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ABSTRACT

The Returns to Language Skills in the US Labor Market*

This paper uses data from the 2010 American Community Survey (ACS) to study the returns to language skills of child and adult migrants in the US labor market. We employ an instrumental variable strategy, which exploits differences in language acquisition profiles between immigrants from English- and non-English-speaking countries of origin, to address problems related to endogeneity and measurement error. We find significantly positive returns to language skills and demonstrate that education is an important channel through which language skills affect wages of child migrants. Although the returns of adult migrants do not depend on education, we find that child and adult migrants exhibit similar returns to language skills.

JEL Classification: F22, J24, J31

Keywords: international migration, language skills, labor productivity

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1 Introduction

Language skills have a strong impact on labor market outcomes and the integration of immigrants into the labor market of their destination countries (Chiswick and Miller, 1995). Recent immigrants from English-speaking source countries typically earn higher wages in the US labor market than comparable immigrants from non-English-speaking countries. However, language skills of immigrants from non-English-speaking countries may improve over the settlement process and these linguistic adjustments may generate wage growth.[1]

Although numerous studies provide evidence on the positive association between language skills and wages (see, e.g., Carliner, 1981; McManus et al., 1983; Kossoudji, 1988; Robinson, 1988; Tainer, 1988; Chiswick, 1991), we know relatively little about the returns to language skills. Unfortunately, the causal effect of language skills on wages cannot be identified by simple ordinary least squares (OLS) regression, because language skills and wages are both determined by unobserved individual ability. At the same time, self-reported language skill measures are prone to substantial measurement error. Recent studies have typically employed instrumental variables to identify the effect of language skills on wages (Chiswick and Miller, 1995; Angrist and Lavy, 1997; Dustmann and van Soest, 2002; Bleakley and Chin, 2004).

Our analysis uses the empirical strategy of Bleakley and Chin (2004) (BC from hereon) as a starting point and extends it in several directions. First, we generalise their approach by exploiting the relationship between immigrants' duration of residence in the host country and language skills to construct a new instrument, which allows us to identify the causal effect of language skills on wages of both child and adult migrants in the US labor market.[2] We study the relationship between our

[1] Figure 2b depicts the relationship between wages and duration of residence in the US by language region of origin.

[2] We define child migrants as foreign-born persons who arrived in the US between ages 0 and 17 years; adult migrants are defined as foreign-born persons who arrived in the US between ages 18 and 45 years.

approach and the one originally proposed by BC for a sample of child migrants. Second, we take into account that child and adult migrants accumulate human capital in different ways by analysing differences in the extent to which the effect of language skills on wages of child and adult migrants is mediated by education. Third, we study the role of thresholds for different durations of residence when constructing instrumental variables based on binary treatments and provide evidence on gender differences in the returns to language skills of child and adult migrants. Finally, we use a recent data source, the 2010 wave of the American Community Survey (ACS), to perform our analysis.

Studying the causal effect of language skills on wages of immigrants is highly relevant because languages constitute important barriers in the international labor market. Language barriers do not only affect international migration flows (Adsera and Pytlikova, 2012), but may also impede the economic integration of immigrants by contributing to labor market discrimination and segregation (Borjas, 2002; Hellerstein and Neumark, 2008). Unfortunately, we cannot simply assume that the returns to language skills of child and adult migrants are the same. While adult migrants typically make the decision to migrate after they have obtained a considerable part of their education in the country of origin, child migrants are brought to the US by their parents and typically receive most or all of their education in the US. Beck et al. (2012) show that the age at arrival of child migrants to the US affects educational outcomes and conclude that children experience migration differently from adults.

Using data from the 1990 Census, BC find a significantly positive effect of English-language skills on wages of individuals who arrived in the US as children. Their identification strategy is motivated by the psychobiological literature, which suggests that there is a critical age range in which children learn languages almost automatically (Newport, 2002). This relationship between language acquisition and age, which is referred to as "critical period hypothesis", explains their choice of an

instrumental variable that is based on differences in age at arrival effects between child migrants from English-speaking and non-English-speaking countries of origin.

In this paper, we study a modification of the instrumental variable proposed by BC to extend the analysis to adult migrants. Instead of using an instrumental variable based on age at arrival, we employ differences in the underlying duration of residence in the US between immigrants from English-speaking and non-English-speaking source countries. It appears likely that the duration of residence affects wages of immigrants through channels other than language, such as the accumulation of country-specific human capital (Chiswick, 1978). To isolate the part of the duration of residence that affects wages through the language channel, we use immigrants from English-speaking countries as a control group for immigrants from non-English-speaking countries. We exploit this variation by using the interaction between immigrants' duration of residence in the US and a dummy for non-English-speaking countries of origin as our identifying instrument.

Our findings reveal significantly positive returns to language skills and demonstrate that a considerable part of the effect on wages of child migrants is mediated by education, confirming the results of BC for the sample of child migrants. By contrast, the returns to language skills of adult migrants do not depend on education, which appears reasonable because most adult migrants were educated in their native language before they immigrated to the US. Despite differences in the relevance of language skills for investments in education, we find that differences in the returns to language skills between child and adult migrants are rather small and insignificant. Robustness checks indicate that the choice of age at arrival or duration of residence thresholds used to construct instrumental variables based on binary treatments does not affect our results significantly. We also find no significant differences in the returns to language skills between male and female workers.

The remainder of this paper is organised as follows. Section 2 explains our estimation strategy. Data and descriptive statistics are presented in Section 3. We

discuss the results in Section 4 and Section 5 concludes.

2 Language and Assimilation

Our empirical analysis utilises differences in assimilation profiles between immigrants from English-speaking and non-English-speaking countries of origin to obtain unbiased estimates of the effects of language skills on wages. While immigrants from English-speaking countries are fluent in English upon arrival in the US, immigrants from non-English-speaking countries are less likely to be fluent in English, but may improve their English skills over time. When compared to a reference point, we may expect that the two groups exhibit different assimilation profiles with regard to both language skills and wages. We exploit these differences to identify the causal effect of language skills on wages. A simple model of the relationship between wages and language skills constitutes the starting point of our analysis. Formally, let Y_i denote (the logarithm of) the annual wage of individual i, which is described by

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 N_i + \beta_3 L_i + X_i'\beta_4 + \eta_i, \quad (1)$$

where D_i denotes the duration of residence (or the age at arrival) of individual i in the US, N_i indicates whether individual i originated from an English-speaking country ($N_i = 0$) or a non-English-speaking country ($N_i = 1$), L_i is a measure of English-language skills, and X_i is a set of control variables. The error term η_i contains an unobserved wage component that is uncorrelated with D_i, N_i, and X_i.

