

# The Gradient of Immigrant Age at Arrival Effects on Socioeconomic Outcomes in the U.S.

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## ABSTRACT

A young age at arrival is believed to be one of the primary predictors of adult immigrant achievement. So important is this pre-adolescent arrival that a special classification is given these ‘1.5 generation’ immigrants. However, it is not agreed if the appropriate dividing line should be 5, 10, 15, or another age. The 2000 census provides opportunity to test a more specific gradient of age at arrival effects by using exact years of age. We test for nonlinearities and breakpoints in the gradient with respect to several outcomes, and we compare Latino and Asian immigrants. Results indicate that the effect of early arrival is much greater for English proficiency than other outcomes, and Latinos benefit more than Asians in most outcomes.

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## Introduction

Age at arrival has been recognized as one of the most crucial measures to determine the outcomes of immigrant adaptation, besides generation and the duration of residence. Period of arrival and U.S. duration have been given much attention by economists as they come to conclusions like “immigrants experience upward mobility; occupational status and expected earnings rise with duration of residence” (Kossoudji 1989, p. 496).

Age at arrival is also important in gauging when in the life cycle an immigrant is beginning their life in a new country (Piore 1979). The age at arrival can effectively determine the extent of acculturation, language acquisition, and schooling, so much so that immigrant children who arrive before adolescence have been coined the 1.5 generation by Rubén Rumbaut (1991). Immigration researchers have long recognized the importance of age at arrival but most have adopted Rumbaut’s general definition of either coming during or after childhood, with the cut off being approximately 10 years of age. This dichotomization of the 1.5 generation is partially due to data limitations, sometimes due to small sample sizes where economy of classification is important, and other times, when large samples from the census are studied, due to the year of arrival data being reported in five-year categories.

For the first time in census data, the year of arrival in the 2000 census was reported in single years. From this it is now possible to compute age at arrival in exact years of age and to gauge its effect on various socioeconomic indicators. With a finer grain measurement now possible for all the association for age at arrival with all census variables, the opportunity is presented to ask exactly what is the gradient of socioeconomic difference that is associated with each successively older year of age. Likely there are differences between variables that were not disclosed by the single dichotomy of arrival before or after childhood. However, it is possible that for many or most outcomes, little is gained by using a more exact measure of age at arrival. In this paper we will test for the shape and magnitude of the gradient for several different outcome measures.

It is broadly accepted that immigrants who arrived as children have a higher socioeconomic status than immigrants who arrived as an adolescent or an adult. This hypothesis applied to those measurements shaped in the early stage of life, such as education attainment and English proficiency (Stevens 1999, Stevens 2004, Bleakley and Chin 2004, Chiswick and DebBurman 2004). The immigrants who arrived in early childhood complete most of their schooling in the United States and have started to learn English during the optimal point of the childhood development process. These two assets in turn provide immigrants with the human capital to better their chances for higher earnings, better occupations, and higher homeownership.

This paper sets out to accomplish three main research questions:

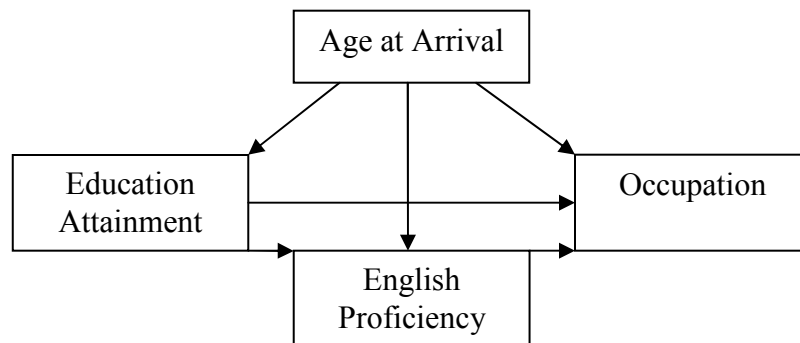
(1) How does an age at arrival gradient affect various socioeconomic indicators (illustrated here by preliminary findings for educational attainment, English proficiency,

and occupational attainment)? Is a single year of age at arrival useful for all outcomes or more for some than others? Is there a linear relationship between age at arrival and socioeconomic outcomes or are there critical break points to consider for certain outcomes? And lastly, how do these results vary by race/ethnicity (specifically for Latinos and Asians since they have the highest proportion of immigrants)?

