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Testing, time limits, and English learners: Does age of school entry affect how quickly students can learn English?

Dylan Conger *

Trachtenberg School of Public Policy and Public Administration, The George Washington University, 805 21st Street NW, MPA 601G, Washington, DC 20052, USA

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ABSTRACT

Using data on young English learners (EL) who enroll in the New York City public school system, I examine how long it takes students to become minimally proficient in English and how the time to proficiency differs for students by their age of school entry. Specifically, I follow four recent entry cohorts of ELs ages 5–10 and use discrete-time survival analysis to model the rate at which different age groups acquire proficiency. I find that approximately half of the students become proficient within three years after school entry and that younger students learn more quickly than older students. Age of entry differences are robust to controls for observed differences between age of entry groups in their economic and demographic characteristics, their disabilities, and the schools they attend. The results lend support to the theory that older students face developmental barriers to learning new languages quickly.

1. Introduction

Policymakers and educators have long struggled with how best to help newcomers to the United States learn English quickly and fully. The pressure to achieve this goal has increased substantially in the last decade with the rise in the English learner (EL) population and new federal mandates that govern the testing of EL students. In 2004, approximately 11 percent of the student population were designated EL, an increase of over 60 percent since 1994 (NCELA, 2006). Public schools are also now held accountable for the performance of their EL students on standardized reading and math exams. The 2001 federal No Child Left Behind Act (NCLB) requires EL students to take standardized tests in English reading/language arts within three years after they enter the school system (US DOE, 2007). Districts and schools that fail to demonstrate gains for EL students on these exams after the three-year time limit risk penalties that range from permitting parents to transfer to alternative schools to closing the school.

Several advocates, educators, and state education agencies have complained about the new federal requirements, claiming that they ignore the variation in the speed with which students learn English (Kossan, 2008; Zehr, 2007). Indeed, the policy was implemented despite a surprising shortage of research on precisely how long it takes young EL students to become proficient and how the trajectory varies by the age at which students enter school. Most of the research on time to proficiency relies on now-dated, small samples of students, often in one or two schools or classrooms, and does not include repeat observations over many years. As a result, a review of the research requested by Congress of the Government Accountability Office in the same year that NCLB was passed concluded that "No clear consensus exists on the length of time children with limited English proficiency need to become proficient in English" (US GAO, 2001, p. 7).

* Fax: +1 202 994 6792.
E-mail address: dconger@gwu.edu

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This study takes advantage of panel data on the census of EL students who enter the New York City public school system between the ages of 5 and 10 to generate reliable estimates of the rate at which students acquire minimum proficiency in English. The study also examines how age of entry into the public school system affects time to proficiency. Estimates of age of entry differences in English acquisition are then adjusted for differences between students in their economic and demographic characteristics as well as the schools they attend. The effect of age on the ability to learn a second language is a question that psycholinguists have been asking for a long time with somewhat inconclusive answers. This study aims to contribute new analyses to that debate and inform policymakers about the heterogeneity in the EL population, drawing particular attention to a group that may face developmental barriers to language learning.

The analysis suggests that the plurality of students reach proficiency in the first year following entry into the public school system: between approximately 25 and 30 percent of new EL entrants are proficient within one year after school entry, with slight variation by the year in which they enter. In addition, approximately 50 percent of the entering EL students are proficient within three years after entry, again with variation by year of entry, suggesting that the NCLB time limits on exemptions may be appropriate for a slim majority of EL students. Yet students' probability of becoming proficient, and the speed with which they acquire proficiency, decrease the older they are when they first enter the school system. Age of entry effects are robust to controls for school and student characteristics, including the students' level of English proficiency upon entry, lending support to the theory that age-related developmental influences hinder older children's ability to learn new languages quickly. The results suggest that while the current policy that sets time limits on exemption from taking exams in English may be appropriate for the median EL student, it may disproportionately penalize older-entering EL students who are unable to become proficient as quickly as younger entrants. The policy may also disadvantage schools that serve large shares of older-entering EL students.

2. Theory and past research on time to proficiency and age of entry effects

There are a number of reasons why age of entry into the public school system (a proxy for the age at which formal learning begins) might influence the rate at which children acquire English proficiency and the ultimate level of proficiency that they can obtain. This section groups the various theories into three broad categories (developmental, socio-demographic, and contextual), reviews the existing empirical work on time to proficiency and age of onset effects, and details the contributions of this study to the existing literature.

2.1. Why age of entry might affect time to proficiency

The effect of age of onset on second language acquisition is a topic of extensive research among linguistic theorists, who search for developmental explanations for language acquisition. The Critical Period Hypothesis (CPH), for instance, posits that the ability to become fully proficient in a second language (often measured by the ability to speak without an accent or follow grammatical rules) is influenced by the developmental period in which exposure to the language begins. Much of the research in this area finds a negative correlation between the age learning begins and the ability to become a native-like speaker, both on self-reported and observed measures of ultimate proficiency (see for example, Johnson and Newport, 1989; Stevens, 1999). There is, however, extensive debate among linguistic theorists over the validity of the CPH, including whether the age of onset effects are asymmetric or linear as well as whether the age effects are due to neurological, maturational, or cognitive factors (for reviews of this research, see Birdsong, 1999 and Singleton and Ryan, 2004).

The theoretical work on how age of onset affects the *rate* at which a young learner can become minimally proficient in a second language is relatively less developed. Since older learners are less likely to become native-like speakers, a natural expectation is that they will also be slower learners. Alternatively, some linguistic theorists speculate that older learners can acquire the basics of the second language more quickly than younger learners because they are more proficient in their first language. That is, older youth may never obtain native-like proficiency in their second language, but their advanced language skills upon onset may permit them to become at least minimally proficient more quickly than younger children (Collier, 1987).

An alternative explanation for age of entry differences in the rate at which English is obtained could be that ELs who emigrate at a given age differ on non-developmental factors that drive the rate of second language acquisition. For instance, studies of immigrant youth in the U.S. typically find that levels of English proficiency are higher among youth whose parents are college educated and earn higher incomes (Bialystock and Hakuta, 1994; Hakuta et al., 2000; Portes and Schauffler, 1994). Large racial, ethnic, and linguistic differences in English proficiency and other school and labor market outcomes have also been widely documented, with Spanish-speaking immigrants generally faring worse than others (e.g. Hirschman, 2001; US DOE, 2001; Van Hook and Fix, 2000). Students who have underlying disabilities can also be expected to have a harder time obtaining proficiency than students without these disadvantages. If age of entry correlates with any of these attributes—student demographics, parental human capital, disabilities, as examples—then the developmental effect of age of entry will be biased in models that fail to control for these attributes.