Equation (1) implies that we may only obtain an unbiased ordinary least squares (OLS) estimate of the effect of language skills on wages if $E(\eta_i|L_i) = 0$, which is quite unlikely. On one hand, both wages and language skills may depend on unobserved ability, which may cause an upward bias of the OLS estimate. On the other hand, measurement error in the language skill measure is likely to cause a severe downward bias of the OLS estimate. Subjective measures of language skills

are prone to substantial degrees of measurement error (Charette and Meng, 1994, 1998; Dustmann and van Soest , 2001; de Coulon and Wolff, 2007) and differences between subjective and objective measures of language skills can be related to poor labor market outcomes (Akresh and Frank, 2011). In sum, we have to take into account the possibility that the conditional expectation of the error term is different from zero and that the OLS estimate of β_3 is biased, although the direction of the bias is a priori unclear.

We employ an instrumental variable (IV) strategy to address these issues, using the interaction term $D_i \cdot N_i$ as an instrument for language skills. The first stage equation of the IV approach relates language skills to the instrument and the set of control variables of equation (1):

$$L_i = \gamma_0 + \gamma_1 D_i + \gamma_2 N_i + \gamma_3 D_i \cdot N_i + X_i' \gamma_4 + \varepsilon_i. \quad (2)$$

By using the interaction between duration of residence (or age at arrival) and non-English-speaking country of origin as an instrument for English skills, we assume that the difference in assimilation profiles between English and non-English-speaking countries affects immigrants' wages exclusively through English skills. It is important to note that country-specific differences between migrants from English-speaking and non-English-speaking countries persist, even after differencing out non-linguistic factors of their years since migration (or age at arrival) profiles. Both child and adult migrants are affected by self-selection and selective immigration policies, although in different ways. While adult migrants have made the decision to migrate for themselves, the selection of child migrants is based on their parents' decision to migrate. For that reason, we follow BC and include country fixed effects (instead of N_i) in all our IV regressions. By using immigrants from English-speaking countries as a control group for immigrants from non-English-speaking countries of origin and controlling for country-of-origin fixed effects in our regression model, we are able to remove any non-linguistic factors from the duration of residence (or age

at arrival) profile. We therefore expect that the resulting variation in our instrument is orthogonal to the error term of equation (1).

Finally, if both D_i and N_i are dummy variables, then we may derive the population analog of the Wald estimator, which is identical to a two-stage least square (2SLS) estimator and may be written as

$$\beta_3 = \frac{[E(Y_{i11}) - E(Y_{i01})] - [E(Y_{i10}) - E(Y_{i00})]}{[E(L_{i11}) - E(L_{i01})] - [E(L_{i10}) - E(L_{i00})]}, \tag{3}$$

where $E(A_{ijk}) \equiv E(A_i|D_i = j, N_i = k)$. The numerator and denominator of equation (3) are the difference in difference estimators of annual wages and English ability, respectively.

In our empirical analysis, we will present a number of results for separate samples of child and adult migrants and modified versions of equations (1) to (3). Specifically, we will construct binary treatment and continuous instrumental variables based on age at arrival and years since migration to present difference in difference estimates of English ability and annual (log) wages and 2SLS estimates of the returns to language skills. We will further study the extent to which the effect of language skills on wages obtained from the 2SLS model is mediated by educational attainment.

3 Data

We use data from the 2006-2010 Public Use Microdata Sample (PUMS) American Community Survey (ACS). To avoid dealing with issues related to labor market dynamics during the Great Recession, we focus on the year 2010.[3] We restrict our analysis to foreign-born persons aged 25 to 55 years and distinguish between child migrants, who arrived in the US between ages 0 and 17 years, and adult migrants, who arrived between ages 18 and 45 years. The narrow age range excludes most

[3]Using data from the period 2006-2010 to perform a cross-sectional analysis does not affect our results qualitatively.

individuals in education and limits the duration of residence in the US to 55 years for child migrants and to 37 years for adult migrants. By excluding individuals above age 55 years, we also reduce problems related to early retirement. Taken together, our sample restrictions allow comparisons over an important part of the age-earnings profile of child and adult migrants.[4]

In addition to these restrictions, we remove 3,104 outliers (1,017 child migrants and 2,087 adult migrants) from our data by dropping the highest and lowest 1.5th percentile of the respective wage distributions of child and adult migrants because robustness checks indicate that the inclusion of these outliers has a considerable impact on our results. After deleting observations with missing values on language skills and wages, we obtain a sample of 125,027 immigrants. To implement our identification strategy, we distinguish between immigrants from English-speaking and non-English-speaking countries.[5] Following BC, we further exclude officially English-speaking countries if less than 50% of adult immigrants report English as their mother tongue.[6] Our sample of immigrants from non-English-speaking countries consists of 30,887 child and 66,558 adult migrants. We further observe 3,089 child and 6,194 adult migrants from English-speaking countries of origin. Table A1 illustrates the composition of the sample with regard to country of origin.

Table 1 contains summary statistics for child and adult migrants by age of arrival and language of origin. The numbers in Table 1 reveal a difference in language skills

[4]Our results are robust to changes in the lower and upper age bound of the sample. BC use a more restrictive sample in their analysis of child migrants. Specifically, they focus on child migrants aged 25 to 38 years and residing in the US between 16 and 30 years, but mention that their results are not sensitive to these particular sample restrictions. Using their sample restrictions does not change our results qualitatively.

[5]The list of English-speaking countries follows BC and includes (in alphabetical order): Antigua and Bermuda, Australia, Bahamas, Barbados, Belize, Bermuda, Canada, England, Grenada, Guyana, Ireland, Jamaica, Liberia, New Zealand, Northern Ireland, Scotland, South Africa, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, United Kingdom, West Indies, and Zimbabwe.