(2) Which measure of age at arrival (before or after childhood versus a gradient of single years of age) is a more efficient determinant of socioeconomic outcomes for immigrants? Are the effects of each measure of age at arrival consistent across all outcomes or do they work differently for different outcomes? How do these results vary by race/ethnicity?

(3) What are the effects of the age at arrival gradient and human capital variable interactions on various socioeconomic outcomes like occupation? How do these results vary by race/ethnicity? One view of how these factors may interrelate is provided in Diagram 1.

**Diagram 1: the effect of age at arrival interacting with other variables**



## Data and Methods

We implement our cross-sectional analysis using 5 percent Public Use Micro sample data from Census 2000. This sample provides more precise information to calculate the single year of age at arrival. For this preliminary analysis we selected only foreign born males aged 25-45 in 2000 and who arrived in United States before 20 years old. This selection was made for simplicity and in order to avoid the noise from gender and older age differences on occupation and education. In our final paper for presentation at the PAA conference we will present a parallel analysis comparing females. There are 154,022 observations included after the above selection. Then we selected two of the largest recent immigrant groups to study on the difference between races and ethnicities, Latinos

(94,538 observations) and Asians (26,970 observations). All the observations with missing values have been dropped before estimation.

Logistic regression is adopted due to the binary treatment of our dependent variables. We measured occupation, English proficiency and education attainment by two levels. All outcomes are expressed as dummy variables in our model, whether one speaks English only or very well, whether one has a bachelor degree or higher, whether one holds a management, professional or related occupation (representing the white-collar jobs). Estimations for high school and construction jobs have also been completed, but these are not presented here.

