The educational and income attainments of late childhood immigrants to the United States

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Abstract

Childhood immigrants arrive at different ages with various skills. However, previous research emphasizes language acquisition and the importance of early immigration. We ask whether the timing matters differently when considering other skills, namely, initial education quality. Using US data, we find that delayed childhood immigration from top-scoring countries can mitigate the language acquisition constraint. Children from top scoring non-English speaking countries appear to benefit most from later immigration, with an additional 2.57 and 0.33 more years of US education respectively for men and women.

Keywords: education economics, educational attainment; immigration

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1 Introduction

The central question of this paper is whether later childhood migration can be beneficial and for whom. It has been established in the literature that immigrants tend to earn less than natives for several reasons.[1] Research on assimilation, enclaves, occupation selection, and English language skills have made important contributions to understanding this gap in the labor market and the mechanisms involved (Edin et al. (2003), Damm (2009), Andersson and Hammarstedt (2015)). The acquisition of language skills have always been considered crucial in this field of research. For example, Bleakley and Chin (2004) document a significant positive effect of English proficiency on wages of adults who emigrated to the United States as children. This has been interpreted as an argument for earlier entry when language is more easily learned.

However, children also immigrate with an initial human capital acquired in their country of origin. Presumably, if the initial educational system is of high quality, the more delayed is immigration, the more children benefit and vice versa, at least on this front. Böhlmark (2009) finds that children immigration has a negative effect on initial compulsory education performance due to initial language acquisition barriers, but the study also report that "*the same individuals catch up strongly in terms of final educational attainment.*" Consider the global early education quality index provided by the Programme for International Student Assessment (PISA).[2] Since 2000, the Organization for Economic Co-operation and Development (OECD) has conducted a test of 15-year-olds from members and other partners countries in mathematics, science, and reading. The tests are organized every three years and involve a growing number of countries. Given that the US is the country with the largest number of immigrants worldwide[3], immigrants from high scoring countries are an interesting comparison group.

In previous research, early entrance into the United States has been associated with the negative impact of language and culture acquisition. In contrast, the positive seminal headstart provided by the original human capital of migrants has been much less explored. This offers a favorable context

[1] Borjas (2018) provides an in-depth survey of the literature. Overall, results show that immigrants initially earn less at the time of entry and that the gap narrows with time. The main reasons invoked are language skills and cultural assimilation, often slowed down by enclaves. This is also the case for immigrants working in computers and engineering fields (Hunt, 2015). In contrast, the entry earnings of Western European immigrants resemble those of the U.S.-born (https://www.ssa.gov/policy).

[2] Henceforth, PISA scores.

[3] In 2020, the Pew Research Center reported that about 13.7% of the US population was foreign, compared to 4.7% in the 1970s.

to investigate the impact of their various origin education on their final education attainment and possibly earnings. A long-standing challenge in education economics has been to disentangle the value of education itself from inherent workers' abilities. Mainly due to endogeneity, this has been a challenge that various instruments have attempted to address. In our study of childhood immigrants, we instead aim to investigate the effect of their various early education qualities on their later life education and earnings. In our approach, this early human capital is not an innate ability, but rather the impact of the origin country's education quality. The initial human capital of migrants could have a positive effect on education. In this case, estimate of the return host country education may be biased (Bratsberg and Ragan Jr, 2002).[4]

The contribution of this paper is to investigate the impact of this initial education quality on attainments of immigrants in the US. Addressing this question sheds light on the link between early education and childhood migrants' outcomes. If earnings vary based on US school attainment and that US school attainment itself depends on initial country quality, the question is of interest. In that case, this could be evidence that early education quality has a persisting effect on educational attainment while in the USA. The hypothesis is that top PISA countries' late childhood immigrants (those above 12 but still under 18 years of age) bring this beneficial human capital that affects their final education attainment in the US. The alternative would be that late immigration, whether from top or lower scoring countries, does not matter. We are not sure which, so we do this research. Our results suggest that late childhood immigrants from top PISA countries acquire more years of U.S. schooling and higher earnings compared to others. This is true both for men and women. The results also holds among non- English-speaking countries of origin, arguing against a language driven mechanism. Our results align with the previous literature that finds a negative effect of late immigration due to language acquisition, but our results shows that this effect can be mitigated when children come from high scoring countries.

The rest of this paper is organized as follows. Section 2 explores the literature on the return to education and childhood immigration. In the following section, we present an overview of the PISA initiative and the other data sources we plan on using. Section 4 and 5, respectively, elaborate on the empirical methods and then the basic results. Section 6 concludes.

