The Returns to Language Skills in the US Labor Market

Ingo Isphording
Ruhr-University Bochum

Mathias Sinning
Australian National University, RWI, IZA, CReAM

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Abstract

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 to address problems related to endogeneity and measurement error. We find a significantly positive effect of language skills on wages and demonstrate that education is an important channel through which language skills affect wages of child migrants. Although the returns to language skills of adult migrants do not depend on education, they are about the same as those of child migrants. Our findings also indicate that the *critical period hypothesis*, which postulates that language acquisition up to native ability is almost certain for young children, is irrelevant for the identification of the causal effect of language skills on wages.

JEL-Classification: F22, J24, J31

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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 higher wages.[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 for two reasons. First, language skills and wages are both determined by unobserved individual ability. Second, 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 empirical 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 generalize 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. Second, we study conceptual differences between instrumental variables and examine the role of the *critical period hypothesis* (Newport, 2002), which suggests that young children are much more likely to acquire languages up to native ability than during adolescence, for the identification of the

[1] Figure 4 depicts the relationship between wages and duration of residence in the US by language region of origin.

returns to language skills. Third, we analyse differences in the extent to which the effect of language skills on wages of child and adult migrants is mediated by education. 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 important because immigration is an important barrier in the international labor market. Language barriers do not only affect international migration flows (Adsera and Pytlikova, 2012), but also the economic integration of immigrants because they may increase the nativity wage gap by contributing to labor market discrimination and segregation. Estimating the causal effect of language skills on wages is challenging because unobserved individual-specific characteristics (such as ability) typically affect both language skills and wages of foreign-born workers from non-English-speaking regions of origin. 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. They implement an identification strategy that is motivated by the psychobiological literature, which suggests that there is a critical age range in which children learn languages almost automatically. This relationship between language acquisition and age, which is refered to as the 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.

Unfortunately, we cannot simply assume that the returns to language skills of adult immigrants are the same as those of immigrant workers who immigrated with their parents. For that reason, we study a modification of the instrumental variable proposed by BC to extend their analysis to adult migrants. The instrument we propose is based on the relationship between immigrants' duration of residence in the US and English-language skills. It appears likely that the duration of residence in the US affects wages of immigrants through channels other than language (Chiswick, 1978). For that reason, we use immigrants from English-speaking countries as a control group for immigrants from non-English-speaking countries to isolate the part of the duration of residence that affects wages through the language channel. 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 a significantly positive effect of language skills on wages and demonstrate that a considerable part of the effect of language skills on wages of child migrants is mediated by education. By contrast, the returns to language skills of adult migrants do not depend on education, which appears reasonable because most adult migrants were probably educated in their native language before they immigrated to the US. Despite differences in the importance of language skills for investments in education, we find that differences in the returns to language skills of child and adult migrants are rather small and insignificant. Our findings further indicate that the critical period hypothesis is irrelevant for the identification of the causal effect of language skills on wages.

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 is based on a simple model of the relationship between wages and language skills. Let Y_i denote (the logarithm of) the annual wage of individual i, which is described by

$$Y_i = \beta_0 + \beta_1 D_i + \beta_2 N_i + \beta_3 S_i + X_i' \beta_4 + \eta_i, \tag{1}$$

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 ($N_i = 1$), S_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 $E(\eta_i|S_i) = 0$, which is very 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.[2] Consequently, we have to account for the possibility that the conditional expectation of the error term is different from zero and that the OLS estimate of β_3 is biased.

We employ an instrumental variable (IV) strategy to address both problems, 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):

$$S_i = \gamma_0 + \gamma_1 D_i + \gamma_2 N_i + \gamma_3 D_i \cdot N_i + X_i' \gamma_4 + \varepsilon_i. \tag{2}$$

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 selection issues, 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 (it should be noted that BC are unable to control for the parental background of child migrants). For that reason, we follow BC and include country fixed effects (instead of N_i) in all our IV regressions. By using

[2] BC provide a detailed discussion of the measurement error problem.

immigrants from English-speaking countries as a control group for immigrants from non-English-speaking countries of origin and including country 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