A third explanation for differences between older and younger students in the rate at which they acquire proficiency could be the amount and quality of the exposure that they have to English outside of the home. The density of the co-ethnic community and the extent to which English is spoken by neighbors will influence students' opportunities for learning the language (e.g. Ishizawa and Stevens, 2007; Potowski, 2004). Since older students are more able to travel outside of the community, their exposure to English-dominant contexts may be more frequent. Conversely, older students might spend more time conversing with their co-linguistic peers than younger students, which may reduce their opportunities to learn English.

Older and younger students may also vary in the quality of the schools they attend and the English language services they receive. Several studies have documented high rates of across-school segregation between EL and fully English proficient students as well as disparities in the qualifications of the teachers and the quality of the schools attended by these two groups (e.g. Gándara et al., 2003; Gershberg et al., 2004; Rumberger, 2003; Van Hook and Fix, 2000). National surveys also indicate that older ELs are less likely than younger ELs to receive any type of English language services (Van Hook and Fix, 2000).[1] If older EL students attend lower quality schools or receive lower quality English instruction than younger EL students, then their rate of English acquisition will be slower. At the same time, if they are more likely to be exposed to English outside of the home, then their rate of acquisition may be faster.

2.2. Empirical research on time to proficiency and age of entry effects among children

A review of the literature surfaced only a handful of studies of North American language learners with a large enough sample size to generate reliable estimates of how long it takes students to become minimally proficient in English (Collier, 1987; Cummins, 1981; Hakuta et al., 2000). Though these studies help to generate hypotheses for the current study, most of them use samples of students in Canada or students in the U.S. during the 1970s and 1980s. In addition, the majority of the studies use measures of academic English proficiency (for instance, performance on English language arts exams), where a low score indicates either limited English proficiency or limited knowledge of the content area, or both.

In exception, there is one recent large scale study that uses both oral and academic measures of English to generate estimates of time to proficiency. Hakuta et al. (2000) study the English acquisition of cross sections of students in San Francisco elementary and middle school grades in 1998 (a sample of approximately 1800 students), all of whom entered school in kindergarten. The study finds that 90 percent of the students reach oral English proficiency within five years of school entry, with most students requiring between two and five years to reach oral proficiency. Most students reach academic English proficiency levels similar to native-English speakers within four to seven years. Students with less-educated parents and students who attend higher-poverty schools take longer to reach both types of proficiency than other students. The study makes significant advances over the earlier studies that failed to observe students at multiple points or relied on small, dated, or non-U.S. samples. Yet the estimates need to be replicated with large samples of students in other jurisdictions. In addition, the field requires more analyses of how the time to proficiency varies for different groups of students.

In particular, research on how age of entry affects the rate at which young children learn English is very thin, primarily because longitudinal data sources that track large samples of EL children in each year after they enter are hard to find. Studies that rely on cross-sectional records are unable to isolate the effect of age of entry from the effect of years in the U.S. because age of entry and years in the U.S. are perfectly inversely correlated for children of a given age (see Stevens, 2006, for a thoughtful discussion of the linear dependence problem in second language acquisition research). In addition, U.S. Census-like surveys rely on self-reported English proficiency levels that are only able to distinguish between people who report to speak English "very well", "well", "not well" and "not at all". More precise time to proficiency estimates can only be obtained from panel data that directly observe students' English abilities in each year after entry.

Many of the panel studies that examine the rate of acquisition rely on small, single age-cohort samples, which prevents across-cohort comparisons (e.g. MacSwan and Pray, 2005; Snow and Hoefnagel-Höhe, 1978). In addition, the handful of large-sample studies that examine the effect of age of onset on rate of acquisition tend to use measures of academic English proficiency instead of measures of oral proficiency and focus on only one or two language groups (Collier, 1987; Cummins, 1981; Ramsey and Wright, 1974). The results from these few studies suggest that among pre-school and elementary school age children, students who are slightly older (ages 8–11) gain academic proficiency more quickly than students who are slightly younger (ages 5–7).

2.3. Contributions of this study

To summarize, the limited research to date indicates that elementary school age students reach oral proficiency in two to five years and age of entry may increase the speed with which students become academically proficient. This study makes a number of contributions to the prior work. First, with panel data and discrete-time survival analyses, I isolate the effect of age of entry from length of residency on English acquisition. More specifically, I compare the estimated probability of proficiency in each year following school entry and the estimated median time to proficiency for each age of entry group. Second, I control for several student characteristics that correlate with age of entry and proficiency, including family poverty, home language, race/ethnicity, gender, disability, and precise English ability upon school entry. In addition to using these variables as controls, I shed light on their relative influence on time to proficiency. Third, I control for differences in the quality of schools attended by older and younger EL students that may influence their time to proficiency. Fourth, I use panel data

[1] There is a large body of literature examining the relative effectiveness of the various instructional approaches to teaching English, yet the evidence is largely inconclusive (see Francis et al. (2006) for a recent review of this literature).

on the census of entering EL students over multiple years and at multiple ages, which eliminates possible biases due to sampling error, lack of sufficient sample sizes for examining subgroups of students, and limited generalizability due to atypical cohorts. Finally, I use a measure that permits a clean analysis of how long it takes students to become minimally proficient in English and that does not also measure more advanced reading skills. The data are described in the following section.

3. Methods

3.1. Data sources and variables

I use data from the New York City Department of Education on all students in the 1st through 8th general education grades in each of the years 1996 through 2004. From these records, I assembled four panel datasets of EL students who were new entrants from 1996 through 1999. Students in these cohorts are observed for a minimum of three years and a maximum of eight years depending upon the year that they entered and their age upon entry. For instance, students who enter as 5-year-old in 1996 (when they are in the 1st grade) are observed through 2003 (when they reach the 8th grade). Students who enter as 10-year-old in 1996 (when they are in the 5th grade) are observed through 1999 (when they reach the 8th grade). The analysis focuses on the 8976 students who entered the school system in 1997, and provides summary information on students in the other entry years to simplify the presentation of results.[2]

Two categories of general education students are excluded from the analysis. The first are students who exit the school system the year immediately following entry and who do not reenter by the time data collection ended (2004) because these students' EL status could not be determined: 7.6 percent of the 1996 entry cohort to 4.8 percent of the 1999 entry cohort are excluded for this reason. The second are students with missing or unclassifiable race/ethnicity data: 0.15 percent of the 1996 entry cohort to 0.20 percent of the 1999 entry cohort are excluded for this reason.