[4]According to International Education Attainment many countries now require primary and secondary school education, and this contributes to lower the chance for selection bias at the origin.

2 Literature review

Timing is an important concept within both the education and immigration economics literatures. Many studies have used standard tests to show that the early education quality of children matters for parental decisions and children's cognitive development and future outcomes (Kohlberg (1968), Neuman (2006), Camilli et al. (2010)). For example, Black (1999) studies the impact of elementary school quality on the housing valuation in neighborhoods in Massachusetts. The author finds that parents are willing to pay $3948 more to purchase housing in an area associated with a one standard deviation increase in test scores. The author used an original approach relying on neighborhood divisions and the house prices variations at the borders to estimate this impact.

Chetty et al. (2011) show that kindergarten tests scores have significant predictive power for future earnings, college attendance, homeownership, and even retirement savings. The study involved the random assignment of 11,571 students in many classrooms with teachers of different experience levels. The students who studied under the more experienced teachers or were assigned to higher-quality classrooms had higher earnings. The project was entitled the Student/Teacher Achievement Ratio (STAR program) in Tennesse from 1985 to 1989. The authors link the original STAR dataset to tax return information to observe these outcomes. To take advantage of the random assignment of the pupils, they rely primarily on an intent-to-treat (ITT) estimator for inference.

The immigration economics literature has identified several explanations for the earning gap of immigrants. However, language skills have been accepted as a main driver. Enclave have also been studied as another determinant. Lazear (1999) models migrants who live in an area with dense country mates concentration. Results indicate that they become less likely to assimilate and learn the host country's language. In other words, when a minority of the migrant population lives among the majority culture, assimilation happens more easily for small groups of expatriates. The author uses data from 1900 and 1990 and shows that more fluent immigrants have a tendency to live in an area with fewer people from the same country of origin. In this framework, the opportunity for trade is the incentive that leads an individual to learn English more quickly when surrounded mostly by the majority culture.

Bleakley and Chin (2004) uses the fact that younger children learn new languages more easily than older ones to generate an instrument for language skills. The instrument was a binary interac-

tion term between a dummy for origin in a non-English speaking country and having arrived young. The study excluded countries which have English and another language officially spoken. This was the case in India, for example. As a result, several large immigrant contributing countries are left out of the analysis. Interestingly, the approach was motivated by the psychology literature on age and language learning. They find a positive effect of English proficiency on wages of immigrants who immigrated to the United States at a younger age, the threshold being at 12 years old.

The impact of origin country education on migrants has also received a some attention in the literature. For example, Chiswick and Miller (2010) studied the impact of origin countries' schooling quality on the return to education. They motivate the question by the observation that immigrants enjoy roughly only half the labor market return compared to natives as a return to schooling. The paper shows that the origin countries' education quality has a strong link to the wage returns immigrants workers can expect. Furthermore, their results suggest that those originally from countries with relatively poor education quality undergo a more intense immigration screening process. This selection can explain the lower payoff, as they explain.

Li and Sweetman (2014) found similar results but using a different host country, Canada. They emphasize that the results are robust in introducing origin countries' GDP per capita measures and other features. Also, they explain that the disparities are less marked for childhood immigrants who reached Canada earlier in their life. They find that the quality of education explains the labor market outcomes of migrants. Their observed effect is stronger for those who do not have children. They measure origin country education quality with the Hanushek and Kimko (2000) index for cognitive skills. They join Canadian Census data of 1986, 1991, 1996, and 2001 to the dataset as mentioned above of skills.

Bratsberg and Terrell (2002) first compute returns to education by countries of origin and then link those to features like pupil-to-teacher ratios and government spending per pupil. The analysis is based on Census data of 1980 and 1990. They find that immigrants from northern Europe and Japan have larger education returns than those of central American origin. It is worth noting that several of these northern European and Asian countries have consistently achieved top ranking in the PISA scores year after year.

The literature surrounding the question of migration has produced many studies which mostly support the long-term impact for host countries (Lehmer and Ludsteck (2011), Brunow and Jost

(2022)). Our measure of early education and the variation in age at arrival offers an opportunity to investigate the question in more recent years with an approach that can potentially address the timing and quality dimension.