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

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 based on separate samples of child and adult migrants and modified versions of equations (1) to (3). Specifically, we will present the difference in difference estimates of English ability and annual (log) wages, using treatment variables based on age at arrival and years since migration. We will also study the robustness of our results with regard to the choice of the underlying threshold that is used for the definition of treatment variables and present 2SLS estimates using instrumental variables based on both age at arrival and years since migration. In a last step, we will 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 5-year 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. Immigrants in the ACS are identified as individuals who were not US citizens at birth. We restrict our analysis to individuals aged 25 to 55 and distinguish between child migrants, who arrived in the US between ages zero and 17 years, and adult migrants, who arrived between ages 18 and 45 years. The narrow age range definition excludes individuals still 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 the same part of the age-earnings profile of child and adult migrants.[3]

In addition to these restrictions, we remove outliers from our data by dropping the highest and lowest 2.5th percentile of the wage distribution. 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.[4] Our sample of migrants from non-English-speaking countries consists of 34,558 child and 81,186 adult migrants. We further observe 3,089 child and 6,194 adult migrants from English-speaking countries of origin.

Table 1 includes the 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 between immigrants from English-speaking and non-English-speaking countries of origin. As expected, child migrants from non-English-speaking countries of origin have better English skills than adult migrants. By construction of the sample, we

[3]BC use a much more restricted sample in their analysis of child migrants. Specifically, they focus on child migrants aged 25 to 38 years who have been living in the US for 16 to 30 years, but mention that their results are not sensitive to these particular sample restrictions. For the sake of comparability, we also study differences between the results obtained from our sample of child migrants and the used by sample BC.

[4]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.

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 of origin are better educated than immigrants from non-English-speaking countries of origin. In the sample of child migrants, differences in educational attainment between the two groups may arise from different language skills. This is probably not the case in the adult migrant sample, for which it is more likely that differences in educational attainment stem from immigrant selection processes because adult migrants typically receive their education in their 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.

Figures 1 to 4 illustrate the patterns that we exploit to generate our instrumental variables. Figure 1 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 2 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.

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, which may be different from those of child migrants. Figure 3 shows the relationship between English ability and duration of residence in the US for our sample of adult migrants. The profiles for adult migrants from English-speaking and non-English-speaking countries of origin reveal that language ability is acquired by increasing exposure to the host country language. Similar to Figure 1, we observe that English ability is almost fixed at the highest level, whereas the language skills of adult migrants from non-English-speaking countries increase over the settlement process without ever reaching the level of native speakers.

The convergence in English skills presented in Figure 3 is translated into a convergence of wages between adult migrants from English-speaking and non-English-speaking countries of origin (Figure 4). 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 selection mechanisms (due to both self-selection and selective immigration policies), 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 aged 25 to 38 years who have been living in the US for 16 to 30 years). After removing outliers from our data by dropping the highest and lowest 2.5th 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 14,234 observations. Panel A 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 of Table 2 do not differ much from the findings of BC, suggesting that the underlying relationships between the variables of interest have not changed over the last two 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 significantly 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). The estimates in Panel C of Table 2 reflect that more established migrants have higher English skills, although the treatment effects on English ability are smaller than those of the treatment based on age at arrival, which is in line with the slower convergence of English ability over the settlement process (Figure 3). 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 our 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.

Since the treatment effects presented in Table 2 may depend on the choice of the underlying thresholds that are used to construct the treatment variables, we use different age at arrival and years since migration thresholds and estimate different treatment effects for child and adult migrants. Figure 5 includes the treatment effect estimates along the age at arrival distribution of child migrants; the corresponding treatment effect estimates along the years since migration distribution of adult migrants are presented in Figure 6. The treatment effects for both the restricted and the full sample of child migrants in Figure 5 reveal that treatment effects are remarkably stable across the age at arrival distribution (especially between ages 5 to 11), indicating that the choice of the age at arrival threshold does not affect the wage differential. Figure 6 confirms a similar pattern over the years since migration distribution for the full samples of child and adult migrants. Although the treatment effects are subject to more variation, they are remarkably stable around the respective sample averages (see also Table 1). Specifically, we find very stable treatment effects between 21 and 29 years since migration for child migrants and relatively stable effects between 10 and 20 years since migration for adult migrants. The confidence intervals indicate that changing the underlying threshold does not affect any of the treatment effects in Figures 5 and 6 significantly.

