non-English/French Speaking country of birth	-0.0043*	-0.0042*				
	(0.0021)	(0.0021)				
Controls:						
max(0, age at arrival -9	-0.0232*		-0.0138*		-0.0058	
	(0.001)		(0.0019)		(0.0201)	
Non- English or French speaking country of birth	-0.2338*	-0.2312*	-0.0002	0.0011	0.0616	0.0933
	(0.0626)	(0.0626)	(0.1053)	(0.1053)	(0.2353)	(0.1323)
Age 30- 34	-0.1315*	-0.1314*	-0.2335*	-0.2335*	-0.1195	-0.1820*
	(0.015)	(0.0151)	(0.0258)	(0.0259)	(0.0936)	(0.0387)
Age 35- 39	-0.0265*	-0.0261*	-0.1350*	-0.1348*		-0.1226*
	(0.0145)	(0.0146)	(0.0249)	(0.0249)		(0.0259)
Age 40- 44	-0.0255*	-0.0266*	-0.0497*	-0.0501*	0.0299	-0.0379
	(0.0139)	(0.0139)	(0.0238)	(0.0238)	(0.0207)	(0.0246)
Age 45- 49	-0.0084	-0.0092	-0.0029	-0.0031	0.0678*	0.0013
	(0.0143)	(0.0144)	(0.0246)	(0.0246)	(0.0217)	(0.0257)
Age at arrival 0-4		0.2384*		0.1409*		0.0320
		(0.0165)		(0.0219)		(0.0461)
Age at arrival 5-9		0.2359*		0.1391*		0.0313
		(0.0164)		(0.0213)		(0.0458))
Age at arrival 10-14		0.1526*		0.0832*		
		(0.0134)		(0.0209)		
Male	-0.0161*	-0.0160*	0.3946*	0.3947*	0.3986*	0.4010*
	(0.0084)	(0.0084)	(0.0144)	(0.0144)	(0.0199)	(0.0152)
Married	-0.0117	-0.0113	0.1494*	0.1496	0.1560*	0.1535*
	(0.0089)	(0.0089)	(0.0153)	(0.0153)*	(0.0176)	(0.0160)

Visible minority	-0.0377*	-0.0376*	-0.0242*	-0.0241	-0.0300	-0.0110
	(0.0167)	(0.0168)	(0.0287)	(0.0287)	(0.0450)	(0.0327)
Newfoundland	0.0312	0.0303	-0.1855	-0.1858	-0.2009	-0.1961
	(0.1154)	(0.1155)	(0.1976)	(0.1976)	(0.2285)	(0.2307)
Quebec	-0.0127	-0.0123	-0.2595	-0.2592	-0.2626	-0.2539
	(0.112)	(0.1120)	(0.1916)	(0.1916)	(0.2229)	(0.2262)
Ontario	-0.0734	-0.0730	0.0163	0.0165	0.0308	0.0450
	(0.1114)	(0.1114)	(0.1906)	(0.1906)	(0.2293)	(0.2256)
Manitoba	-0.0803	-0.0795	-0.0435	-0.0432	-0.0277	-0.0124
	(0.1118)	(0.1119)	(0.1914)	(0.1914)	(0.2314)	(0.2264)
British Columbia	-0.0686	-0.0682	-0.1344	-0.1342	-0.1194	-0.1076
	(0.1116)	(0.1117)	(0.1911)	(0.1911)	(0.2284)	(0.2259)
United States	0.1465*	0.1465*	-0.0074	-0.0074	-0.0428	-0.0618
	(0.0385)	(0.0385)	(0.0659)	(0.0659)	(0.1325)	(0.0747)
United Kingdom	0.0891*	0.0893*	0.0895	0.0896	0.0772	0.0581
	(0.0363)	(0.0363)	(0.0621)	(0.0621)	(0.0927)	(0.0657)
Jamaica	0.2161*	0.2131*	-0.0782	-0.0793	-0.1324	-0.1606*
	(0.0412)	(0.0413)	(0.0706)	(0.0706)	(0.1900)	(0.0891)
Other Caribbean Countries	0.2120*	0.2110*	0.0527	0.0523	0.0044	-0.0292
	(0.0407)	(0.0407)	(0.0696)	(0.0696)	(0.1864)	(0.0845)
Eastern Africa	0.0495	0.0497*	0.2233*	0.2235*	0.2142	0.2030
	(0.0443)	(0.0443)	(0.0758)	(0.0758)	(0.0867)	(0.0772)