3 Data and empirical methods

The Programme for International Student Assessment (PISA) is conducted by the Organisation for Economic Co-operation and Development (OECD) and measures 15 years old ability to use various cognitive skills to meet real-life challenges in a way that can be assessed.[5] The initiative also involves a few participating non-OECD members. It was launched in 2000 and was repeated 7 times to date. The program involves more than 90 countries and surveys around three million students worldwide. In 2018, out of 78 countries, the US ranked 38th, 19th, and 14th in mathematics, science, and reading. We choose 2006 for two reasons. First, it is the first year when a substantial number of non-OECD jurisdictions participated in the test, offering a richer comparison pool. Second, compared to 2018, the year 2006 may be more representative of the educational context of migrants of earlier years given that the first recorded migration in our sample occurs earlier than 2000. We address this later by restricting the window of migrants and see if results are comparable. PISA scores have gained an increasing importance at the international level impacting education policy in countries like Germany, Norway, Denmark and the US (Martens and Niemann, 2013).

For U.S. market outcomes, we plan to use microdata from the Integrated Public Use Micro sample Series (IPUMS) by Ruggles et al. (2003). We will use the 5% state sample and 1% metro sample of 2018. The main variables will be measures of annual wages, educational attainment, age, and age at migration.

In our study, we label top PISA scorers as countries above the 75th percentile of the average of reading, mathematics and science. We also try alternative specification with the 85th, 90th percentile but do not report these results due to great similarity. Figure 1A shows that the educational atttainment of top scoring immigrants is higher than others which comes as no surprise. Figure 1 B however, shows that this gap increases with age of arrival, but an inflection point occurs between

[5] All countries' scores can be access via the OECD database and participating countries are listed on Figure 4. Available files include background questionnaires and other additional information relevant to test administration. We use the information for the year 2006. The testing categories are mathematics, science and reading.

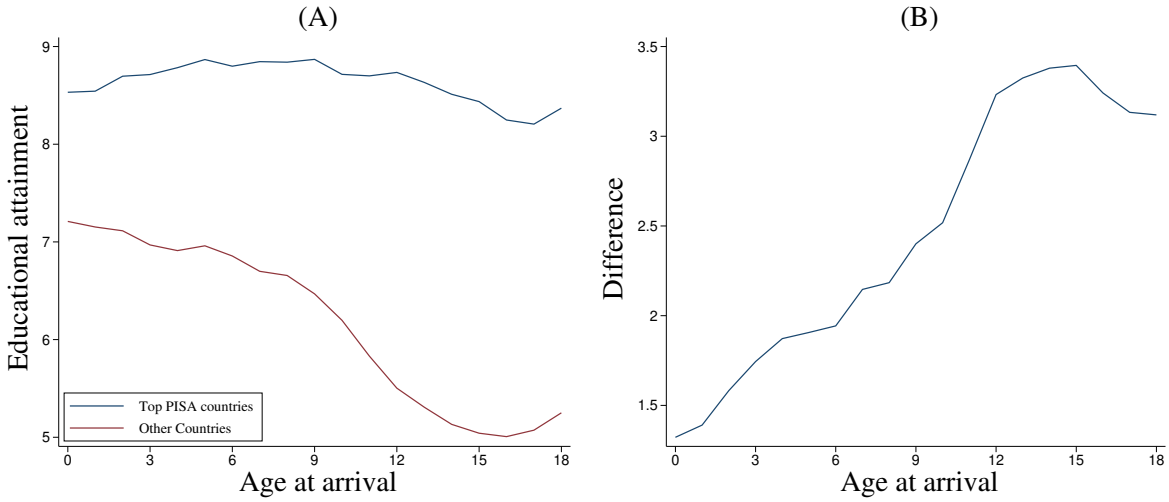

Figure 1: **Educational attainment of migrants based on country of origin's PISA ranking**. Top scorer countries are above the 75th percentile worldwide. The age of arrival varies between 1 and 18 years old.

6 and 10 years old which is consistent with the literature Böhlmark (2009). At 15 years old, the gap is largest and reaches 3.4 years of final education difference, after which it lowers.

Figure 1 present another important insight. The gap in education attainment between top PISA country immigrants and others has a noteworthy origin. Top PISA countries expatriates averages are relatively stable even when arriving late. Rather it is the attainment of the comparison group that significantly decline with delayed US entry. In other words, it may not be that immigrants from high scoring countries do significantly better after entry, but rather that others do noticeably worse the later they enter the US. We restrict the analysis to immigrants under 19 years old at migration. The PISA scores are available from the OECD website, and we will use the 2006 sample. We will rank the countries between the top and bottom categories in terms of performance, and eventually match the rankings on each individual in the ACS based on the birthplace.