Table 3 contains the IV estimates for the full sample of child migrants (we do not present the estimates for the restricted sample of BC because the impact of the sample restrictions on the IV estimates is rather small). The first two columns of 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 due to 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 of origin (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 of origin exhibit a steeper age-earnings profile than child migrants from non-English-speaking countries of origin. For that reason, we obtain second stage results that are similar to those of Panel A when we control for differences in age effects 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 the 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 are also insignificant.

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 receive their education in the destination country, while adult migrants typically receive most of 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. After controlling for education, the IV estimates of child migrants are considerable smaller, while the IV estimates of adult migrants are almost unchanged. We find that the contribution of education explains between 28.8 and 43.8% of the effect of language skills on wages of child migrants, while education contributes between -3.7 and 6.4% 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 important 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 because unobserved individual-specific characteristics (such as ability) typically affect both language skills and wages of foreign-born workers from non-English-speaking regions of origin. BC propose a convincing instrumental variable strategy that allows them to estimate the effect of English-language skills on wages of child migrants. However, we cannot just 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 seems reasonable to expect that language skills have very different effects on the formation of human capital of child and adult migrants.

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 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. We study conceptual differences between instrumental variables and examine the role of the *critical period hypothesis* for the identification of the returns to language skills. We further analyse differences in the extent to which the effect of language skills on wages of child and adult migrants is mediated by education.

Our findings reveal a significantly positive effect of language skills on wages and demonstrate that a considerable part of the effect of language skills on wages of child migrants is mediated by education. By contrast, the returns to language skills of adult migrants do not depend on education, which appears reasonable because most adult migrants were probably educated in their native language before they immigrated to the US. Despite differences in the importance of language skills for investments in education, we find that differences in the returns to language skills of child and adult migrants are rather small and insignificant. Our findings further indicate that the critical period hypothesis – although probably correct – is irrelevant for the identification of the causal effect of language skills on wages.

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	10.225	10.319	10.185	10.591	10.592	10.590
	(0.796)	(0.755)	(0.809)	(0.778)	(0.732)	(0.801)
English-speaking ability variables:						
Ordinal measure (scale of 0 to 3, 3=best)	2.101	2.462	1.948	2.974	2.981	2.971
	(0.989)	(0.836)	(1.010)	(0.193)	(0.179)	(0.200)
Speaks English not at all (0)	0.078	0.036	0.096	0.001	0.000	0.001
	(0.268)	(0.186)	(0.295)	(0.024)	(0.022)	(0.024)
Speaks English not well (1)	0.210	0.118	0.249	0.004	0.005	0.004
	(0.407)	(0.322)	(0.432)	(0.067)	(0.071)	(0.065)
Speaks English well (2)	0.245	0.196	0.266	0.015	0.008	0.019
	(0.430)	(0.397)	(0.442)	(0.121)	(0.089)	(0.135)
Speaks English very well (3)	0.467	0.651	0.389	0.980	0.987	0.976
	(0.499)	(0.477)	(0.487)	(0.140)	(0.115)	(0.152)
Control variables:						
Age at arrival	21.871	10.466	26.702	21.436	8.978	28.014
	(9.698)	(5.440)	(6.550)	(11.007)	(5.357)	(6.690)
Years since migration	17.200	26.147	13.411	19.861	30.386	14.303
	(10.452)	(9.804)	(8.157)	(12.037)	(10.569)	(8.546)
Age	39.068	36.601	40.113	41.291	39.350	42.317
	(8.393)	(8.256)	(8.231)	(8.365)	(8.697)	(7.997)
White	0.067	0.050	0.074	0.451	0.499	0.426
	(0.251)	(0.219)	(0.262)	(0.498)	(0.500)	(0.495)
Black	0.460	0.490	0.447	0.453	0.402	0.480
	(0.498)	(0.500)	(0.497)	(0.498)	(0.490)	(0.500)
Asian or other nonwhite race	0.473	0.460	0.479	0.096	0.099	0.094
	(0.499)	(0.498)	(0.500)	(0.294)	(0.299)	(0.292)
Hispanic	0.538	0.597	0.512	0.013	0.017	0.010
	(0.499)	(0.491)	(0.500)	(0.111)	(0.128)	(0.101)
Female	0.425	0.433	0.422	0.510	0.533	0.498
	(0.494)	(0.496)	(0.494)	(0.500)	(0.499)	(0.500)
Schooling variables:						
Years of schooling	12.183	12.407	12.088	14.070	14.159	14.024
	(3.919)	(3.401)	(4.116)	(2.274)	(1.939)	(2.431)
Completed high school	0.714	0.751	0.699	0.943	0.964	0.932
	(0.452)	(0.433)	(0.459)	(0.231)	(0.186)	(0.251)
Completed college	0.299	0.261	0.315	0.427	0.421	0.431
	(0.458)	(0.439)	(0.464)	(0.495)	(0.494)	(0.495)
Number of observations	115,744	34,558	81,186	9,283	3,089	6,194