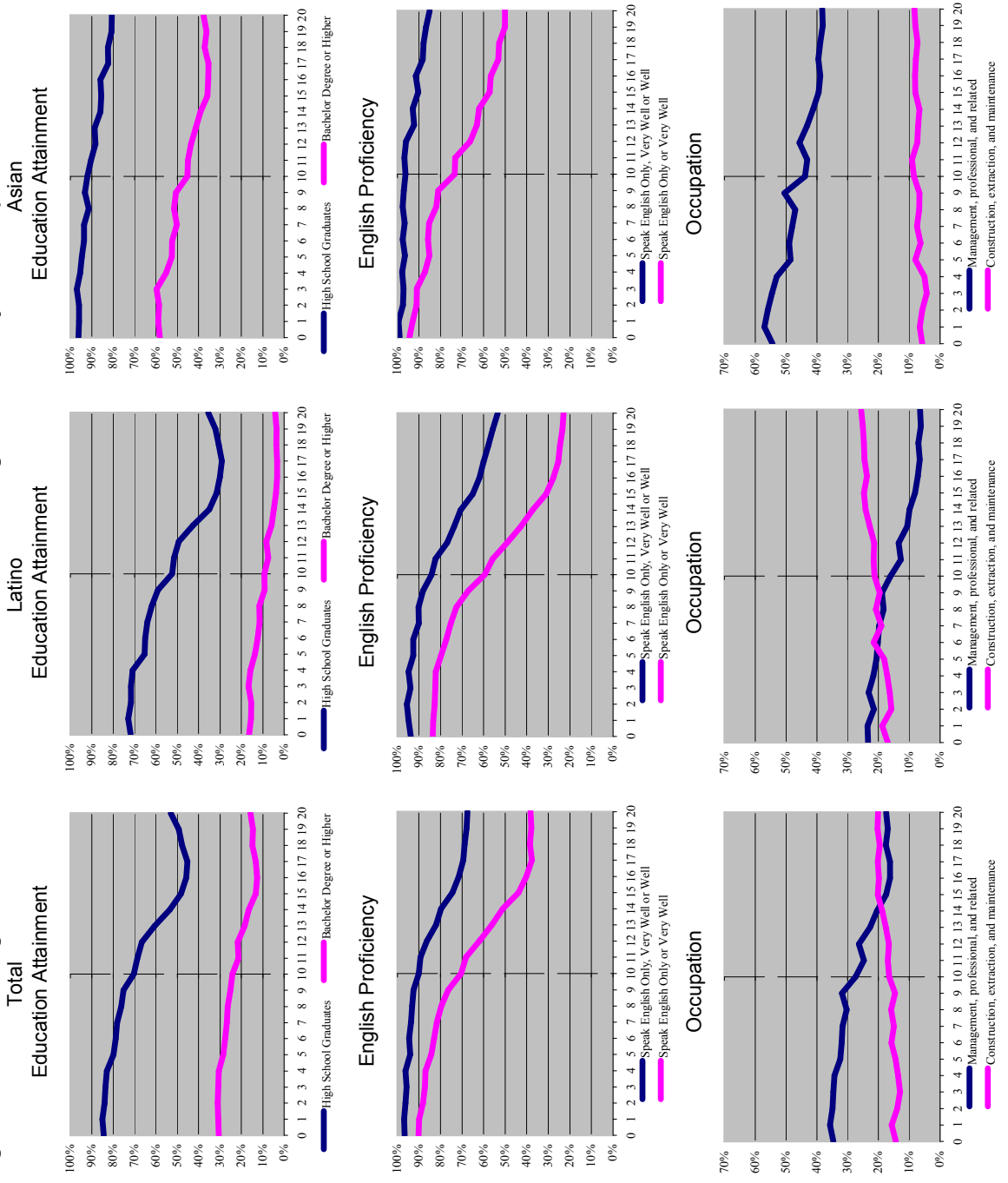
## **Descriptive Results**

A descriptive overview of the gradients for age at arrival effects is presented in Figure 1, where the top row of graphs pertain to educational attainment, showing both the percent holding a BA degree or higher and the percent holding a high school degree or higher. The second row pertains to English proficiency, graphing the percent who speak English only or very well or, alternatively, the more inclusive percent who speak English well, very well, or only. The third row of graphs then graphs the percent who are either construction workers or who are managers and professionals.

To facilitate reading the graphs, a vertical line is superimposed at age 10, demarcating the portion of the life course that is under and over age 10. A visual inspection shows that immigrants who reported arriving under age 10, and especially under age 5, have notably higher socioeconomic achievement than those who arrived at older ages. This age at arrival also appears to matter more for Latinos and Asians, and it matters more for the higher achievement levels (e.g. BA+) than for the middle ranks (e.g., HS+).

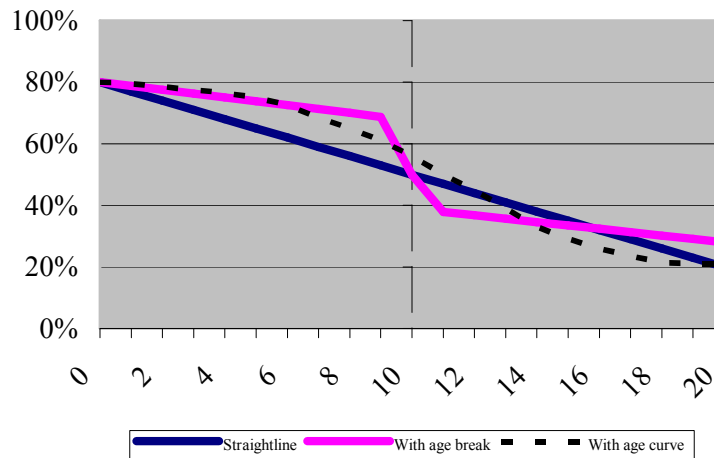
In few of these graphs is the age gradient a straight line sloping from age 0 to age 20. The question is what shape best represents the gradient. As a schematic representation, Figure 2 portrays three alternatives. One version portrays the straight line assumption. A second depicts a fairly abrupt age break around age 10, as assumed by the 1.5-generation convention. And the third alternative is a more curvilinear representation of the gradient that shows a relatively steeper slope around age 10.

**Figure 1. Gradients of Age at Arrival Effect on Educational Attainment, English Proficiency and Occupation, US, 2000**



Data Source: US Census 5% PUMS Data 2000, Weighted

**Figure 2. Assumption of the break at age 10 for 1.5 generation for higher social economic outcomes**



*Hypothetical data to show the assumption of break age for 1.5 generation.*

## Logistic Regression Model Results

The tests presented here seek to measure the gradient in three ways. We introduce a dichotomous indicator variable to represent men who arrived before or after age 10. We also utilize a straight line measure in the form of a continuous variable measuring age at arrival. And we utilize the square of age at arrival in order to capture any curvature to the gradient. In these logistic estimations the binary outcome measures described above are regressed on these alternative measures of the gradient. We then compare which combinations of factors best represents the gradient for each outcome and for each immigrant group.

A second stage of analysis then seeks to determine how age at arrival interacts with education to determine English proficiency or interacts with both those factors to determine the likelihood of holding a professional/managerial job.

We turn first to the simple tests of the gradient shape.