Figure 2 shows that the wages and income salary of childhood immigrants of higher scoring countries is higher. Even if immigration happens right after birth, earnings of top scoring expatriates are about 32% higher and the gap increases. The peak difference seems to be around the age of 12 years old, after which it starts decreasing. The difference graph has a hump shape curve.

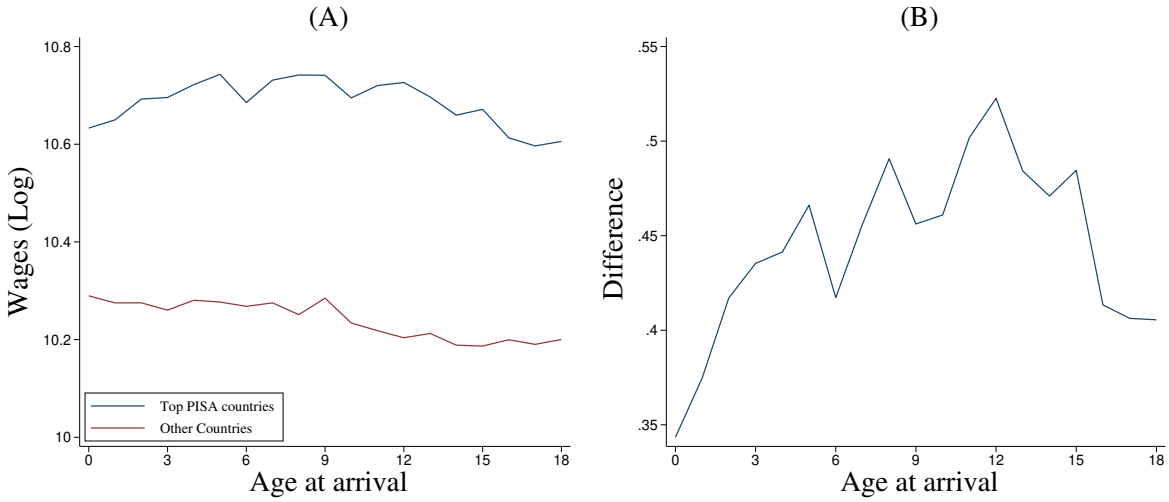

Figure 2: **Wages (Log) of migrants based on country of origin's PISA ranking**. Top scorer countries are above the 75th percentile worldwide. The age of arrival varies between 1 and 18 years old.

Table 1: Descriptive Statistics

	Control group			Late & Top PISA scorers			
	n	mean	sd	n	mean	sd	Difference
Education	296397	6.52	2.99	25931	8.38	2.52	1.862***
Female	296397	0.42	0.49	25931	0.52	0.50	0.099***
Wage and salary income ($1000)	296397	48,78	59,77	25931	70,25	81,70	21,47***
Age	296397	40.74	12.56	25931	43.69	13.37	2.945***
Married	296397	0.56	0.50	25931	0.63	0.48	0.074***
English speaking	296397	0.65	0.48	25931	0.69	0.46	0.042***

To investigate the impact of initial education on childhood immigrants outcomes in the US, we begin with the following reduced form model:

$$y_{ija} = \alpha + \beta_1(Late)(TopPISA_{ij}) + \beta_2 Late + \beta_3 TopPISA_{ij} + \delta Z_{ija} + \epsilon_{ija} \quad (1)$$

where y_{ija} is the outcome of interest of individual i from country j who arrived in the US at age a. β is the coefficient of interest, and the variable is an interaction term. One dummy is for late childhood arrival (after 12 but before 18 years old) and the other for migration from a top 25% PISA scoring country. Z_{ija} is a vector of control variables, including age at arrival, sex, race,

and married status. We add fixed effects for the country of origin, year of migration and age at migration.

The objective is to assess whether the future educational attainment and maybe earnings of childhood immigrants differ when we jointly consider their age at migration and the PISA score ranking of their country of origin. For more clarity, we emphasize that the treatment group includes migrants from top PISA scores countries who arrived in late years (after 13) while the control group has arrived in late years but from lower-scoring countries. In explaining the annual earnings, we emphasize that we avoid using PISA scores themselves to instruments for educational attainment. Instead, we use the interaction of the top-ranking PISA dummy on the one hand and the late arrival measure on the other. The psychology literature associates the cutoff at age 12 with languages acquisition skills. Therefore, we will present more results with different choices of cutoffs and compare the results.