Weighted numbers based on weights provided by the ACS. Standard deviations in parentheses.

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

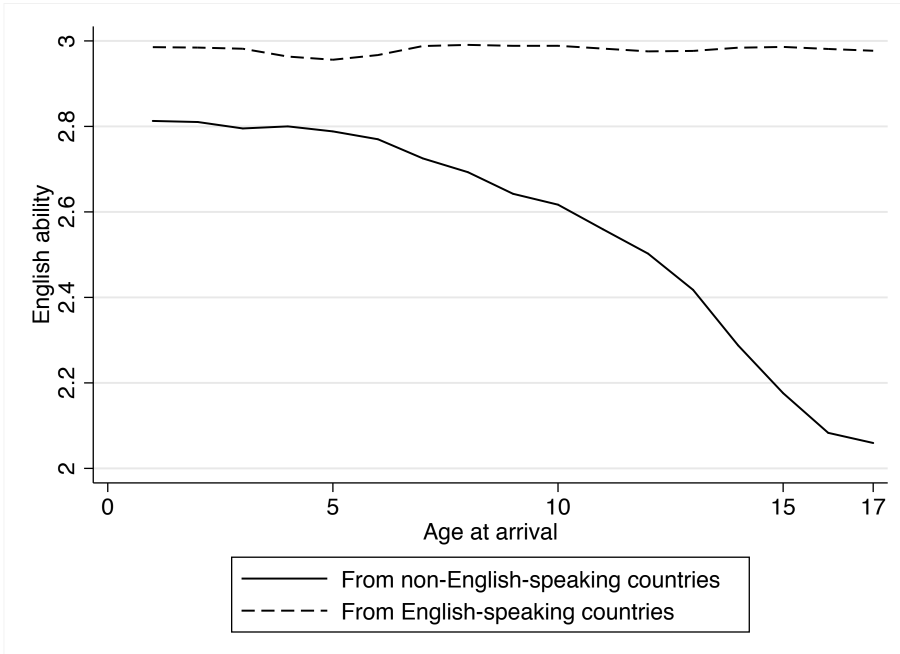

Figure 2: Log annual wage of child migrants by age at arrival
(3-year moving average)