Hong Kong	-0.4789*	-0.4789*	0.3068*	0.3067*	0.4374	0.4864*
	(0.0399)	(0.0399)	(0.0686)	(0.0686)	(0.3855)	(0.1333)
Philippines	0.0071	0.0076	0.1336*	0.1337*	0.1267	0.1277
	(0.0419)	(0.0419)	(0.0716)	(0.0716)	(0.0689)	(0.0692)
India	-0.3809*	-0.3804*	0.1040	0.1041	0.2043	0.2456
	(0.0398)	(0.0399)	(0.0683)	(0.0683)	(0.3068)	(0.1126)
Pakistan	-0.2038*	-0.2029*	0.0537	0.0540	0.1108	0.1275
	(0.0612)	(0.0612)	(0.1047)	(0.1047)	(0.1927)	(0.1255)
Central America	0.0083	0.0021	-0.1138	-0.1163	-0.1164	-0.1142
	(0.0611)	(0.0612)	(0.1046)	(0.1047)	(0.1136)	(0.1167)
South America	0.2899*	0.2864*	0.0681	0.0667	0.0012	-0.0400
	(0.0537)	(0.0538)	(0.0920)	(0.0920)	(0.2576)	(0.1262)
Germany	0.3179*	0.3162*	0.0324	0.0315	-0.0253	-0.0876
	(0.058)	(0.0581)	(0.0991)	(0.0991)	(0.2886)	(0.1388)
Other Northern and western Europe	0.3681*	0.3662*	0.0208	0.0200	-0.0538	-0.1181
	(0.0561)	(0.0562)	(0.0958)	(0.0958)	(0.3234)	(0.1431)

Poland	0.0366	0.0314	0.0198	0.0178	0.0106	0.0078
	(0.0602)	(0.0602)	(0.1030)	(0.1030)	(0.1156)	(0.1144)
Other Eastern Europe	0.2381*	0.2333*	0.1768*	0.1750*	0.1201	0.0883
	(0.0606)	(0.0606)	(0.1037)	(0.1037)	(0.2245)	(0.1284)
Italy	0.2634*	0.2617*	0.0144	0.0136	-0.0192	-0.0845
	(0.056)	(0.0561)	(0.0956)	(0.0957)	(0.2487)	(0.1289)
Portugal	0.2457*	0.2422*	0.0346	0.0331	-0.0256	-0.0574
	(0.0566)	(0.0566)	(0.0966)	(0.0966)	(0.2289)	(0.1247)
Other Southern Europe	0.1176*	0.1156*	0.0743	0.0735	0.0586	0.0305
	(0.0575)	(0.0575)	(0.0982)	(0.0982)	(0.1477)	(0.1135)
Northern Africa	0.4669*	0.4620*	0.2191*	0.2172*	0.1144	0.0444
	(0.0657)	(0.0657)*	(0.1125)	(0.1125)	(0.4048)	(0.1794)
Other Africa	0.3648*	0.3602	0.0670	0.0652	-0.0277	-0.0694
	(0.0639)	(0.0639)	(0.1093)	(0.1093)	(0.3203)	(0.1525)
West Central Asia and Middle East	0.0900	0.0870	0.1026	0.1014	0.0763	0.0694
	(0.0559)	(0.0560)	(0.0958)	(0.0958)	(0.1292)	(0.1103)
China	-0.3585*	-0.3628*	0.1412	0.1395	0.2467	0.2796*
	(0.0586)	(0.0586)	(0.1004)	(0.1004)	(0.2999)	(0.1330)
Other Easter Asia	0.0278	0.0252	0.2546*	0.2535*	0.2543*	0.2455*
	(0.0605)	(0.0606)	(0.1035)	(0.1035)	(0.1142)	(0.1137)
Other Southeast Asia	-0.1497*	-0.1540*	0.1556*	0.1539*	0.1942	0.2145*
	(0.0534)	(0.0534)	(0.0914)	(0.0914)	(0.1522)	(0.1052)
Age at arrived dummies	No	Yes	No	Yes	No	Yes
Country of birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.2223	0.2228	0.0875	0.0874		

Notes: single asterisks denote statistically significant level of 95% of confidence. The number of observations is 16,078 for each column.