The data contain information on students' socio-demographic characteristics and their receipt of part-time special education services for mild or moderate disabilities. Demographic variables include gender, race/ethnicity (white- not of Hispanic origin, black- not of Hispanic origin, Hispanic, and Asian or Pacific Islander), birthplace, age, and the language that is most frequently spoken in the home as determined through a home language survey. As is characteristic of public school records, the one available measure of income is whether the student is eligible for the subsidized meal program, where free lunch eligible students come from families with incomes at or below 130 percent of the federal poverty level and reduced-price lunch eligible students come from homes between 130 and 185 percent of the poverty level. Students are also linked to the schools they attend and some of the characteristics of their schools, such as per-pupil expenditures, enrollment, the percentage of teachers with master's degrees, and the percent of teachers with more than two years teaching in the school.

Also included in each year are students' scores on the Language Assessment Battery (LAB), a test of their basic proficiency in speaking, listening, reading, and writing English. Students from homes where a language other than English is primarily spoken and students whose native language is not English are required to take the LAB. Students who score at or below the 40th percentile on the LAB are designated as EL and eligible for English language instruction. Students are retested each spring until they score above the 40th percentile. Those scoring above the 40th percentile are considered to have the ability to comprehend and speak English better than 40 percent of the normed population, which includes both native speakers of English and native speakers of other languages.

Table 1 provides the mean characteristics of the 1997 EL entrants overall and by age of entry. The first column shows that the average student scores at the 7.96th percentile on the LAB (which reaches a maximum of 40 for this group) and that the majority of EL students are poor, foreign-born, Hispanic, and from homes where the most frequently spoken language is Spanish.

Moving across the columns, there is a notable decrease in initial English proficiency level by age of entry, ranging from an average LAB score of 11.37 among 5-year-old entrants to 4.69 among 10-year-old entrants. Comparisons across columns also reveal differences in other student characteristics by age of entry: the older entrants are more likely to be foreign-born, Asian, and white and, correspondingly, less likely to be Hispanic and part-time special education participants. Older entrants are also more likely to speak Chinese, Russian, and Bengalese at home than younger entrants. These age of entry differences are consistent with other research on New York City public school students, which shows that students who enter the school system at older ages are disproportionately foreign-born, and that foreign-born are disproportionately white and Asian (Ellen et al., in press).

The bottom part of the table shows the characteristics of the 699 schools attended by the average EL entrant, and the average EL entrant in each age group. In 1997, the average EL elementary school student attended a school with enrollment of 1075 students, spending of $6993 per pupil, 68.3 percent of teachers with more than 5 years of experience, and 89.8 percent of teachers with master's degrees. The typical elementary school student in that year attended a school with very similar characteristics.[3] In addition, looking across the columns reveals modest differences in the size, expenditures, and teacher

[2] The 1997 cohort is used for the analyses because it can be followed for more years than the later cohorts and because it has more complete data than the 1996 cohort. Two of the control variables in the analysis—eligibility for subsidized meals and participation in the part-time special education program—were not available for students in 1996.

[3] The typical elementary school student attended a school with 1034 students, spending of $7250 per pupil, 69.4 percent of teachers with more than 5 years of experience, and 89.2 percent of teachers with master's degrees (author's calculations).

Table 1
Mean characteristics of English learners in New York City schools by age, 1997 entrants

	All	Age of entry					
		5	6	7	8	9	10
LAB score upon entry	7.96	11.37	10.36	7.16	6.73	5.58	4.69
Student characteristics							
Free lunch	0.877	0.882	0.887	0.877	0.881	0.862	0.866
Reduced-lunch	0.046	0.042	0.041	0.049	0.048	0.053	0.044
Female	0.479	0.487	0.474	0.487	0.494	0.458	0.472
Foreign-born	0.707	0.448	0.552	0.791	0.814	0.859	0.901
Hispanic	0.572	0.667	0.659	0.550	0.549	0.474	0.468
Black	0.060	0.059	0.050	0.066	0.063	0.061	0.070
Asian	0.225	0.184	0.167	0.223	0.230	0.280	0.303
White	0.143	0.090	0.124	0.161	0.159	0.185	0.158
Spanish at home	0.552	0.634	0.631	0.532	0.537	0.461	0.460
Chinese at home	0.051	0.037	0.039	0.041	0.055	0.072	0.070
Russian at home	0.076	0.044	0.059	0.086	0.091	0.098	0.092
Bengalese at home	0.038	0.039	0.032	0.032	0.032	0.049	0.045
Haitian at home	0.017	0.017	0.016	0.021	0.017	0.011	0.024
Korean at home	0.013	0.012	0.010	0.016	0.012	0.010	0.018
English at home	0.043	0.067	0.051	0.042	0.032	0.035	0.026
Other non-English language at home	0.210	0.150	0.163	0.230	0.224	0.263	0.266
Part-time special education (PTSE)	0.021	0.026	0.027	0.021	0.026	0.015	0.008
School characteristics							
Enrollment	1075	1070	1062	1053	1086	1053	1136
Total per-pupil expenditures	$6993	$6969	$7007	$6953	$6932	$6970	$7126
Proportion of teachers with more than 5 years experience	0.683	0.673	0.680	0.683	0.682	0.684	0.699
Proportion of teachers with master's degrees	0.898	0.892	0.894	0.900	0.900	0.901	0.901
Observations	8976	1511	2097	1400	1323	1336	1309
Proportion of sample	1.00	0.168	0.234	0.156	0.147	0.149	0.146

Notes: (i) Students attended 699 schools upon entry. School characteristics are weighted by number of students of each group in the school.

characteristics of the schools attended by EL entrants in each age group. Ten-year-old entrants attend slightly larger schools and schools with slightly higher levels of per-pupil expenditures and experienced teachers than younger entrants, but there are few other differences. Taken together, these relatively small differences in observed student characteristics and school resources by age of entry suggest that controlling for these characteristics in models of time to proficiency is unlikely to dramatically alter age of entry effects.

3.2. Estimation strategy

Given that students' English proficiency status cannot be determined after the last year that they have been observed, estimates of the average time to proficiency would likely be biased using standard analytic techniques. To generate meaningful estimates that account for these right-censored observations, I employ a discrete-time survival model where the primary independent variable is time.