4 Results

Table 4 shows the joint effect of early education quality and immigration timing on two outcomes: final educational attainment (or total schooling of individuals) and earnings. After joining the two data sets, 35 countries are matched. The results suggest that late childhood arrival from top-scoring countries is associated with more education overall and higher wages for certain groups. In our interpretation of the interaction terms, we follow Brambor et al. (2006) and refrain from discussing isolated parameters in this context. Panel A show that the interaction term is consistently positive. The effects are found both among women and men. Unanimously, all specifications for childhood immigrants of non-English speaking countries show this pattern across genders. The second insight from these results is that although this effect is positive, it may not be strong enough to overturn the language constraint documented in the literature. For example, late immigration even from top scoring countries is associared with $0.84(1)(1) - 2.05(1) + 0.52(1) \approx -0.7$ fewer years of final education (-0.88 for females and -0.44 among males). Nevertheless, the most interesting insight is that a similar late immigration from a non-top scoring country would be associated with as much as $-2.05(1) \approx -2.05$ fewer year of education, an approximately 192% difference. For women and men respectively, it would be 2.80 and 1.36 fewer years of education.

Table 2: Early education quality and childhood immigrants future outcomes

	Final Education Attainment			Log Annual Wages		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Female	Male	All	Female	Male
	Panel A: All countries					
Late*PisaT	0.84***	0.75***	0.94***	0.02	0.04*	0.04**
	(0.03)	(0.04)	(0.05)	(0.01)	(0.02)	(0.02)
Late	-2.06***	-2.81***	-1.38***	-0.09	-0.32	0.03
	(0.37)	(0.54)	(0.50)	(0.16)	(0.25)	(0.21)
PisaT	0.52***	1.18***	0.02	0.12**	0.23***	0.04
	(0.13)	(0.16)	(0.18)	(0.05)	(0.08)	(0.06)
Age	0.02	0.06**	-0.01	0.01	0.02	0.01
	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
Female	0.42***	.	.	-0.39***	.	.
	(0.01)			(0.01)		
Married	0.19***	0.22***	0.16***	0.22***	0.06***	0.33***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	322,328	138,217	184,111	322,328	138,217	184,111
R-squared	0.38	0.36	0.38	0.17	0.14	0.18
	Panel B: Non-English-speaking origin countries					
Late*PisaT	0.80***	0.73***	0.89***	-0.08*	0.02	0.02
	(0.04)	(0.05)	(0.05)	(0.04)	(0.02)	(0.02)
Late	-1.91***	-2.91***	-1.05*	0.09	-0.31	0.03
	(0.40)	(0.58)	(0.54)	(0.43)	(0.27)	(0.23)
PisaT	2.64***	2.51***	2.73***	-0.06	0.43***	0.50***
	(0.07)	(0.10)	(0.11)	(0.06)	(0.05)	(0.05)
Observations	289,392	122,318	167,074	32,936	122,318	167,074
R-squared	0.37	0.35	0.36	0.16	0.14	0.17
	Panel C: English-speaking origin countries					
Late*PisaT	-0.14	0.01	-0.23*	-0.08*	-0.12**	-0.05
	(0.09)	(0.13)	(0.12)	(0.04)	(0.06)	(0.06)
Late	-2.13**	-1.03	-3.16***	0.09	-0.23	0.05
	(0.84)	(1.20)	(1.19)	(0.43)	(0.63)	(0.57)
PisaT	-0.22**	-0.22	-0.24	-0.06	0.08	-0.16**
	(0.11)	(0.14)	(0.15)	(0.06)	(0.09)	(0.07)
Observations	32,936	15,899	17,037	32,936	15,899	17,037
R-squared	0.13	0.16	0.13	0.16	0.14	0.20

Notes: This table uses the average PISA scores to measure early education quality. It is turned into a binary variable taking the value one when a country scores above the 90th percentile. This measure incorporates the country's means in mathematics, reading, and science. English-speaking countries include those where only English is spoken and those were it is a dominant language. Late Arrival is also a binary variable, for immigrants who arrived after age 12. We consider only childhood immigrants. All regressions include the control variables listed in Panel A. All regressions include age at arrival dummies, country of origin dummies and year of migration dummies.