Table A.3.
Effect on Earnings and Schooling –Alternative Countries in Sample
Dependent Variable: Log of Annual Earnings

	Panel A. All countries (base)		Panel B. Excluding immigrants from United States and United Kingdom		Panel C. Excluding immigrants from United States, United Kingdom, and Oceania		Pane D. Caribbean countries only	
	OLS (I)	2SLS (II)	OLS (I)	2SLS (II)	OLS (I)	2SLS (II)	OLS (I)	2SLS (II)
English or French speaking ability	0.1487*	0.5281*	0.1478*	0.5193*	0.1481*	0.4995*	0.1367*	0.5630*
	(0.0135)	(0.2352)	(0.0135)	(0.2455)	(0.0135)	(0.2357)	(0.0130)	(0.2361)
max(0, age at arrival -9)*Non-English/French Speaking country of birth	0.0001		0.0006		0.0007		-0.0009	
	(0.0036)		(0.0036)		(0.0036)		(0.0034)	
max(0, age at arrival -9	-0.0167*		-0.0172*		-0.0174*		-0.0165*	
	(0.0046)		(0.0046)		(0.0046)		(0.0045)	
Non- English or French speaking country of birth	-0.0537	-0.0342	-0.0669	0.0511	-0.0591	0.0578	-0.0258	0.0028
	(0.1236)	(0.1390)	(0.0930)	(0.1338)	(0.0927)	(0.1344)	(0.0204)	(0.0243)
Age 30- 34	-0.2335*	-0.1820*	-0.2373*	-0.1869*	-0.2382*	-0.1902*	-0.2378*	-0.1695*
	(0.0259)	(0.0387)	(0.0258)	(0.0395)	(0.0258)	(0.0385)	(0.0251)	(0.0438)
Age 35- 39	-0.1348*	-0.1226*	-0.1386*	-0.1269*	-0.1392*	-0.1275*	-0.1371*	-0.1223*
	(0.0249)	(0.0259)	(0.0249)	(0.0258)	(0.0249)	(0.0257)	(0.0244)	(0.0259)
Age 40- 44	-0.0502*	-0.0379	-0.0522*	-0.0403	-0.0527	-0.0407	-0.0491	-0.0349
	(0.0238)	(0.0246)	(0.0238)	(0.0246)	(0.02380	(0.0245)	(0.0236)	(0.0248)
Age 45- 49	-0.0031	0.0013	-0.0043	0.0002	-0.0050	-0.0004	-0.0022	0.0028
	(0.0246)	(0.0257)	(0.0246)	(0.0257)	(0.0246)	(0.0256)	(0.0245)	(0.0258)
Age at arrival 0-4	-0.0256	0.0320	-0.0254	0.0356	-0.0253	0.0401	-0.0321	0.0015
	(0.0366)	(0.0461)	(0.0366)	(0.04810	(0.0366)	(0.0461)	(0.0365)	(0.0558)
Age at arrival 5-9	-0.0274	0.0313	-0.0272	0.0351	-0.0272	0.0394	-0.0269	0.0172
	(0.0367)	(0.0458)	(0.0367)	(0.0476)	(0.0367)	(0.04570	(0.03670	(0.0504)
Male	0.3947*	0.4010*	0.3953*	0.4020*	0.3956*	0.4016*	0.3978*	0.4067*
	(0.0144)	(0.0152)	(0.0144)	(0.0154)	(0.0144)	(0.0152)	(0.0144)	(0.0157)
Visible Minority	-0.0241	-0.0110*	-0.0195	0.0024	-0.0248	-0.0092	0.0496*	0.1677*