[6]The list of countries comprises American Samoa, Dominica, Fiji, Gambia, Ghana, Gibraltar, Guam, Hong Kong, India, Kenya, Kiribati, Malta, Marshall Islands, Mauritius, Micronesia, Nigeria, Pakistan, Palau, Papua New Guinea, Philippines, Senegal, Seychelles, Sierra Leone, Singapore, Tanzania, Tonga, Uganda, US Territory, Zambia, and the category "not specified". Including these countries as non-English-speaking countries in our analysis does not affect our results qualitatively.

between immigrants from English-speaking and non-English-speaking countries of origin. As expected, child migrants from non-English-speaking countries have better English skills than adult migrants. By construction of the sample, we observe large differences in age at arrival and years since migration between child and adult migrants from both regions. We further observe that immigrants from English-speaking countries are better educated than immigrants from non-English-speaking countries. In the sample of child migrants, differences in educational attainment between the two groups may arise from different language skills. Differences in educational attainment in the adult migrant sample are more likely to stem from immigrant selection processes because adult migrants typically receive their education in the country of origin. In our empirical analysis, we will examine the extent to which the effect of language skills on wages is mediated by education. Further control variables include the individual age, racial indicators for black and Asian or other non-white background and an indicator for hispanic origin.

Figures 1 and 2 illustrate the patterns that we exploit to generate our instrumental variables. Figure 1a depicts the relationship between age at arrival of child migrants and our measure of English skills. We observe that the English skill measure of child migrants from English-speaking countries is almost fixed at the highest level (3=very well), while it is lower for child migrants from non-English-speaking countries and strongly decreasing with increasing age at arrival. This observation is consistent with previous findings by BC and the linguistically-based critical period hypothesis. The difference in the relationship between age at arrival and English ability of child migrants motivates the identification strategy of BC.

Figure 1b shows how differences in language skills between child migrants from English-speaking and non-English-speaking countries are translated into wage differentials. We observe that wages of immigrants from English-speaking countries are considerably higher than those of immigrants from non-English-speaking countries. For both groups, wages decline as age at arrival increases. However, the wage

decline is stronger for child migrants from non-English-speaking countries, and as a result the wage gap is larger at higher ages of entry. BC argue that the difference in the variation in wages across the age at arrival distribution between the two groups is entirely due to English ability. Figures 1c and 1d present differences in means between child migrants from English-speaking and non-English-speaking countries and specify the corresponding 95% confidence intervals, which indicate that the differences are significant along the entire age at arrival distribution.

We extend the underlying mechanisms of the identification strategy of BC into the realm of assimilation. Specifically, we consider the relationship between English ability and duration of residence in the US to derive an empirical strategy that allows us to estimate the returns to language skills of adult migrants. Figure 2a depicts the relationship between English ability and duration of residence in the US for our sample of adult migrants. The profiles of adult migrants from English-speaking and non-English-speaking countries reveal that language skills improve over the settlement process. Similar to Figure 1a, we observe that English ability of adult migrants from English-speaking countries is almost fixed at the highest level, whereas language skills of adult migrants from non-English-speaking countries increase with increasing duration of residence in the US without ever reaching the level of native speakers.

The convergence in English skills presented in Figure 2a is translated into a convergence of wages between adult migrants from English-speaking and non-English-speaking countries (Figure 2b). Figures 2c and 2d confirm that the differences in means are significant along the entire duration of residence distribution. Although both groups exhibit an upward-sloping wage profile over the duration of residence in the US, adult migrants from non-English-speaking countries start with a larger wage disadvantage and experience a steeper increase in wages over time. While the wage differential between adult migrants from English-speaking and non-English-speaking countries is a result of differences in source country characteristics and se-

lection mechanisms, we may difference out non-linguistic factors by using differences in assimilation profiles between the two groups to construct an instrumental variable for language skills of adult migrants. As described in Section 2, we will control for country origin fixed effects in all our IV regressions to account for country-specific differences that could affect the linguistic part of the assimilation profiles.

4 Results

Table 2 presents the difference in difference estimates of the numerator and the denominator of equation (3) for different samples of child and adult migrants and different treatment and outcome variables. Panel A of Table 2 includes the treatment effects for the sample restriction employed by BC (child migrants from selected countries of origin between ages 25 and 38 years residing in the US between 16 and 30 years). After removing outliers from our data by dropping the highest and lowest 1.5th percentile of the wage distribution and after deleting observations with missing values on language skills and wages, the restricted sample of child migrants in the ACS includes 12,713 observations.[7]

Panel A of Table 2 includes the treatment effects of a treatment based on age at arrival between 0 and 11 years, which is consistent with the definition of BC. The coefficients of the interaction term in Columns (1) to (4) indicate that early arrival increases English ability both along the cumulative distribution (Columns (1) to (3)) and is higher on the ordinal scale of the English ability measure (Column (4)). Column (5) further reveals that the wage differential between early and late arrival from English-speaking-countries minus the difference between early and late arrivals from non-English-speaking countries is significantly positive. The estimates presented in Panel A do not differ much from those of BC, suggesting that the underlying relationships between the variables of interest have not changed over the last two

[7]Our restricted sample of child migrants is considerably smaller than the 1990 Census sample of BC because the ACS is designed as a rolling cross-section and sample sizes of yearly data collections are smaller than those of previous US Censuses.

decades.

Panel B of Table 2 includes the estimates of the full sample of child migrants (aged 25 to 55 years), which do not differ substantially from the estimates presented in Panel A. In Panel C, we replace the treatment variable by an interaction between an indicator variable for a duration of residence above the sample average and an indicator for non-English-speaking countries of origin. We choose the sample average of the duration of residence as a threshold for the duration of residence indicator because sample averages differ considerably for child and adult migrants (see Table 1).[8] The estimates in Panel C of Table 2 indicate that more established immigrants exhibit higher English skills, although the treatment effects on English ability are smaller than in Panels A and B, which is in line with the relatively slow convergence of English ability over the settlement process (see Figures 1a and 2a). At the same time, the treatment effect on wages does not differ significantly from the treatment effects presented in Panels A and B.

Using a treatment variable based on years since migration allows us to extend the empirical analysis to adult migrants. The treatment effect estimates for the full sample of adult migrants, which are presented in Panel D of Table 2, indicate that the difference in difference estimates between more and less established adult migrants from non-English and English-speaking countries are positive, although not increasing along the cumulative English ability distribution, suggesting that the treatment effects are more important for speaking English "Well or Very Well" than for speaking English "Very Well". We further observe that the treatment effect on wages is slightly smaller, although not significantly different from the corresponding treatment effect presented in Panel C.