### A. Tests of the Gradient Shape

Three models are estimated for each ethnic group (or the total immigrants) with regard to each of the outcomes (see Table 1). Model 1 includes only an intercept and the dichotomous variable representing arrival under age 10. Some general conclusions can be drawn from comparing Model 1 across all groups and outcomes. First, just as the

literature would have it, there is a large and significant effect on higher socioeconomic status if an immigrant arrived young. We note also that the size of this logit coefficient is substantially larger for Latinos than Asians or all immigrants, suggesting that early arrival is more important for them (although this is not directly tested here). The third conclusion is that the age at arrival effect is much larger in the case of speaking English very well (or only English) than it is for education or occupation. Again, just as the literature has it, language ability is especially sensitive to early age at arrival.

In Model 2 we introduce an alternative measure—the exact age at arrival and a squared term. This squared term is fairly weak and not always significant. As before, the exact measurement of age of arrival has much stronger effect for English than the other outcomes. However, the differences between Latinos and Asians seem slight. The major difference between the two immigrant groups in Model 2 is with regard to the intercept: Latinos have a much lower achievement overall.

Turning to Model 3, the dichotomous measure is combined with the exact age at arrival measures. Its coefficient is far smaller than when it was included alone in Model 1. However, what is noteworthy is that this dichotomy still adds explanatory power even after the continuous measurement with exact age is employed. That implies that arriving younger than age 10 adds even more to adult socioeconomic status than the straight age at arrival. There is something extra about arriving young.

A comparison of the explanatory power across the three models is afforded by the BIC statistic (Raftery 1986). The larger the negative value, the more of the variance is captured by the model relative to the degrees of freedom. In all the models in Table 1 save two, it is Model 3 that is the best explanatory model. The exceptions are for Asian education and Asian English speaking. There does not appear that the dichotomous measure for young arrival adds anything to the continuous gradient in those cases.

A visual representation of the differences between the shapes of the three models also may be useful. Figure 3 displays the expected values for percent with a BA or higher degree among total immigrants, computed from the coefficients from Table 1. The actual (raw) data are also displayed for comparison. The staircase effect of the dichotomous variable in Model 1 is plainly evident. Model 2 is visible as a slightly curving line. Model 3 then combines the two effects, sloping downward but with an abrupt break. This pattern of outcome closely resembles the ideal type suggested in Figure 2 (which was prepared before the model estimations). And in fact that is the model that is the best fit to the raw gradient, according to the BIC statistics in Table 1.

The tentative overall conclusion is that young arrival is important to later success, but it helps to know exactly how young. And the effect of young arrival varies substantially across outcomes and groups.

**Table 1. Age at Arrival Effects on Education, English Proficiency and Management Occupation, United States, 2000**  
Logistic regression estimates

	Bachelor Degree or Higher								
	Total			Latino			Asian		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	-1.748 ***	-0.681 ***	-1 ***	-3.158 ***	-1.461 ***	-1.81 ***	-0.5 ***	0.501 ***	0.274 ***
Arrive < age 10 (yes/no)	0.793 ***		0.25 ***	1.266 ***		0.283 ***	0.633 ***		0.161 ***
Age at arrival		-0.069 ***	-0.04 ***		-0.101 ***	-0.07 ***		-0.09 ***	-0.07 ***
Age at arrival squared		0.000	0.000		0.000	0.000		0.002 ***	0.001 **
Observations		154,022			94,538			26,970	
-2 Log	2,943	3,293	3,357	1,690	1,964	1,982	527	612	620
BIC	-2,931	-3,269	-3,321	-105,163	-105,425	-105,432	-108,510	-108,585	-108,583

	Speaking English Only or Very Well								
	Total			Latino			Asian		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	0.265 ***	2.710 ***	2.186 ***	-0.853 ***	2.09 ***	1.47 ***	0.297 ***	2.916 ***	2.462 ***
Arrive < age 10 (yes/no)	1.923 ***		0.335 ***	2.006 ***		0.405 ***	1.545 ***		0.271 ***
Age at arrival		-0.234 ***	-0.178 ***		-0.203 ***	-0.137 ***		-0.23 ***	-0.18 ***
Age at arrival squared		0.003 ***	0.002 ***		0.001 ***	0.000		0.004 ***	0.003 ***
Observations		154,022			94,538			26,970	
-2 Log	19,932	24,451	24,567	12,246	15,184	15,285	2,199	2,734	2,748
BIC	-19,920	-24,427	-24,531	-99,622	-102,548	-102,638	-180,318	-180,843	-180,847

