The Impact of Language Training on the Transfer of Pre-Immigration Skills and the Wages of Immigrants*

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Abstract

In this paper, I estimate the impact of English-language courses on the wages of new immigrants. These estimates are the first of the kind in the literature. I develop a model of immigrants' investment in language skills in which language proficiency may affect wages directly, but also may increase the proportion of pre-immigration skills transferred into the host-country economy. The model shows that participation in language courses depends on immigrants' unobserved abilities, as well as the cost-shifters, such as the distance to the nearest course provider and refugee status. I use a unique panel data set, the Longitudinal Survey of Immigrants to Canada, to estimate the equations of the model. I address the endogeneity of language course participation by using instrumental variables. I find that attending language courses for six months leads to a 0.3 standard deviations gain in language skills, corresponding to an average wage increase of 11.7 percent. The increase in the total return to language skill accounts for 5.5 percent of wage growth, while the remaining 6.2 percent is driven by the transfer of pre-immigration cognitive skills into the host-country economy. Given the declining labour market performance of successive cohorts of immigrants to Canada, the immigration policy which selects individuals with high cognitive skills, and the recent cuts to language program budgets, the findings have significant policy relevance.

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1 Introduction

While there is a vast literature documenting the returns to immigrants' proficiency in host-country languages, the literature on the returns to host-country language training has been limited by data availability.[1] Immigrants constitute approximately a fifth of the Canadian labour force and Canada welcomes approximately 250,000 new immigrants every year.[2] Considering these numbers, the declining labour market performance of successive cohorts of new immigrants reported in the literature [e.g., Aydemir and Skuterud (2005)], and the significant budget cuts language programs offered to new immigrants in Canada have suffered in the recent years[3], the evaluation of the impact of ESL training on immigrants' economic outcomes is important for Canada's policies aimed at assisting with new immigrants' settlement.

In this paper I use the unique data set, Longitudinal Survey of Immigrants to Canada (LSIC), to estimate the effect of time spent in ESL courses on wages. I find that attending ESL courses full-time for six months (with a full-time monthly attendance of 126 hours) causes an 11.7 percent increase in an immigrant's wages. The increase in the total return to language skill accounts for 5.5 percent of wage growth, while the remaining 6.2 percent of the wage increase is driven by the change in the proportion of cognitive skills transferred into the Canadian economy. These are the first estimates of the kind in the literature.

Language skills can be thought of as a part of a person's human capital portfolio. Studying the return to and investment in these skills for native-born workers is problematic, as

[1] Commonly, "host-country" refers to the immigrant's target country of immigration, while "source-country" – to the point of origin.

[2] According to the Labour Force Survey (LFS) in 2011 immigrants accounted for approximately 21.1 percent of the Canadian labour force as indicated on the Citizenship and Immigration Canada website `http://www.cic.gc.ca/english/resources/research/2012-migrant/sec02.asp`. The approximate annual number of new immigrants is based on the annual immigration numbers from 1990 to 2014 found at `http://www.cic.gc.ca/english/resources/statistics/facts2014/permanent/01.asp`

[3] For example, a 22 million dollar cut to the funding of colleges offering free English as a Second Language (ESL) courses to immigrants in British Columbia in 2014 (Shen, 2014).

they possess "baseline" proficiency in the language. Immigrants, however, may not have "baseline" proficiency in the host-country official language, providing an environment to study the returns to and investment in language skills. Moreover, the level of investment in host-country language skills can be clearly measured as it comes in the form of time spent in language classes. As noted by Chiswick and Miller (2014), immigrants' investment in host-country language skills has been given a very limited treatment in the literature due to data limitations. Specifically, very few data sets contain a record of immigrants' participation in host-country language courses. Among the data sets containing such information, several are cross-sectional which makes it more problematic to study changes in language skills due to investment. Furthermore, of all data on immigrants, to my knowledge, only LSIC contains a detailed record of host-country language course participation including the start and end dates and weekly in-class hours.

I construct a two-period model of investment in host-country language skills in which the immigrant decides on the optimal time spent on ESL training. Both the language evolution and the wage determination are modeled explicitly. Furthermore, I explicitly model the mechanism through which pre-immigration skills are transferred into the host-country economy. Together, the language skill return to the time spent in ESL courses, wage returns to the language skill and cognitive skills, and the pre-immigration skill transfer equation describe the returns to language course participation. The solution to the model provides two insights regarding the optimal ESL course participation. First, the time spent on ESL training depends on the immigrant's language learning ability and her work-related ability. Both of these abilities are unobserved; hence, the coefficients of the language evolution equation cannot be consistently estimated by OLS due to endogeneity. Second, variables that shift the cost of participation in the ESL courses, such as distances to ESL course providers and refugee status, affect the optimal time spent on ESL training while not being correlated with the language learning ability. This allows me to to use such cost-shifters as instrumental

variables when estimating the effect of time spent in ESL courses on language skill gains.

A further complication in estimating the key equations of the model arises from the presence of measurement error in the language skill variable. While this does not impact the estimation of the coefficients in the language evolution equation, it prevents obtaining consistent estimates of the wage equation and skill transfer equation coefficients on language skill by using OLS. This issue is addressed by using instrumental variables combined with a fixed effects estimation. While fixed effects address the time-invariant component of the measurement error, the instrumental variables mitigate the correlation between the language skill and the idiosyncratic component of the measurement error. Moreover, in the case of the wage equation, using fixed effects estimation addresses the potential correlation between occupational skills and the unobserved work ability which would also serve as a threat to identification.

Unlike the majority of previous studies which use speaking ability-based binary variables to measure being "proficient" and "not proficient" in the host-country language, I use a continuous measure of language skill. This measure is constructed by performing principal component analysis (PCA) on self-reported measures of speaking, reading, and writing ability and the responses to five additional questions regarding the immigrant's speaking and comprehension capabilities recorded in LSIC. To enable the estimation the model, I augment LSIC with data from the Career Handbook, the Canadian 2001 Census of Population, and hand-collected data on the 2001-2003 ESL providers in English-speaking Canadian provinces. The hand-collected data on ESL providers contains six-character postal codes for providers' class locations which, paired with the immigrants' residential postal codes, allows me to calculate the distance between each immigrant and the nearest ESL provider. The Career Handbook data on the level of nine aptitudes and complexity of three tasks corresponding to four-digit National Occupational Classification (NOC) codes together with occupational weights corresponding to the 2001 Canadian labour market calculated using

the 2001 Census are used to obtain two occupational skills using PCA. An advantage of using the Career Handbook data for the Canadian labour market versus the Dictionary of Occupational Titles (DOT) or Occupational Information Network (O*NET) data is that it obviates the assumption that the occupations within the US use the same skills as those in Canada.[4]

I find that attending ESL courses for six months increases the English language skill by 0.291 standard deviations. The number of months spent in Canada between the interviews and the number of household members who speak English also serve as significant predictors of the language skill acquisition. I find that a one standard deviation increase in language skill results in a 18.99 percent increase in wages, which is consistent with previous literature finding significant returns for immigrants to becoming proficient in the host-country language. I also find significant returns to cognitive and manual skills, as well as work experience acquired in Canada. In line with the previous studies, I find returns to cognitive skills, which encompass analytical and communication skills, to be larger than returns to manual skills which, in this paper, correspond to dexterity-related and hand-eye coordination tasks performed on the job. Finally, estimates from the skill transfer equations for cognitive and manual skills indicate that host-country language skills play an important role in transferring pre-immigration cognitive skills into the host-country economy. On the other hand, I find no evidence that language skills affect the transfer of pre-immigration manual skills.

The remainder of the paper is organized as follows. Section 2 provides a review of relevant literature. Section 3 presents the theoretical model of investment in language skills. Section 4 describes the data sources and provides descriptive statistics for the estimation sample. Section 5 discusses the identification and estimation of the language skill evolution, wage determination, and skill transfer equations. Section 6 discusses the estimates from these

[4]Imai, Stacey and Warman (2016) note the necessity of this assumption as one of the caveats in employing O*NET data in their analysis using LSIC.

equations and calculates the effect of ESL course attendance on wages. Section 7 concludes.

2 Review of Relevant Literature

My paper draws on and contributes to three main strands of literature: research on immigrants' post-arrival investment in human capital, papers on the return to immigrants' human capital, especially the host-country language skills, and the work on the transferability of the source-country human capital into the host-country economy. I will focus my review of the prior work on post-immigration human capital investment on papers which examine the host-country language acquisition.