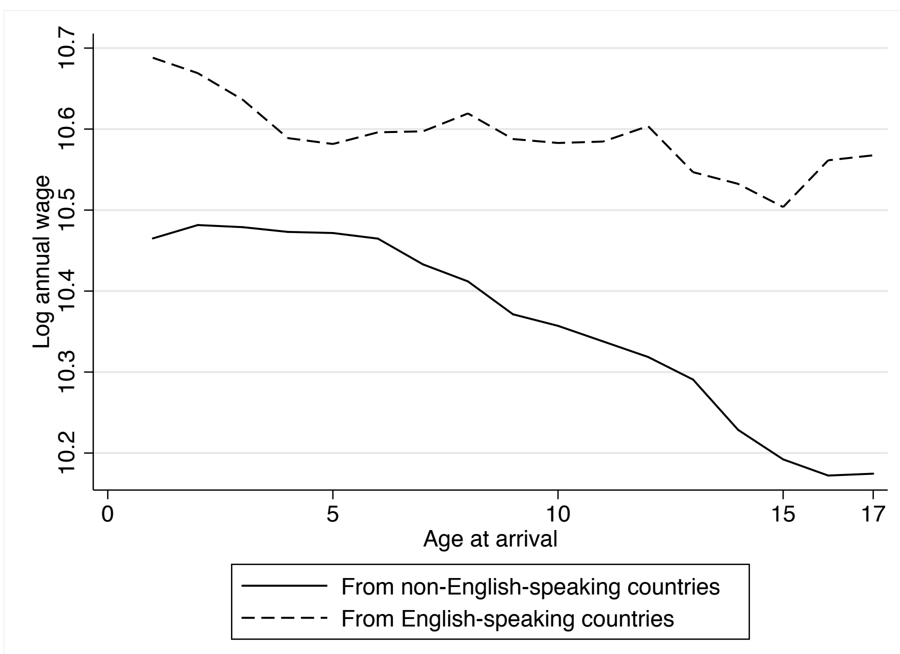

Figure 3: English ability of adult migrants by years since migration (3-year moving average)

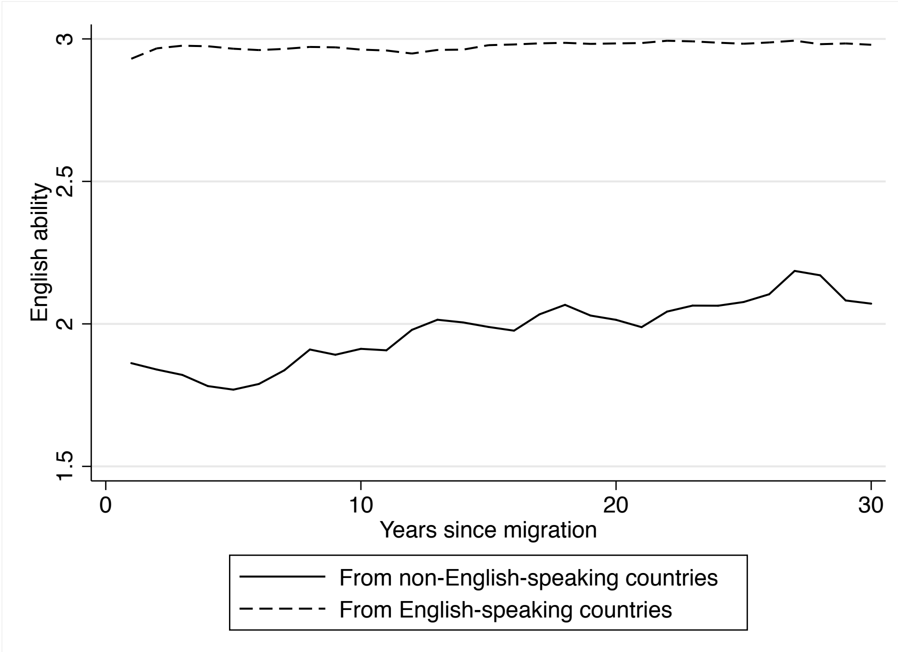

Figure 4: Log annual wage of adult migrants by years since migration (3-year moving average)