	Management, Professional, and Related Occupations								
	Total			Latino			Asian		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Intercept	-1.523 ***	-0.553 ***	-0.824 ***	-2.472 ***	-1.130 ***	-1.434 ***	-0.417 ***	0.258 ***	0.176 *
Arrive < age 10 (yes/no)	0.762 ***		0.209 ***	1.087 ***		0.234 ***	0.427 ***		0.059
Age at arrival		-0.047 ***	-0.024 ***		-0.048 ***	-0.023 **		-0.056 ***	-0.048 ***
Age at arrival squared		-0.001 ***	-0.001 ***		-0.002 ***	-0.002 ***		0.000 *	0.001
Observations		154,022			94,538			26,970	
-2 Log	3,023	3,556	3,606	1,944	2,396	2,417	241	299	300
BIC	-3,011	-3,532	-3,570	-99,823	-100,264	-100,274	-122,575	-122,622	-122,613

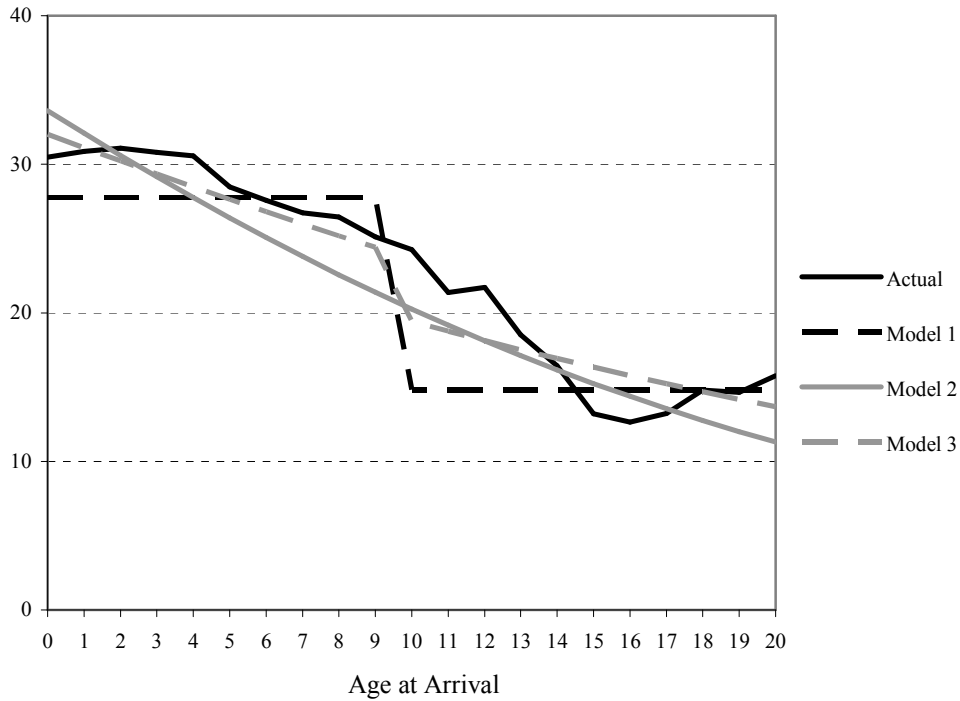
\*\*\* p<0.01 \*\*p<0.05 \*p<0.1

Sample is age 25 to 45 in 2000, arrived before age 20, male only.

Data Source: US Census 5% PUMS Data 2000, Weighted



**Figure 3: Expected Values for Bachelor Degree Models, Total Immigrants**



## B. Interactive Models of English Proficiency

In this preliminary paper, we also estimated some multivariate models to explain two outcomes. First, Table 2 presents logistic estimates for the likelihood of speaking English very well (or only English). As before, adding a dichotomous variable for arrival under the age of 10 adds significantly to the model. (BIC statistics will be completed for all these models in the final paper to be presented at PAA.) Among Latinos, holding a BA degree is the strongest predictor of speaking English well, but among Asians, that is much less important.

Of greater interest to this paper is whether age at arrival interacts with holding a BA degree in increasing the likelihood of speaking English very well. In fact, for Latinos, Asians, and total immigrants, holding a BA has extra value for elevating English proficiency among immigrants who arrive as teenagers. It should be recalled that our sample is restricted to immigrants who arrived before age 20. Nonetheless, it appears there may be a selection effect between educational and language propensities. More research is required into this.

