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ABSTRACT

Using Achievement Tests to Measure Language Assimilation and Language Bias among Immigrant Children*

We use Woodcock Johnson III child assessment data in the New Immigrant Survey to examine language assimilation and test score bias among children of Hispanic immigrants. Our identification strategy exploits the test language randomization (Spanish or English) to quantitatively measure the degree and speed of language assimilation, in addition to the potential costs associated with taking a test in one's non-dominant language. We find that U.S. born children of Hispanic immigrants are not bilingual as predicted by most language assimilation models but rather are English dominant. English language assimilation occurs at a rapid pace for foreign born children as well; children who arrive in the U.S. at an early age or who have spent more than four years in the U.S. do not benefit from taking the tests in Spanish. Results are robust to a fixed effects specification that controls for household level characteristics constant across siblings.

JEL Classification: J24, I20, J18, O15, F22

Keywords: immigration, language assimilation, New Immigrant Survey, Woodcock Johnson achievement tests

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1. Introduction

Concern over immigration and immigrant assimilation in the latter half of the twentieth century has not abated as we have moved into the twenty-first. Fueled by apprehension over the shifts in the composition of the immigrant pool, the public and policy makers alike debate the prospects for the assimilation of these 'new' origin groups. Specifically, of the 9,095,417 individuals granted legal permanent residency between 1991 and 2000, 30.7 percent were from Asia, 24.7 percent were from Mexico, and only 14.9 percent were from Europe. In comparison, of the 3,321,677 persons granted legal permanent residency between 1961 and 1970, 33.8 percent were from Europe, 12.9 percent were from Asia, and 13.7 percent were from Mexico (U.S. Department of Homeland Security, 2003). This dramatic shift in sending countries, and the lower average education levels associated with the new composition of countries, has increased anxiety over whether the new arrivals will integrate economically and socially into American society in a manner similar to that observed in previous waves (Massey, 1981, 1995; Card, DiNardo and Estes, 2000; Card, 2005).

The broad concerns about recent trends in immigration are well-captured by the following quote by Massey (1995, p. 631): "The rapidity of the change and the scale of the movement have led to much consternation about what the 'new immigration' means for American society…Some worry about the economic effects of immigration…Others worry about the social welfare caused by immigrants…Observers also express fears of linguistic fragmentation." Massey (1995) summarizes that "what the public really wants to know…is whether or not the new immigrants will assimilate into the Euro-American society of the United States, and how that society and its culture might change as a result of this incorporation." These concerns are not limited to the sociological literature; Card (2005) also noted a shift within the

economics profession from general optimism in the 1970s about the prospects for immigrants' economic integration to currently pervasive pessimism surrounding this possibility. A substantial portion of these fears is driven by questions concerning immigrants' use of and proficiency in English. The increased presence and visibility of ethnic enclaves and their continual replenishment with new arrivals, who often have limited English proficiency, have raised questions about immigrants' incentives to learn English at all (McManus, Gould and Welch, 1983; Zhou and Logan, 1989; McManus, 1990; Chiswick and Miller, 2005). Further, concern over the declining quality of immigrants is directly linked to their future earnings potential and their possible need for means-tested public assistance (Blau, 1984; Borjas, 1985; Borjas and Trejo, 1991; Trejo, 1992; Borjas and Trejo, 1993; Borjas, 1994, 1995; Borjas and Hilton, 1996). English language proficiency is a critical step in the broader process of immigrant assimilation and economic mobility (McManus, Gould and Welch, 1983; Kossoudji, 1988; Tainer, 1988; Bleakley and Chin, 2004, *Forthcoming*).

In the current study, we use child achievement test data available in the New Immigrant Survey to examine language assimilation and test score bias among the children of Hispanic immigrants. The New Immigrant Survey sampled adult immigrants who were granted legal permanent residency between May and November of 2003 and administered four Woodcock Johnson achievement tests to the co-resident children of this sample. The achievement tests were randomly administered in either English or Spanish to children of Hispanic immigrants. Our empirical identification strategy exploits this randomization of test language to measure the degree and speed of language assimilation, as well as the potential costs associated with taking a test in one's non-dominant language.

The test language randomization revealed that average scores for tests taken in English were significantly higher for two of the four tests but significantly lower for one of tests with no difference on the fourth test. However, this result masks significant heterogeneity of the impact of test language that has important implications for understanding immigrant assimilation and for developing accurate policy prescriptions.

When we examine this heterogeneity, first we find that the children of Hispanic immigrants have a higher degree of English language assimilation than that predicted by the standard immigrant language assimilation models. These models argue that first generation immigrants are monolingual in their native language, second generation immigrants are bilingual in English and their native language, and third generation immigrants are monolingual in English (see Fishman (1972) for seminal work on this topic and Stevens (1992) and Alba et al. (2002) for empirical tests of the model). We find that second generation children (those born in the U.S.) of Hispanic immigrants are not bilingual but rather are English dominant with results showing over a one standard deviation disadvantage for U.S. born immigrant children who take the test in Spanish instead of English. This impact is even larger for children at the lowest quantiles of the test score distribution, with one test showing more than a four standard deviation disadvantage for U.S. born children who take the test in Spanish. Results are consistent and robust to estimating a sibling fixed effects model which controls for observable and unobservable household level characteristics (such as parent's education, English proficiency, and desire to have their children learn English) that are constant across siblings.

Second, we find that English language assimilation occurs at a rapid pace for foreign born children as well. Children who arrive in the U.S. at an early age or children who have spent more than three to four years in the U.S. do not benefit from taking the achievement tests in

Spanish. This raises doubts about the conclusions of Alba et al. (2002) who find that the descendants of Spanish speakers are learning English at a slower pace than previous immigrants and slower than current immigrants from other regions.

Third, we find an effect of being born in the U.S. that impacts test scores beyond English proficiency. For both U.S. and foreign born immigrant children proficient in English, not surprisingly there is generally an advantage to taking the test in English. However, among those with limited English proficiency, foreign born children only do well if the test is taken in Spanish, while no significant difference in average test scores based on the test language is observed for U.S. born children. This language advantage for limited English proficient U.S. born children could be due to test-taking skills learned in U.S. schools or general immersion in American culture, but it is clear that within a short time period, Hispanic immigrant children learn English.

Finally, we are able to measure the extent of any test score bias associated with the language in which the standardized tests are administered. Low test scores due to limited English proficiency among recent arrivals or children who arrive at an older age may track students into non-honors classes, less academically oriented schools, and less competitive post-secondary schools. As described in recent reports by the Pew Hispanic Center, Latinos are less likely to enroll in postsecondary education and are twice as likely to drop out of high school as non-Hispanic whites (Pew Hispanic Center, 2002; Fry, 2003). Previous work using different datasets suggests a strong link between achievement test scores and later life outcomes (Murnane, Willet and Levy, 1995; Neal and Johnson, 1996). In particular, Currie and Thomas (2001) use the National Child Development Study in Britain and find that achievement test scores at age seven are predictive of future labor market outcomes as well as future earnings for

men and women. Duncan et al. (2007) conduct a meta-analysis using six datasets and consistently show that early assessments of math and reading skills are the strongest predictors of later academic and occupational achievement.

The remainder of the paper is organized as follows. Section 2 describes the New Immigrant Survey data and the Woodcock Johnson achievement tests. Section 3 describes the empirical identification strategy. Section 4 presents the main results as well as robustness tests measuring the rate of language assimilation. Section 5 concludes.

2. Data and Empirical Setting

2.1 New Immigrant Survey Data

The data used in this study come from the New Immigrant Survey (NIS) 2003 cohort. The survey was originally pilot tested with a 1996 sample cohort of immigrants (refer to http://nis.princeton.edu for additional information). The sampling frame for the NIS 2003 was immigrants aged 18 and older who were granted legal permanent residency between May and November of 2003 and the response rate was 69 percent (Jasso et al., *Forthcoming*).[1] Interviews were conducted in the language of the respondent's choice as soon as possible after legal permanent residency was granted and individuals who were new arrivals to the U.S. as well as those who had adjusted their visa status were included in the sample (Jasso et al., *Forthcoming*).

Woodcock Johnson III tests were administered to all co-resident biological, step, and adopted children of the adult sampled immigrants.[2] In order to assess any test score bias due to limited English proficiency, children whose sampled immigrant parent was born in a Spanish-

[1] The sampling design dictates that undocumented migrants and others without legal permanent residency status are not eligible for inclusion.

[2] Biological children represent 97.3 percent of the sample (899 children) and all results are consistent if the analysis is restricted to these children. There are 6 stepsons (0.7 percent of the sample), 18 stepdaughters (1.9 percent of the sample), and 1 adopted child (0.1 percent of the sample) who make up the remainder of the sample.

speaking country and whose first language was Spanish were randomly administered the test in English or Spanish.

Of the 1,029 experiment eligible children who completed the tests, 924 are available for the majority of the analysis. One hundred and five observations cannot be used due to missing information on the country of birth, a key variable in the analysis.[3] Of the 924 children, 472 completed the tests in English and 452 completed the tests in Spanish. Forty-seven percent of the 924 children are from Mexico, 24 percent are from El Salvador, 9 percent are from Guatemala, and no other origin country accounts for more than 5 percent of the sample.

2.2 Woodcock Johnson III Tests

Four achievement tests were administered to age eligible children. The Passage Comprehension and Calculation tests were administered to children between the ages of six and twelve inclusive (leaving 689 children available for these analyses). The Applied Problems and Letter Word Identification tests were administered to children between the ages of three and twelve inclusive (using all 924 children).

The Passage Comprehension and Calculation tests are designed to evaluate reading comprehension and vocabulary and mathematical and quantitative ability, respectively. The Applied Problems test measures aptitude in practical problem solving in mathematics, while the Letter Word Identification test evaluates symbolic learning and reading identification skills (Woodcock and Johnson, 1989). As described by Johnson and Schoeni (2007), the Woodcock Johnson test is an easel test, where the answer book is placed in front of the respondent. The interviewer is instructed to place the easel at an angle that allows them and the respondent to view the pictures simultaneously. The order of question presentation is crucial as the easiest

[3] A t-test comparing the 924 children in the analysis and the 105 excluded children who are missing country of birth information reveals no statistically significant difference between the proportions administered the test in Spanish.

questions are presented first followed by increasingly harder ones. The starting point for the test is determined by the education level of the child.[4] The scores in the current analysis were normed by age based on national averages to have a mean of 100 and a standard deviation of 15.

2.3 Data Overview

The four Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. To confirm that the randomization was effective, in Table 1, we compare characteristics for children who were randomly administered the test in English with characteristics for those children who were randomly administered the test in Spanish. The final column presents the mean difference across test language as well as the standard error of the difference. For almost all characteristics, there is no statistically significant difference for those children who take the test in English or Spanish. The fraction of children who are born in the U.S., the child's age at arrival, the number of years spent in the U.S., and the proportion of the child's life in the U.S. are similar across the randomized test languages. Similarly, the child's years of education, years of education in the U.S., age, and whether English is spoken at home show no statistically significant difference across the groups of children who were randomly given the test in English or Spanish. A higher proportion of Spanish language test takers are female, a difference that is statistically significant at the 10 percent level. To address this potential bias, in the regression analysis, we include controls for the child's gender, but the results are consistent. Finally, there are no statistically significant differences across

[4] For the administration of these tests to children in the New Immigrant Survey, the NIS administrators took into account the immigrant children's unique backgrounds. Because these children may not have received as much education as similar-aged non-immigrant children, the starting level for their achievement tests was adjusted accordingly. Specifically, children in preschool through third grade began each test at the suggested level for one grade below their actual school grade. As the relationship between school grade and level of achievement test difficulty is not perfectly linear, children in grades four and higher began the test at the suggested level for two grades below their actual school grade.

parent characteristics, including parent's years of education, parent's English proficiency, or the parent's number of years of U.S. experience.