Table 3 presents the IV estimates for the full sample of child migrants.[9] The first

[8]Table A2 in the Appendix includes the estimates obtained from different underlying age at arrival and duration of residence thresholds around the respective sample averages. The estimates of our preferred model specifications (Panels A and C of Table A2) are remarkably stable, while the results vary significantly across thresholds if we apply an instrument based on years since migration to the sample of child migrants (Panel B).

[9]The identifying instruments are highly significant in all specifications. The Kleibergen-Paap

two columns in Panel A of Table 3 include the estimated parameters of different specifications of the first stage regression. Similar to BC, we estimate a model with a control variable for age at arrival and another one with age at arrival fixed effects, which does not affect our results qualitatively. The estimates confirm the negative effect of the instrument based on age at arrival on English ability. The OLS estimates presented in Columns (3) and (4) indicate that an increase in the English ability measure by one unit increases wages by about 20%. However, the second stage estimates in Columns (5) and (6) reveal a considerable downward bias in the OLS estimates and suggest that the wage increase induced by a one unit increase in the English ability measure is about 30%. These results confirm the findings of BC who demonstrate that the OLS estimates suffer from substantial downward bias due to measurement error, which sets off the smaller upward bias resulting from endogeneity.

Panel B of Table 3 includes the estimates for the instrumental variable based on years since migration. The estimates of the first stage regression (Columns (1) and (2)) are significantly positive, reflecting that English ability improves over the settlement process. In contrast to Panel A, the second stage estimates (presented in Columns (5) and (6)) are much higher when we use years since migration instead of age at arrival to construct the instrumental variable. The difference between the second stage estimates presented in Panels A and B may be attributed to different age-earnings profiles between child migrants from English and non-English-speaking countries (note that *age at arrival* = *age* − *years since migration*). Specifically, the increase in the second stage estimates in Panel B reflects that child migrants from English-speaking countries exhibit a steeper age-earnings profile than child migrants from non-English-speaking countries.[10] For that reason, we obtain second stage results that are similar to those of Panel A when we control for differences in age effects

statistic clearly exceeds the critical values of Stock and Yogo (2005) in all cases.

[10]Separate linear regressions of log annual wages on age, age squared, and the control variables of the regressions presented in Table 3 confirm that child migrants from English-speaking countries have a steeper age-earnings profile than child migrants from non-English-speaking countries.

between child migrants from English-speaking and non-English-speaking countries of origin (Panel C). Overall, these estimates suggest that our new instrument based on years since migration appears to have the expected properties, even though we are unable to test its validity.

Table 4 includes the IV estimates for the sample of adult migrants, using our instrumental variable based on years since migration. The estimates in Panel A of Table 4 reveal that differences in the returns to language skills between child and adult migrants are rather small and not significant. The estimates in Panel B, which account for differences in age effects between adult migrants from English and non-English-speaking countries of origin, further suggest that the age-earnings profiles of adult migrants do not differ much across regions of origin. As a result, differences in the second stage estimates between Panels A and B of Table 4 are also insignificant.[11]

Although our findings suggest that the returns to language skills between child and adult migrants are about the same, we have reason to expect that the channels through which language skills affect wages of child and adult migrants are very different. In particular, child migrants typically receive their education in the destination country, while adult migrants typically receive their education abroad. Consequently, it seems reasonable to expect that a considerable part of the effect of language skills on wages of child migrants is mediated by education, while the contribution of education to the effect of language skills on wages of adult migrants should be very small. The estimates in Table 5 confirm this hypothesis. Specifically, we use the IV estimates from Column (6), Panel A of Tables 1 and 2 as base results and compare them to a model in which we include years of schooling and years of schooling fixed effects, respectively.[12] After controlling for education, the

[11]Since the results presented in Tables 3 and 4 are not necessarily the same for male and female workers, we also study gender differences in the returns to language skills. The results, which are presented in Table A3, suggest that differences in the returns to language skills between male and female workers are insignificant.

[12]Years of schooling are computed from individual responses on the highest degree. We use a modified version of the definition proposed by Jaeger (1997) because categories in the ACS are

IV estimates of child migrants are considerable smaller, while the IV estimates of adult migrants are almost unchanged. We find that education explains between 26.4 and 46.6% of the effect of language skills on wages of child migrants, and contributes between −3.0 and 6.3% to the effect of language skills on wages of adult migrants. Overall, these findings indicate that the returns to language skills of child and adult migrants in the US labor market are about the same, although the channels through which language skills affect the wages of the two groups are very different.

5 Conclusions

Studying the causal effect of language skills on wages of immigrants is highly relevant because immigration is an important barrier in the international labor market that may affect the economic integration of immigrants by contributing to labor market discrimination and segregation. Estimating the causal effect of language skills on wages is challenging, not only because unobserved individual-specific characteristics (such as ability) typically affect both language skills and wages of foreign-born workers, but also because subjective language skill measures typically suffer from severe measurement error. BC propose a convincing instrumental variable strategy that allows them to estimate the effect of English-language skills on wages of child migrants in the US. Unfortunately, we cannot simply assume that the returns to language skills of child migrants are representative for the population of foreign-born workers in the US labor market, especially because it is reasonable to expect that language skills play a very different role in the integration process of child and adult migrants.

slightly different from those of the 1990 Census used by Jaeger (1997). Specifically, we employ the following definition: No schooling completed = 0, Nursery school to grade 4 = 4, Grade 5 or grade 6 = 6, Grade 7 or grade 8 = 8, Grade 9 = 9, Grade 10 = 10, Grade 11 = 11, 12th grade, no diploma = 12, High school graduate = 12, Some college, but less than 1 year = 13, One or more years of college, no degree = 13, One or more years of college, no degree = 14, Associate's degree = 14, Bachelor's degree = 16, Master's degree = 18, Professional school degree = 18, Doctorate degree = 18.

Against this background, we use data from the 2010 wave of the American Community Survey (ACS) and exploit the relationship between immigrants' duration of residence in the host country and the language spoken in the country of origin to construct a new instrument, which allows us to identify the causal effect of language skills on wages of both child and adult migrants in the US labor market. We further study the extent to which the effect of language skills on wages of child and adult migrants is mediated by education.

Our findings reveal significantly positive returns to language skills and demonstrate that a considerable part of the effect of language skills on wages of child migrants is mediated by education. Although the returns to language skills of adult migrants do not depend on education, differences in the returns to language skills between child and adult migrants are insignificant. The instrumental variable proposed in this paper permits an analysis of the effect of language skills on other relevant outcome variables beyond the group of child migrants (see Bleakley and Chin, 2010).