The literature on the effect of host-country language courses on immigrants' outcomes is very limited, largely due to lack of data on the subject, as noted in the literature review by Chiswick and Miller (2014).[5] Gonzalez (2000) and Hayfron (2001) investigate this topic using cross-sectional data. Gonzalez (2000) uses the 1992 National Adult Literacy Survey (NALS) to investigate the factors linked to immigrants' proficiency in speaking, understanding, reading, and writing in English as well as the impact of these proficiencies on earnings. Hayfron (2001) uses Norwegian data on immigrants from Morocco, Pakistan, and Chile to estimate the contribution of Norwegian language courses on language proficiency. He also estimates the effect of Norwegian proficiency on wages, but does not find a statistically significant effect even after instrumenting for the potential measurement error in the recorded proficiency.[6] Gonzalez (2000) and Hayfron (2001) use instrumental variables to address the

[5] Other examinations of language acquisition do not use data on language courses in their models. For example, Chiswick, Lee and Miller (2004) use the Longitudinal Survey of Immigrants to Australia (LSIA) to estimate a model of language acquisition focusing on the role of factors such as age at migration, visa status, and birthplace. To see whether unobservable characteristics play a role in language proficiency, Chiswick and Miller estimate bivariate probit models with English proficiency at different interviews as the dependent variable arguing that the positive correlation between the disturbance terms would indicate that the same unobservables are relevant for proficiency in the two time periods.

[6] A potential caveat is that the *ethnicity of wife* variable that Hayfron (2001) uses as one of the instruments for language proficiency does not have a statistically significant effect as a determinant of language proficiency.

endogenity of language course participation. Gonzalez utilizes the use of another language at work or while shopping as proxies for residing in an ethnic enclave (which should reduce incentives to participate in language courses). Hayfron uses the dummies for receiving unemployment and other social benefits. Both studies use cross-sectional data with only the measure of present language abilities which are coded into binary proficiency indicators.

The lack of a pre-language-training measure of proficiency makes interpreting the probit estimates of the effect of language courses on present proficiency problematic. Furthermore, both data sets include immigrants with a long residency in the host-country (e.g., NALS includes immigrants who have been in the US for over 40 years) and the language course questions identify only the participation and completion of the course at some point since arriving in the country.

Beenstock (1996) uses the Immigration Absorption Survey (IAS) data from Israel to examine how new immigrants acquire Hebrew. He finds a positive effect of attending a language school, but the study does not correct for potential self-selection into language courses. Beiser and Hou (2000) use panel data on Southeast Asian refugees who arrived in Vancouver (British Columbia, Canada) in 1981. The refugees were interviewed at arrival, and again two and then ten years after arrival in Canada. The study does not find a statistically significant effect of ESL courses on language acquisition in the first two years in Canada using an ordered logistic regression.[7] However, the authors do not test or correct for self-selection into ESL courses. Akresh (2007) uses the New Immigrant Survey-Pilot (NIS-P) panel data covering the immigrants' first year after receiving the US permanent resident status. Regression of log earnings on covariates including an ESL course participation dummy with fixed effects introduced to address selection into ESL courses does not yield a statistically or economically significant effect of language courses on earnings. Finally, Kaida (2013) uses

[7]Beiser and Hou (2000) find an effect limited only to female refugees after ten years in Canada, though there is no statistically significant effect when the interaction is not present in the model.

the Longitudinal Survey of Immigrants to Canada (LSIC) to examine the role of language course completion, rather than participation, and the host-country education in immigrants' exit from poverty. She estimates a bivariate probit of an indicator for language course completion and an indicator for poverty exit which has the former as an independent variable. She finds a statistically significant effect of ESL courses on poverty exit.

There are several areas in which the present paper expands the knowledge on the effects of ESL courses. First, none of the preceding papers estimate the effect of intensive margin of ESL courses. It is very likely that immigrants can benefit from attending ESL courses even if they do not officially complete the prescribed program. From the policy standpoint, knowing the returns to a fixed unit of ESL course participation time (e.g., full-time equivalent months) is useful for budget planning. Second, obtaining the returns to time spent in ESL courses in terms of wages allows cost-benefit assessment of existing and planned language programs for immigrants.

The seminal work by Chiswick (1978) that proposed that English language proficiency can play an important role in the economic assimilation of immigrants prompted the development of a vast literature concerning the returns to immigrants' language proficiency. The majority of literature covers immigrants in the US, Canada, UK, Australia, Germany, and Israel. A vast majority of these studies find that immigrants enjoy significant returns to becoming proficient in the host-country language [for examples, see Chiswick (1991), Dustmann (1994), Dustmann and Fabbri (2003), Berman et al. (2003), Bleakley and Chin (2004), Gonzalez (2005), Skuterud (2011)]. Chiswick and Miller (2014) provide a detailed overview of the literature for all of these countries.

The majority of studies of returns to immigrants' host-country language proficiency use self-reported proficiency. Immigrants may under- or over-report their level of fluency which may bias the estimates of returns to host-country language proficiency. Dustmann and Van Soest (2001, 2002) address the problem of misclassification of host-country language profi-

ciency within the German Socio-Economic Panel (GSOEP). Dustmann and Van Soest (2001) use a model of language acquisition to correct for the probabilities of misreporting the speaking proficiency level. The authors simultaneously estimate the monthly earnings equation for full-time workers and a model of language acquisition which includes variables that are constant over time (country-of-origin dummies, year of entry, age at entry, father's education) and vary as time passes (years of education, family composition and marital status, years since migration). The estimates of the latent speaking fluency are used as a measure of language skill in the earnings equation. Dustmann and Van Soest (2002) treat the misclassification as an additive measurement error and use an instrumental variable approach to deal with the issue. They use parental education to deal with both idiosyncratic and time-independent measurement errors in language. Both studies find that misclassification results in underestimation of returns to German speaking proficiency (driven by immigrants overstating their speaking ability). In the current paper, I perform an IV estimation which includes fixed effects to address the potential sources of bias in the coefficients; however, my set of instruments differs from Dustmann and Van Soest (2002).

Some of the more recent studies have utilized data sets with objective measures of literacy (e.g., document literacy). Ferrer, Green, and Riddell (2006) estimate the returns to immigrant literacy skills using the Ontario Immigrant Literacy Survey (OILS) and the International Adult Literacy Survey (IALS). They find that there is a significant return to literacy as well as lack of difference in returns between immigrant and native-born workers. Clarke and Skuterud (2014) come to similar conclusions using data from the Adult Literacy and Life Skills Survey (ALLS) on US, Canada, and Australia.

Work on the economic assimilation of immigrants suggests a U-shaped pattern of occupational mobility: an initial downgrade from the pre-immigration job followed by a recovery, which may be attained through human capital investment. For example, Duleep and Regets (1999) develop a two-period model of immigrants' investment in human capital with an

exogenously determined incomplete transfer of immigrants' source-country skills into the host-country economy. The paper offers evidence to support the predictions of the model such as higher levels of human capital investment by immigrants who are subject to lower skill transferability. Duleep (2014) provides an excellent discussion of work on occupational mobility and skill transferability of immigrants. While, until recently, the literature on the transferability of pre-immigration skills has not explicitly considered the role of host-country language proficiency in the skill transfer mechanism, the idea that returns to host-country language skills may be occupation-specific was discussed in Kossoudji (1988). Chiswick and Miller (2003) use Canadian 1991 Census data, providing evidence that higher host-country language proficiency enhances the gains from schooling and pre-immigration work experience. Imai et al. (2016) develop a theoretical model of occupational choice where the proportion of pre-immigration skills useable in the host-country depends on the level of the language skill. O*NET data is used in conjunction with LSIC and the Canadian Census of Population to obtain occupational skill vectors. The paper presents descriptive statistics supporting the mismatch between source-country and host-country occupations, with lower levels of mismatch associated with higher language proficiency levels. The authors further show that speaking proficiency (measured on a discrete three-level scale) leads to a reduction in skill gaps between pre-immigration and post-immigration occupational skills, measured as the difference in the ordinal rank of the pre- and post-immigration occupation based on the particular skill.

3 The Model of Immigrant's Investment in Language Skills

This section presents a model of investment in language skills for an individual i. There are two time periods; let t denote time. In each period t the immigrant is endowed with one unit

of time. At $t = 1$, the immigrant can allocate one unit of time between work $wk_{i1} \in [0, 1]$ and an ESL course $esl_{i1} \in [0, 1]$. At $t = 2$, she can only work, that is, $esl_{i2} = 0$ and $wk_{i2} = 1$.[8]. In what follows I denote scalars with lower case letters (e.g., l_{it}) and 1-by-k vectors with upper case letters (e.g., X^j_{it}, where k is j-specific) with associated coefficients being considered k-by-1 vectors. Consistently with previous research, working earns a wage described by a Mincer-style function

$$w_{it} = \exp\{l_{it}\beta_l + xp_{it}\beta_{xp} + s_{it}\beta_s + \alpha^W_i\}, \tag{1}$$

where l_{it} denotes the host-country language proficiency, xp_{it} is the work experience, s_{it} refers to a measure of human capital, the skill individual i uses at work, and α^W_i is the individual's work ability.[9] Equation (1) lends itself to the linear-in-parameters log-wage form commonly used in the literature:

$$\ln w_{it} = l_{it}\beta_l + xp_{it}\beta_{xp} + s_{it}\beta_s + \alpha^W_i \,. \tag{2}$$

Let s_{i0} denote the individual's pre-immigration skill. The skill is transferred to the host-country economy using the technology

$$s_{it} = s_{i0} \exp\{-\tau_l(\bar{l} - l_{it})\}, \tag{3}$$

where $\bar{l}$ denotes the near-native language skill level (the highest language skill level for immigrants). Previous work suggests that immigrants' host-country language proficiency affects the amount of pre-immigration skills which are useable in the host-country; τ_l measures the skill transfer "penalty" imposed for not having a near-native proficiency level.[10]

[8]This is not a restriction, as the optimal time allocation in a two-period problem has $esl_{i2} = 0$

[9]In the present section the measure of skills is kept as a scalar for the ease of exposition. When estimating the model, I distinguish between cognitive and manual skills.