To examine the relationship between test languages and test score, we compare the mean test scores for children who took the test in the different languages. Table 2 presents the comparison results for each of the four achievement tests. Of the 689 children who completed the Passage Comprehension and Calculation tests, 348 of them took the test in English and 341 in Spanish. Average test scores for these two tests (in Panel A) are higher for those children who took the test in English and the results are statistically significant at the 1 percent level. Figures 1a and 1b show the kernel density estimates for the Passage Comprehension and Calculation exams broken down by the randomized test language. For both tests, the kernel density for the test scores for children who took the test in English are shifted to the right and have a smaller left tail than the kernel density for the test scores for children who took the test in Spanish.

For the Applied Problems and Letter Word Identification exams, 472 children took the tests in English and 452 took the tests in Spanish. Panel B of Table 2 indicates that for the Applied Problems test there is no significant difference in average test scores based on the test language, consistent with the kernel density graph in Figure 1c. Finally, for the Letter Word Identification exam, children taking the test in Spanish performed on average 4.75 points better than children taking the test in English, and the result is statistically significant at the 1 percent level. Figure 1d shows that the kernel density for test scores in Spanish is shifted to the right of the kernel density for English test scores.

3. Empirical Identification Strategy

To measure the causal impact of language on achievement test scores, we exploit the test language randomization, which meant that one half of the children of Hispanic immigrants were

randomly administered all of the Woodcock Johnson tests in English and the other half received the tests in Spanish. In Tables 3a and 3b we explore how test language is related to test scores for first generation immigrant children (those who are foreign born) and for second generation immigrant children (those who are U.S. born). In Table 4, we combine the test language and birthplace information using a two-by-two difference-in-differences table to illustrate the identification strategy.

In Table 3a, we present average achievement test scores for each of the four tests for three distinct groups of first generation immigrant children. Columns 1 and 2 are for the experiment eligible children of Hispanic immigrants who are randomly assigned to take the test in English (column 1) or Spanish (column 2). Column 3 presents the test scores for non-experiment eligible children, all of whom take the test in English and are the children of non-Hispanic immigrant parents. The test language randomization indicates large differences between foreign born children of Hispanic immigrants who took the tests in English compared to Spanish. For three out of the four tests, foreign born children who take the test in Spanish score between 10.71 to 22.54 points (0.71 to 1.50 standard deviations) higher than those who take the test in English and the differences are significant at the 1 percent level. Only the Calculation test shows no significant difference in average test scores across the test languages. Comparing the children of Hispanic immigrants with the children of non-Hispanic immigrants provides a useful benchmark to measure the magnitude of the impact of test language on test scores. This comparison shows that English proficiency is significantly worse for Hispanic foreign born children compared to the non-experiment eligible foreign born children of other immigrant origin groups. The Hispanic children who take the tests in English have lower average test scores with deficits ranging from 6.11 to 14.44 points. This result contrasts with that for the foreign born

children of Hispanic immigrants who take the tests in Spanish. When comparing these children with the non-Hispanic children, for the Passage Comprehension and Applied Problems tests there are no statistically significant differences and for the Letter Word Identification test the Hispanic children taking the test in Spanish score significantly better. Only for the Calculation test do the Hispanic children taking the test in Spanish still do significantly worse than the non-experimental children.

Table 3b is analogous to Table 3a but is restricted to second generation children. The test randomization results for U.S. born children are in stark contrast with those in Table 3a in which foreign born children taking the test in Spanish did significantly better than those taking it in English. U.S. born children of Hispanic immigrants who take the achievement tests in English experience significantly higher test scores than those who take the tests in Spanish. Results are significant at the 1 percent level for the Passage Comprehension and Calculation exams, at the 5 percent level for the Applied Problems test, and are not statistically significant for the Letter Word Identification test. This reversal is a combination of U.S. born Hispanic children scoring both higher on the tests in English and lower on the tests in Spanish compared to foreign born Hispanic children. When comparing the U.S. born children of Hispanic immigrants with those of non-Hispanic immigrants, there are still significant differences in English proficiency, but the size of the gap is greatly reduced compared to foreign born children. The U.S. born non-experiment eligible, non-Hispanic children have higher average test scores for all four tests than the children of Hispanic immigrants who take the test in English and the differences are significant at the 1 percent level for three of the four tests, but the magnitude of the differences are smaller than those reported in Table 3a for the foreign born children. Finally, results indicate that Spanish ability has also decreased for U.S. born children of Hispanic immigrants. The U.S.

born non-Hispanic children score significantly better on all four tests than the U.S. born children of Hispanic immigrants who were randomly administered the test in Spanish and the results are significant at the 1 percent level. These differences are even larger than those in Table 3a where Hispanic foreign born children taking the test in Spanish appeared to narrow the gap in test scores with non-Hispanic children.

In Table 4, we combine the test language and birthplace information into a single cross-tabulation table to highlight the identification strategy. Each panel in the table is for one of the four achievement tests, and we present average test scores for foreign born and U.S. born children of Hispanic immigrants who were randomly administered the tests in either English or Spanish. As previously discussed, for the Passage Comprehension, Applied Problems and Letter Word Identification tests, being administered the test in Spanish is a significant advantage for foreign born children of Hispanic immigrants. However, taking the test in Spanish for U.S. born children of Hispanic immigrants is a significant disadvantage for the Passage Comprehension, Calculation, and Applied Problems exams. Table 4 allows us to more directly compare the average test scores in a given language across foreign born and U.S. born children. U.S. born children of Hispanic immigrants randomly administered the test in English always do better than foreign born children of Hispanic immigrants who take the test in English and results are significant at the 1 percent level for three of the four tests (only the Calculation test shows no statistically significant difference). Conversely, U.S. born children of Hispanic immigrants randomly given the exams in Spanish always do worse than foreign born children who take the test in Spanish, although only the Passage Comprehension and Letter Word Identification differences are statistically significant. Calculating the difference-in-differences estimator shows that U.S. born children of Hispanic immigrants who were administered the test in Spanish

instead of English on average score 21.86, 2.17, 17.86, and 22.59 points lower than foreign born children on the four achievement tests respectively. The results can be interpreted as the impact of test language on achievement test scores under the assumption that the foreign born and U.S. born children who were randomly administered the test in Spanish would have exhibited the same average test score difference as the children who were randomly given the test in English; given the Table 1 results verifying the validity of the test language randomization, this assumption seems plausible.

4. Empirical Results

While the previous cross tabulations are informative, they do not control for other factors that might influence test scores such as child or parent characteristics. In Tables 5a and 5b, we estimate OLS regressions that are comparable to the difference-in-differences estimator predicting each test score but we also include child and parent characteristics.[5] We clearly see that the test language impact depends on nativity. In column 1 of Table 5a, U.S. born children of Hispanic immigrants who take the Passage Comprehension test in English experience almost a full standard deviation advantage (13.20 points higher) compared to foreign born children who take the test in English, while the foreign born who take the test in Spanish experience a 10.71 point advantage compared to foreign born children taking the test in English. Meanwhile, children of Hispanic immigrants who are born in the U.S. but take the test in Spanish experience a disadvantage of 1.46 standard deviations (21.86 points), suggesting English dominance within this group. This pattern holds when including controls for only child characteristics (column 2),

[5] Correlation among the error terms for children in a given household might bias the OLS standard errors downward, so in all regressions we cluster the standard errors by household (Moulton, 1986; Bertrand, Duflo and Mullainathan, 2004).

only parent characteristics (column 3), and both child and parent characteristics (column 4).[6] The child and parent characteristics (coefficients not shown) generally exhibit the expected signs and are jointly significantly different from zero at the 1 percent level. The most consistent and statistically significant characteristic is the parent's years of education which is positively correlated with higher average test scores for all four achievement tests. Consistent with the results in Table 4, the Calculation test results do not reveal a significant effect of test language or birthplace. There is no statistically significant difference by test language for foreign born children, and there is no statistically significant difference between foreign and U.S. born children who take the test in English.

Table 5b displays regressions for the Applied Problems and Letter Word Identification tests, and the results are similar to those for the Passage Comprehension test. Foreign born children who are randomly given these tests in Spanish instead of English experience a benefit of 13.66 and 22.54 points, respectively, compared to the 10.71 point advantage observed in the Passage Comprehension test. Taking the tests in English for U.S. born compared to foreign born children yields a 14.07 and 6.99 test score advantage, respectively. Overall, these patterns are robust to the inclusion of parent and child characteristics and indicate a substantial advantage for second generation children of Hispanic immigrants who take the test in English and for first generation children of Hispanic immigrants who take the test in Spanish, and a substantial disadvantage for U.S. born children of Hispanic immigrants who are randomly administered the test in Spanish.

[6] The child characteristics include birth year dummies, child's years of education, child's years of U.S. education, child's sex, and whether English is spoken at home (based on the parent's report). The parent characteristics include parent's years of education, parent's English proficiency, parent's years of U.S. experience, and parent's years of U.S. experience squared.

To examine how test language impacts children at different levels of the test score distribution, we estimate quantile regressions for the 10^{th}, 25^{th}, 50^{th}, 75^{th}, and 90^{th} percentiles. The results indicate that, in general, at the lowest quantiles of the distribution, the impacts of test language and birthplace are significantly larger. For instance, U.S. born children in the 10^{th} percentile on the Passage Comprehension test experience a 66.93 point disadvantage when they take the test in Spanish; similar children experience a 49.47 point disadvantage on the Applied Problems test and a 26.93 point disadvantage on the Calculation test. For each achievement test, we compare the coefficients on the three variables (U.S. born, test in Spanish, and U.S born interacted with test in Spanish) at the 10^{th} and 90^{th} percentiles and at the 25^{th} and 75^{th} percentiles and can reject at the 1 percent level that they are jointly equal in magnitude.

The previous baseline results could be driven by observable household characteristics that we are not able to control for (e.g., wealth or occupational status) or unobservable characteristics (e.g., preferences for learning English, parents' aspirations for their children), so to test the robustness of the previous results, in Table 7 we estimate a sibling fixed effects specification. The sibling fixed effects estimation controls for factors that are constant across siblings in a given household. Identification is driven by multiple child households with children who differ in their birthplace (U.S. or foreign born) and by households where the children differ in the language of test administration (Spanish or English).[7] We find that even after controlling for both unobserved and observed household characteristics that are constant across siblings, the original pattern in Table 5 is robust. U.S. born children taking the test in English score 13.38, 21.92, and 19.73 points higher than foreign born children given the test in English for the Passage Comprehension, Applied Problems and Letter Word Identification tests. On the same

[7] Of the 924 children in the analysis, 584 of them are in multiple child families and 340 are in single child families. For the age restricted sample of 689 children (Panels A and B in Table 7), 435 of them are in multiple child families and 254 are in single child families.

three tests, foreign born children who take the test in Spanish instead of English also experience a significant advantage of 12.89, 17.77, and 28.23 points respectively. For these three tests, U.S. born children who are randomly administered the test in Spanish experience 18.40, 22.75, and 29.23 points lower scores on the three tests respectively (corresponding to drops of 1.23, 1.52, and 1.95 standard deviations). Similar to the previous analysis, the results for the Calculation test do not show a strong impact of test language and birthplace on test scores. U.S. born children taking the Calculation test in English do not score higher than foreign born children taking it in English and there is no additional disadvantage for U.S. born children who take the test in Spanish, indicating that the skills required to succeed on the quantitative test are uncorrelated with test language or birthplace.