Tables and Figures

Table 1: Descriptive Statistics

	Non-English-Speaking Countries			English-Speaking Countries		
	Overall (1)	Arrived Aged 0-17 (2)	Arrived Aged 18-45 (3)	Overall (4)	Arrived Aged 0-17 (5)	Arrived Aged 18-45 (6)
Log annual wages	10.152	10.284	10.092	10.591	10.592	10.590
	(0.771)	(0.747)	(0.775)	(0.778)	(0.732)	(0.801)
English-speaking ability:						
Ordinal measure (scale of 0 to 3, 3=best)	1.989	2.417	1.795	2.974	2.981	2.971
	(1.008)	(0.860)	(1.011)	(0.193)	(0.179)	(0.200)
Speaks English not at all (0)	0.091	0.040	0.115	0.001	0.000	0.001
	(0.288)	(0.195)	(0.319)	(0.024)	(0.022)	(0.024)
Speaks English not well (1)	0.240	0.129	0.291	0.004	0.005	0.004
	(0.427)	(0.336)	(0.454)	(0.067)	(0.071)	(0.065)
Speaks English well (2)	0.256	0.205	0.280	0.015	0.008	0.019
	(0.437)	(0.404)	(0.449)	(0.121)	(0.089)	(0.135)
Speaks English very well (3)	0.412	0.625	0.315	0.980	0.987	0.976
	(0.492)	(0.484)	(0.464)	(0.140)	(0.115)	(0.152)
Control variables:						
Age at arrival	21.539	10.539	26.558	21.436	8.978	28.014
	(9.723)	(5.451)	(6.612)	(11.007)	(5.357)	(6.690)
Years since migration	17.499	26.112	13.570	19.861	30.386	14.303
	(10.482)	(9.856)	(8.149)	(12.037)	(10.569)	(8.546)
Age	39.035	36.639	40.128	41.291	39.350	42.317
	(8.382)	(8.286)	(8.197)	(8.365)	(8.697)	(7.997)
White	0.059	0.048	0.064	0.451	0.499	0.426
	(0.235)	(0.214)	(0.244)	(0.498)	(0.500)	(0.495)
Black	0.535	0.541	0.533	0.453	0.402	0.480
	(0.499)	(0.498)	(0.499)	(0.498)	(0.490)	(0.500)
Asian or other nonwhite race	0.406	0.411	0.403	0.096	0.099	0.094
	(0.491)	(0.492)	(0.491)	(0.294)	(0.299)	(0.292)
Hispanic	0.628	0.662	0.613	0.013	0.017	0.010
	(0.483)	(0.473)	(0.487)	(0.111)	(0.128)	(0.101)
Female	0.417	0.426	0.412	0.510	0.533	0.498
	(0.493)	(0.495)	(0.492)	(0.500)	(0.499)	(0.500)
Schooling variables:						
Years of schooling	11.826	12.259	11.628	14.286	14.357	14.248
	(4.140)	(3.634)	(4.337)	(2.603)	(2.318)	(2.741)
Completed high school	0.672	0.727	0.647	0.943	0.964	0.932
	(0.470)	(0.446)	(0.478)	(0.231)	(0.186)	(0.251)
Completed college	0.237	0.234	0.239	0.427	0.421	0.431
	(0.425)	(0.423)	(0.426)	(0.495)	(0.494)	(0.495)
Number of observations	97,445	30,887	66,558	9,283	3,089	6,194

Note: Weighted numbers based on weights provided by the ACS. Standard deviations in parentheses. Sample restrictions: age 25-55 years, age at arrival $\leq$ 45 years; the samples do not include the highest and lowest 1.5th percentile of the respective wage distributions of child and adult migrants.

Figure 1: English ability and wages of child migrants by age at arrival
(3-year moving average)

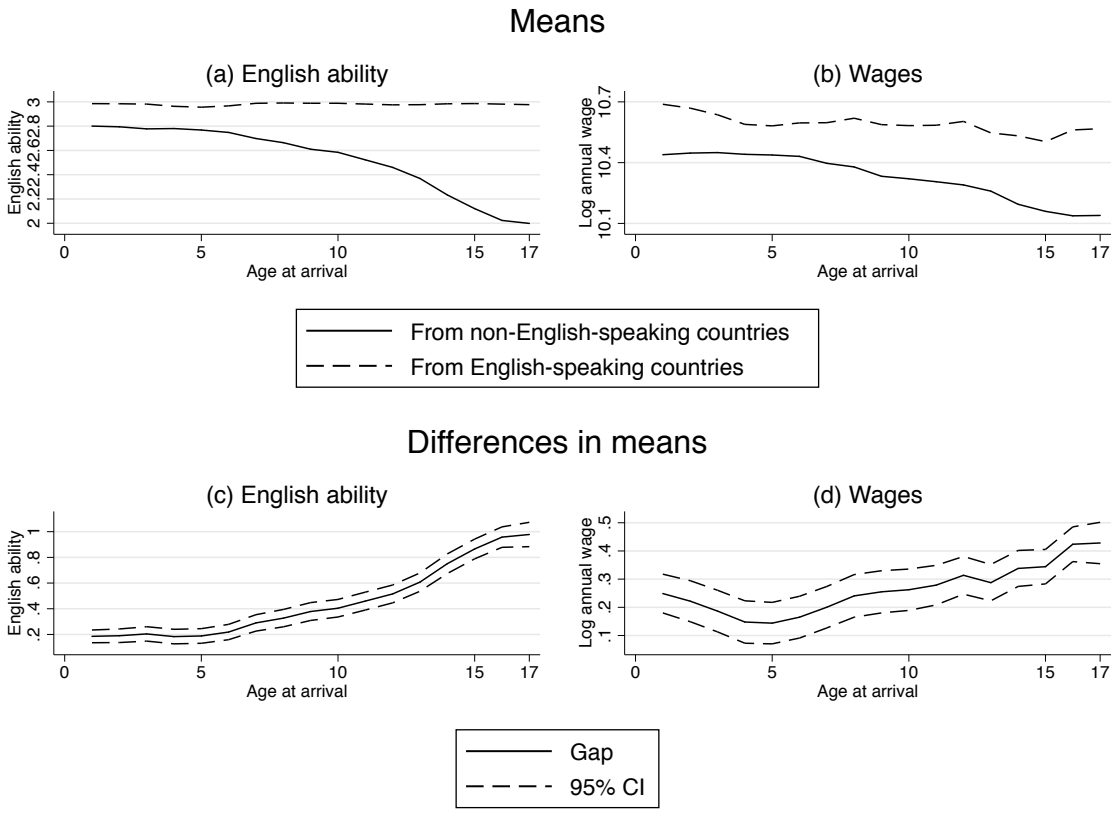

Figure 2: English ability and wages of adult migrants by years since migration (3-year moving average)