**Table 2. Age at Arrival Effects on English Proficiency Adjusted for Education, United States, 2000**  
Logistic regression estimates

	Speaking English Only or Very Well					
	Total		Latino		Asian	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept	2.447 ***	1.965 ***	1.934 ***	1.320 ***	2.613 ***	2.202 ***
Arrive before age 10		0.310 ***		0.403 ***		0.240 ***
Age at arrival	-0.227 ***	-0.176 ***	-0.199 ***	-0.134 ***	-0.237 ***	-0.191 ***
Age at arrival squared	0.003 ***	0.001 ***	0.001 ***	0.000	0.004 ***	0.003 ***
Bachelor degree or higher	0.649 ***	0.689 ***	0.915 ***	0.972 ***	0.389 **	0.428 ***
BA+ * Age at arrival	0.127 ***	0.120 ***	0.187 ***	0.179 ***	0.081 ***	0.073 ***
BA+ * Age at arrival squared	-0.003 ***	-0.002 ***	-0.008 ***	-0.008 ***	-0.001	-0.001
Observations	154,022		94,538		26,970	
-2 Log	43,152	43,155	10,844	10,845	8,749	8,750

\*\*\* p<0.01 \*\*p<0.05 \*p<0.1

Sample is age 25 to 45 in 2000, arrived before age 20, male only.

*Data Source: US Census 5% PUMS Data 2000, Weighted*

### C. Interactive Models of Occupational Attainment

A similar set of interactive models was estimated between age at arrival and attainment of a professional or managerial occupation. In Table 3 the estimate results include an additional explanatory variable, namely English proficiency. In this case, arrival at a young age seems to matter little. The dichotomous variable is not significant, and the continuous measurements of age at arrival also have virtually no effect. All that matters for this occupational attainment is education and English proficiency.

It is well known that education and language skills are the strongest predictors of occupational status. Yet it is surprising that there is no benefit to arriving at a young age. The Myers and Cranford (1998) study, for example, showed clearly that immigrant children were much more likely to enter white collar employment than their parents. However, that study did not seek to measure differences among the children in the fine grained matter we have here. It is possible that there was less internal differentiation than was presumed. Another matter to inquire about is the broad categorization of managers and professionals. If the store manager of a 7-11 is included, that might indicate this occupational classification is not as uniformly high status as presumed. This is a matter that will be investigated further before preparing the final version of the paper.

**Table 3. Age at Arrival Effects on Manager/Professional Occupation Adjusted for Education and English P**

Logistic regression estimates

	Management, Professional, and Related Occupations					
	Total		Latino		Asian	
	Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Intercept	-2.123 ***	-2.213 ***	-2.716 ***	-2.823 ***	-1.394 ***	-1.300 ***
Arrive before age 10		0.060		0.071		-0.026
Age at arrival	-0.031 **	-0.022	-0.009	0.002	-0.015	0.000
Age at arrival squared	0.000	-0.001	-0.001	-0.001	0.000	-0.056
Bachelor degree or higher	2.318 ***	2.318 ***	2.394 ***	2.397 ***	2.141 ***	2.138 ***
BA+ * Age at arrival	0.017	0.017	0.044 **	0.043 **	-0.018	-0.017
BA+ * Age at arrival squared	0.001	0.001	-0.002 **	-0.002 **	0.002 **	0.002 **
English only/very well	0.706 ***	0.719 ***	1.033 ***	1.049 ***	0.354 **	0.337
English only/ v.well *AgeArrival	0.025	0.021	0.018	0.013	0.014	0.018
English only/ v.well *AgeArrival S	0.000	0.000	-0.002 *	-0.001	0.000	0.000
Observations		154,022		94,538		26,970
-2 Log	37,920	38,015	#####	17,839	4,804	4,815

\*\*\* p<0.01 \*\*p<0.05 \*p<0.1

Sample is age 25 to 45 in 2000, arrived before age 20, male only.

*Data Source: US Census 5% PUMS Data 2000, Weighted*

## Conclusion

Arriving at a young age matters, unless perhaps one has a BA degree and speaks fluent English. For the others early arrival can provide a lifelong assist.

This paper has estimated differences the age at arrival effect, testing parameters that best describe the shape of the gradient of age at arrival effects. The preliminary results are very promising because they indicate the method applied to 2000 census data is sensitive enough to distinguish between effects in different immigrant groups and in different outcome areas. We plan to develop this paper further and introduce several more outcome measures, including homeownership, earnings, transportation method, and others.

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