We also present the results for English-speaking countries and non-English speaking countries. Panel B shows the results when comparing only children immigrants from non-English speaking countries. Here the story remarkably changes. Late immigration from top scoring non english speaking countries is associated with $0.80(1)(1) - 1.91(1) + 2.64(1) \approx +1.53$ more years of education. The effect is even larger among men (+2.57) compared to women (+0.33) in terms of final education. For this small group of immigrants, it appears that late immigration from high scoring countries does in fact mitigate the language acquisition deficit and especially among men. Among English-speaking countries of origin (Panel C), however, the results are less significant, except for men. We find that in this subgroup, late immigration from top scoring countries seems to have a strong negative effect on earnings. In terms of earnings, the impact is also less clear. The interaction term of interest is often not significant.

5 Sensitivity analysis

In this section, we will conduct a few robustness checks of our findings. We begin by varying the cut-off for being considered a late arriver. Practically, we will present the results for the eight-year-old cut-off as well as the fourteen-year-old cut-off and compare them. The first cut-off is motivated by Böhlmark (2009) and the second can be thought of as a "worst case scenario." These insights should speak to our hypothesis that the educational attainment gap increases with lateness in arrival.

Table 3 shows the results from the same specification before but with varying cut-offs. We notice that both magnitude and signs are mostly comparable to the baseline estimations of the previous section and results are comparable across genders. We estimate that when the cut-off is placed at 8 years old, we expect 0.88 fewer years of schooling compared to 0.76 few when the cut-off is placed at 16 years. The adds credibility to our results as they align in significance and sign with Bleakley and Chin (2004) estimates.[6]

[6] Another concern is the use of the year 2006. The assumption is that initial country education quality has been stable over the years, but this may not be the case.Several countries including Finland have undergone profound educational change that resulted in remarkable test score increases in very short periods of time. In our sample, migrations occur between 1929 and 2018. This assumption may pose a problem. To address this issue, we restrict the previous analysis to migrants between 2000-2018. The PISA score of these years are likely more representative for those who emigrated then. We find similar results and these results are available upon request.

Table 3: Early education quality and future outcomes (Varying cut-offs)

	Final Education Attainment			Log Annual Wages		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Female	Male	All	Female	Male
	Panel A: All countries cut-off at 8 years old					
Late*PisaT8	0.87***	0.78***	0.96***	-0.00	0.03	0.01
	(0.03)	(0.04)	(0.04)	(0.01)	(0.02)	(0.02)
Late8	-2.05***	-2.80***	-1.36***	-0.09	-0.32	0.04
	(0.37)	(0.53)	(0.50)	(0.16)	(0.25)	(0.21)
PisaT	0.37***	1.04***	-0.14	0.13**	0.22***	0.05
	(0.13)	(0.16)	(0.18)	(0.05)	(0.08)	(0.06)
Age	0.02	0.06*	-0.01	0.01	0.02	0.01
	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
Female	0.42***			-0.39***		
	(0.01)			(0.01)		
Married	0.20***	0.22***	0.16***	0.22***	0.06***	0.33***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	322,328	138,217	184,111	322,328	138,217	184,111
R-squared	0.38	0.36	0.38	0.17	0.14	0.18
	Panel B: All countries cut-off at 16 years old					
Late*PisaT16	0.59***	0.65***	0.60***	0.03	0.08**	0.03
	(0.04)	(0.06)	(0.07)	(0.02)	(0.03)	(0.03)
Late16	-2.03***	-2.80***	-1.35***	-0.10	-0.33	0.04
	(0.37)	(0.54)	(0.50)	(0.16)	(0.25)	(0.21)
PisaT	0.68***	1.30***	0.21	0.12**	0.23***	0.05
	(0.13)	(0.16)	(0.18)	(0.05)	(0.08)	(0.06)
Age	0.03	0.06**	-0.00	0.01	0.02	0.01
	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)	(0.01)
Female	0.43***			-0.39***		
	(0.01)			(0.01)		
Married	0.19***	0.22***	0.16***	0.22***	0.06***	0.33***
	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)	(0.01)
Observations	322,328	138,217	184,111	322,328	138,217	184,111
R-squared	0.38	0.35	0.38	0.17	0.14	0.18

Notes: This table uses the average PISA scores as the proxy for early education quality. It is turned into a binary variable taking the value one when a country scores above the 90th percentile. This measure incorporates the country's means in mathematics, reading, and science. English-speaking countries include those where only English is spoken and those where it is a dominant language. Late Arrival is also a binary variable, for immigrants who arrived after age 8 in Panel A and after age 16 in Panel B. We consider only childhood immigrants. All regressions include the control variables listed in Panel A. All regressions include age at arrival dummies, country of origin dummies and year of migration dummies.