Having provided evidence that children of Hispanic immigrants experience a significant degree of English language assimilation and having tested the robustness of these results, we next attempt to measure the speed of this language assimilation. In Table 8, we present baseline regressions similar to those in Tables 5a and 5b, but we incorporate the child's age at arrival in the U.S. (Panel A), child's years in the U.S. (Panel B), and percent of the child's life spent in the U.S. (Panel C). We find that first generation children who arrive in the U.S. at an early age or children who have spent more than three to four years or about one-third of their life in the U.S. do not benefit from taking the achievement tests in Spanish. Results in Panel A indicate that, for children who take the test in English, for each additional year older that the child came to the U.S., test scores on the Passage Comprehension, Applied Problems, and Letter Word Identification are reduced by 2.20, 2.57, and 1.55 points respectively. Similarly, for children who take the test in Spanish, each additional year older that they arrive in the U.S. is associated with a 2.99 to 4.41 point test score gain. Panel B yields qualitatively similar conclusions

indicating that, for children who take the test in English, each additional year the child is in the U.S. is associated with a 1.92, 1.50, and 1.46 point higher score on the Passage Comprehension, Applied Problems, and Letter Word Identification tests, respectively. For each additional year the child is in the U.S., test scores for children randomly administered the test in Spanish decline by 2.67, 2.86, and 3.02 points respectively for these same three tests. Panel C indicates that each additional one percent of the child's life spent in the U.S. is associated with an increase in the Passage Comprehension score of 0.23 points for those who are randomly administered the test in English and a decrease of 0.33 points for those who are given it in Spanish. Put differently, for children who take the test in English, a one standard deviation (34.6 percent) increase in the percent of the child's life spent in the U.S. would be associated with an increase of 7.89 points in the Passage Comprehension test score, 8.20 points for the Applied Problems, and 5.05 points for Letter Word Identification. Conversely, a one standard deviation increase in the proportion of life spent in the U.S. is associated with an 11.45 point deficit for Spanish language test takers in Passage Comprehension, 10.62 points for Applied Problems, and a 12.77 point disadvantage for the Letter Word Identification test.

To further explore how quickly children of Hispanic immigrants acquire English language skills, we explore the non-parametric relationship between achievement test scores, test language, and different characteristics measuring the child's length of U.S. exposure. In Figures 2, 3, and 4 respectively, we estimate kernel weighted local polynomial regressions of test scores on the child's age at arrival in the U.S., years in the U.S., and percent of life spent in the U.S., broken down by randomized test language. Figures 2a through 2d correspond to Panel A in Table 8 and display scores by randomized test language and age at arrival. Results indicate a non-linear relationship between test language and age at arrival. Children who arrive in the U.S.

at younger ages experience a test score advantage when given the test in English, while those who arrive at older ages generally experience a strong disadvantage if randomly given the test in English. Figure 2a indicates a crossover in scores by test language at approximately age 7 such that children who come to the U.S. prior to this age experience an advantage when taking the Passage Comprehension test in English, while those arriving at older ages experience an advantage when the test is given in Spanish. Figure 2b suggests a similar crossover point for the Calculation test, although there is no subsequent drop in test scores for children who arrive at older ages and take the test in English. The Applied Problems and Letter Word Identification tests, in Figures 2c and 2d, indicate that the distinction between taking the test in English and Spanish is less pronounced for children who arrive up to approximately age four, at which point there is a clear Spanish language advantage. For children who arrive after age four, there exists a substantial advantage of taking both tests in Spanish or, conversely, a disadvantage for being randomly given the test in English.

Figures 3a through 3d show comparable patterns to those seen in Figure 2, but now display the non-parametric relationship between test scores and a child's years spent in the U.S., broken down by the randomized test language. Figure 3a displays an advantage for children who have been in the U.S. for less than 3 years and were randomly administered the test in Spanish, while those children of Hispanic immigrants who have been in the U.S. for more than 3 years experience a substantial deficit if taking the test in Spanish. The Applied Problems and Letter Word Identification tests display similar patterns, with children who have spent few years in the U.S. doing significantly better on the achievement tests if the test language is Spanish and experiencing no advantage or even a small deficit if they have spent many years in the U.S. and the test language is Spanish. Finally, in Figures 4a through 4d, when the percent of the child's

life spent in the U.S. is used as the measure of U.S. exposure, the pattern remains similar to the previous figures. For Passage Comprehension, taking the test in Spanish provides an advantage for children who have spent less than approximately one-third of their life in the U.S. For the Applied Problems and Letter Word Identification tests, that advantage continues for children who have spent up to about one-half of their life in the U.S. Children who have spent larger fractions of their life in the U.S. experience a small disadvantage when randomly given the test in Spanish, and consistent with the previous tables and figures, the results for the Calculation test show no clear correlation between test scores and test language.

The results from the previous tables indicate that the impact of the randomly assigned test language is critically linked with a child's birthplace and whether the child is a first or second generation immigrant. In an attempt to disentangle the mechanisms explaining why birthplace matters for achievement test scores, in Table 9 we use a sub-sample of 514 children for whom explicit information was collected on the child's English proficiency.[8] This allows us to determine if birthplace is simply proxying for proficiency in English. We compare average test scores for each achievement test for English proficient and limited English proficient children who were randomly administered the tests in Spanish or English and results are broken down by birthplace. For English proficient children (both foreign born and U.S. born) being randomly administered the Passage Comprehension, Applied Problems, or Letter Word Identification tests in English instead of Spanish generally yields a higher average test score.[9] This differs from the results for the limited English proficient children. For foreign born, limited English proficient children, results indicate 23.56 to 42.19 points (1.57 to 2.81 standard deviations) lower average

[8] Only 514 children out of the 924 are available for these analyses as information on the child's English proficiency was only gathered for those children who were administered the complete child interview.

[9] The difference in average test scores for English proficient children taking the test in Spanish or English can be calculated by adding the regression coefficients from Table 9 for the test in Spanish main effect and the interaction term of English proficient times test in Spanish.

test scores for those taking the test in English instead of Spanish. This contrasts with U.S. born limited English proficient children whose test scores show no statistically significant difference if they are administered the test in English instead of Spanish.[10] These results indicate an effect of being born in the U.S. that impacts achievement test scores beyond English proficiency. In summary, for both U.S. and foreign born children proficient in English, there is generally an advantage to being given the test in English. However, for limited English proficient children, foreign born children experience a significant disadvantage when taking the test in English, but U.S. born children experience no significant difference if randomly given the test in English. This is evidence that, although these U.S. born children may not yet have attained English fluency, their time in the U.S. and immersion in American society are imparting skills that translate into improved achievement test scores.

5. Conclusions

This is the first paper we are aware of that can explicitly measure the extent and rate of language assimilation among the children of Hispanic immigrants. Our identification strategy exploits the test language randomization of the four Woodcock Johnson III tests in the New Immigrant Survey and allows us to address potential selection biases that have hindered previous comparisons of educational achievement. Although an initial comparison of the test scores by randomized test language indicates that English language test takers scored higher than Spanish language test takers on two of the tests, lower on one test, and did not significantly differ on the fourth test, these patterns mask substantial heterogeneity. A closer examination that incorporates birthplace as a mediating factor reveals several important findings for these children.

[10] The notable exception to these English proficiency results again is in the Calculation test, where language is arguably less of a determining factor in quantitative reasoning.

First, in contrast to the prevailing linguistic models of immigrant assimilation, we present compelling evidence that the children of Hispanic immigrants both within and across generations quickly become English dominant. We find that children born in the U.S. are not bilingual as these models would predict, but are English dominant, experiencing over a one standard deviation test score disadvantage when randomly administered the test in Spanish. These results are robust to various specifications, including a sibling fixed effects model that controls for observed and unobserved household characteristics that are constant across siblings.

Second, we show a rapid assimilation of English among the foreign born. Children who arrive in the U.S. at an early age or who have spent more than three to four years in the U.S. experience no advantage associated with taking the test in Spanish. Both of these patterns challenge previous work showing that Hispanic immigrants are learning English more slowly than previous immigrant waves and more slowly than other origin groups (Alba et al., 2002).

Third, we show that foreign born children experience a test score disadvantage ranging from 0.71 to 1.50 standard deviations when randomly administered the test in English. If we consider this a cost of giving the test in English to foreign born children, this suggests significant implications for long-run academic and lifetime achievement. Children with lower test scores due to this bias may be subsequently tracked into less academically oriented classes and set up for a lower likelihood of economic success later in life. Given previous research demonstrating the positive correlation between early test scores and later academic and labor market outcomes, these findings provide key insight into a population that may face significant challenges.

Fourth, we show that for children of Hispanic immigrants born in the U.S., there is a nativity effect that impacts achievement test scores beyond English proficiency. For English proficient children (both U.S. and foreign born), there is generally an advantage to being given

the test in English. However, limited English proficient, foreign born children experience a significant disadvantage when taking the test in English, but U.S. born children experience no significant difference if randomly given the test in English. We interpret this as evidence that for U.S. born children, despite having limited English proficiency, their exposure to American society imparts a basic working knowledge of English or test taking skills that benefit them with the Woodcock Johnson III.

Fifth, the results indicate that the children of Hispanic immigrants may be at greater risk of not experiencing the benefits of learning English and the subsequent socioeconomic mobility than the children of immigrants from other regions. When given the test in English, foreign born children of Hispanic immigrants score worse than foreign born children from other regions. However, for second generation Hispanic children the test score gap is significantly reduced from the foreign born case. Yet, despite the improvement for the U.S. born children of Hispanic immigrants who take the achievement tests in English, they continue to experience a small test score disadvantage compared to the children of non-Hispanic immigrants and their early language disadvantage may have lingering effects if not addressed.

Finally, our findings yield important policy implications. First, the rapid assimilation of English should assuage some of the fears associated with the immigrant waves in the latter half of the twentieth century. In fact, our results for Hispanics suggest a rapid loss of Spanish language proficiency. Second, these results point to the importance of English language instructional help, particularly for Hispanic children who arrive in the U.S. at older ages. These children are the most likely to suffer from a test score bias and for whom targeted language assistance could yield critical economic gains.