[10]While I do not make s_{i0} explicitly depend on α^W_i, it does not change any insights obtained from the solution for optimal ESL participation. Furthermore, I address the endogeneity of s_{it} caused by s_{i0} being dependent on the unobservable α^W_i when discussing the identification of the wage equation in Section 5.

New immigrants live in an English-language environment; hence, it is unlikely that their language skills would depreciate over time. Even if some immigrants reside in ethnic enclaves, this is more likely to deter acquisition of further language skills rather than cause the deterioration of existing language skills, at least in the relatively short two-year period considered in this paper. Therefore, I assume that language skills do not depreciate over time and host-country language skill evolution can be described by

$$l_{i2} = l_{i1} + esl_{i1}\varphi_{esl} + X_{i1}^{L}\varphi_x + \alpha_i^L \,. \tag{4}$$

The coefficient on l_{i1} is assumed to be one, reflecting zero depreciation of the language skill over time, X_{i1}^L represents other variables affecting language learning (the number of other household members who are proficient in English and the individual's age), and α_i^L is the individual's language learning ability. Without loss of generality, assume that $xp_{i1} = 0$ and $xp_{i2} = wk_{i1}$. Participating in an ESL course involves a cost $X_{i1}^C\gamma_x$. X_{i1}^C consists of the distance to the ESL provider, which accounts for travel costs in attending the course, and refugee status, which may account for some monetary costs being alleviated for refugees who attend ESL courses paired with the impact of case workers directing refugees to attend courses. The immigrant has preferences represented by the utility function

$$u_{it} = wk_{it} \cdot \ln w_{it} - esl_{it} \cdot X_{it}^C\gamma_x, \quad t \in \{1, 2\} \,. \tag{5}$$

This means that the individual extracts utility from total per-period income (all of the income gets consumed within the period), while experiencing disutility from paying costs connected to attending ESL courses. I assume that there is no psychic cost of attending ESL

courses. Let ρ be the discount factor. The immigrant's problem is then

$$\max_{esl_{i1},\, wk_{i1}} \left\{u_{i1} + \rho u_{i2}\right\} = \max_{esl_{i1},\, wk_{i1}} \left\{wk_{i1} \cdot \ln w_{i1} - esl_{i1} \cdot X_{i1}^{C}\gamma_x + \rho \cdot wk_{i2} \cdot \ln w_{i2}\right\}$$

$$\text{subject to}$$

$$esl_{i1} + wk_{i1} = 1$$

$$esl_{i1} \geq 0, \quad wk_{i1} \geq 0$$

$$esl_{i2} = 0, \quad wk_{i2} = 1$$

$$l_{i2} = l_{i1} + esl_{i1}\varphi_{esl} + X_{i1}^{L}\varphi_x + \alpha_i^L$$

$$xp_{i2} = wk_{i1} + xp_{i1}$$

$$l_{i1},\, xp_{i1},\, s_{i0},\, X_{i1}^{L},\, X_{i1}^{C},\, \alpha_i^W,\, \alpha_i^L \qquad \text{given.}$$

Solving this problem for optimal investment in language skills, $esl_{i1}^{\star}$, I obtain a result that is a function of both language learning ability α_i^L and the vector of cost-of-investment variables X_{i1}^{C} in addition to other variables.

$$esl_{i1}^{\star} = \frac{1}{\tau_l \varphi_{esl}}\left(\tau_l(\bar{l} - l_{i1} - X_{i1}^{L}\varphi_x - \alpha_i^L) + \ln\left(l_{i1}\beta_l + s_{i1}\beta_s + \alpha_i^W + X_{i1}^{C}\gamma_x + \rho\beta_{xp}\right) - \ln\left(\rho\tau_l s_{i0}\varphi_{esl}\right)\right) \tag{6}$$

There are two insights relevant for the estimation of the equations of the model from the above solution. First, $esl_{i1}^{\star}$ is not independent from the language learning ability α_i^L and the work ability α_i^W which are unobserved in the data. Since the language skill evolution equation contains esl_{i1}, OLS estimation will yield biased results. Taking a derivative of (6) with respect to α_i^L we obtain

$$\frac{\partial\, esl_1^{\star}}{\partial\, \alpha_i^L} = -\frac{1}{\varphi_{esl}}\,, \tag{7}$$

meaning that higher language learning ability will be associated with less time spent in ESL courses. This is not surprising, since those immigrants who are better at picking up language

skills through day-to-day interactions will choose to spend less time in ESL courses. Second, the cost variable vector X_{i1}^C enters $esl_{i1}^\star$, but does not enter the wage or the language skill evolution equations. Differentiating (6) with respect to X_{i1}^C we obtain

$$\frac{\partial\, esl_1^\star}{\partial\, X_{i1}^C} = \left(\frac{1}{\tau_l \varphi_{esl}}\right)\left(\frac{\gamma_x}{l_{i1}\beta_l + s_{i1}\beta_s + \alpha_i^W + X_{i1}^C\gamma_x + \rho\beta_{xp}}\right). \tag{8}$$

That is, an increase in costs associated with attending ESL courses reduces the optimal time spent in ESL courses. For example, living further away from the nearest ESL provider would decrease the optimal time spent in ESL courses. On the other hand, as being a refugee may involve reductions of these costs, refugees are likely to attend ESL courses for longer periods of time. At the same time, neither of these variables would have a direct effect on language acquisition. Hence, variables in X_{i1}^C can serve as instruments for ESL_{i1} in order to address the aforementioned endogeneity issue.

4 Data

To estimate the parameters of the model, I use data from three sources: the Longitudinal Survey of Immigrants to Canada (LSIC), the Career Handbook paired with the 2001 Canadian Census of Population, and a personally collected data set containing the locations of LINC/EAL/ELSA providers from 2001 to 2003 paired with the Postal Code Conversion File (PCCF).

4.1 Longitudinal Survey of Immigrants to Canada (LSIC)

LSIC is a panel data set collected and created jointly by Statistics Canada and Citizenship and Immigration Canada under the Policy Research Initiative. The data include immigrants who arrived in Canada between October 1, 2000 and September 30, 2001. Surveys were ad-

ministered to the same individuals in three waves: approximately six months (Wave 1), two years (Wave 2), and four years (Wave 3) after arrival in Canada. LSIC is a restricted-access data set and is available only through the Statistics Canada Research Data Centers. LSIC is an extremely rich data set and is uniquely suited for this study. I use data from LSIC to obtain measures of l_{i1} and l_{i2}, esl_{i1}, w_{i1} and w_{i2}, xp_{i1} and xp_{i2}, X_{i0}^{L} and X_{i1}^{L}, and two of the variables in X_{i1}^{C}.

LSIC contains extremely rich data on immigrants' language ability. Self-reported English-language speaking, reading, and writing ability are further complemented by responses to five questions on speaking and comprehension competence (e.g., "How easy is it for you to understand a message in English over the telephone?"). The answers to these eight questions permit me to construct a continuous measure of language proficiency using principal component analysis (PCA).[11] The continuous factor for Waves 1 and 2 of LSIC obtained by performing PCA is used as l_{i1} and l_{i2} respectively.[12]

Responses on the methods of improving English language proficiency contain participation in English as a Second Language (ESL) courses. Further, to my knowledge, LSIC is the only panel data set that contains the history of participation in ESL courses which includes weekly hours and the start and end dates of the course attendance. One important limitation of LSIC is that no detailed records exist for ESL courses that were started between Wave 1 and Wave 2 interviews. Further, the record of courses from Wave 2 to Wave 3 interviews makes it impossible to separate hours of ESL and hours of French as a Second Language (FSL) training if the immigrant participated in both activities. In this paper I focus on the investment in language skills which occurred between six months and two years in Canada. I, therefore, use the available records of immigrants participating in ESL courses between

[11] The majority of previous studies use self-reported speaking proficiency to derive binary ("proficient/not proficient") or three-level categorical ("low/medium/high proficiency") measures of proficiency which are not suitable for examining the gradual increase in host-country language skills over time.