The data are organized in student-years, where the number of years observed for each student is equal to the number of years that it took them to obtain proficiency, or to the end of the data collection year for those who did not obtain proficiency. The baseline hazard model for each cohort is estimated with a logit specification. The model for the 1997 entrants, for example, takes the following form:

$$\text{logit}(E_{it}) = \alpha \boldsymbol{Y}_{it} + \varepsilon_{it}. \quad (1)$$

where E_{it} equals one if student i reached English proficiency in year t. The variables Y_1 through Y_7 are indicator variables representing each year the student was retested over the following seven years and the parameters α_1 through α_7 can be converted into the estimated probability of reaching English proficiency in each of these years provided that proficiency was not reached in the previous year. These parameters capture the hazard function (or, in this case, the time to proficiency function) for this cohort of students. Estimates of the parameters can also be substituted back into the equation to calculate the estimated cumulative percent of students who do and do not become proficient in each year and the median number of years to proficiency if at least 50 percent of the students reach proficiency before the last year they are observed.

I estimate Eq. (1) for all students entering in a given year and separately by age of entry so that the estimated time to proficiency can be compared across age of entry cohorts. For instance, Eq. (1.1) produces time to proficiency estimates for 5-year-old entrants and Eq. (1.2) produces time to proficiency estimates for 6-year-old entrants:

$$\text{logit}(E_{it}) = \alpha \boldsymbol{Y}_{it} + \varepsilon_{it}, \quad \text{where age of entry} = 5. \quad (1.1)$$

$$\text{logit}(E_{it}) = \theta \boldsymbol{Y}_{it} + \varepsilon_{it}, \quad \text{where age of entry} = 6. \quad (1.2)$$

One advantage of this approach is that it holds time since entry into the school system constant and isolates the effect of age of entry on the rate of English acquisition. In order to determine whether differences in estimated time to proficiency rates for each age group are statistically significant, interval estimates are presented in the tables.[4]

To isolate the effect of age of entry on the probability of obtaining proficiency controlling for other determinants of English acquisition, I then estimate a model with sets of covariates added to the right-hand side as follows:

$$\text{logit}\ (E_{ijt}) = \alpha \boldsymbol{Y}_{it} + \beta \boldsymbol{A}_i + \gamma \boldsymbol{S}_i + \boldsymbol{\delta} L_i + d_j + \varepsilon_{ijt}. \quad (2)$$

where E_{ijt} equals one if student i from school j become English proficient in year t. $\boldsymbol{Y}_{it}$ includes indicator variables representing each year the student was retested; $\boldsymbol{A}_i$ includes indicator variables representing students' age of entry into the school system; $\boldsymbol{S}_i$ includes other student characteristics (female, eligible for free or reduced-price lunch, race/ethnicity, foreign-born, language most frequently spoken at home, and receipt of part-time special education services);[5] L_i is the student's LAB score in the year she entered the school system; d_j are indicator variables capturing students' elementary schools upon entry; and ε_{ijt} is an error term.

Eq. (2) provides adjusted age of entry effects on the probability that students acquire English. The year indicators ($\boldsymbol{Y}$) control for differences between students in the number of years they are observed and the rate they acquire proficiency. With the addition of $\boldsymbol{S}_i$, L_i, and d_j the coefficients on the age of entry variables indicate the effect of age of entry independent of the demographic and economic characteristics of the students, their underlying disabilities, their level of English proficiency upon entry, and the schools they attend. In addition to controlling for the school resources described in Table 1, the school fixed effects absorb the effect of all other characteristics of schools that might drive time to proficiency, such as the characteristics of the students and the leadership of the principals. Given that schools are predominantly neighborhood-based, the school fixed effects also hold constant some of the community-level influences on English language acquisition, such as the extent to which community members speak English. If Eq. (2) yields adjusted age of entry differences, the age differences can be more confidently attributed to developmental, as opposed to contextual or socio-demographic, factors that influence the probability of obtaining proficiency.

3.3. Robustness checks

Sensitivity analyses are estimated to address four concerns. The first is that the exact time to proficiency cannot be determined for a sub-sample of students who exit the school system as EL and return proficient more than one year later. The percentage of students in each cohort that fall into this category ranges from a high of 3.33 percent among 1996 entrants to a low of 0.92 percent among 1999 entrants. For the primary analyses, I assign to these students the maximum number of years that it could have taken them to become proficient and in a sensitivity analysis, I assign the minimum number of years it could have taken them. For instance, consider an EL student who entered in 1997 and who has the following record: not observed in 1998, not observed in 1999, observed in 2000 and recorded as English proficient in that year. This student's minimum possible time to proficiency is one year (assuming she became proficient in 1998) and her maximum time to proficiency is three years (assuming she became proficient in 2000).

A second sensitivity analysis is conducted to determine whether entering the school fixed effects as time-varying affects the age of entry estimates. The primary model controls for the school that the student attends upon entry into the school system. Ideally, the model would control for each school that the student attends while observed since some students transfer to different schools. However, for the small percentage of students who exit as EL and reenter as proficient, the school they attend in the years that they were not in the school system cannot be entered into the model. To maximize the sample size, I keep these students in the analytic sample and control only for the school they attend in their first year. To check for the sensitivity of this decision, I restrict the model to students who are observed in each year and enter a year-specific school fixed effect to control for the influence of schools that students transfer to after the first year.

The third concern is that the data do not indicate whether students received formal English language instruction—for instance, from private schools or English language day care centers—prior to their entry into the public school system. Time to proficiency estimates may be biased downward by this omission. Age of entry effects might also be biased. The most likely scenario is that 5- and 6-year-old entrants are more likely to have received prior instruction than students who enter at older, non-traditional, entry points (indicating that they are probably new entrants to the U.S.). Prior research on immigrant children under the age of 6 finds that most are cared for by their parents and relatives prior to entering the public school system so the magnitude of these possible biases is likely to be small (Capps et al., 2004; Magnuson et al., 2006). In addition, the fully-specified models controls for initial proficiency level, which should account for some of the effects of prior exposure to English. Finally, the data include a variable that identifies foreign-born students who have entered any U.S. public school

[4] An alternative approach to testing the statistical significance of age of entry differences would be to estimate pooled models that interact each year indicator ($\boldsymbol{Y}$) with each age of entry indicator ($\boldsymbol{A}$) as follows: $\text{logit}(E_{it}) = \alpha \boldsymbol{Y}_{it} + \beta \boldsymbol{A}_i + \delta(\boldsymbol{Y}_{it} * \boldsymbol{A}_i) + \varepsilon_{it}$. However, the variation in the years observed for each age group renders this interacted model unnecessarily complex. Given that the results from the two methods are the same, I simply estimate separate models and report the intervals estimates.