Another challenge with our results is whether the choice of an age of arrival and initial country

score cut-off makes sense. Despite the abundant literature on the subject, the cut-offs may fail to capture important information in this context. We therefore relax our previous assumption and consider the case where both variables are specified as continuous:

$$y_{ija} = \beta_0 + \beta_1 agorival_i * PISA_{ij} + \beta_2 agorival_i + \beta_2 PISA_{ij} + \beta_4 Z_{ija} + \epsilon_{ija} \quad (2)$$

where y_{ija} is the outcome considered, $agorival_i$ is the age at arrival, $PISA_{ij}$ is the continuous score from each country. Under this specification, the interaction remain significantly positive.

Table 4: Early education quality and future outcomes (Continuous specifications)

	Final Education Attainment			Log Annual Wages		
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Female	Male	All	Female	Male
Age at arrival * PISA	0.015***	0.014***	0.016***	0.000	0.001**	0.000
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Age at arrival	-0.421***	-0.434***	-0.409***	-0.012	-0.039***	-0.007
	(0.019)	(0.027)	(0.026)	(0.008)	(0.012)	(0.010)
PISA score	0.453	0.177	0.701	0.330	0.889	-0.217
	(0.504)	(0.771)	(0.627)	(0.358)	(0.618)	(0.255)
Age	0.058***	0.082***	0.038*	0.015**	0.025**	0.010
	(0.017)	(0.024)	(0.022)	(0.007)	(0.011)	(0.009)
Female	0.426***			-0.393***		
	(0.014)			(0.006)		
Married	0.188***	0.215***	0.155***	0.217***	0.060***	0.329***
	(0.014)	(0.021)	(0.020)	(0.006)	(0.009)	(0.007)
Observations	322,328	138,217	184,111	322,328	138,217	184,111
R-squared	0.378	0.354	0.378	0.172	0.142	0.175

Notes: This table uses the average PISA scores as the proxy for early education quality. For ease of interpretation, all scores are divided by 10. This measure incorporates the country's means in mathematics, reading, and science. We consider only childhood immigrants. All regressions include age at arrival dummies, country of origin dummies and year of migration dummies.

Due to the continuous nature of the variables, standard interaction term interpretations are not adequate. Instead, we rely on a marginal effect plot. Intuitively, this quantity represent $\frac{\Delta y_{ija}}{\Delta PISA} = \beta_2 + \beta_1 \text{agorival}$. Figure 3 shows that as the age of arrival is higher, the marginal impact of initial education quality increases. This effect is recorded both for final education attainment and wages, although the former ought to be considered carefully given the lack of significance of some parameters.

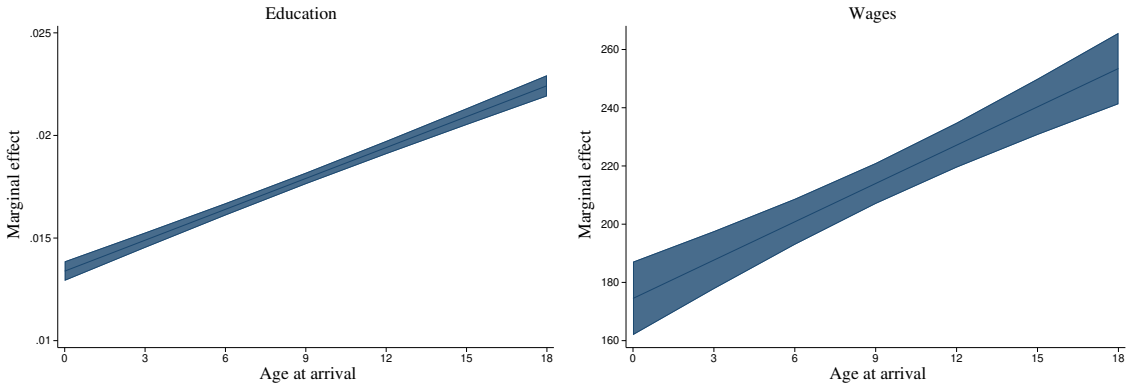

Figure 3: **Marginal effects of country of origins scores on US attainments.** Solid lines are estimates of $\beta_2 + \beta_1$agorival. Shaded regions represent 90% confidence intervals. The marginal effects for education and income are positive and increasing with later immigration from top scoring countries.