	(0.0287)	(0.0327)	(0.0287)	(0.0354)	(0.0282)	(0.0331)	(0.0177)	(0.0734)
Married	0.1496*	0.1535*	0.1492*	0.1531*	0.1488*	0.1524*	0.1461*	0.1558*
	(0.0153)	(0.0160)	(0.0153)	(0.0160)	(0.0153)	(0.0159)	(0.0152)	(0.0168)
Newfoundland	-0.1859	-0.1961	-0.2039	-0.2175	-0.2041	-0.2171	-0.2029	-0.2139
	(0.1976)	(0.2307)	(0.1975)	(0.23010	(0.1975)	(0.2301)	(0.1978)	(0.2319)
Quebec	-0.2593	-0.2539	-0.2610	-0.2549	-0.2621	-0.2567	-0.2534	-0.2419
	(0.1916)	(0.2262)	(0.1917)	(0.2253)	(0.1917)	(0.2253)	(0.1918)	(0.2273)
Ontario	0.0164	0.0450	0.0204	0.0506	0.0195	0.0476	0.0235	0.0684
	(0.1906)	(0.2256)	(0.1907)	(0.2249)	(0.1907)	(0.2248)	(0.1908)	(0.2272)
Manitoba	-0.0432	-0.0124	-0.0406	-0.0090	-0.0421	-0.0119	-0.0359	0.0150
	(0.1914)	(0.2264)	(0.1915)	(0.2257)	(0.1915)	(0.2256)	(0.19170	(0.2282)
British Columbia	-0.1342	-0.1076	-0.1325	-0.1056	-0.1356	-0.1086	-0.1224	-0.0640
	(0.1911)	(0.2259)	(0.1911)	(0.2251)	(0.1911)	(0.2251)	(0.1913)	(0.2283)
United States	-0.0616	-0.1894						
	(0.0940)	(0.1350)						

United Kingdom	0.0353	-0.0694						
	(0.0912)	(0.1254)						
Jamaica	-0.1334	-0.2881*	-0.1444*	-0.1985*	-0.1363*	-0.1828*	-0.2216*	-0.3787*
	(0.0931)	(0.1465)	(0.0468)	(0.0614)	(0.0461)	(0.0580)	(0.0399)	(0.10020
Other Caribbean Countries	-0.0018	-0.1568	-0.0112	-0.0651	-0.0032	-0.0499	-0.0870*	-0.2383*
	(0.0926)	(0.1433)	(0.0452)	(0.0547)	(0.0445)	(0.0514)	(0.0384)	(0.0925)
Eastern Africa	0.1694*	0.0754	0.1593*	0.1655*	0.1675*	0.1772*		
	(0.0978)	(0.1254)	(0.0545)	(0.0562)	(0.0538)	(0.0566)		
Hong Kong	0.2527*	0.3588*	0.2415*	0.4425*	0.2509*	0.4451*		
	(0.0919)	(0.1247)	(0.0455)	(0.1445)	(0.0446)	(0.1432)		
Philippines	0.0797	0.0001	0.0697	0.0885*	0.0789	0.1007*		
	(0.0941)	(0.1160)	(0.0498)	(0.0497)	(0.0490)	(0.0508)		
India	0.0501	0.1180	0.0395	0.2030*	0.0489	0.2075*		
	(0.0917)	(0.1126)	(0.0452)	(0.1203)	(0.0443)	(0.1199)		
Oceania	-0.0542	-0.1275	-0.0626	-0.0320				
	(0.1048)	(0.1255)	(0.0615)	(0.0648)				
Central America	-0.1162	-0.1142	-0.1140	-0.1093	-0.1149	-0.1110		
	(0.1047)	(0.1167)	(0.1047)	(0.1163)	(0.1047)	(0.1157)		
South America	0.0669	-0.0400	0.0681	-0.0340	0.0665	-0.0309		