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Figure 1a: Passage Comprehension Test Scores, By Randomized Test Language

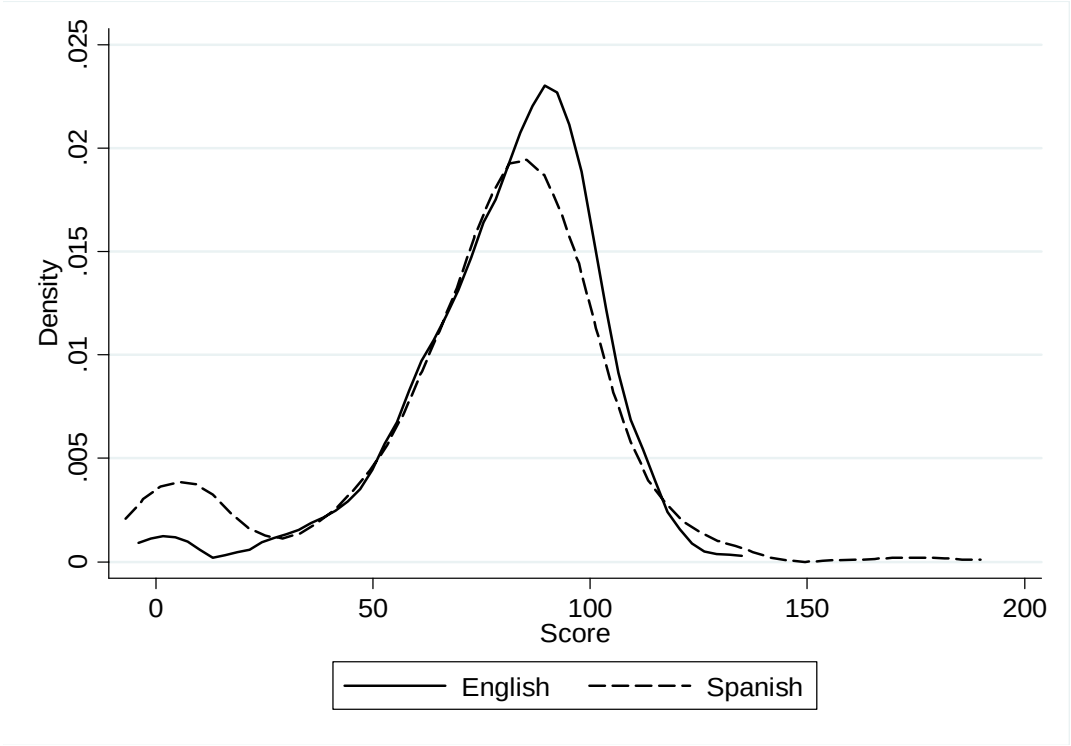


Figure 1b: Calculation Test Scores, By Randomized Test Language

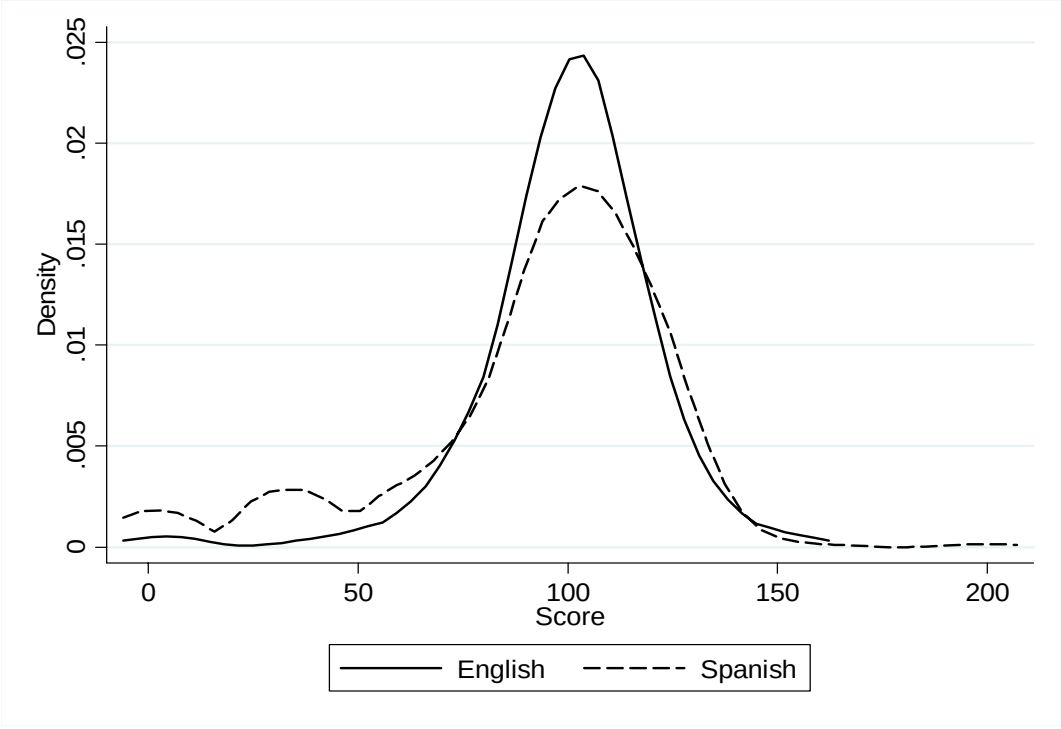


Figure 1c: Applied Problems Test Scores, By Randomized Test Language

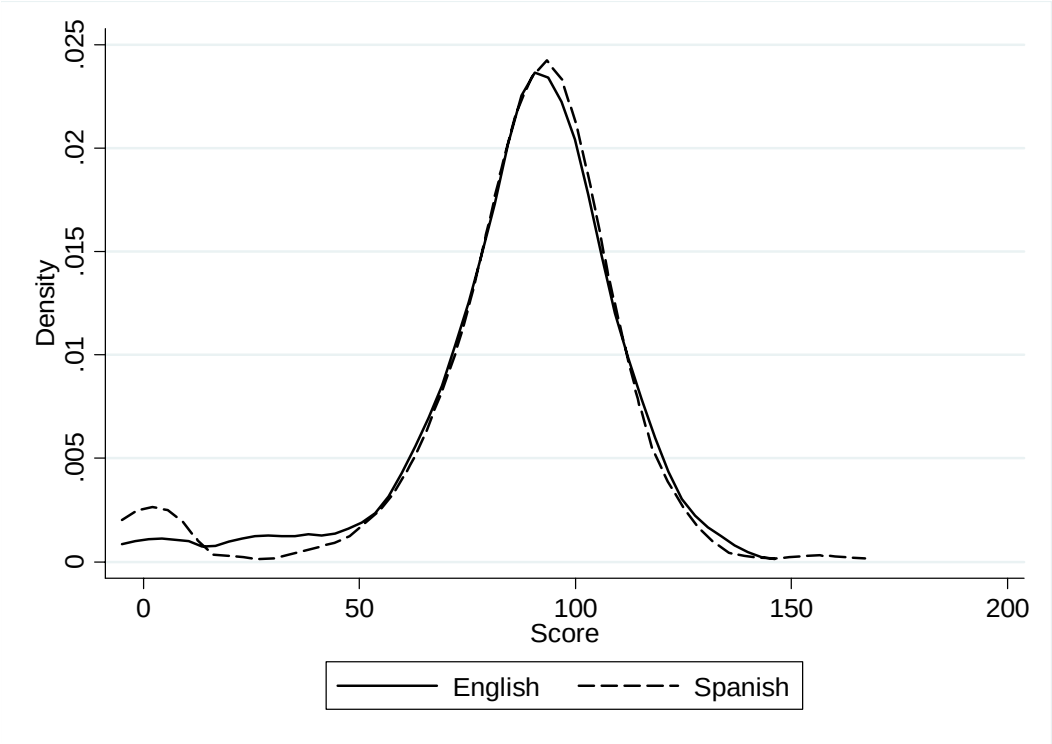
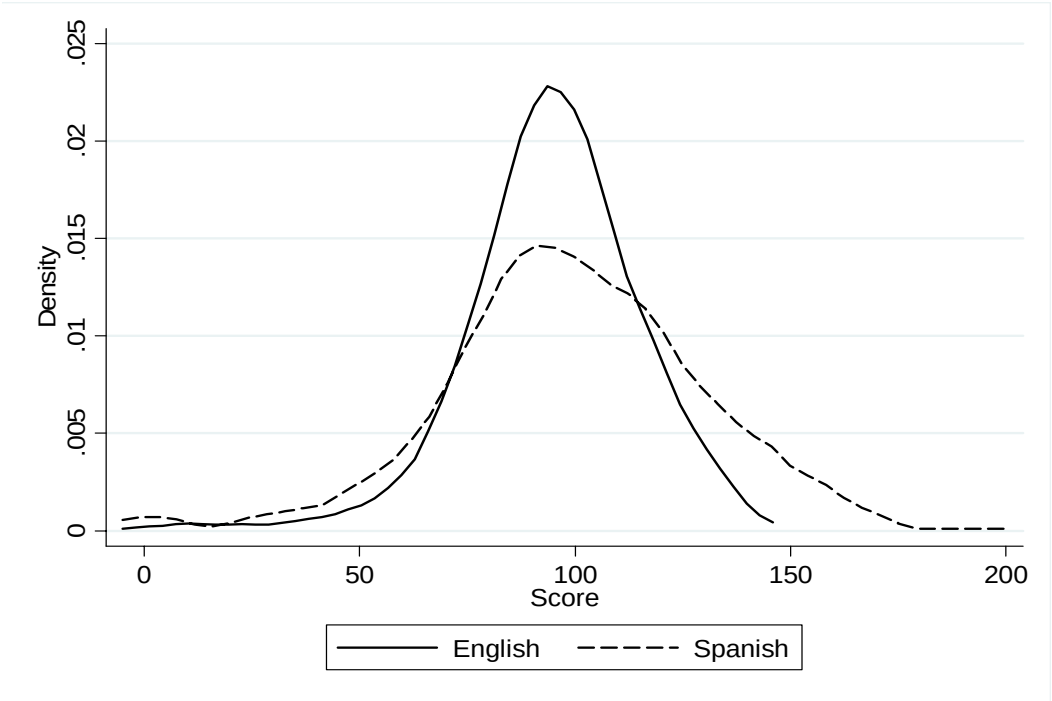


Figure 1d: Letter Word Identification Test Scores, By Randomized Test Language



Notes: Kernel density estimates of the Woodcock Johnson achievement tests. Tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Figure 2a: Passage Comprehension Test Scores, By Age at Arrival in the U.S. and Randomized Test Language

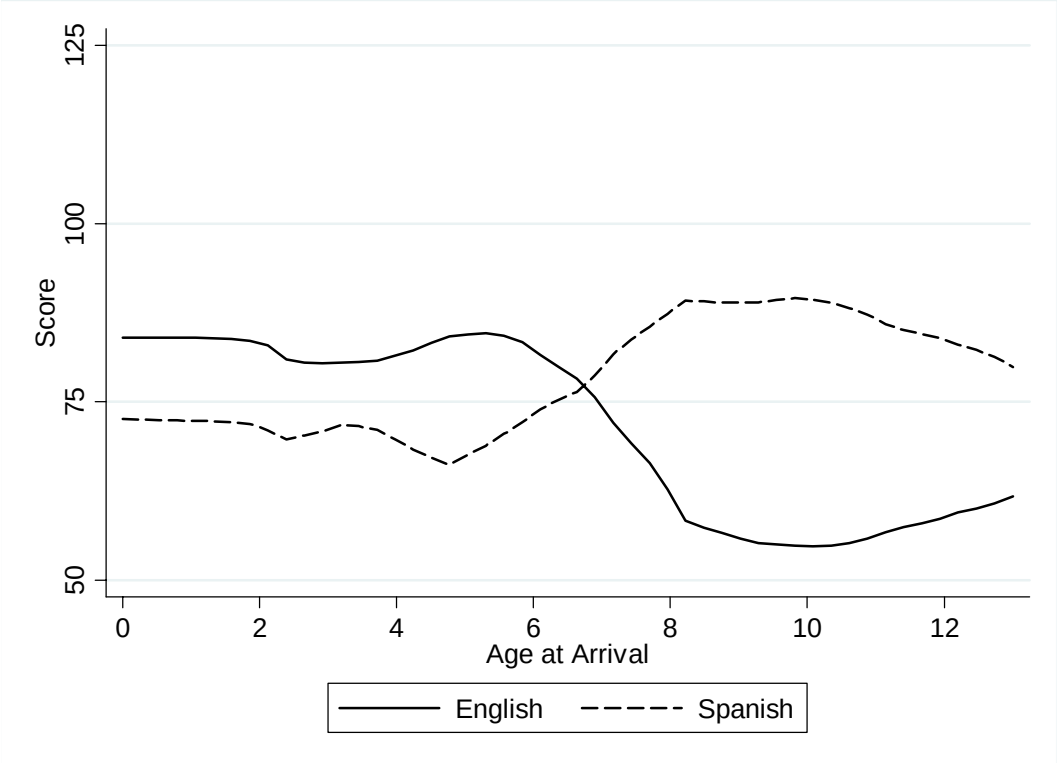


Figure 2b: Calculation Test Scores, By Age at Arrival in the U.S. and Randomized Test Language