[5] All student characteristics are entered as time-invarying attributes measured in the year upon entry. Though eligibility for subsidized meals and participation in the special education program could vary over time, most students who participate in these programs in the first year remain in the programs throughout their schooling.

within the last three years, and comparisons reveal that the majority of foreign-born (more than 93 percent in each age group) who are recent to the city's school system are also recent to any U.S. school system. Nevertheless, I conduct an additional sensitivity analysis by restricting the analysis only to these "recent immigrants" to ensure that time to proficiency and age of entry effects are picking up first time exposure to formal English language instruction.

A final analysis addresses a change of measurement in the panel. Beginning in school year 2002–03 (referred to in the paper as 2003), the New York City Department of Education changed the procedure for identifying students who become proficient in English. Prior to 2003, the LAB was used to identify students for services, monitor their progress in each year, and determine their eligibility for exit from EL status. In 2003 and 2004, the LAB was used to determine eligibility only for new entrants into the school system and a different test, the New York State English as a Second Language Test (NYSESLAT), was administered to determine continued eligibility for previously-tested students. The values on the NYSESLAT include beginner, intermediate, advanced, and proficient, where only students who receive a proficient on the exam are considered to have exited EL status. Obtaining a value of proficient on the NYSESLAT is more difficult than scoring above the 40th percentile on the LAB so that estimates of exit from EL status drop significantly in 2003 when the NYSELAT is implemented. There is, unfortunately, no combination of scores on the NYESLAT (e.g. proficient and advanced) that can be equated to an above 40th percentile on the LAB. If the change in measures somehow uniquely disadvantages a particular age group, then age of entry effects will be biased by this measurement shift. To address this problem, I first estimate all models using the New York City definition of English proficient on the NYSELAT (receiving a value of proficient) and discuss these results in the text. I then re-estimate the fully-specified model using a more generous definition of English proficiency on the NYSELAT (receiving a value of proficient or advanced) and discuss the robustness of the age of entry effects to this alternative definition.

4. Results

4.1. How long does it take the average student to become proficient?

The first analysis provides point and interval estimates of the estimated probability of reaching proficiency in each year following school entry by year of entry (see Table 2). Among 1996 entrants, for instance, 0.244 reach proficiency in the first year, 0.178 of those who were not proficient by the end of the first year become proficient in the second year, and so on.

For each entry cohort, the probability of reaching proficiency is highest for students one year after they enter the public school system. The likelihood in the first year post entry also increases across the year of entry cohorts, with the largest jump between 1996 and 1997 entrants, reaching a probability of 0.303 for 1999 entrants. This increase may reflect differences in the instruction provided to EL students over time, changes in the policies regarding who is tested, or to changes in the composition of the testing pool. The later year of entry cohorts are, in fact, less likely to be Hispanic, poor, and receiving special education services. Their initial English proficiency levels (LAB scores) are also slightly higher, from a low of 7.51 among 1996 entrants to 8.18 among 1999 entrants (see Appendix Table 1 for the characteristics of students in each entry cohort).

After the first year following school entry, the probability of proficiency hovers at around 0.18–0.25, with relatively small differences across the year of entry cohorts and by the year after school entry within each cohort. For instance, in 1996, proficiency rates range from 0.18 to 0.22 from the second to the sixth year after entry but most of the differences are not statistically different as indicated by overlapping interval estimates. The same is true of proficiency rates in 1997, which range between 0.19 and 0.24 from the second to the fifth year after entry (again, with overlapping interval estimates). The last two years for each entry cohort are italicized to remind the reader of the measurement change that occurred in 2003. As

Table 2
Estimated probability (95% confidence interval) of English proficiency in each year after school entry by year of entry

	Year of entry			
	1996	1997	1998	1999
Estimated probability of proficiency in year after entry				
1st year	0.244 (0.235–0.252)	0.273 (0.264–0.282)	0.283 (0.272–0.293)	0.303 (0.293–0.314)
2nd year	0.178 (0.169–0.187)	0.205 (0.195–0.215)	0.233 (0.221–0.245)	0.247 (0.235–0.259)
3rd year	0.190 (0.180–0.201)	0.187 (0.176–0.199)	0.222 (0.209–0.237)	0.254 (0.240–0.269)
4th year	0.181 (0.168–0.194)	0.220 (0.206–0.236)	0.250 (0.233–0.269)	*0.061 (0.051–0.073)*
5th year	0.183 (0.167–0.200)	0.242 (0.223–0.263)	*0.081 (0.067–0.098)*	*0.172 (0.152–0.194)*
6th year	0.220 (0.198–0.243)	*0.102 (0.084–0.123)*	*0.153 (0.129–0.181)*	NA
7th year	*0.122 (0.099–0.148)*	*0.176 (0.146–0.210)*	NA	NA
8th year	*0.177 (0.134–0.228)*	NA	NA	NA
Estimated median years to proficiency	3.03	2.72	2.41	2.19
Proportion not proficient by last year observed (censored)	0.392	0.314	0.352	0.380
Number of students (person-years)	9919 (29,658)	8976 (25,754)	7394 (20,028)	7417 (18,613)

Notes: (i) Italics represent a change in measurement that occurred in 2003. See Section 3.3 for details. (ii) NA indicates that students were not followed long enough to produce estimates in those years.

explained in Section 3.3, the measure used in 2003 made reaching proficiency more difficult, which explains the large decreases in the probability in this year.

The bottom of the table provides the estimated median number of years to proficiency and the proportion of students who are censored (proficiency was not obtained by the last year they were observed). The 1996 median is 3.03, indicating that almost half of the students became proficient within three years after entry. Reflecting the higher rates of proficiency in the first year for later-entering cohorts, the median time to proficiency decreases by year of entry, reaching a low of 2.19 for the 1999 entrants. Note again that the new measure used in 2003 rendered reaching proficiency more difficult, such that the increase in the speed with which later entry cohorts become proficient is not due to the measurement shift.