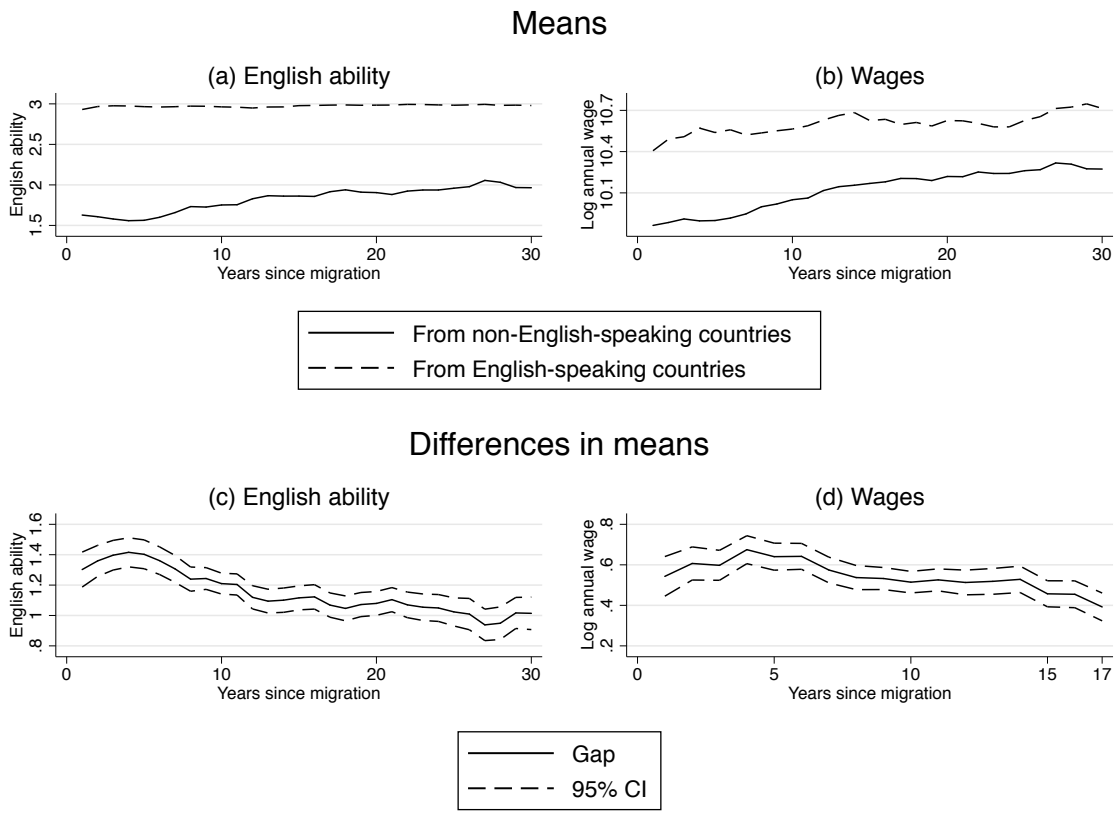

Table 2: Difference in differences with binary treatment variable

	Speaks English Not Well, Well, or Very Well (1)	Speaks English Well or Very Well (2)	Speaks English Very Well (3)	English Ability Ordinal Measure (4)	Log Annual Wages (5)
Panel A. Child migrants, restricted sample, treatment based on age at arrival					
(Arrived young) × (non-English speaking country of birth)	0.031***	0.130***	0.259***	0.420***	0.132**
	(0.005)	(0.011)	(0.019)	(0.027)	(0.065)
Arrived young (aged 0 to 11)	-0.003	-0.013*	-0.007	-0.023	0.026
	(0.003)	(0.007)	(0.016)	(0.021)	(0.063)
Non-English-speaking country of birth	-0.018***	-0.108***	-0.302***	-0.429***	-0.179***
	(0.004)	(0.010)	(0.020)	(0.026)	(0.059)
Adjusted R-squared	0.027	0.100	0.182	0.168	0.103
Number of observations	12,713	12,713	12,713	12,713	12,713
Panel B. Child migrants, full sample, treatment based on age at arrival					
(Arrived young) × (non-English speaking country of birth)	0.033***	0.157***	0.300***	0.490***	0.179***
	(0.003)	(0.006)	(0.009)	(0.014)	(0.033)
Arrived young (aged 0 to 11)	0.001	0.002	0.016**	0.019**	0.018
	(0.001)	(0.004)	(0.007)	(0.010)	(0.031)
Non-English-speaking country of birth	-0.018***	-0.111***	-0.312***	-0.441***	-0.176***
	(0.002)	(0.005)	(0.010)	(0.014)	(0.028)
Adjusted R-squared	0.030	0.121	0.223	0.204	0.137
Number of observations	33,976	33,976	33,976	33,976	33,976
Panel C. Child migrants, full sample, treatment based on years since migration					
(Established migrant) × (non-English speaking country of birth)	0.025***	0.077***	0.123***	0.225***	0.129***
	(0.003)	(0.006)	(0.009)	(0.015)	(0.033)
Established migrant (years since migration above sample average)	0.006**	0.045***	0.134***	0.185***	0.064*
	(0.003)	(0.006)	(0.009)	(0.015)	(0.033)
Non-English-speaking country of birth	-0.015***	-0.072***	-0.223***	-0.310***	-0.158***
	(0.002)	(0.005)	(0.009)	(0.014)	(0.029)
Adjusted R-squared	0.026	0.091	0.159	0.150	0.130
Number of observations	33,976	33,976	33,976	33,976	33,976
Panel D. Adult migrants, full sample, treatment based on years since migration					
(Established migrant) × (non-English speaking country of birth)	0.070***	0.110***	0.042***	0.222***	0.113***
	(0.003)	(0.005)	(0.007)	(0.011)	(0.023)
Established migrant (years since migration above sample average)	0.013***	0.044***	0.062***	0.119***	0.081***
	(0.002)	(0.004)	(0.006)	(0.009)	(0.023)
Non-English-speaking country of birth	-0.054***	-0.208***	-0.460***	-0.723***	-0.325***
	(0.002)	(0.004)	(0.006)	(0.010)	(0.018)
Adjusted R-squared	0.066	0.176	0.230	0.240	0.168
Number of observations	72,752	72,752	72,752	72,752	72,752