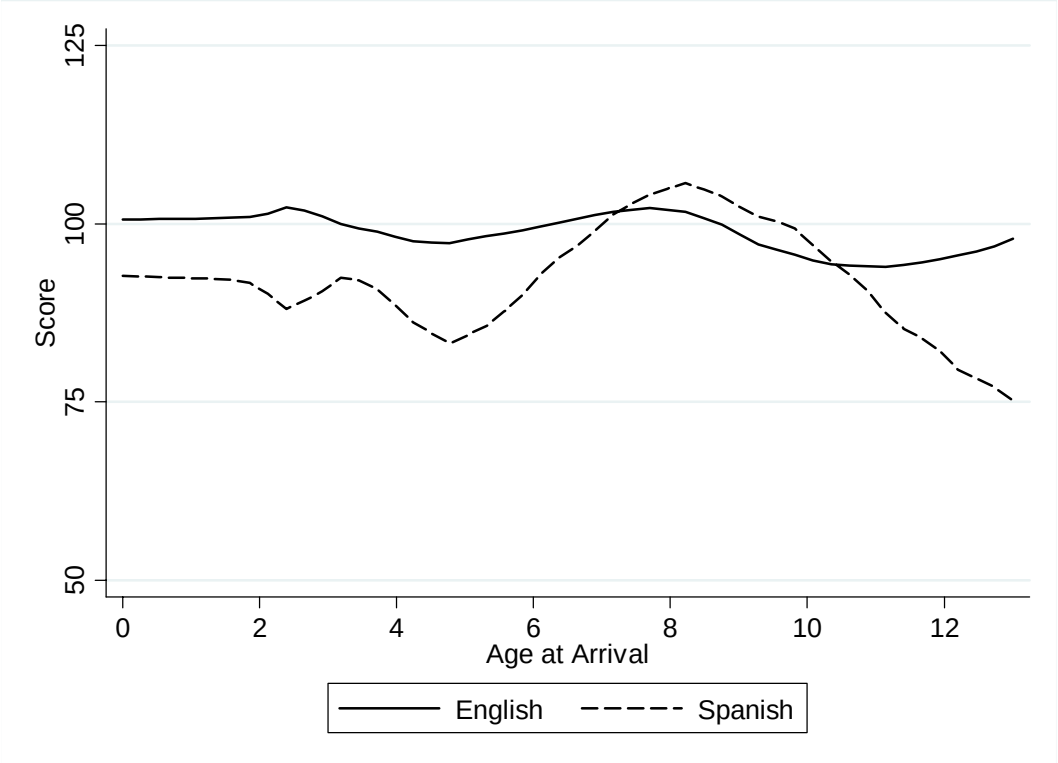


Figure 2c: Applied Problems Test Scores, By Age at Arrival in the U.S. and Randomized Test Language

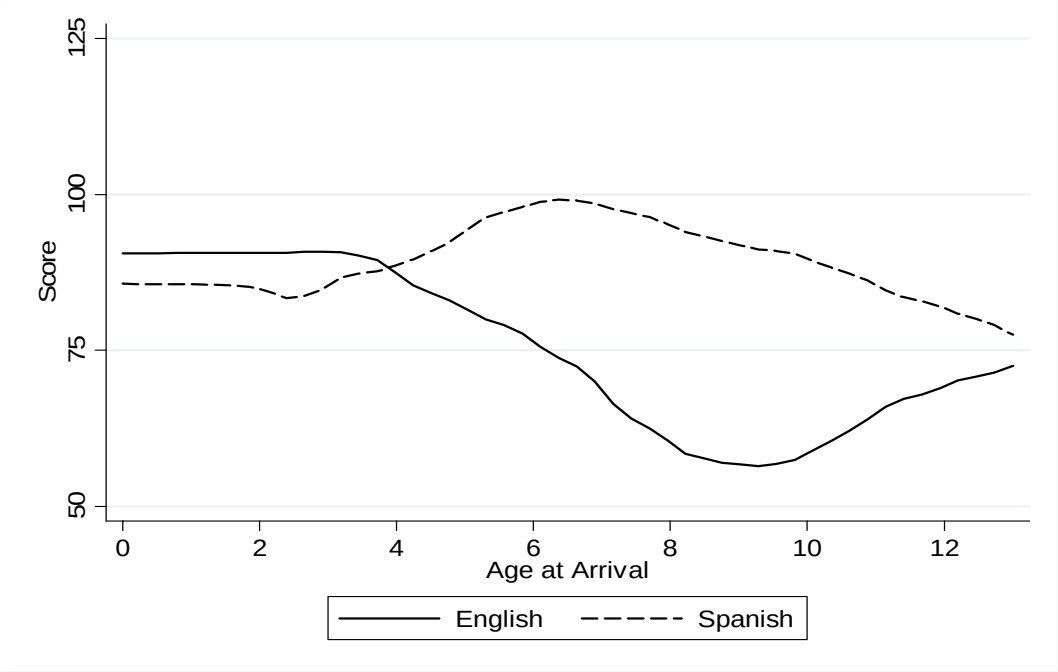
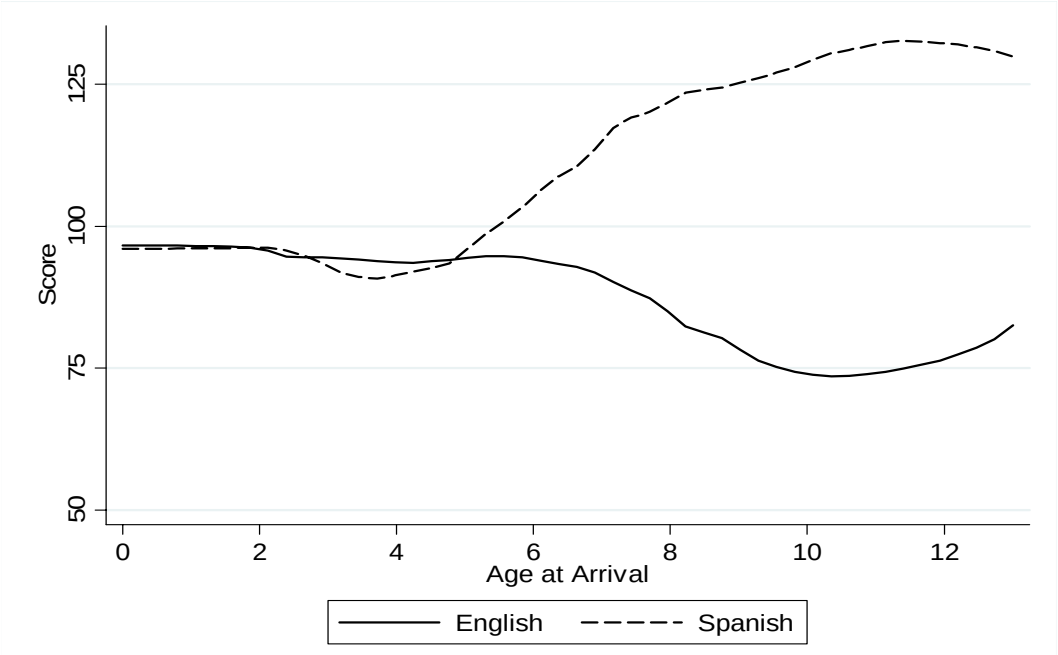


Figure 2d: Letter Word Identification Test Scores, By Age at Arrival in the U.S. and Randomized Test Language



Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of Woodcock Johnson achievement test scores on age at arrival in the U.S. Tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Figure 3a: Passage Comprehension Test Scores, By Years in the U.S. and Randomized Test Language

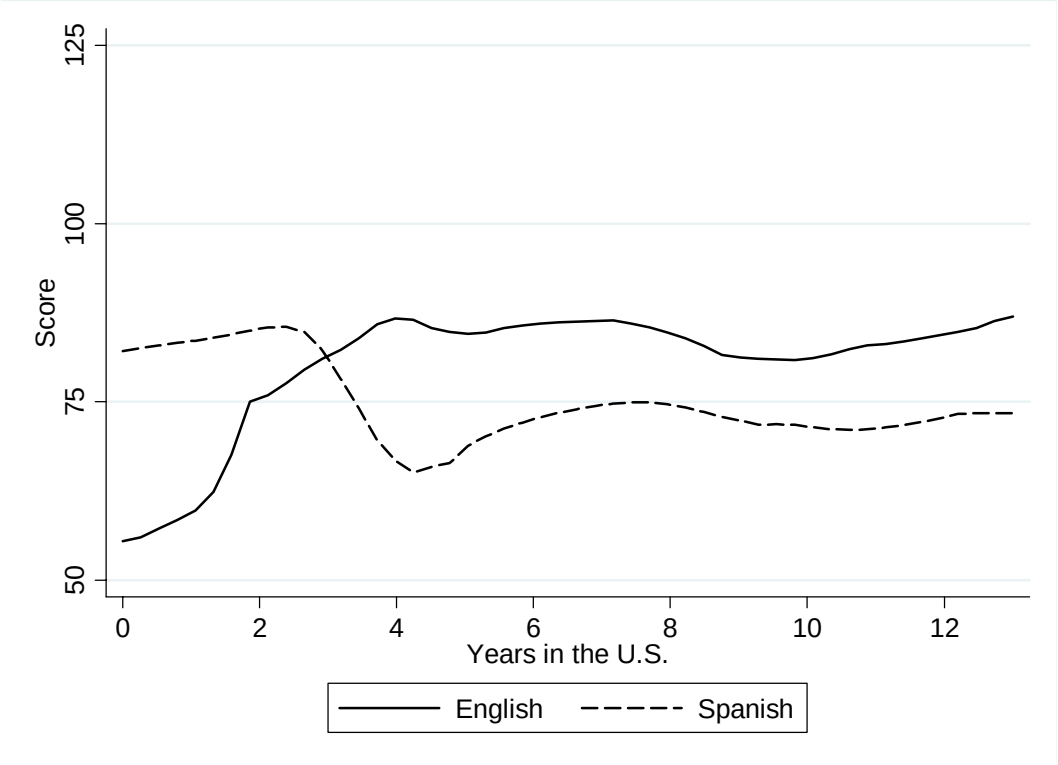


Figure 3b: Calculation Test Scores, By Years in the U.S. and Randomized Test Language