[12] Details can be found in Appendix B.1.

Wave 1 and Wave 2 interviews as my measure of esl_{i1}.

I use data on immigrants' age and the number of household members who are proficient in English as the two measures in X_{i1}^L. I assume that the number of individuals in the household who speak English reported in an interview served as one of the inputs in the language evolution equation for the language proficiency reported in that interview (e.g., X_{i1}^L that determines l_{i2} includes the number of English-proficient household members reported in the Wave 2 interview). X_{i1}^L also includes the lag of age at Wave 2 (i.e., age at Wave 1 interview). I use the visa status of the immigrant to identify refugees and sponsored family members. The two visa status indicators are used as components of X_{i1}^C. I use the six-character postal codes of immigrants' residences in calculation of distances to ESL providers in Section 4.3.

LSIC contains a detailed employment history for each immigrant for the first four years in Canada from which I obtain the information on wages, Canadian work experience, and occupations worked in after the arrival in Canada. I divide the provided weekly wages by weekly hours and the provincial CPI at the start date of the job to obtain real hourly wages. The hourly wages earned between Wave 1 and Wave 2 interviews are used as a measure of w_{i1} and wages earned between Wave 2 and Wave 3 interviews - as w_{i2}.[13] Days worked between arrival in Canada and the Wave 1 interview are used to measure xp_{i1}, days worked between arrival and the Wave 2 interview - to measure xp_{i2}. I convert the number of days worked into six month-equivalent intervals.[14] The occupational information is used to match the skills, obtained from the Career Handbook in the next section, with immigrants in LSIC. Further, I use the pre-immigration occupation reported in the Wave 1 interview to obtain measures of pre-immigration skills. Data on the pre-immigration occupation is one of the unique features of LSIC not found in other data sets.

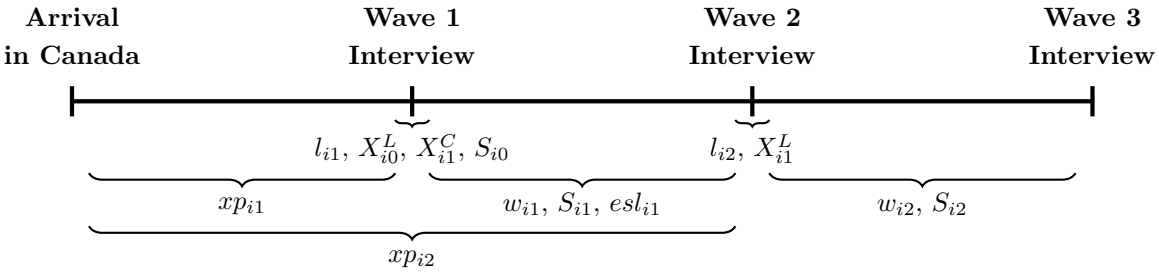
Figure 1 shows the timing of the data; variables under the braces were obtained from

[13] I use wages for the job which Statistics Canada identifies as the "main job."

[14] This choice is one of convenience: both the time spent in ESL courses and work experience are measured in the same units, as it makes interpreting and comparing the coefficients in Section 6 easier.

the employment and language course histories corresponding to the time between the interviews. No retrospective questions regarding the language proficiency at arrival in Canada were asked in LSIC, so the measure of l_{i0} is not available. Based on the timing, I assume that wages between Waves 1 and 2 (w_{i1}) and Waves 2 and 3 (w_{i2}) are a function of language proficiency recorded at the Wave 1 (l_{i1}) and Wave 2 (l_{i2}) interviews respectively. This leaves me with two time periods worth of data for the estimation of wage equation. I use the data for waves 1 and 2 (l_{i1}, l_{i2}, esl_{i1}, X^L_{i1}, X^C_{i1}) to estimate the language skill evolution equation.

Figure 1: Data Timeline



4.2 Career Handbook

In Section 3, an individual's pre- and post-immigration skills are represented by scalars for the ease of exposition. For the empirical portion of the paper, I use two separate variables to measure cognitive and manual skills. Let S_{it} denote a two-by-one vector $\{s^c_{it}, s^m_{it}\}$. To obtain S_{i1} and S_{i2} represented by measures of cognitive and manual skills used on the job and the vector of pre-immigration skills S_{i0}, I use the Career Handbook paired with the 2001 Canadian Census of the Population. The Career Handbook is the counseling component of the National Occupational Classification (NOC) system. It contains the information on 923 occupations with corresponding attributes, task complexity, and physical and environmental requirements. The attributes have five levels, with "1" corresponding to the ability within the lowest 10 percent of the population, "2" corresponding to the lowest third of the pop-

ulation excluding the lowest 10 percent, and so forth. Tasks in working with data, people, and machinery (things) are ranked based on their complexity on an eight-level scale. I have combined some of the levels due to the similarity of tasks performed to create four-level measures of task complexity (where "0" corresponds to the task not playing a significant role for the occupation and the rest of the levels correspond to "low", "medium", and "high" levels of complexity).

Many of these attributes and task measures are highly correlated. To reduce the dimensionality of data and improve its interpretation, I obtain two skill measures underlying these variables using principal component analysis (PCA). Two approaches to reducing the dimensionality of attribute and task vectors which come from the Dictionary of Occupational Titles (DOT) and Occupational Information Network (O*NET) have been discussed in the recent literature. The first approach, used by Ingram and Neumann (2006) and Poletaev and Robinson (2008), does not assume an *a priori* knowledge of the skills underlying the multitude of task and attribute measures and relies on using a set of factors which are orthogonal to each other to represent skills. The second approach, used in Yamaguchi (2012), assumes that a subset of attributes and tasks measures one skill. There is no clear advantage of using one methodology over the other. However, the interpretation of skills obtained using the second approach may be easier as the resulting factors are constructed from a group of conceptually similar or related variables. In the case of the first approach, the several seemingly unrelated variables may have high factor loadings on the same factor (such as numerical ability and finger dexterity) making clear interpretation of this factor more problematic.

I follow the second approach in performing my analysis of the skills in the Career Handbook. I assume that there are two skills, cognitive and manual, underlying the nine attributes and data, people, and things tasks. I use general learning ability, numerical ability, verbal ability, clerical perception, and the aforementioned task complexity in working with data and people to construct a composite measure of occupational cognitive skills. I use motor

coordination, manual dexterity, finger dexterity, form perception, spatial perception and the task complexity in working with machines and tools ("things") to construct the measure of occupational manual skills reflecting hand-eye coordination.

Each occupation appears within the Career Handbook only once. When performing PCA, this will result in all occupations being assigned the same weight. However, in the labour market, occupations are not uniformly distributed (e.g., there are more retail salespersons than computer programmers). Following the literature, I use the native-born workers of the 2001 Canadian Census of Population for appropriate weighting when obtaining factors. Therefore, zero corresponds to the mean of cognitive and manual skills for the Canadian native-born workers. The resulting skill vectors are then matched with the immigrants in LSIC using the NOC and SOC 1991 codes. Details on the factor loadings for both skills can be found in Appendix B.2.

4.3 LINC/EAL/ELSA Data

To complete the data used in the estimation of the language skill evolution and wage determination equations, I obtain the distance between the immigrant's residence and the nearest ESL course provider. This variable is the third component of X_{i1}^{C}. In the period of interest, the Canadian Federal Government directly financed the Language Instruction for Newcomers (LINC) program in Ontario, Nova Scotia, Prince Edward Island, New Brunswick, Newfoundland, Alberta, and Saskatchewan. Both Manitoba and British Columbia received transfers from the government but managed their respective programs, English as an Additional Language (EAL) and English Language Services for Adults (ELSA), on the provincial level.[15] All these programs were provided free of charge to individuals who were over 18 years of age and had permanent resident (economic or family) or refugee (convention or government

[15] As the focus of the paper is on English language proficiency, I do not include residents of Quebec in the analysis.

claimant) status. As there was no readily available data set including the addresses of ESL providers to match the LSIC, I hand-collected the data (details are provided in Appendix A). The resulting data set contains the names and postal codes of 368 ESL providers. I have also made note of programs which provided ESL training exclusively to women. Combining this data with the Postal Code Conversion File (PCCF) and information on the immigrants' postal codes of residence from LSIC, I calculated the distances from each immigrant's residence to the nearest ESL provider.