	(0.0921)	(0.1262)	(0.0921)	(0.1267)	(0.0921)	(0.1253)		
Germany	0.0318	-0.0876	0.0361	-0.0717	0.0309	-0.0758		
	(0.0995)	(0.1388)	(0.0995)	(0.1361)	(0.0994)	(0.1367)		
Other Northern and western Europe	0.0202	-0.1181	0.0250	-0.1013	0.0198	-0.1044		
	(0.0962)	(0.1431)	(0.0962)	(0.1405)	(0.0961)	(0.1408)		
Poland	0.0179	0.0078	0.0224	0.0219	0.0172	0.0124		
	(0.1031)	(0.1144)	(0.1031)	(0.1131)	(0.1030)	(0.1131)		
Other Eastern Europe	0.1751	0.0883	0.1797*	0.1041	0.1745*	0.0985		
	(0.1038)	(0.1284)	(0.1038)	(0.1258)	(0.1037)	(0.1265)		
Italy	0.0139	-0.0845	0.0172	-0.0702	0.0116	-0.0755		
	(0.0961)	(0.1289)	(0.0961)	(0.1262)	(0.0959)	(0.1268)		
Portugal	0.0333	-0.0574	0.0374	-0.0425	0.0321	-0.0478		
	(0.0969)	(0.1247)	(0.0969)	(0.1220)	(0.0968)	(0.1227)		
Other Southern Europe	0.0737	0.0305	0.0773	0.0440	0.0719	0.0359		
	(0.0985)	(0.1135)	(0.0985)	(0.1113)	(0.0984)	(0.1119)		
Northern Africa	0.2173*	0.0444	0.2222*	0.0600	0.2181*	0.0619		
	(0.1127)	(0.1794)	(0.1127)	(0.1789)	(0.1126)	(0.1775)		
Other Africa	0.0654	-0.0694	0.0692	-0.0567	0.0662	-0.0556		
	(0.1095)	(0.1525)	(0.1096)	(0.1519)	(0.1095)	(0.1511)		
West Central Asia and Middle East	0.1015	0.0694	0.1053	0.0794	0.1025	0.0756		
	(0.0958)	(0.1103)	(0.0958)	(0.1092)	(0.0958)	(0.1092)		
China	0.1395	0.2796*	0.1394	0.2774*	0.1401*	0.2705*		
	(0.1004)	(0.1330)	(0.1005)	(0.1351)	(0.1005)	(0.1323)		
Other Easter Asia	0.2536*	0.2455*	0.2539*	0.2464*	0.2545*	0.2473*		
	(0.1036)	(0.1137)	(0.1037)	(0.1135)	(0.1037)	(0.1130)		
Other Southeast Asia	0.1540*	0.2145*	0.1548*	0.2148*	0.1551*	0.2121*		
	(0.0915)	(0.1052)	(0.0915)	(0.1055)	(0.0915)	(0.1046)		
Adjusted R^2	0.0873		0.0869		0.0869		0.0836	

Notes: single asterisks denotes statistically significant of 95% confidence interval. The official Canada language speaking score is defined as: 0 for those who do not speak English or French at home at all; 1 for those who speak other language most often at home but also speak English or French; 2 for those who speak English or French most often at home but also speak other

language at home; and 3 for those who speak only English or French at home. The number of observations is 16,078 for each column