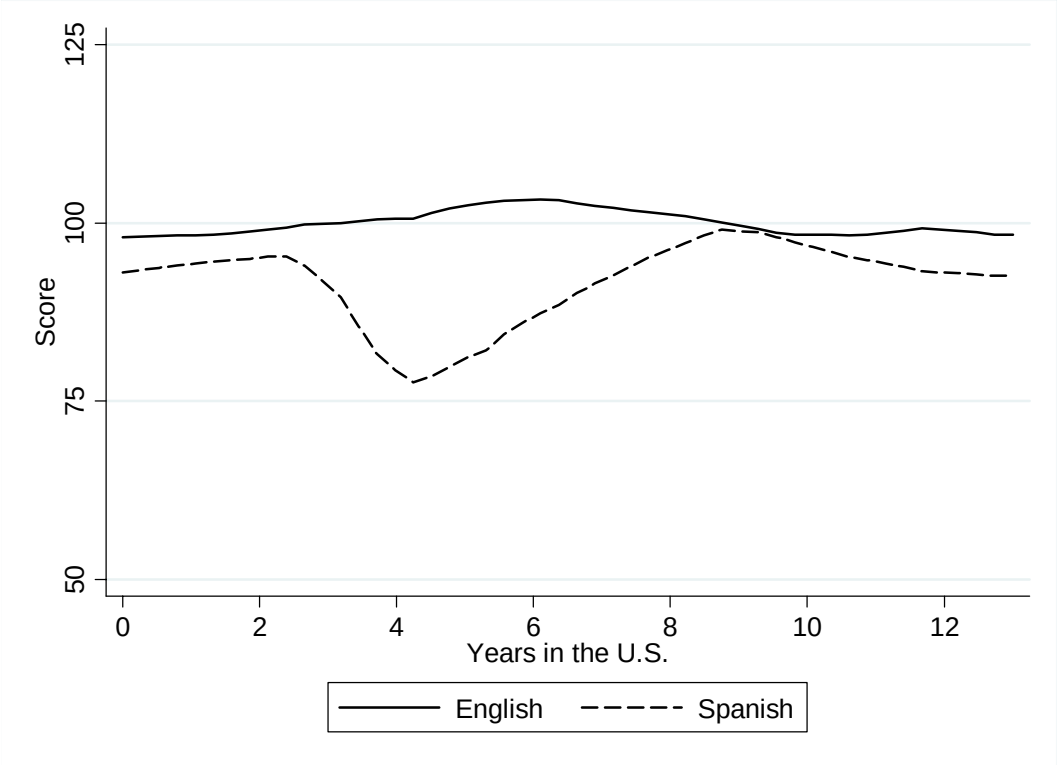


Figure 3c: Applied Problems Test Scores, By Years in the U.S. and Randomized Test Language

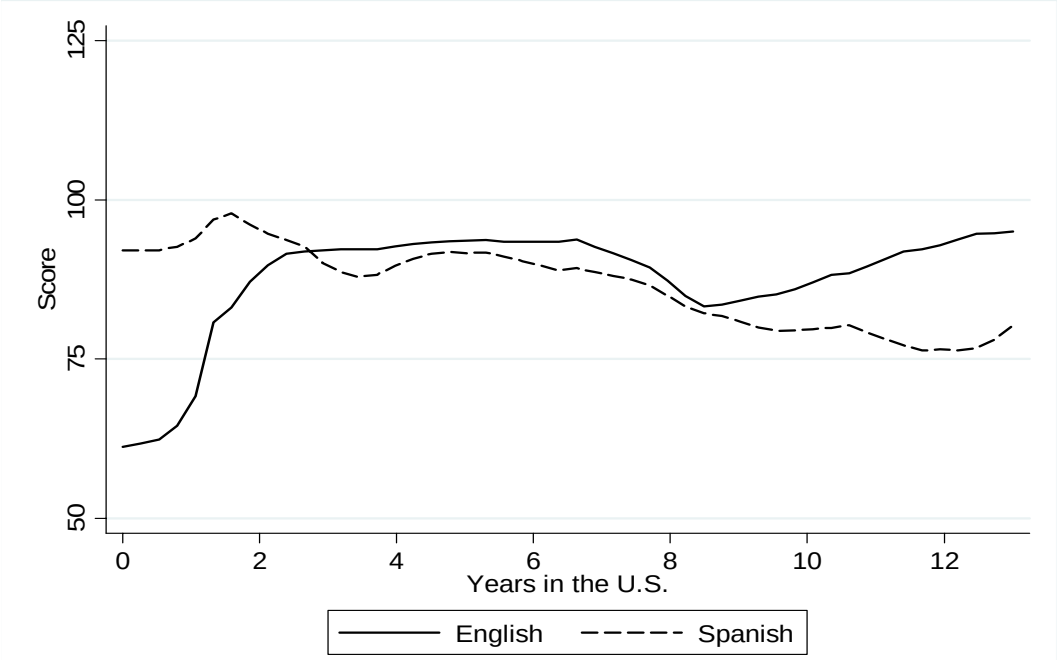
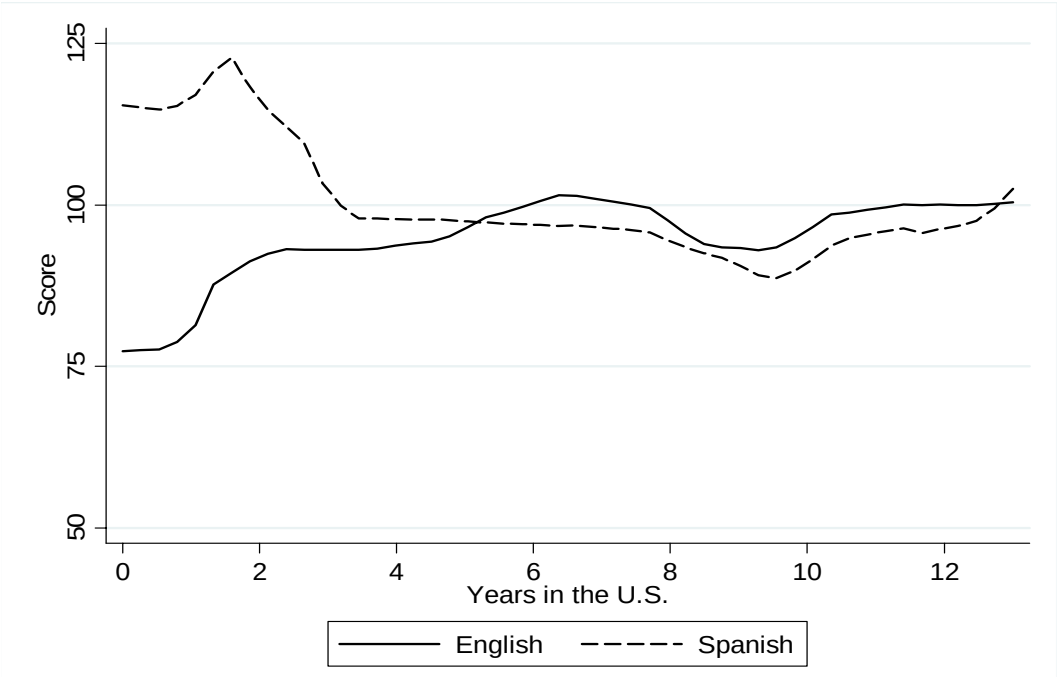


Figure 3d: Letter Word Identification Test Scores, By Years in the U.S. and Randomized Test Language



Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of Woodcock Johnson achievement test scores on years in the U.S. Tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Figure 4a: Passage Comprehension Test Scores, By Percent of Life in the U.S. and Randomized Test Language

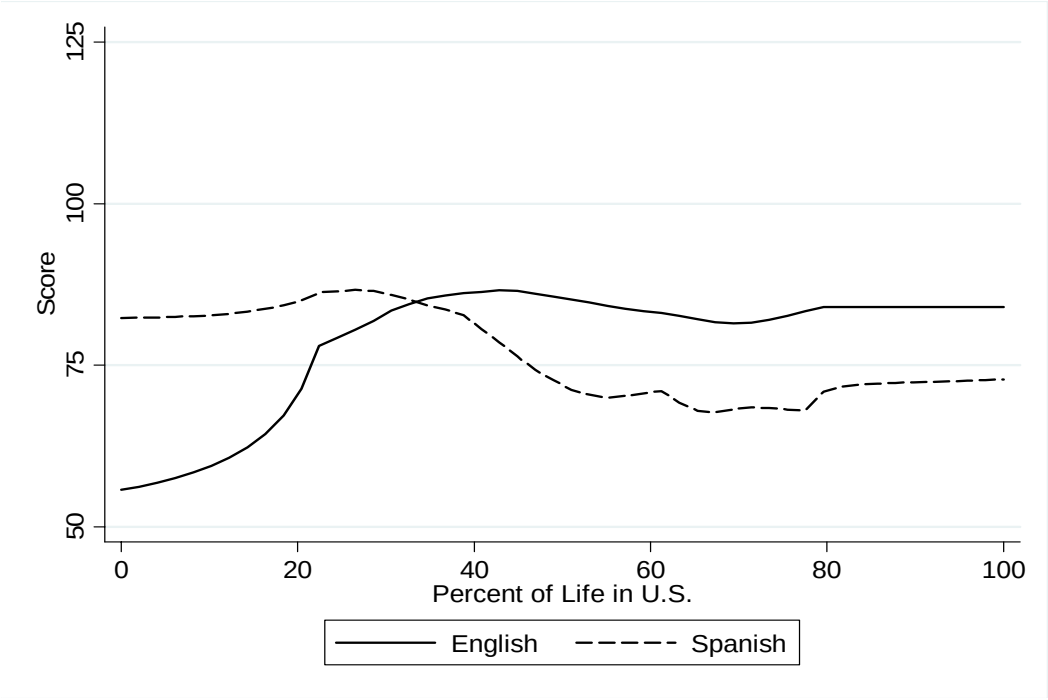


Figure 4b: Calculation Test Scores, By Percent of Life in the U.S. and Randomized Test Language

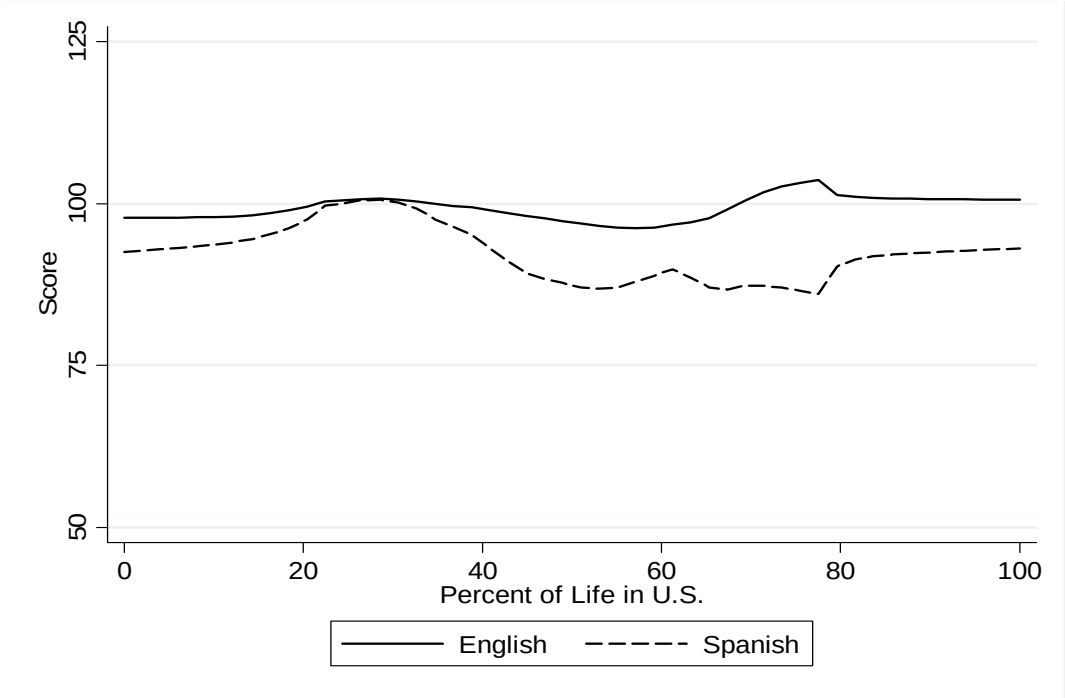


Figure 4c: Applied Problems Test Scores, By Percent of Life in the U.S. and Randomized Test Language