4.4 Estimation Sample and Descriptive Statistics

The data set resulting from combining all of the above sources contains a sample representative of immigrants who have lived in Canada for approximately four years. I impose a set of restrictions on these data to obtain my estimation sample. I use the age reported at the first interview to measure the age at immigration and restrict the sample to contain immigrants who were between 25 and 55 years old at arrival. This ensures that the sample includes individuals who have completed the major part of their human capital investment, excluding the investment in the host-country language skills, in their source-countries. I further trim the top and bottom 1 percent of observations based on their hourly real wages to remove any outliers. I do not restrict the sample to males, in contrast to previous studies. This is backed by the argument that, at least in Canada, female immigrant workers follow an economic assimilation pattern similar to that of men, presented in Adserà and Ferrer (2014). I exclude immigrants who lived in Canada for six or more months at any point prior to immigration, as their economic integration pattern is likely to be very different from the majority of immigrants who have not resided in Canada for any significant amount of time prior to their arrival. Because I focus on acquisition of and returns to English language skills I exclude immigrants with the native ability in English, those residing in Quebec and those who cross the linguistic border between Quebec and the rest of Canada.

Table 1 provides the descriptive statistics for Waves 1 and 2 of the data. These statistics were obtained using the weights provided for LSIC by Statistics Canada. The "Number of Observations" column shows the total weight for the individuals in the relevant subsample.

There is an increase in the average immigrants' language skill from 0.095 in Wave 1 to 0.234 in Wave 2 along with a decrease in the standard deviation, as more immigrants become proficient in the language. 71.3 percent of immigrants in the sample have a record of ESL hours (including zero hours for no participation). Out of these individuals, 23.8 percent of immigrants report participating in an ESL course between the first and the second interview. The ESL hours have been converted to full-time equivalent six months with the assumption of 126 hours of ESL per month. Immigrants who participated in ESL courses between the interviews on average attended them for approximately 6.8 full-time equivalent months.

When estimating the language skill gains equation in Section 6, I use the distance to the nearest ESL course provider as one of the instrumental variables for the time spent in ESL courses. There are multiple factors that are likely to affect the immigrant's choice of residence, including availability of housing, rent levels, and access to amenities such a stores and public transit. I, therefore, treat the residential location as chosen independently from the existing locations of ESL course providers, which would make it a credible instrument. On average immigrants lived approximately 3.8 kilometers away from the nearest ESL course provider. Furthermore, the standard deviation is 23.9 kilometers, implying a high amount of variation in the data, further supporting the use of the distance to the nearest ESL provider as an instrument for ESL course participation time. I also use the visa status as an instrument for time spent in ESL courses as it may affect the costs of participating in ESL courses. Around 5.1 percent of immigrants are refugees and 17 percent arrived in Canada as sponsored family members.

Since zero corresponds to the average occupational skill for the native-born workers, an average immigrant in the sample is employed in an occupation which uses cognitive skills

Table 1: Descriptive Statistics for the Estimation Sample

Variable Name	Wave 1 Mean	Wave 1 Std. Dev.	Wave 2 Mean	Wave 2 Std. Dev.	Number of Obs.
Language Skill	0.0947	0.8761	0.2340	0.7833	78545
Record of Hours in an ESL Course	0.7131	–	–	–	78545
Participation in an ESL Course	0.2380	–	–	–	56017
Time in an ESL Course	1.1361	0.9744	–	–	13331
English-proficient HH Members	2.3324	1.1819	3.0645	1.3647	78545
Months Between Interviews	–	–	19.8279	1.2112	78545
Age	35.75	7.15	37.41	7.15	78545
Refugee Status	0.0507	–	0.0507	–	78545
Family Visa Status	0.1700	–	0.1700	–	78545
Distance to the Nearest ESL Provider	3.8403	23.9195	–	–	78545
Real Hourly Wage	13.8163	6.6021	16.3234	7.4713	34577
Cognitive Skill	−0.1775	1.0784	0.0256	1.0833	34577
Manual Skill	0.1779	0.9660	0.2209	0.9994	34577
Cognitive Skill Gap	1.1221	1.1838	0.9113	1.1258	32430
Manual Skill Gap	0.0840	1.1756	0.0424	1.2153	32430
Canadian Work Experience	0.6944	0.3203	3.5005	0.9405	34577
Male	0.6167	–	0.6167	–	34577
Interview Conducted in English	0.5927	–	0.6649	–	78545

Note 1: All variables are weighted using the weights provided with LSIC by Statistics Canada.

Note 2: The number of observations is the total weight reported for the relevant statistic. Unweighted descriptive statistics cannot be disclosed under the Statistics Canada RDC regulations for LSIC.

0.1775 standard deviations below and manual skills 0.1779 standard deviations above the native-born average in Wave 1. Therefore, on average, immigrants are employed in occupations with greater use of manual skills. However, in Wave 2 these numbers change to

0.0256 and 0.2209 standard deviations above the native-born average, respectively, which may indicate the continuing economic assimilation of immigrants including the transfer of their pre-immigration skills. Looking at the gaps between pre-immigration skills and current occupational skills used on the job we can see that the mean gap decreases from 1.1221 to 0.9113 standard deviations for cognitive skills. For manual skills the gap changes from 0.084 to 0.042 standard deviations on average from Wave 1 to Wave 2. This reduction in the skill gaps over time together with the increase in host-country language skill and work experience may indicate that more of the pre-immigration skills transfer over time, which is consistent with the U-shaped occupational mobility of immigrants proposed in the earlier literature. On average, the immigrants' real wage is 13.82 dollars per hour in Wave 1 rising to 16.32 dollars per hour in Wave 2. This real wage growth of 18.1 percent is driven by the increase in language skills, Canadian work experience (which increased from 4.1 to 21 months on average), and cognitive and manual skills used on the job, as becomes evident from the results in Section 6.

5 Model Identification and Estimation

The goal of this paper is to estimate the return to investment in language skills, which is driven by the language skill increase due to ESL participation, φ_{esl} from equation (4), the wage return to language skills, β_l, and occupational skills, β_s, from equation (1), and the language skill-driven transfer of pre-immigration skills, τ_l, from equation (3). This section discusses the empirical model and its identification.

First, using the assumption that language does not depreciate, I rewrite (4) as a language skill gains equation:

$$\Delta l_{it} = esl_{it-1}\varphi_{esl} + X^L_{it-1}\varphi_x + \alpha^L_i \tag{9}$$

Table 2: Reported Change in Language Skills (Wave 1 to Wave 2)

Reported Change	Percentage	Number of Obs.
"Declined"	30.04%	23,592
"Remained the Same"	24.00%	18,852
"Improved"	45.96%	36,101

Note: The number of observations is the total weight reported for the relevant statistic. Unweighted tabulations cannot be disclosed under the Statistics Canada RDC regulations for LSIC.

Since language skill l_{it} is constructed based on self-reported language proficiency it may be subject to measurement error. Table 2 shows that a sizable portion of the sample reports a decline in language proficiency. A decline of English language proficiency while living in an English speaking country is not likely as noted earlier, in Section 3.

As discussed by Dustmann and Van Soest (2002) this pattern of reported language change indicates the presence of the measurement error. Following their work, I assume that the reported language skill measure l_{it}^{rep} takes the form

$$l_{it}^{rep} = l_{it} + \eta_i^L + \upsilon_{it}^L \tag{10}$$

Where η_i^L is a time-independent measurement error which reflects that some individuals may always understate their language ability, while others - always overstate it. υ_{it}^L is the idiosyncratic measurement error. Substituting (10) into (9) we obtain

$$\Delta l_{it}^{rep} = esl_{it-1}\varphi_{esl} + X_{it-1}^L\varphi_x + \alpha_i^L + \varepsilon_{it}^L \tag{11}$$

where I rewrite $\upsilon_{it}^L - \upsilon_{it-1}^L$ as ε_{it}^L. I assume that ε_{it}^L is independent from esl_{it-1} and X_{it-1}^L. That is, the measurement error does not affect the estimation of the language evolution equation. However, as evident from solution for the optimal time spent in ESL courses, esl_{it-1} is not independent from α_i^L which is unobserved by the econometrician. To address

the endogeneity of esl_{it-1}, I use the distance to the nearest ESL provider and refugee and family visa status as instrumental variables.[16] These variables can be thought of as X_{it}^C in the solution for the optimal ESL attendance. Variables in X_{it}^C affect the optimal ESL attendance but are not correlated with the unobserved language learning ability α_i^L. Without the use of instrumental variables, we expect the coefficient for esl_{it-1} to be biased towards zero, since having higher α_i^L corresponds to a lower esl_{it-1}.[17]

Second, suppose that hourly wages are measured with error, that is $w_{it}^{rep} = w_{it} \exp\{\upsilon_{it}^W\}$.[18] The log-wage equation which can be obtained from equation (2) by introducing measurement error and substituting the scalar s_{it} for the vector of cognitive and manual skills S_{it} is then:

$$\ln w_{it}^{rep} = l_{it}\beta_l + S_{it}\beta_s + xp_{it}\beta_{xp} + \alpha_i^W - \upsilon_{it}^W \tag{12}$$

where υ_{it}^W is measurement error independent from l_{it}, S_{it}, and xp_{it}. Further, substituting (10) into (12) we obtain

$$\ln w_{it}^{rep} = l_{it}^{rep}\beta_l + S_{it}\beta_s + xp_{it}\beta_{xp} + \alpha_i^W - \eta_i^L\beta_l + \varepsilon_{it}^W \tag{13}$$

where $\varepsilon_{it}^W = -\upsilon_{it}^W - \upsilon_{it}^L\beta_l$. As l_{it} is not independent from η_i^L and υ_{it}^L and, hence, the unobservable $-\eta_i^L\beta_l + \varepsilon_{it}^W$ of (13), using OLS will not yield consistent estimates. S_{it} may be correlated with α_i^W as it depends on both l_{it} (α_i^W and α_i^L may be correlated) and S_{i0}, which in turn likely depends on α_i^W. I use individual fixed effects to address the $\alpha_i^W - \eta_i^L\beta_l$ portion of the unobservables and instrumental variables to address the time-varying portion of the measurement error in language. Specifically, I use an indicator for whether the interview

[16] Distance to one's ESL provider affects travel costs in terms of time and money. Refugees may receive additional benefits such as public transit tickets to cover travel expenses. Further, they may experience pressure to attend ESL classes from their case-workers.