4.2. Does age of entry affect time to proficiency?

Table 3 provides the time to proficiency estimates for students in the 1997 entry cohort by their age upon entry into the school system. The table shows a large decrease in the probability of proficiency one year after entry as students' age increases, from 0.413 among 5-year-old entrants to 0.139 among 10-year-old entrants. The confidence intervals reveal that 8- and 9-year-old entrants have statistically equivalent exit rates in the first year while all other age of entry differences are statistically significant from one another.[6]

For 5-and 6 year-old entrants, the probability of becoming proficient decreases dramatically after the first year, for instance, from 0.413 to 0.214 for 5-year-old entrants. But for all other ages, the differences between the first and second years are statistically insignificant. There are also no clear patterns in the proficiency rates over time for each age group: some are statistically equivalent, some decrease slightly, and some increase slightly (note that the large increase in the estimated probability of proficiency for 10-year-old entrants in year 5 may be due to a high rate of censored observations and a relatively small remaining number of students in that year). However, looking across the columns within each row reveals that the estimated probability of proficiency in each year decreases slightly with age of entry (again, the last two years are italicized to indicate the change in the measure used to determine proficiency). The median times to proficiency also increase consistently with age of entry from a low of 1.69 for the 5-year-old entrants to a high of 3.78 for the 10-year-old entrants.

Fig. 1 provides another way to examine the distribution in the time to proficiency by age of entry for the 1997 entry cohort. Specifically, the Figure shows the estimated cumulative rates of proficiency in each year following entry by age of entry. Replicating the numbers shown in Table 3, for example, 0.413 of the 5-year-old entrants reach proficiency in the first year. Another 0.162 reach proficiency in the second year for a cumulative of 0.539 proficient by the end of the second year, and so on. The graph reveals that the cumulative proportion of students who reach proficiency by the end of each year decreases as age of entry increases. Again, the largest differences are found in the proficiency rates obtained in the first year with relatively similar slopes for the age of entry groups after that first year.

4.3. Does age of entry affect proficiency holding other influences constant?

The age differences observed in Table 3 may be driven by differences in the characteristics of the students and the schools they attend. To examine these possibilities, I estimate several models of English proficiency, beginning with unadjusted age of entry effects followed by estimates that are adjusted by sets of covariates (see Table 4). The first column of Table 4 provides the age of entry effects when only year indicators are included in the model to allow for differences in the time to proficiency and adjust for censored observations. Consistent with the trend observed in Table 3, the coefficients indicate that the older children are when they enter the system, the lower their likelihood of becoming proficient in English. Age 6 entrants, for instance, have a probability of reaching proficiency that is 2 percentage-points lower than age 5 entrants. As age of entry increases by one year, the probability of becoming proficient falls by roughly 2–3 points.

Introducing socio-demographic and disability characteristics to the model has almost no effect on the age of entry coefficients (see Column 2 of Table 4). Given the shortage of research on variations in the speed with which young learners pick up English, it is important to interpret the estimates on the covariates in this model. The results suggest that, conditional on other controls, students who are female, never poor, native-born, white, and not receiving special education services for mild or moderate disabilities are more likely to become proficient than other children. Students whose parents predominantly speak Russian, Bengalese, or Korean at home are also more likely to become proficient than those who speak other languages at home, including English. Children from homes where Spanish or Haitian is the primary language are least likely to obtain proficiency. Though the home language differences are larger when the race/ethnicity indicators are not included in the model, it is notable that the race/ethnic variables do not wipe out the effect of the language spoken at home (models without race/ethnicity are not shown in the table). See Appendix Table 2 for the unadjusted estimated median time to proficiency for each of the economic and demographic subgroups in the analysis.

[6] The higher probability of attaining proficiency one year after school entry for 5- and 6-year-olds does not appear to be explained by the possibility that younger entrants may have been in the U.S. longer than older entrants. When the analysis is restricted to recent immigrants only (foreign-born students who have been in the U.S. for less than three years), the estimated probability of attaining proficiency by age of entry are very similar to those reported in the table: 0.403, 0.331, 0.242, 0.232, 0.198 and 0.133 for 5- to 10-year-old entrants, respectively. Of course, it is still possible that there is variation among recent immigrants in the precise year that they entered (e.g. 5-year-old recent immigrants entered three years earlier while 8-year-old entrants entered one year earlier).

Table 3
Estimated probability (95% confidence interval) of English proficiency in each year after school entry by age, 1997 entrants

	Age of entry					
	5	6	7	8	9	10
Estimated probability of proficiency in year after entry						
1st year	0.413 (0.388–0.438)	0.354 (0.334–0.375)	0.238 (0.216–0.261)	0.231 (0.209–0.255)	0.197 (0.176–0.219)	0.139 (0.121–0.159)
2nd year	0.214 (0.188–0.243)	0.227 (0.205–0.251)	0.259 (0.233–0.289)	0.212 (0.188–0.239)	0.157 (0.136–0.181)	0.154 (0.134–0.178)
3rd year	0.187 (0.159–0.219)	0.205 (0.180–0.232)	0.199 (0.172–0.230)	0.172 (0.146–0.201)	0.174 (0.150–0.202)	0.177 (0.147–0.213)
4th year	0.280 (0.243–0.320)	0.251 (0.221–0.284)	0.205 (0.174–0.240)	0.155 (0.127–0.186)	0.206 (0.170–0.248)	0.212 (0.147–0.297)
5th year	0.226 (0.189–0.272)	0.239 (0.204–0.277)	0.231 (0.194–0.273)	0.263 (0.218–0.313)	0.250 (0.177–0.340)	0.529 (0.303–0.745)
6th year	*0.081 (0.053–0.121)*	*0.105 (0.078–0.141)*	*0.096 (0.063–0.142)*	*0.163 (0.097–0.260)*	*0.150 (0.089–0.532)*	NA
7th year	*0.187 (0.140–0.245)*	*0.153 (0.117–0.211)*	*0.211 (0.133–0.316)*	*0.105 (0.027–0.337)*	NA	NA
Estimated median years to proficiency	1.69	2.00	2.57	3.02	3.51	3.78
Proportion not proficient by last year observed (censored)	0.022	0.038	0.034	0.052	0.073	0.093
Number of students (person-years)	1511 (4367)	2097 (6204)	1400 (4459)	1323 (4025)	1336 (3682)	1309 (3017)

Notes: (i) Italics represent a change in measurement that occurred in 2003. See Section 3.3 for details. (ii) NA indicates that students were not followed long enough to produce estimates in those years.