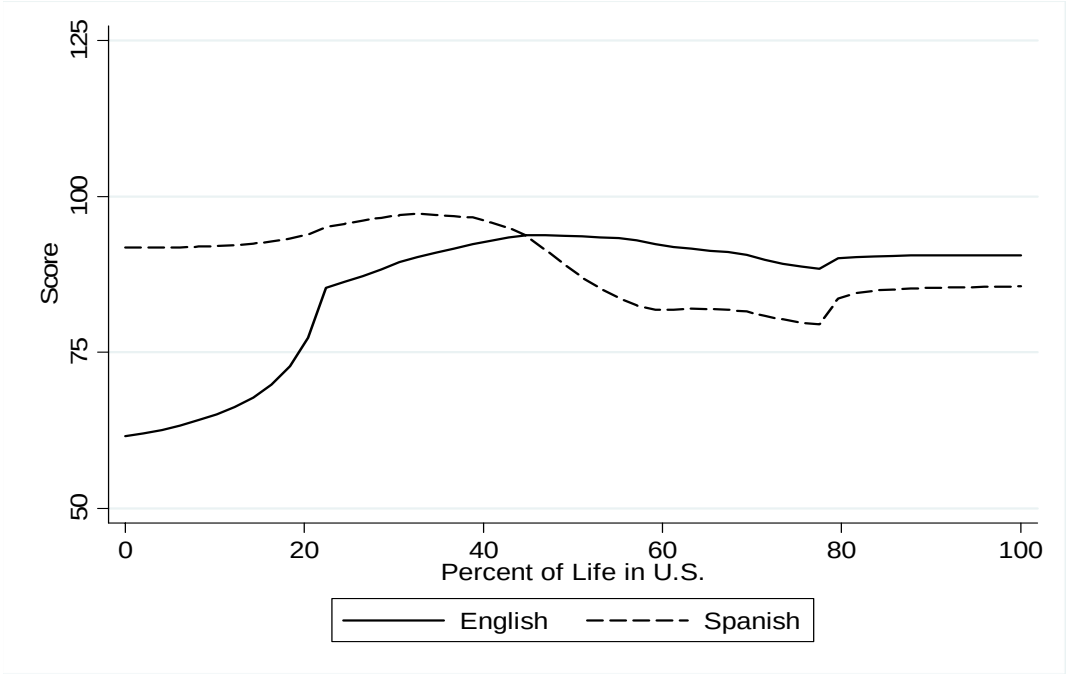
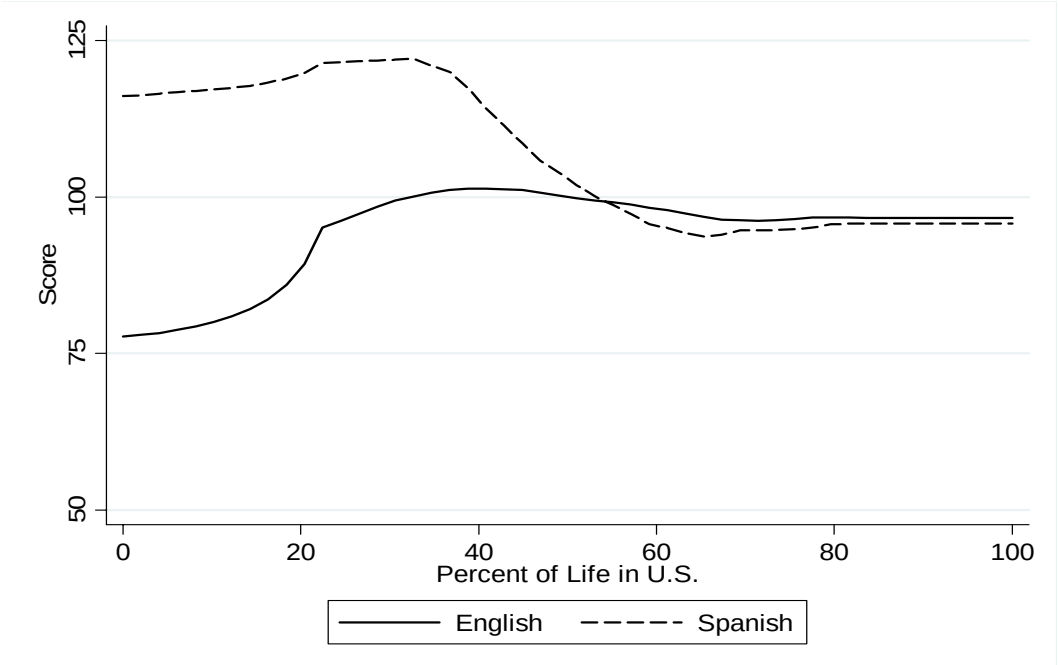


Figure 4d: Letter Word Identification Test Scores, By Percent of Life in the U.S. and Randomized Test Language



Notes: Kernel-weighted local polynomial regression (using Epanechnikov kernel) of Woodcock Johnson achievement test scores on percent of life spent in the U.S. Tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 1: Sample Characteristics for Experiment Eligible Children, By Randomized Test Language

	English (1)	Spanish (2)	Difference (1)-(2)
Fraction U.S. Born	0.803	0.781	0.022
	(0.398)	(0.414)	[0.027]
Child's Age at Arrival	1.479	1.533	-0.054
	(3.121)	(3.192)	[0.208]
Child's Number of Years in the U.S.	6.275	6.456	-0.181
	(3.536)	(3.684)	[0.238]
Child's Proportion of Life Spent in U.S.	0.824	0.824	0.0003
	(0.344)	(0.349)	[0.023]
Child's Years of Education	3.673	3.825	-0.152
	(2.250)	(2.344)	[0.160]
Child's Years of U.S. Education	3.236	3.378	-0.142
	(2.332)	(2.432)	[0.172]
Child's Age	7.752	7.987	-0.235
	(2.846)	(2.903)	[0.189]
English Spoken at Home (parent's report)	0.301	0.309	-0.008
	(0.459)	(0.463)	[0.030]
Female	0.466	0.529	-0.063*
	(0.500)	(0.500)	[0.033]
Parent's Years of Education	9.566	9.538	0.028
	(4.411)	(4.000)	[0.277]
Parent's English Proficiency	0.272	0.256	0.016
	(0.021)	(0.437)	[0.029]
Parent's Years of U.S. Experience	9.350	9.884	-0.534
	(6.789)	(6.802)	[0.447]
Number of children	472	452	

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Standard deviations are in parentheses and standard errors are in brackets. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. Data source: New Immigrant Survey 2003.

Table 2: Average Test Scores for Experiment Eligible Children, By Randomized Test Language

	English (1)	Spanish (2)	Difference (1)-(2)
Panel A			
Passage Comprehension	80.559	74.384	6.175***
	(21.561)	(29.734)	[1.976]
Calculation	100.137	92.862	7.275***
	(20.185)	(31.782)	[2.024]
Number of children	348	341	689
Panel B			
Applied Problems	87.209	86.611	0.598
	(23.180)	(25.539)	[1.603]
Letter Word Identification	94.665	99.411	-4.746***
	(19.665)	(29.919)	[1.659]
Number of children	472	452	924

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Standard deviations are in parentheses and standard errors are in brackets. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 3a: Average Test Scores by Randomized Test Language for Experiment Eligible Children and Non-Experiment Eligible Children, Restricted to Foreign Born Only

	Experiment-Eligible, Test in English	Experiment-Eligible, Test in Spanish	Non-Experiment Eligible, Test in English	Difference	Difference	Difference
	(1)	(2)	(3)	(1)-(2)	(3)-(1)	(3)-(2)
Panel A						
Passage Comprehension	70.128	80.837	82.771	-10.709***	12.643***	1.934
	(25.397)	(26.486)	(26.486)	[4.002]	[3.246]	[2.994]
Calculation	98.810	93.226	104.920	5.584	6.110**	11.694***
	(15.437)	(28.533)	(23.111)	[3.728]	[2.768]	[2.703]
Number of children	73	87	697			
Panel B						
Applied Problems	75.913	89.572	90.351	-13.659***	14.439***	0.780
	(30.897)	(21.434)	(27.577)	[3.819]	[3.035]	[2.861]
Letter Word Identification	89.052	111.591	100.012	-22.539***	10.961***	-11.578***
	(23.596)	(31.244)	(23.643)	[4.015]	[2.572]	[2.589]
Number of children	93	99	920			

Notes: Standard deviations are in parentheses and standard errors are in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 3b: Average Test Scores by Randomized Test Language for Experiment Eligible Children and Non-Experiment Eligible Children, Restricted to U.S. Born Only

	Experiment-Eligible, Test in English	Experiment-Eligible, Test in Spanish	Non-Experiment Eligible, Test in English	Difference	Difference	Difference
	(1)	(2)	(3)	(1)-(2)	(3)-(1)	(3)-(2)
Panel A						
Passage Comprehension	83.328	72.174	89.277	11.154***	5.949***	17.103***
	(19.559)	(30.910)	(23.647)	[2.232]	[1.994]	[2.656]
Calculation	100.489	92.737	102.926	7.752***	2.437	10.189***
	(21.278)	(32.873)	(22.641)	[2.390]	[2.040]	[2.740]
Number of children	275	254	197			
Panel B						
Applied Problems	89.981	85.781	99.079	4.200**	9.098***	13.299***
	(19.952)	(26.544)	(22.480)	[1.728]	[1.550]	[1.824]
Letter Word Identification	96.042	95.995	106.160	0.0473	10.118***	10.165***
	(18.349)	(28.665)	(20.270)	[1.767]	[1.410]	[1.836]
Number of children	379	353	372			

Notes: Standard deviations are in parentheses and standard errors are in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 4: Average Test Scores for Experiment Eligible Children by Randomized Test Language and Birthplace

Panel A: Passage Comprehension	Test in English	Test in Spanish	Difference
Foreign Born	70.128	80.837	10.709***
	[2.951]	[3.167]	[4.002]
U.S Born	83.328	72.174	-11.154***
	[1.546]	[1.939]	[2.232]
Difference	13.200***	-8.663**	-21.863***
	[2.753]	[3.669]	[4.624]

Panel B: Calculation	Test in English	Test in Spanish	Difference
Foreign Born	98.810	93.226	-5.584
	[2.749]	[3.412]	[3.728]
U.S Born	100.489	92.737	-7.752***
	[1.656]	[2.063]	[2.390]
Difference	1.679	-0.490	-2.169
	[2.660]	[3.954]	[4.815]

Panel C: Applied Problems	Test in English	Test in Spanish	Difference
Foreign Born	75.913	89.572	13.659***
	[2.742]	[2.565]	[3.819]
U.S Born	89.981	85.781	-4.200**
	[1.200]	[1.413]	[1.728]
Difference	14.068***	-3.791	-17.859***
	[2.606]	[2.902]	[3.899]

Panel D: Letter Word Identification	Test in English	Test in Spanish	Difference
Foreign Born	89.052	111.591	22.539***
	[2.883]	[2.939]	[4.015]
U.S Born	96.042	95.995	-0.047
	[1.227]	[1.526]	[1.767]
Difference	6.990***	-15.596***	-22.586***
	[2.255]	[3.326]	[4.015]

Notes: Standard errors in brackets. * significant at 10%, ** significant at 5%, *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Sample sizes in the cells are the same as in Table 3. For Panels A and B, 73 foreign born children took the test in English and 87 took it in Spanish; 275 U.S. born children took the test in English and 254 took it in Spanish. For Panels C and D, 93 foreign born children took the test in English and 99 took it in Spanish; 379 U.S. born children took the test in English and 353 took it in Spanish. Data source: New Immigrant Survey 2003.