[17] Here $\hat{\varphi_{esl}} = \varphi_{esl} + \texttt{Cov}(esl_{it-1}, \alpha_i^L)/\texttt{Var}(esl_{it-1})$ and $\texttt{Cov}(esl_{it-1}, \alpha_i^L) < 0$ according to the model.

[18] Since the record of weekly wages and weekly hours is based on the self-reported values this assumption is rather reasonable.

was conducted in English and the number of the household members that are proficient in English as instruments. While the latter is only one of the variables in X^L_{it-1}, it is the only variable which is not correlated with other explanatory variables in (13). The direction of bias on β_l is difficult to sign *ex ante*: unobserved ability can cause an *over*estimation of the the effect, if α^W_i and α^L_i are positively correlated, while the measurement error in the language skill - an *under*estimation. Dustmann and Van Soest (2002) find that the returns to language a subject to a significant downward bias.

The final two equations which I need to estimate in order to obtain the returns to time spent in ESL courses are the skill transfer equations for cognitive and manual skills. Taking a log of equation (3) and rearranging terms, we obtain

$$\ln s^j_{i0} - \ln s^j_{it} = \tau^j_l(\bar{l} - l_{it}) \qquad , \tag{14}$$

where j indexes cognitive and manual skills (i.e., $j \in \{c, m\}$). Since language is measured with error described in equation (10), the equation which will be estimated is

$$\ln s^j_{i0} - \ln s^j_{it} = \tau^j_l(\bar{l} - l^{rep}_{it}) + \tau^j_l \eta^L_i + \tau^j_l \upsilon^L_{it} \tag{15}$$

Since l^{rep}_{it} is correlated with the error term $\tau^j_l \eta^L_i + \tau^j_l \upsilon^L_{it}$, estimation of this equation using OLS will yield biased estimates of τ^j_l for $j \in \{c, m\}$. As with the wage equation, to address this problem, I use the combination of fixed effects and instrumental variables (using an indicator for whether the interview was conducted in English and the number of the household members that are proficient in English as IV).

6 Estimation Results

6.1 Language Skill Evolution, Wage, and Skill Transfer Equations

In this section I present and discuss the estimates of parameters in equations (11), (13), and (15).

First, I estimate the language gains equation. In the full specification, X^L_{it-1} is represented by three variables: months between the interviews, the number of other household members who can speak English, and the immigrant's age at $t-1$. Months between the interviews relates to the "passive" learning outside of the ESL classroom due to exposure to English through media and day-to-day interactions. I expect the sign on this variable to be positive. The number of household members able to speak English is another measure of exposure to English. There are two ways in which household members' English ability can affect language acquisition. On one hand, having access to a household member who is proficient in English and is able to assist one with learning should have a positive effect on language acquisition. On the other hand, English-proficient individuals could act as translators for other members of the household reducing the exposure to the host-country language and the effort they may put into learning from daily activities. Therefore, no statement can be made regarding the sign of the coefficient prior to obtaining the estimates. Immigrant's age accounts for the fact that over the years people lose brain plasticity and, hence, language acquisition becomes a slower process. We would expect the sign on the lag of age to be negative.

Table 3 presents the estimated coefficients for the language evolution equation (11). For the ease of interpretation the ESL participation time has been standardized to six month intervals. The results in columns (1) through (4) present the estimates for the OLS models, while columns (5) through (8) cover the estimates obtained by using the generalized method of moments (GMM) procedure where the distance to the nearest ESL provider and the

Table 3: Estimates for the Language Skill Evolution Equation

Language Skill Gains	OLS				IV-GMM			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Time in an ESL Course	0.1761***	0.1734***	0.1719***	0.1721***	0.2976***	0.2953***	0.2911***	0.2910***
	(0.0171)	(0.0170)	(0.0169)	(.0169)	(0.0401)	(0.0403)	(0.0403)	(0.0403)
Months Between	–	0.0209**	0.0212**	0.0212**	–	0.0151*	0.0157*	0.0158*
Interviews	–	(0.0089)	(0.0089)	(0.0089)	–	(0.0091)	(0.0092)	(0.0092)
English-proficient HH	–	–	0.0213***	0.0224***	–	–	0.0187**	0.0206**
Members	–	–	(0.0083)	(0.0084)	–	–	(0.0083)	(0.0085)
Lag of Age	–	–	–	−0.0009	–	–	–	−0.0014
	–	–	–	(0.0017)	–	–	–	(0.0017)
N	–	–	–	–	–	–	–	–
R^2	0.0568	0.0586	0.0613	0.0614	0.0298	0.0316	0.0355	0.0357

Note 1: "Time in an ESL Course" is measured in full-time six month equivalents.

Note 2: IV-GMM specifications use the distance to the nearest ESL provider, refugee status, and sponsored family visa status as instruments for the "Time in an ESL Course" variable.

Note 3: Robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 4: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.

refugee and sponsored family visa status were used as instrumental variables.[19] For all specifications the signs of the coefficients are as expected: positive for ESL participation, the number of family members who can speak English, months between the interviews, and negative for the lag of age. The coefficients on the time spent in an ESL course estimated by OLS are lower than those estimated with the use of instrumental variables, indicating bias towards zero predicted in the previous section. I focus the discussion on the results for the specification (8), which is the preferred specification for this paper. The coefficient on the ESL course time is 0.291, meaning that increasing ESL participation time by six months yields a language skill gain of a 0.291 of a language skill standard deviation. An additional month's stay in Canada results in a 0.0158 standard deviations gain in the language skill. We can conclude that attending ESL courses is a more effective way of acquiring language skills than learning from the day-to-day activities. Family members who can speak English prove to be beneficial for language skill acquisition. While acquisition slows down with age based on the sign of the coefficient, the effect is small and statistically not different from zero.

Now that I have obtained an unbiased estimate φ_{esl}, I need to obtain an estimate of wage returns to language skills β_l. In what follows, I discuss the estimates for the equation (13) which was estimated using fixed effects and fixed effects with instrumental variables. I use measures of cognitive and manual skills discussed in Section 4.

The first column of Table 4 shows a pooled OLS model provided for comparison. The next two columns show the model estimated with fixed effects without correcting for the measurement error in language skill and with the use of instrumental variables to account for the measurement error. All coefficients change noticeably when moving from the OLS to

[19] I use GMM as there are three variables instrumenting for the time in ESL courses, so the model is over-identified. Furthermore, GMM estimators are a better choice if the model might have heteroscedastic errors. Baum, Schaffer, Stillman et al. (2003) contains a discussion on the subject. First stage estimates can be found in Appendix C.1.

Table 4: Estimates for the Log Wage Equation

Log of Hourly Real Wage	OLS	FE	IV-FE
Language Skill	0.0762***	−0.0010	0.1899**
	(0.0065)	(0.0140)	(0.0970)
Cognitive Skill	0.2104***	0.1299***	0.1279***
	(0.0061)	(0.0122)	(0.0122)
Manual Skill	0.0574***	0.0228**	0.0210*
	(0.0065)	(0.0113)	(0.0115)
Canadian Job Experience	0.0413***	0.0417***	0.0361***
	(0.0038)	(0.0026)	(0.0038)
Individual Effects	No	Yes	Yes
Instruments for Language	No	No	Yes
N	–	–	–
R^2	0.4324	0.4025	0.3646

Note 1: The IV-FE specification uses the number of household members who speak English and the indicator for whether the interview was conducted in English as instrumental variables.