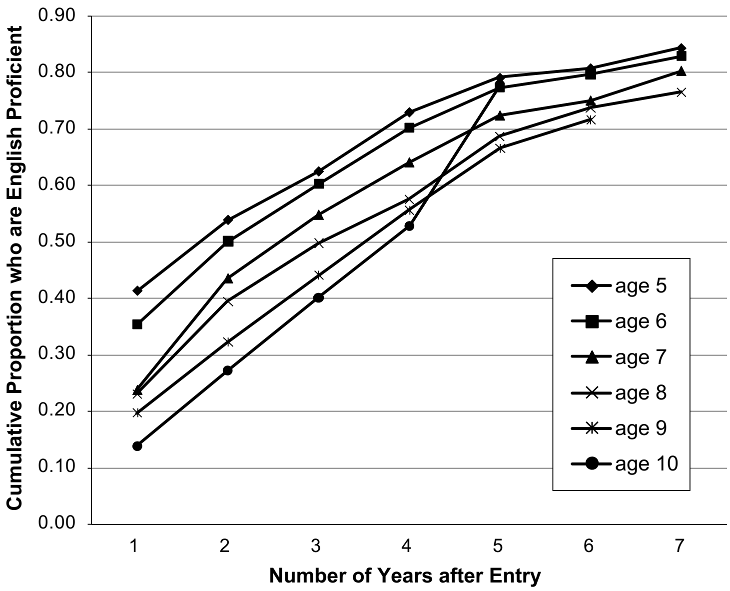

Fig. 1. Estimated cumulative proficiency rates by age of entry, 1997 entrants.

All of the estimates in Column 2 of Table 3 may be picking up the effects of unobserved attributes on students proficiency, such as parental education, more precise measures of parental income or wealth, and time-invarying attitudes towards school and learning. The third specification aims to remove some of this bias by controlling for the student's LAB score in her year of entry. Correspondingly, the estimated coefficients on the age of entry variables capture the extent to which age of entry affects the probability of becoming proficient independent of several unobserved inputs to this initial level. The estimated parameter on the LAB score in 1997 suggests that an increase of only 1 percentile-point on the initial LAB raises the probability of reaching proficiency by 1 percentage-point. Holding initial LAB score constant reduces the estimated parameters on the age of entry variables by approximately 30–60 percent. The initial LAB score also reduces the estimated effects of several other covariates in the model, such as the negative effect of foreign-born status and Spanish at home.

The final specification controls for elementary school fixed effects (see Column 4 of Table 4). The resulting estimated parameters on the age of entry variables capture the within-school difference in age of entry effects and controls for all

Table 4
Marginal effects (standard errors) from logistic regressions of english proficiency, 1997 entrants

	(1)	(2)	(3)	(4)
Age 6	−0.02** (0.01)	−0.02* (0.01)	−0.01* (0.01)	−0.02 (0.01)
Age 7	−0.05*** (0.01)	−0.05*** (0.01)	−0.02** (0.01)	−0.03* (0.02)
Age 8	−0.07*** (0.01)	−0.07*** (0.01)	−0.04*** (0.01)	−0.06*** (0.02)
Age 9	−0.09*** (0.01)	−0.10*** (0.01)	−0.06*** (0.01)	−0.10*** (0.02)
Age 10	−0.12*** (0.01)	−0.12*** (0.01)	−0.08*** (0.01)	−0.15*** (0.02)
Free lunch		−0.13*** (0.02)	−0.09*** (0.02)	−0.07** (0.03)
Reduced-lunch		−0.02 (0.02)	0.01 (0.02)	0.01 (0.04)
Female		0.01** (0.00)	0.01* (0.01)	0.02** (0.01)
Foreign-born		−0.05*** (0.01)	0.01* (0.01)	0.01 (0.01)
Spanish at home		−0.04** (0.02)	−0.01 (0.02)	−0.00 (0.03)
Chinese at home		0.00 (0.02)	0.00 (0.03)	−0.01 (0.04)
Russian at home		0.09*** (0.03)	0.07** (0.03)	0.10** (0.05)
Bengalese at home		0.04* (0.03)	0.03 (0.03)	0.04 (0.04)
Haitian at home		−0.05*** (0.02)	−0.07*** (0.02)	−0.10 (0.07)
Korean at home		0.10** (0.05)	0.07 (0.05)	0.04 (0.07)
Other non-English at home		−0.01 (0.02)	−0.01 (0.02)	−0.03 (0.03)
Hispanic		−0.11*** (0.03)	−0.11*** (0.03)	−0.11** (0.04)
Asian		−0.05*** (0.02)	−0.04*** (0.01)	−0.06** (0.03)
Black		−0.04*** (0.02)	−0.05*** (0.02)	−0.00 (0.04)
Part-time special education		−0.07*** (0.01)	−0.07*** (0.01)	−0.18*** (0.03)
LAB score in 1997			0.01*** (0.00)	0.02*** (0.00)
School fixed effects	No	No	No	Yes
Observations	25,754	25,754	25,754	25,400
Log pseudo likelihood	−13457.77	−13032.16	−12248.73	−10649.04

Notes: (i) All models include indicators for year and whether meal code data is non-missing in 1997.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

across-school variation in factors such as the school-level quality of English language instruction, additional services, and peers. All of the estimated coefficients on age of entry variables in Column 4 are more negative than those in Column 3, though the difference between 5- and 6-year-old becomes statistically insignificant. The estimated differences in proficiency rates for 10- and 5-year-olds reaches a high of 15 percentage-points with the addition of school fixed effects. This increase in the negative effect of age on proficiency, conditional on school, suggests that across-school sorting reduces age differences in time to proficiency estimates. Note that the school fixed effects do not necessarily control for differences in the type of English language program students receive since multiple programs are often offered within the same school.

To demonstrate that the findings for 1997 are not atypical, Table 5 provides the fully-adjusted age of entry effects for all entry cohorts. All models include the variables shown in Column 4 of Table 4 with one exception: data on eligibility for subsidized meals and receipt of part-time special education were not available for the 1996 cohort. Based on the 1997 cohort data, younger students are more likely to be free lunch eligible and to participate in special education, which explains why several of the age effects are slightly smaller in the 1996 regressions than the effects in later years. Though there are differences in the magnitude of the age of entry effects across the years, the general story holds: entering late, particularly after the age of 6, lowers the likelihood of becoming proficient in English for all entry cohorts. The adjusted penalty of increasing age by one year ranges from 1 to 7 percentage-points depending upon the year of entry and the initial age of entry.