Table 5a: OLS Regressions of the Determinants of Passage Comprehension and Calculation Test Scores

Dependent Variable:	Passage Comprehension				Calculation			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Test in Spanish	10.709***	11.225***	11.636***	12.014***	-5.584	-4.999	-5.079	-4.894
	[4.034]	[3.966]	[3.854]	[3.810]	[3.554]	[3.328]	[3.440]	[3.261]
U.S. Born	13.199***	11.896***	12.018***	12.013***	1.679	1.162	1.650	1.034
	[3.249]	[3.641]	[3.548]	[3.799]	[2.159]	[2.714]	[2.888]	[3.154]
U.S. Born*Test in Spanish	-21.863***	-22.808***	-23.147***	-23.778***	-2.168	-2.527	-2.845	-2.707
	[4.678]	[4.636]	[4.511]	[4.481]	[4.280]	[4.106]	[4.140]	[4.023]
Constant	70.128***	71.668***	61.236***	65.882***	98.810***	72.688***	88.503***	67.626***
	[3.024]	[8.663]	[4.140]	[8.754]	[1.808]	[8.351]	[3.543]	[8.749]
Child Characteristics?	No	Yes	No	Yes	No	Yes	No	Yes
Parent Characteristics?	No	No	Yes	Yes	No	No	Yes	Yes
Number of Children [a]	689	677	687	677	689	677	687	677

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Child characteristics include birth year dummies, child's years of education, child's years of U.S. education, child's sex, and whether English is spoken at home (parent's report). Parent characteristics include parent's years of education, parent's English proficiency, parent's years of U.S. experience, and parent's years of U.S. experience squared. Data source: New Immigrant Survey 2003.

[a] Missing child and parent characteristics explain the reduced sample sizes for regressions in columns 2, 3, 4, 6, 7, and 8. Baseline regression results in columns 1 and 4 are consistent using the restricted samples.

Table 5b: OLS Regressions of the Determinants of Applied Problems and Letter Word Identification Test Scores

Dependent Variable:	Applied Problems				Letter Word Identification			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Test in Spanish	13.659***	10.491***	13.959***	10.652***	22.539***	23.057***	23.299***	23.561***
	[3.734]	[3.680]	[3.635]	[3.641]	[4.216]	[4.525]	[4.011]	[4.368]
U.S. Born	14.068***	3.912	12.791***	3.651	6.990***	8.927**	10.834***	12.285***
	[3.465]	[3.422]	[3.607]	[3.703]	[2.668]	[3.471]	[3.224]	[3.880]
U.S. Born*Test in Spanish	-17.859***	-15.515***	-18.520***	-15.872***	-22.586***	-24.229***	-23.351***	-24.529***
	[4.149]	[4.254]	[4.075]	[4.216]	[4.612]	[5.057]	[4.455]	[4.956]
Constant	75.913***	75.262***	66.892***	71.503***	89.052***	82.135***	80.346***	78.844***
	[3.314]	[7.996]	[4.407]	[8.385]	[2.514]	[9.722]	[3.863]	[9.767]
Child Characteristics?	No	Yes	No	Yes	No	Yes	No	Yes
Parent Characteristics?	No	No	Yes	Yes	No	No	Yes	Yes
Number of Children [a]	924	768	921	768	924	768	921	768

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Child characteristics include birth year dummies, child's years of education, child's years of U.S. education, child's sex, and whether English is spoken at home (parent's report). Parent characteristics include parent's years of education, parent's English proficiency, parent's years of U.S. experience, and parent's years of U.S. experience squared. Data source: New Immigrant Survey 2003.

[a] Missing child and parent characteristics explain the reduced sample sizes for regressions in columns 2, 3, 4, 6, 7, and 8. Baseline regression results in columns 1 and 4 are consistent using the restricted samples.

Table 6: Quantile Regressions of the Determinants of Test Scores

Quantiles:	10th	25th	50th	75th	90th
Panel A: Passage Comprehension					
Test in Spanish	18.529	21.283***	16.650***	3.089	5.062
	[17.025]	[5.651]	[5.399]	[3.356]	[4.256]
U.S. Born	21.930***	20.722***	16.565***	3.760	6.928**
	[6.242]	[4.512]	[5.202]	[2.867]	[3.201]
U.S. Born*Test in Spanish	-66.934***	-34.509***	-24.817***	-8.223**	-8.265*
	[20.645]	[6.849]	[5.726]	[3.714]	[4.997]
Constant	38.630***	54.156***	69.310***	91.891***	98.012***
	[5.670]	[4.167]	[5.066]	[2.780]	[2.620]
Panel B: Calculation					
Test in Spanish	-16.677	-6.959	-0.410	1.118	3.557
	[13.726]	[5.486]	[3.047]	[3.999]	[6.793]
U.S. Born	-1.545	4.502	3.265	3.230	4.513
	[4.480]	[3.235]	[2.127]	[2.462]	[4.776]
U.S. Born*Test in Spanish	-26.929*	-3.026	-1.368	1.485	-1.872
	[16.357]	[6.861]	[3.504]	[4.401]	[7.261]
Constant	79.760***	88.998***	98.774***	108.731***	118.154***
	[3.349]	[2.685]	[1.821]	[2.046]	[4.118]
Panel C: Applied Problems					
Test in Spanish	40.451***	25.312***	8.752*	2.345	-1.926
	[6.171]	[8.444]	[4.569]	[3.211]	[4.486]
U.S. Born	38.884***	25.287***	8.343*	2.944	3.160
	[5.670]	[8.209]	[4.528]	[2.821]	[3.344]
U.S. Born*Test in Spanish	-49.469***	-28.754***	-10.557**	-1.917	0.395
	[7.838]	[8.770]	[4.925]	[3.640]	[4.739]
Constant	30.045***	56.628***	83.369***	98.365***	108.291***
	[5.468]	[8.065]	[4.446]	[2.645]	[3.219]
Panel D: Letter Word Identification					
Test in Spanish	7.253	9.258*	23.493***	29.384***	29.932***
	[8.355]	[5.578]	[5.495]	[5.154]	[5.324]
U.S. Born	12.410**	8.355**	4.766*	0.345	1.483
	[5.938]	[4.141]	[2.700]	[4.013]	[4.514]
U.S. Born*Test in Spanish	-20.516**	-14.366**	-24.343***	-23.566***	-19.605**
	[9.814]	[6.058]	[5.787]	[5.513]	[6.686]
Constant	63.636***	76.897***	91.604***	106.693***	117.325***
	[5.863]	[3.897]	[2.563]	[3.834]	[4.091]

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. There are 689 children in the quantile regressions in Panels A and B and 924 children in the quantile regressions in Panels C and D. Data source: New Immigrant Survey 2003.

Table 7: Sibling Fixed Effects Estimation of the Determinants of Test Scores

Dependent Variable:	Passage Comprehension	Calculation	Applied Problems	Letter Word Identification
Test in Spanish	12.889**	-12.996**	17.765***	28.229***
	[6.234]	[5.501]	[5.652]	[5.637]
U.S. Born	13.381**	0.258	21.919***	19.727***
	[6.100]	[6.310]	[5.136]	[6.684]
U.S. Born*Test in Spanish	-18.401**	4.608	-22.747***	-29.228***
	[7.303]	[6.331]	[6.289]	[6.245]
Constant	67.634***	101.071***	69.552***	78.715***
	[5.194]	[4.983]	[4.408]	[5.449]
Number of Children	689	689	924	924

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 8: OLS Regressions of the Determinants of Test Scores, by Age at Arrival in the U.S., Years in the U.S., and Percent of Life in the U.S.

Dependent Variable:	Passage Comprehension	Calculation	Applied Problems	Letter Word Identification
Panel A: Age at Arrival in the U.S.				
Test in Spanish	-12.350***	-7.810***	-5.038***	-1.925
	[2.277]	[2.374]	[1.783]	[1.913]
Age at Arrival	-2.195***	-0.312	-2.567***	-1.550***
	[0.350]	[0.245]	[0.446]	[0.374]
Test in Spanish*Age at Arrival	3.394***	0.299	2.987***	4.406***
	[0.499]	[0.486]	[0.510]	[0.524]
Constant	84.495***	100.697***	91.006***	96.957***
	[1.220]	[1.261]	[1.054]	[0.972]
Number of Children	689	689	924	924
Panel B: Years in the U.S.				
Test in Spanish	13.289***	-11.366***	17.596***	23.980***
	[4.530]	[4.334]	[3.112]	[3.394]
Years in the U.S.	1.920***	-0.076	1.503***	1.461***
	[0.339]	[0.268]	[0.357]	[0.258]
Test in Spanish*Years in the U.S.	-2.674***	0.557	-2.860***	-3.020***
	[0.532]	[0.509]	[0.442]	[0.505]
Constant	66.640***	100.685***	77.775***	85.498***
	[2.806]	[2.134]	[2.776]	[1.974]
Number of Children	689	689	924	924
Panel C: Percent of Life in U.S.				
Test in Spanish	20.727***	-5.153	24.676***	35.180***
	[4.783]	[4.435]	[4.097]	[4.432]
Percent of Life in U.S.	0.228***	0.025	0.237***	0.146***
	[0.034]	[0.026]	[0.041]	[0.031]
Test in Spanish * Percent of Life in U.S.	-0.331***	-0.026	-0.307***	-0.369***
	[0.055]	[0.052]	[0.047]	[0.049]
Constant	61.939***	98.068***	67.666***	82.606***
	[3.081]	[2.161]	[3.834]	[2.858]
Number of Children	689	689	924	924

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.

Table 9: OLS Regressions of the Determinants Test Scores, by English Proficiency and Birthplace

	Foreign Born				U.S. Born			
	Passage Comprehension	Calculation	Applied Problems	Letter Word Identification	Passage Comprehension	Calculation	Applied Problems	Letter Word Identification
Test in Spanish	23.562***	-6.863	27.006***	42.190***	-7.271	-5.682	-0.021	3.683
	[5.369]	[4.895]	[5.392]	[5.532]	[4.657]	[5.030]	[4.533]	[4.686]
English Proficient	30.191***	-0.490	34.211***	30.131***	5.877**	2.538	6.273**	7.056**
	[5.613]	[5.008]	[6.427]	[5.222]	[2.826]	[2.986]	[3.117]	[2.788]
English Proficient*	-29.747***	9.835	-38.530***	-37.408***	-5.952	1.584	-9.190*	-9.184
Test in Spanish	[7.267]	[7.462]	[8.113]	[8.650]	[5.627]	[6.085]	[5.517]	[5.681]
Constant	58.256***	98.745***	62.377***	78.233***	79.564***	97.963***	84.857***	92.806***
	[3.884]	[2.485]	[5.220]	[3.837]	[2.128]	[2.217]	[2.530]	[2.251]
Observations	126	126	129	129	360	360	385	385

Notes: Robust standard errors in brackets, clustered at the household level. * significant at 10%; ** significant at 5%; *** significant at 1%. Woodcock Johnson achievement tests were randomly administered in English or Spanish to children of Hispanic immigrants. The Passage Comprehension and Calculation tests were administered to children ages 6 to 12 and the Applied Problems and Letter Word Identification tests were administered to children ages 3 to 12. Scores are normed by age based on national averages to have a mean of 100 and a standard deviation of 15. Data source: New Immigrant Survey 2003.