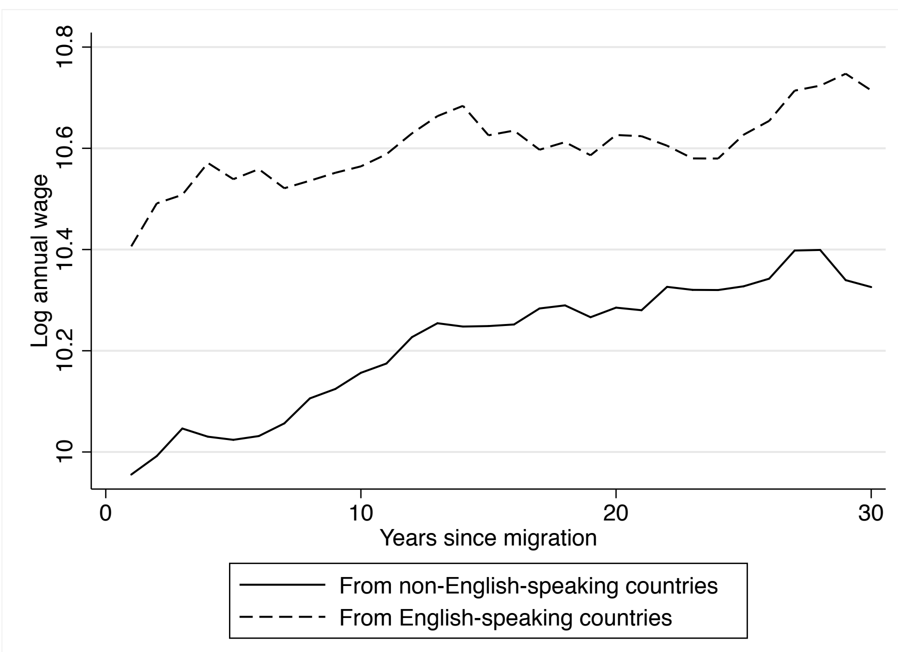

Table 2: Difference in differences with binary treatment variable

	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)	0.028***	0.118***	0.239***	0.385***	0.122*
	(0.005)	(0.010)	(0.019)	(0.026)	(0.064)
Arrived young (aged 0 to 11)	-0.003	-0.011	-0.004	-0.018	0.030
	(0.003)	(0.007)	(0.016)	(0.021)	(0.063)
Non-English-speaking country of birth	-0.016***	-0.093***	-0.268***	-0.377***	-0.156***
	(0.003)	(0.009)	(0.019)	(0.025)	(0.059)
Adjusted R-squared	0.030	0.108	0.181	0.174	0.107
Number of observations	14,234	14,234	14,234	14,234	14,234
PANEL B. CHILD MIGRANTS, FULL SAMPLE, TREATMENT BASED ON AGE AT ARRIVAL					
(Arrived young) × (non-English speaking country of birth)	0.030***	0.142***	0.277***	0.450***	0.169***
	(0.003)	(0.006)	(0.009)	(0.014)	(0.033)
Arrived young (aged 0 to 11)	0.001	0.002	0.018***	0.021**	0.020
	(0.001)	(0.004)	(0.007)	(0.009)	(0.031)
Non-English-speaking country of birth	-0.015***	-0.096***	-0.278***	-0.389***	-0.147***
	(0.002)	(0.005)	(0.009)	(0.013)	(0.028)
Adjusted R-squared	0.032	0.126	0.219	0.208	0.142
Number of observations	37,647	37,647	37,647	37,647	37,647
PANEL C. CHILD MIGRANTS, FULL SAMPLE, TREATMENT BASED ON YEARS SINCE MIGRATION					
(Established migrant) × (non-English speaking country of birth)	0.023***	0.069***	0.110***	0.201***	0.127***
	(0.003)	(0.006)	(0.009)	(0.014)	(0.033)
Established migrant (years since migration above sample average)	0.006**	0.041***	0.127***	0.174***	0.056*
	(0.003)	(0.006)	(0.009)	(0.014)	(0.033)
Non-English-speaking country of birth	-0.013***	-0.060***	-0.194***	-0.267***	-0.134***
	(0.002)	(0.005)	(0.009)	(0.013)	(0.028)
Adjusted R-squared	0.028	0.099	0.160	0.158	0.135
Number of observations	37,647	37,647	37,647	37,647	37,647
PANEL D. ADULT MIGRANTS, FULL SAMPLE, TREATMENT BASED ON YEARS SINCE MIGRATION					
(Established migrant) × (non-English speaking country of birth)	0.059***	0.090***	0.027***	0.175***	0.087***
	(0.003)	(0.005)	(0.006)	(0.010)	(0.023)
Established migrant (years since migration above sample average)	0.012***	0.044***	0.067***	0.124***	0.099***
	(0.002)	(0.004)	(0.006)	(0.009)	(0.023)
Non-English-speaking country of birth	-0.042***	-0.155***	-0.376***	-0.573***	-0.236***
	(0.002)	(0.004)	(0.006)	(0.009)	(0.018)
Adjusted R-squared	0.078	0.208	0.231	0.269	0.179
Number of observations	87,380	87,380	87,380	87,380	87,380