Note 2: Clustered robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 3: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.

fixed effects estimation, reflecting the endogeneity of the occupational skills which are likely correlated with the unobserved ability. As anticipated, the coefficient on the language skill is statistically and economically insignificant in the fixed effects specification. This result is driven by the idiosyncratic portion of the measurement error. I use the number of members of the household who speak English which has been shown to be a significant determinant of language skill and an indicator set to one if the interview was conducted in English as instruments. The latter indicates that the individual was sufficiently comfortable with the interview to be conducted in language other than his or her native one.[20] Comparing the FE and FE-IV specifications we can see that the coefficient changes from −0.001 to 0.1899 and

becomes statistically significant when instrumenting for language skill.[21] An 18.99 percent increase in wages for a standard deviation increase in language skill is consistent with the previous literature finding significant wage gains from becoming proficient in the host-country language. Returns to cognitive and manual skills are positive and significant, indicating a 12.79 and 2.1 percent gain in real wages for a standard deviation increase in the corresponding skill. Consistently with earlier work, cognitive skill returns are larger than the manual skill returns. Canadian work experience also has a positive effect on wages.

Finally, I estimate the effect that immigrants' English-language skills and Canadian work experience have on the transfer of their pre-immigration skills. Table 5 shows the skill transfer equation estimation results for cognitive and manual skills. The first column for each skill shows the results using only the fixed effects estimator, while the second column shows the estimates using both fixed effects and instrumental variables estimation. There is a significant change in the coefficient reflecting the penalty for non-native proficiency for cognitive skills (the coefficient changes from 0.0774 to 0.6526 and its statistical significance increases). The coefficient implies that an individual who is 3 standard deviations below the near-native proficiency in English, for example, can use only 14.12 percent of their pre-immigration cognitive skills in the host-country job, and so on. For manual skills I do not find any evidence of language skills assisting in the skill transfer.[22] This is not a surprising finding if one considers the use of each of the skills on the job. The use of cognitive skills may include, for example, understanding and preparing documents, an activity which necessitates the knowledge of the host-country language. An immigrant who knows how to work with the same types of documents in his native language but has poor command of English will be unable to perform the task at hand. The use of manual skills, conversely, involves physical

[20] One of the advantages of LSIC is that the interviews were conducted in a language chosen by the interviewee.

[21] First stage estimates can be found in Appendix C.1

[22] First stage estimates for both cognitive and manual skills can be found in Appendix C.3.

Table 5: Estimates for the Skill Transfer Equations

Gap in Log-Skills	Cognitive Skills		Manual Skills	
	FE	IV-FE	FE	IV-FE
Language Gap	0.0774***	0.6526***	0.0361	−0.1211
	(0.0291)	(0.1774)	(0.0434)	(0.2082)
Individual Effects	Yes	Yes	Yes	Yes
Instruments for Language	No	Yes	No	Yes
N	–	–	–	–
R^2	0.0335	0.0335	0.0002	0.0002

Note 1: The skill levels have been shifted to be positive in order to take logs, with the standard deviation preserved.

Note 2: The IV-FE specification uses the number of household members who speak English and the indicator for whether the interview was conducted in English as instrumental variables.

Note 3: Robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note 4: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.

tasks, the successful completion of which does not require host-country language proficiency.

6.2 Returns to Attending ESL Courses

Now that all the key equations have been estimated and I have unbiased estimates of φ_{esl}, β_l, and τ_l^c, it is possible to calculate the impact of time spent in ESL courses on immigrant wages. As I find no evidence of language skills affecting the transfer of manual skills, I calculate the returns to ESL training accounting only for the increase in total return to language skills and the increase in the total return to cognitive skills. Consider the following

$$\frac{\partial \ln w_{it}}{\partial\, esl_{it-1}} = \frac{\partial \Delta \ln w_{it}}{\partial\, esl_{it-1}} = \frac{\partial \Delta \ln w_{it}}{\partial \Delta l_{it}} \cdot \frac{\partial \Delta l_{it}}{\partial\, esl_{it-1}} = (\beta_l + \tau_l^c\, \beta_s^c\, s_{i0}^c \exp\{-\tau_l^c(\bar{l} - l_{it})\}) \cdot \varphi_{esl} \quad (16)$$

That is, $\beta_l \cdot \varphi_{esl}$ is the effect of time spent in an ESL course on wage growth generated by the increase in the total return to the English-language skill. The whole expression in (16) describes the total effect which includes the return to skills transferred into the host-country economy due to the increase in the host-country language skill.

Given the estimates in Tables 3, 4, and 5, I calculate that attending an ESL course for six full-time equivalent months results in an 11.65 percent wage increase on average, with the standard deviation of 2.51 percent. The total return to language skills accounts for a 5.53 percent wage increase, while 6.12 percent of the increase in wages is the result of a larger proportion of the immigrants' cognitive skills being transferred into the host-country economy. This effect is heterogeneous in pre-immigration skills and the current language skill. To my knowledge, this is the first estimate of the impact of ESL attendance on immigrants' wage in the literature. By comparison, gaining an additional six months of host-country work experience increases the individuals wages by 3.61 percent. In line with the Chiswick and Miller (2003) finding regarding English proficiency acting as a substitute to Canadian work experience, I argue that ESL course attendance can act as a substitute for acquiring Canadian work experience for new immigrants.

The findings have high policy relevance, since the Canadian immigration policy selects individuals based on high cognitive skills but the outcomes of recent cohorts of immigrants have been declining. This decline has been attributed, in part, to the compositional shifts in language ability. As the present paper shows, a decline in language ability could have a two-fold negative effect on the labour market outcomes of immigrants: directly and through a reduction in the proportion of skills transferred to the Canadian economy. ESL courses are a potential channel through which new immigrants' outcomes can be improved; however, language programs across Canada have recently been subject to significant budget cuts.

7 Conclusion

In this paper I postulate a two-period model of immigrants' investment in language skills. Motivated by the recent literature on the transferability of immigrants' pre-immigration skills, I allow the language skill to affect the proportion of pre-immigration skills which enters the wage equation. I estimate the key equations of the model, language skill evolution, wage determination, and skill transfer, using the insights gained from the optimal solution to the theoretical model. I use instrumental variables to overcome the endogeneity inherent to the language evolution equation and fixed effects estimation with instrumental variables to address the endogeneity in the wage and skill transfer equations.

I find that time spent in ESL courses has an economically and statistically significant impact on the growth of immigrants' wages. There are three further contributions of the paper. First, I find that immigrants' host-country language skills play and important role in the transfer of pre-immigration cognitive skills into the economy; this is, however, not true for manual skills. Second, I use principal component analysis (PCA) to construct a continuous measure of English language skill from eight self-reported English-language proficiency measures. Previous studies have relied on dichotomous measures of language proficiency based on self-reported speaking proficiency. Such dichotomous variables would not be suitable for use in my study as I focus on the gradual increase in language skills. The third contribution is the use of Career Handbook data paired with the Canadian 2001 Census of Population in constructing occupational skills using PCA. Previous studies focusing on the returns to occupational skills note the use of US data, such as DOT and O*NET, as a potential caveat for examining the Canadian labour market outcomes if the skills within occupations with the same or similar names (hence, SOC 1991 to NOC code correspondences) differ between Canada and the US (Imai et al., 2016).

One of the limitations of the present study is the assumption that the return to a unit of

time spent in an ESL course in terms of language skill gains is the same for all individuals. It is possible that ESL instructors may distribute their in-class help according to students' ability, dedicating more resources to students who lag behind. However, it is also likely that students with higher language learning ability α_i^L progress through the course material faster, reaping higher returns per unit of time spent in the course. Unfortunately, estimation of the model in which the time spent in ESL courses is augmented by the unobserved language learning ability is precluded by data availability, as more than three periods of observations on language and ESL courses will be needed for identification. It may, admittedly, be possible to estimate marginal treatment effects (MTE) in a model with dichotomous ESL participation with essential heterogeneity in language skill returns. However, estimates from such framework would be unable to distinguish between ability and training intensity gains. I intend to explore this in future work.

Appendix A The LINC/EAL/ELSA Data Set

As there was no readily available data set including the addresses of LINC/EAL/ELSA providers for the time period from 2001 to 2003, I hand-collected the data. To collect the information on LINC programs I used the 2001-2002, 2002-2003, and 2003-2004 Public Accounts of Canada, Transfer Payments documents (under Citizenship and Immigration Canada: Language Instruction for Newcomers) for the names of organizations. Using the names of organizations I have recovered their postal codes from their websites where available or by using internet searches (if no website could be located). To obtain the information on ELSA programs, I used multiple 2002 and 2003 imprints of the *www.elsanet.org* using the *Internet Archive: Wayback Machine (https://archive.org/web/)* which contained the lists of all ELSA providers in British Columbia including their addresses. Finally, the data on EAL programs was provided at my request by Labour and Immigration Manitoba. The

postal codes of EAL providers were obtained using Google Maps when necessary. The result was a data set that included 368 locations of ESL course providers with multiple locations corresponding to the same provider in some cases (e.g., a school board offering ESL courses at several school campuses). The ESL providers' postal code data was then used in conjunction with the Postal Code Conversion File (PCCF) to match the postal codes with the latitude and longitude.