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. Sample restrictions: the full sample of child migrants (Panel B & C) is restricted to age 25-55 years and age at arrival < 18 years; the full sample of adult migrants (Panel D) is restricted to age 25-55 years and age at arrival ≥ 18 years; the full samples of child and adult migrants do not include the highest and lowest 1.5th percentile of the respective wage distributions; the restricted sample of child migrants (Panel A) is based on the full sample of child migrants and restricted to years since migration 16-25 and age 25-38 years. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 3: Effect on log annual wages: child migrants

	English Ability		Log Annual Wages			
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	2SLS (5)	2SLS (6)
Panel A. Instrument based on age at arrival						
Endogenous regressor:						
English-speaking ability			0.198***	0.194***	0.294***	0.307***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.072)	(0.070)
Identifying instrument:						
max(0, age at arrival − 11) × non-	-0.108***	-0.110***				
English-speaking country of birth	(0.003)	(0.003)				
Controls:						
max(0, age at arrival − 11)	0.000		-0.017***		-0.007	
	(0.002)		(0.002)		(0.007)	
Age-at-arrival dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.260	0.265	0.205	0.207		
Number of observations	33,976	33,976	33,976	33,976	33,976	33,976
Panel B. Instrument based on years since migration						
Endogenous regressor:						
English-speaking ability			0.195***	0.191***	0.589***	0.453***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.114)	(0.138)
Identifying instrument:						
Years since migration × non-	0.014***	0.012***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.030***		0.009***		-0.008*	
	(0.001)		(0.001)		(0.005)	
Year since migration dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.253	0.259	0.206	0.210		
Number of observations	33,976	33,976	33,976	33,976	33,976	33,976
Panel C. Instrument based on years since migration, controlling for age effects						
Endogenous regressor:						
English-speaking ability			0.195***	0.191***	0.328***	0.280***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.067)	(0.072)
Identifying instrument:						
Years since migration × non-	0.046***	0.044***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.000		0.009***		0.003	
	(0.001)		(0.001)		(0.003)	
Year since migration dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.257	0.263	0.207	0.210		
Number of observations	33,976	33,976	33,976	33,976	33,976	33,976

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. See note to Table 2 for sample restrictions. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 4: Effect on log annual wages: adult migrants

	English Ability		Log Annual Wages			
	OLS (1)	OLS (2)	OLS (3)	OLS (4)	2SLS (5)	2SLS (6)
Panel A. Instrument based on years since migration						
Endogenous regressor:						
English-speaking ability			0.202***	0.200***	0.329***	0.330***
(scale of 0 to 3, 3=best)			(0.004)	(0.004)	(0.073)	(0.074)
Identifying instrument:						
Years since migration × non-	0.019***	0.019***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.016***		0.012***		0.008***	
	(0.001)		(0.001)		(0.003)	
Year since migration dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.330	0.332	0.267	0.270		
Number of observations	72,752	72,752	72,752	72,752	72,752	72,752
Panel B. Instrument based on years since migration, controlling for age effects						
Endogenous regressor:						
English-speaking ability			0.202***	0.200***	0.262***	0.248***
(scale of 0 to 3, 3=best)			(0.004)	(0.004)	(0.051)	(0.052)
Identifying instrument:						
Years since migration × non-	0.035***	0.034***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.002***		0.012***		0.010***	
	(0.001)		(0.001)		(0.002)	
Year since migration dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.331	0.333	0.267	0.270		
Number of observations	72,752	72,752	72,752	72,752	72,752	72,752

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. See note to Table 2 for sample restrictions. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table 5: Effect on log annual wages, controlling for years of schooling

	Child Migrants			Adult Migrants		
	Base result			Base result		
	(1)	(2)	(3)	(4)	(5)	(6)
Endogenous regressor:						
English-speaking ability	0.307***	0.164*	0.226**	0.330***	0.340***	0.309***
	(0.070)	(0.087)	(0.100)	(0.074)	(0.070)	(0.069)
Controls:						
Years of schooling		0.059***			0.026***	
		(0.008)			(0.006)	
Dummies for years of schooling		No	Yes		No	Yes
Contribution of years of schooling		46.6%	26.4%		-3.0%	6.3%
Number of observations	33,976	33,976	33,976	72,752	72,752	72,752

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. See note to Table 2 for sample restrictions. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

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Table A1: Sample composition by country of origin

Non-English-Speaking Countries								
Total			Child Migrants			Adult Migrants		
Country	Obs.	Freq.	Country	Obs.	Freq.	Country	Obs.	Freq.
Mexico	36,516	37.47%	Mexico	13,425	43.46%	Mexico	23,091	34.69%
China	5,259	5.40%	Vietnam	1,854	6.00%	China	4,537	6.82%
Vietnam	4,745	4.87%	El Salvador	1,263	4.09%	El Salvador	2,900	4.36%
El Salvador	4,163	4.27%	Korea	1,171	3.79%	Vietnam	2,891	4.34%
Korea	2,826	2.90%	Cuba	1,105	3.58%	Guatemala	1,741	2.62%
Cuba	2,609	2.68%	Dominican Republic	777	2.52%	Korea	1,655	2.49%
Dominican Republic	2,405	2.47%	China	722	2.34%	Dominican Republic	1,628	2.45%
Guatemala	2,373	2.44%	Guatemala	632	2.05%	Cuba	1,504	2.26%
Colombia	2,066	2.12%	Colombia	563	1.82%	Colombia	1,503	2.26%
Haiti	1,789	1.84%	Haiti	514	1.66%	Haiti	1,275	1.92%
Other	32,694	33.55%	Other	8,861	28.69%	Other	23,833	35.81%
Total	97,445	100.00%		30,887	100.00%		66,558	100.00%
English-Speaking Countries								
Total			Child Migrants			Adult Migrants		
Country	Obs.	Freq.	Country	Obs.	Freq.	Country	Obs.	Freq.
Canada	2,293	24.70%	Canada	837	27.10%	Canada	1,456	23.51%
Jamaica	2,093	22.55%	Jamaica	795	25.74%	Jamaica	1,298	20.96%
England	926	9.98%	England	365	11.82%	UK, Not Specified	664	10.72%
Guyana	889	9.58%	Guyana	317	10.26%	Guyana	572	9.23%
UK, Not Specified	827	8.91%	UK, Not Specified	163	5.28%	England	561	9.06%
Ireland	331	3.57%	Barbados	69	2.23%	Ireland	276	4.46%
South Africa	271	2.92%	Ireland	55	1.78%	South Africa	221	3.57%
Australia	264	2.84%	Belize	54	1.75%	Australia	214	3.45%
Liberia	207	2.23%	Bahamas	52	1.68%	Liberia	169	2.73%
Barbados	167	1.80%	South Africa	50	1.62%	Barbados	98	1.58%
Other	1,015	10.93%	Other	332	10.75%	Other	665	10.74%
Total	9,283	100.00%		3,089	100.00%		6,194	100.00%