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Figure 5: Treatment effect on log annual wage by age at arrival

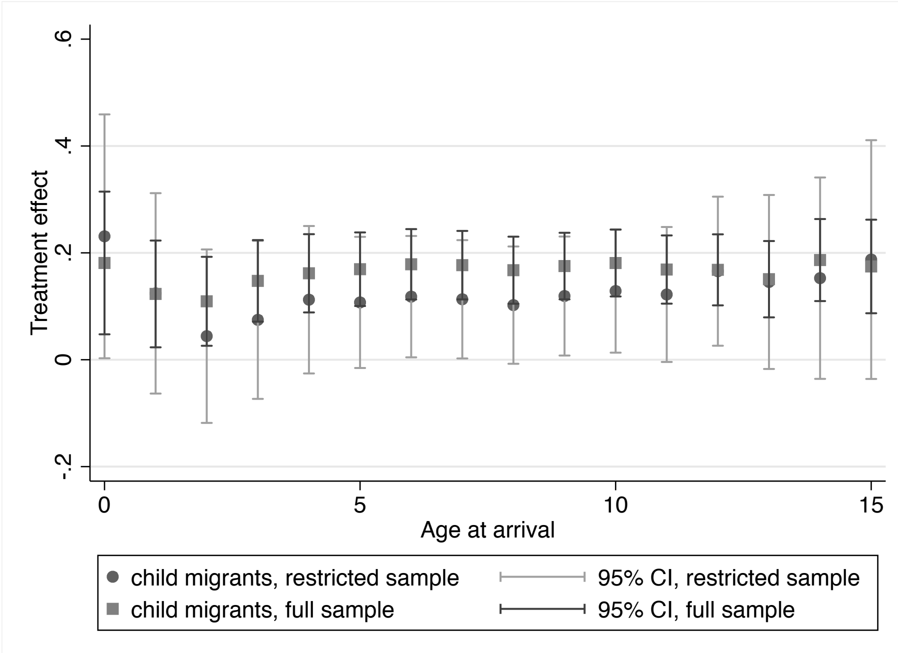

Figure 6: Treatment effect on log annual wage by years since migration

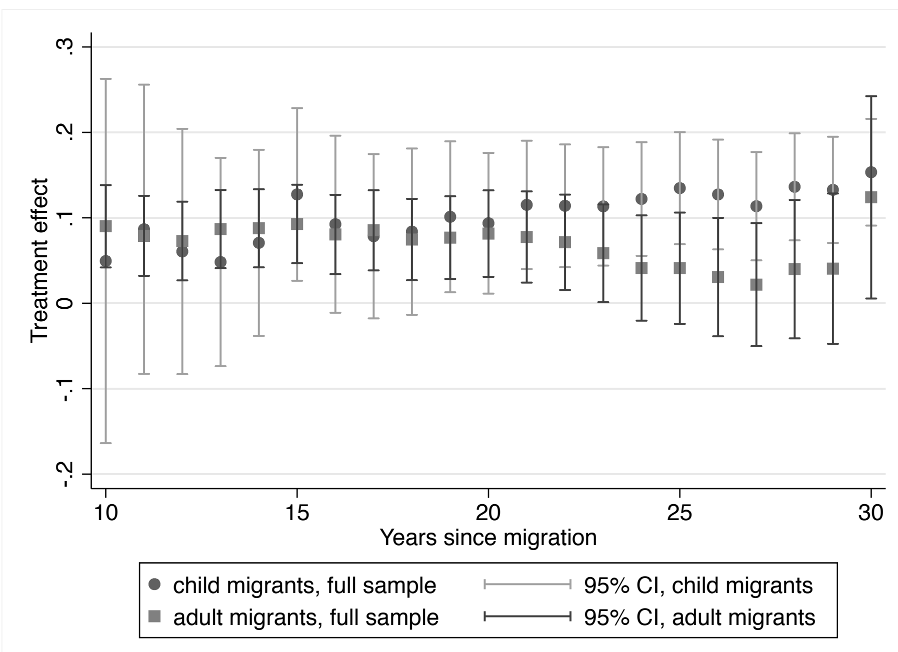

Table 3: Effect on log annual wages: child migrants

	English Ability		Log Annual Wages			
	OLS	OLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A. Instrument based on age at arrival						
Endogenous regressor:						
English-speaking ability			0.199***	0.196***	0.297***	0.313***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.077)	(0.075)
Identifying instrument:						
max(0, age at arrival − 11) × non-	-0.101***	-0.102***				
English-speaking country of birth	(0.003)	(0.003)				
Controls:						
max(0, age at arrival − 11)	0.000		-0.016***		-0.007	
	(0.002)		(0.002)		(0.008)	
Age-at-arrival dummies	No	Yes	No	Yes	No	Yes
Country-of-birth dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R-squared	0.266	0.270	0.207	0.209		
Number of observations	37,647	37,647	37,647	37,647	37,647	37,647
Panel B. Instrument based on years since migration						
Endogenous regressor:						
English-speaking ability			0.196***	0.192***	0.656***	0.521***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.124)	(0.150)
Identifying instrument:						
Years since migration × non-	0.013***	0.011***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.028***		0.009***		-0.010*	
	(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	0.260	0.265	0.209	0.213		
Number of observations	37,647	37,647	37,647	37,647	37,647	37,647
Panel C. Instrument based on years since migration, controlling for age effects						
Endogenous regressor:						
English-speaking ability			0.196***	0.192***	0.337***	0.286***
(scale of 0 to 3, 3=best)			(0.006)	(0.006)	(0.072)	(0.078)
Identifying instrument:						
Years since migration × non-	0.043***	0.040***				
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	0.263	0.268	0.209	0.213		