6 Conclusion and discussion

This paper has investigated the impact of early education quality on US immigrants later life outcomes. We find that some latecomers from highly ranked PISA countries have higher final education levels and earn more. This is the case across genders and especially among non-English-speaking countries of origin.

We end by acknowledging that our results are in line with the previous literature on language acquisition and cultural assimilation (Lazear (1999), Bleakley and Chin (2004), Böhlmark (2009)). Late migration has a negative effect on attainments, based on our results. The contribution of this paper is to show that this negative effect is lessened among migrants of top scoring countries, presumably due to initially acquired human capital.

Nonetheless, a limitation of our study has been the possibility of endogeneity. Perhaps, migrants who aim for high educational attainments in the US tend to move later during childhood. However, the use of an interaction term somewhat lessen this concern. Migrants or their families may choose letter immigration for educational purposes, but birth in a top scoring country is random, and we can argue that with regard to this dimension the two groups are plausibly comparable. Our results also do not address the question of the importance of family features in this process. We believe that these are two fruitful avenues for researchers interested in the timing of children immigration.

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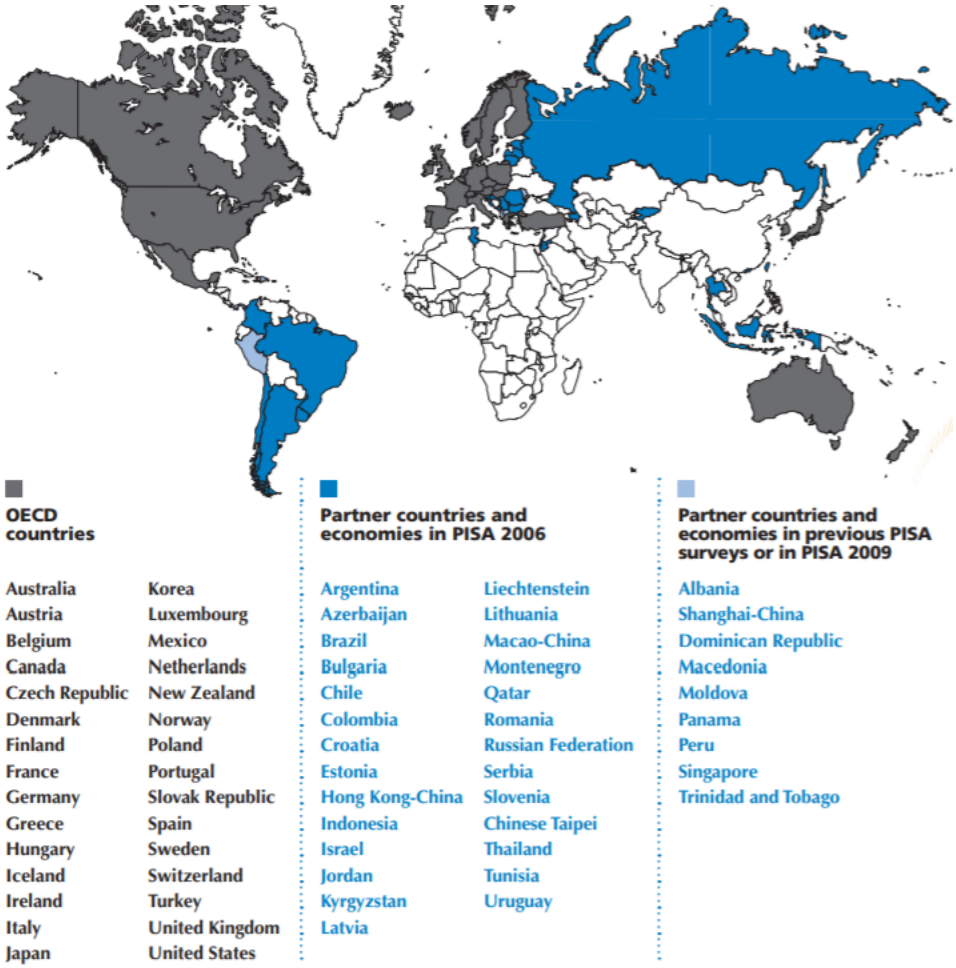

Figure 4: Countries involved in the PISA testing of 2006. (Source: https://www.oecd.org/pisa/aboutpisa/pisa-participants.htm)