Note: Numbers based on detailed place of birth codes provided by the ACS. The largest ten countries in each sample are reported. See note to Table 2 for sample restrictions.

Table A2: Treatment and IV effects using different thresholds

	Treatment Effects		IV
	English Ability Ordinal Measure	Log Annual Wages	Log Annual Wages
Panel A. Child migrants, full sample, treatment/IV based on age at arrival			
(Arrived young (before age 5)) ×	0.407***	0.181***	0.444***
(non-English-speaking country of birth)	(0.016)	(0.035)	(0.087)
Number of observations	33,976	33,976	33,976
(Arrived young (before age 10)) ×	0.478***	0.191***	0.399***
(non-English-speaking country of birth)	(0.014)	(0.032)	(0.067)
Number of observations	33,976	33,976	33,976
(Arrived young (before age 15)) ×	0.479***	0.187***	0.390***
(non-English-speaking country of birth)	(0.018)	(0.045)	(0.093)
Number of observations	33,976	33,976	33,976
Panel B. Child migrants, full sample, treatment/IV based on years since migration			
(Established migrant (YSM $\geq$ 20)) ×	0.290***	0.096**	0.331**
(non-English speaking country of birth)	(0.017)	(0.042)	(0.145)
Number of observations	33,976	33,976	33,976
(Established migrant (YSM $\geq$ 25)) ×	0.232***	0.138***	0.593***
(non-English speaking country of birth)	(0.015)	(0.034)	(0.147)
Number of observations	33,976	33,976	33,976
(Established migrant (YSM $\geq$ 30)) ×	0.258***	0.156***	0.605***
(non-English speaking country of birth)	(0.015)	(0.032)	(0.126)
Number of observations	33,976	33,976	33,976
Panel C. Adult migrants, full sample, treatment/IV based on years since migration			
(Established migrant (YSM $\geq$ 5) ×	0.271***	0.126***	0.463***
(non-English speaking country of birth)	(0.017)	(0.035)	(0.128)
Number of observations	72,752	72,752	72,752
(Established migrant (YSM $\geq$ 10) ×	0.242***	0.109***	0.452***
(non-English speaking country of birth)	(0.012)	(0.025)	(0.101)
Number of observations	72,752	72,752	72,752
(Established migrant (YSM $\geq$ 15) ×	0.221***	0.119***	0.539***
(non-English speaking country of birth)	(0.011)	(0.023)	(0.106)
Number of observations	72,752	72,752	72,752

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. See note to Table 2 for sample restrictions. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.

Table A3: Returns to language skills by gender

	Men			Women		
	English ability	Log. annual wages		English ability	Log. annual wages	
	OLS	OLS	2SLS	OLS	OLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Child migrants, instrument based on age at arrival						
Endogenous regressor:						
English-speaking ability		0.181***	0.318***		0.219***	0.326***
(scale of 0 to 3, 3=best)		(0.007)	(0.120)		(0.009)	(0.080)
Identifying instrument:						
max(0, age at arrival − 11) × non-	-0.098***			-0.127***		
English-speaking country of birth	(0.004)			(0.005)		
Number of observations	18,645	18,645	18,645	15,331	15,331	15,331
Panel B. Child migrants, instrument based on years since migration						
Endogenous regressor:						
English-speaking ability		0.177***	0.504**		0.217***	0.399**
(scale of 0 to 3, 3=best)		(0.007)	(0.205)		(0.009)	(0.200)
Identifying instrument:						
Years since migration × non-	0.011***			0.011***		
English-speaking country of birth	(0.001)			(0.001)		
Number of observations	18,645	18,645	18,645	15,331	15,331	15,331
Panel C. Child migrants, instrument based on years since migration net of age effects						
Endogenous regressor:						
English-speaking ability		0.177***	0.247**		0.217***	0.328***
(scale of 0 to 3, 3=best)		(0.007)	(0.118)		(0.009)	(0.087)
Identifying instrument:						
Years since migration × non-	0.038***			0.049***		
English-speaking country of birth	(0.002)			(0.002)		
Number of observations	18,645	18,645	18,645	15,331	15,331	15,331
Panel D. Adult migrants, instrument based on years since migration						
Endogenous regressor:						
English-speaking ability		0.188***	0.267***		0.216***	0.316**
(scale of 0 to 3, 3=best)		(0.005)	(0.084)		(0.006)	(0.139)
Identifying instrument:						
Years since migration × non-	0.022***			0.015***		
English-speaking country of birth	(0.001)			(0.001)		
Number of observations	40,666	40,666	40,666	32,086	32,086	32,086
Panel E. Adult migrants, instrument based on years since migration net of age effects						
Endogenous regressor:						
English-speaking ability		0.188***	0.280***		0.216***	0.177**
(scale of 0 to 3, 3=best)		(0.005)	(0.068)		(0.006)	(0.079)
Identifying instrument:						
Years since migration × non-	0.035***			0.033***		
English-speaking country of birth	(0.001)			(0.001)		
Number of observations	40,666	40,666	40,666	32,086	32,086	32,086

Note: Weighted numbers based on weights provided by the ACS. Robust standard errors in parentheses. See note to Table 2 for sample restrictions. Additional control variables: female, age, black, other non-white, hispanic.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.