Number of observations	37,647	37,647	37,647	37,647	37,647	37,647

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 4: Effect on log annual wages: adult migrants

	English Ability		Log Annual Wages			
	OLS	OLS	OLS	OLS	2SLS	2SLS
	(1)	(2)	(3)	(4)	(5)	(6)
PANEL A. INSTRUMENT BASED ON YEARS SINCE MIGRATION						
Endogenous regressor:						
English-speaking ability			0.213***	0.210***	0.359***	0.360***
(scale of 0 to 3, 3=best)			(0.003)	(0.003)	(0.085)	(0.086)
Identifying instrument:						
Years since migration × non-	0.017***	0.016***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.015***		0.013***		0.008***	
	(0.001)		(0.000)		(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	0.376	0.378	0.291	0.295		
Number of observations	87,380	87,380	87,380	87,380	87,380	87,380
PANEL B. INSTRUMENT BASED ON YEARS SINCE MIGRATION, CONTROLLING FOR AGE EFFECTS						
Endogenous regressor:						
English-speaking ability			0.213***	0.210***	0.310***	0.292***
(scale of 0 to 3, 3=best)			(0.003)	(0.003)	(0.057)	(0.058)
Identifying instrument:						
Years since migration × non-	0.031***	0.030***				
English-speaking country of birth	(0.001)	(0.001)				
Controls:						
Years since migration	0.002***		0.013***		0.010***	
	(0.001)		(0.000)		(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	0.377	0.379	0.291	0.295		
Number of observations	87,380	87,380	87,380	87,380	87,380	87,380

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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	0.313***	0.176*	0.223**	0.360***	0.374***	0.337***
	(0.075)	(0.095)	(0.107)	(0.086)	(0.081)	(0.079)
Controls:						
Years of schooling		0.057***			0.025***	
		(0.009)			(0.007)	
Dummies for years of schooling		No	Yes		No	Yes
Contribution of years of schooling		43.8%	28.8%		-3.7%	6.4%
Number of observations	37,647	37,647	37,647	87,380	87,380	87,380

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

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