Appendix B Principle Component Analysis

B.1 Constructing the Measure of the Language Skill

As binary (or even three-level) speaking-proficiency-based measures of host-country language proficiency employed in previous studies are not suitable for examining the gradual acquisition of language skills, I construct a continuous measure of language skill by conducting principle component analysis (PCA) on the self-reported measures of English-language speaking, reading, and writing proficiencies and the responses to five additional questions related to speaking and comprehension abilities. I use the weights provided in LSIC to make the resulting factor representative of the new immigrant population in Canada in 2001. Therefore, the responses to questions related to language ability in Wave 1 are used to conduct the PCA and obtain factor loadings. These loadings are then used to construct the factor (language skill measure) for both Wave 1 and Wave 2. There is an underlying assumption that the factor loadings do not change over time. Given that approximately only a year and a half passes between the interviews the assumption is not unreasonable.

Speaking, reading, and writing proficiencies were reported on a five-point scale. The question in the LSIC survey asked: "How well can you speak/read/write (in) English?". The potential answers were: "cannot speak/read/write (in) this language," "poorly," "fairly well," "well," and "very well." I code the responses as ranging from "0" to "4" respectively.

Further five questions expanded on the comprehension and speaking ability:

1. How easy is it for you to tell someone in English what your address is?
2. How easy is it for you to tell someone in English what you did before immigrating to Canada?
3. How easy is it for you to understand a message in English over the telephone?
4. How easy is it for you to tell a doctor who speaks only English what the problem is?
5. How easy is it for you to ask someone who speaks only English to re-arrange a meeting with you?

Respondents had a choice between: "cannot do this," "can do this with a lot of help," "can do this with some help," and "can do this easily." I have assigned these responses values from 0 to 3 respectively.

Individuals identified as native speakers of English (those reporting English as their mother tongue and the language most spoken at home) were excluded from the sample. I first calculate a matrix of polychoric correlations (as the eight underlying variables are ordinal categorical variables). This matrix is then used to perform the principal component analysis. Table 6a presents the Eigenvalues and the proportion of variance of the variables accounted for by the underlying factor. As evident the first factor is sufficient to serve as a measure of English-language skill. Table 6b shows the factor loadings for the factor used as the language skill.

Table 6: PCA of English-Language Proficiencies

(a)

Factor	Eigenvalue	Proportion of Variance
Factor 1	6.9927	0.9699
Factor 2	0.2656	0.0368
Factor 3	0.0826	0.0115
Factor 4	−0.0047	−0.0006
Factor 5	−0.0130	−0.0018
Factor 6	−0.0293	−0.0041
Factor 7	−0.0401	−0.0056

(b)

Variable	Factor Loading
Speaking	0.9432
Reading	0.9192
Writing	0.9047
Ability Question 1	0.9391
Ability Question 2	0.9500
Ability Question 3	0.9466
Ability Question 4	0.9257
Ability Question 5	0.9499

B.2 Constructing the Measures of Cognitive and Manual Skills

I follow Yamaguchi (2012) by *a priori* assuming which attributes and tasks in the Career Handbook measure the level of the cognitive skill and which - of the manual skill. General learning ability, numerical ability, verbal ability, clerical perception, "data" and "people" task complexities correspond to the cognitive skill. Motor coordination, finger dexterity, manual dexterity, form perception, spatial perception, and the "things' task complexity correspond to the manual skill. All abilities are measured on a five-point scale. "1" corresponds to the ability of the lowest ten percent of the population, "2" - to the lowest third of the population excluding the lowest ten percent, "3" - to the middle third, "4" - to the top third excluding the top ten percent of the population, and "5" - to the the top ten percent of the population. Data, people, and things tasks were rescaled to a four-point scale, with "0" designating no significant use of the task and "1" through "3" designating increasing complexity of performed tasks. Weighted counts of occupations within the 2001 Canadian Census of Population are used to make the generated factors representative of the Cana-

dian native-born workers. Table 7a shows the eigenvalues and the proportion of variance accounted for by each of the first five factors in the cognitive skill group. Table 7b does the same for the manual skill group. The first factor for each group is retained to serve as the measure of the cognitive and manual skill respectively. This choice is consistent with the amount of variance in the variables accounted for by the first factor in each group. Table 8 shows the factor loadings for the variables in the cognitive and manual groups.

Table 7: PCA of Career Handbook Abilities and Tasks

(a) Cognitive Group

Factor	Eigenvalue	Proportion of Variance
Factor 1	4.0790	0.9770
Factor 2	0.2639	0.0632
Factor 3	0.0929	0.0223
Factor 4	−0.0241	−0.0058
Factor 5	−0.0985	−0.0236

(b) Manual Group

Factor	Eigenvalue	Proportion of Variance
Factor 1	3.0251	0.9101
Factor 2	0.5779	0.1739
Factor 3	0.1415	0.0426
Factor 4	−0.0593	−0.0178
Factor 5	−0.1373	−0.0413

Table 8: Factor Loadings for the Cognitive and Manual Skills

(a) Cognitive Group

Variable	Factor Loading
General Learning Ability	0.8996
Numerical Ability	0.8520
Verbal Ability	0.9224
Clerical Perception	0.6496
“Data” Tasks	0.8420
“People” Tasks	0.7497

(b) Manual Group

Variable	Factor Loading
Motor Coordination	0.7808
Finger Dexterity	0.6656
Manual Dexterity	0.7076
Spacial Perception	0.6408
Form Perception	0.7100
“Things” Tasks	0.7464

Appendix C First Stage Regressions

C.1 Language Evolution Equation

Table 9 presents the estimates from the first stage regressions for the language evolution equation shown in Table 3. The corresponding specifications are shown above each column. The coefficients on the instrumental variables (distance to the nearest ESL provider, refugee status, and sponsored family visa status) are highly significant and have expected signs.

Table 9: Estimates for for First Stage of the Language Skill Evolution Equation

Time in an ESL Course	(5)	(6)	(7)	(8)
Distance to the Nearest ESL Provider	-0.0010^{***}	-0.0010^{***}	-0.0010^{***}	-0.0010^{***}
	(0.0002)	(0.0002)	(0.0002)	(0.0002)
Refugee Status	1.0362^{***}	1.0293^{***}	1.0285^{***}	1.0273^{***}
	(0.0595)	(0.0593)	(0.0593)	(0.0592)
Sponsored Family Status	-0.0375	-0.0365	-0.0346	-0.0386
	(0.0311)	(0.0310)	(0.0314)	(0.0321)
Months Between Interviews	–	0.0454^{***}	0.0455^{***}	0.0455^{***}
	–	(0.0113)	(0.0113)	(0.0113)
English-proficient HH Members	–	–	0.0046	0.0012
	–	–	(0.0097)	(0.0100)
Lag of Age	–	–	–	0.0027
	–	–	–	(0.0018)
N	–	–	–	–
R^2	0.2016	0.2062	0.2063	0.2069

Robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.

C.2 Wage Equation

Table 10 presents the estimates from the first stage regression for the fixed effects instrumental variables log wage equation shown in Table 4. The coefficients on both instruments, the indicator for whether the interview was conducted in English and the number of household members who can speak English, are economically and statistically significant.

Table 10: Estimates for First Stage of the Log-Wage Equation

Language Skill	Coefficient	Standard Error
Interview Conducted in English	0.1587***	(0.0517)
English-proficient HH Members	0.0447**	(0.0178)
Cognitive Skill	0.0054	(0.0186)
Manual Skill	0.0095	(0.0199)
Canadian Job Experience	0.0170**	(0.0070)
Individual Effects	Yes	
N	–	
R^2	0.2398	
Robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$		
Note: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.		

C.3 Skill Transfer Equations

Table 11 presents the estimates from the first stage regression for the fixed effects instrumental variables skill transfer equation shown in Table 5. The coefficients on both instruments, the indicator for whether the interview was conducted in English and the number of household members who can speak English, are economically and statistically significant. Note that the regression for cognitive and manual skill transfer share the first stage, as the language gap is the only explanatory variable.

Table 11: Estimates for First Stage of the Skill Transfer Equations

Language Skill	Coefficient	Standard Error
Interview Conducted in English	-0.1543^{***}	(0.0504)
English-proficient HH Members	-0.0583^{***}	(0.0159)
Individual Effects	Yes	
N	–	
R^2	0.2009	

Robust standard errors in parenthesis; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Note: All models are unweighted, N is not displayed at present due to Statistics Canada RDC disclosure process.

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