A final table provides results from four robustness checks (see Table 6). The age of entry effects from the original fully-specified model from Column 4 of Table 4 are provided again in Column 1 of Table 6. Column 2 (Alternative 1) of Table 6 provides estimates of the same model but adjusts for the fact that I could not identify the precise number of years to proficiency for students who exited the school system and returned proficient in a later year. The original model uses the maximum possible number of years while the alternative model uses the minimum possible number of years. Column 3 (Alternative 2) enters the school fixed effects as time-varying since some students transferred schools during the years they were observed. Column 4 (Alternative 3) adjusts for the fact that, for some students, age of entry into the New York City schools system may not equal their age of entry into the U.S. and may not capture their first exposure to formal English language instruction. This model is therefore restricted to recent immigrants, defined as students who are foreign-born and new to any U.S. school system within the previous three years. Column 5 (Alternative 4) adjusts for the fact that the measurement of EL status changed in 2003, and I use a more generous definition of reaching proficiency than the definition used by the school district and the original model.

Each alternative specification changes the estimated coefficients on the age of entry variables from between 0 and 4 percentage-points. One notable change occurs in the model that allows school fixed effects to vary over time (Alternative 2); the effect of age 9 increases from −0.10 to −0.14 and the effect of age 10 increases from −0.15 to −0.19 moving from the original model to the time-varying school fixed effects model. However, the effect of a 1 year increase in age (that is, the difference in

Table 5
Marginal effects (standard errors) on age of entry indicators from fully-specified logistic regressions of english proficiency by year of entry

	Year of entry			
	1996	1997	1998	1999
Age of entry				
6	−0.01	−0.02	−0.02	−0.01
	(0.01)	(0.01)	(0.02)	(0.02)
7	−0.03*	−0.03*	−0. 05***	−0.06***
	(0.01)	(0.02)	(0.02)	(0.02)
8	−0.06***	−0. 06***	−0.06***	−0. 10***
	(0.02)	(0.02)	(0.02)	(0.02)
9	−0.07***	−0. 10***	−0.09***	−0. 13***
	(0.02)	(0.02)	(0.02)	(0.02)
10	−0.11***	−0. 15***	−0.16***	−0. 16***
	(0.02)	(0.02)	(0.02)	(0.02)
Observations	29,256	25,400	19,637	18,231
Log pseudo likelihood	−11654.20	−10649.04	−8212.51	−7540.14

Notes: (i) All models include the following variables: year indicators; eligibility for free or reduced-price lunch, gender, foreign-born, language at home, race/ethnicity, part-time special education, and LAB score upon entry. The 1996 model, however, does not include eligibility for subsidized meals or receipt of part-time special education services because the data were not available in that year.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

Table 6
Robustness checks, 1997 entrants, marginal effects (standard errors), fully-specified regression

	Original	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Age 6	−0.02 (0.01)	−0.01 (0.01)	−0.02 (0.02)	−0.04* (0.02)	−0.01 (0.01)
Age 7	−0.03* (0.02)	−0.02 (0.02)	−0.05** (0.02)	−0.04** (0.02)	−0.03* (0.01)
Age 8	−0.06*** (0.02)	−0.06*** (0.02)	−0.08*** (0.02)	−0.08*** (0.02)	−0.06***(0.01)
Age 9	−0.10*** (0.02)	−0.10*** (0.02)	−0.14*** (0.02)	−0.11*** (0.02)	−0.09*** (0.02)
Age 10	−0.15*** (0.02)	−0.14*** (0.02)	−0.19*** (0.01)	−0.16*** (0.03)	−0.12***(0.02)
Free lunch	−0.07** (0.03)	−0.10*** (0.03)	−0.12*** (0.03)	−0.08** (0.04)	−0.08** (0.03)
Reduced-lunch	0.01 (0.04)	0.01 (0.03)	−0.02 (0.04)	0.01 (0.04)	0.00 (0.03)
Female	0.02** (0.01)	0.02** (0.01)	0.01 (0.01)	0.01 (0.01)	0.02*** (0.01)
Foreign-born	0.01 (0.01)	0.02 (0.01)	0.01 (0.01)	0.06* (0.03)	0.02 (0.01)
Spanish at home	−0.00 (0.03)	−0.01 (0.03)	−0.00 (0.04)	−0.08 (0.05)	−0.03 (0.03)
Chinese at home	−0.01 (0.04)	−0.02 (0.04)	0.00 (0.04)	−0.05 (0.05)	−0.02 (0.04)
Russian at home	0.10** (0.05)	0.10* (0.06)	0.07 (0.05)	0.04 (0.06)	0.09* (0.06)
Bengalese at home	0.04 (0.04)	0.02 (0.04)	0.04 (0.04)	0.01 (0.05)	0.02 (0.04)
Haitian at home	−0.10 (0.07)	−0.12** (0.05)	−0.21***(0.07)	−0.16* (0.08)	−0.07 (0.05)
Korean at home	0.04 (0.07)	0.00 (0.07)	0.01 (0.06)	−0.00 (0.07)	0.02 (0.07)
Other non-English at home	−0.03 (0.03)	−0.05 (0.03)	0.03 (0.04)	−0.08* (0.04)	−0.04 (0.03)
Hispanic	−0.11** (0.04)	−0.08** (0.04)	−0.12*** (0.05)	−0.08 (0.05)	−0.08** (0.04)
Asian	−0.06** (0.03)	−0.05** (0.03)	−0.07** (0.03)	−0.08* (0.03)	−0.09* (0.03)
Black	−0.00 (0.04)	0.00 (0.04)	−0.01 (0.04)	−0.02 (0.05)	−0.00 (0.04)
Part-time special ed.	−0.18*** (0.03)	−0.15*** (0.03)	−0.24*** (0.04)	−0.26*** (0.04)	−0.13*** (0.02)
LAB score upon entry	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)	0.02*** (0.00)
Observations	25,400	24,547	20,789	18,409	25,132
Log pseudo likelihood	−10649.04	−10717.03	−8432. 82	−7335.36	−10940.82

Notes: (i) Alternative 1 uses the minimum possible number of years to proficiency for those who exited and returned as proficient in a later year. Alternative 2 estimates a fixed effects model where the school varies over time. Alternative 3 restricts the sample to recent immigrants. Alternative 4 adjusts for the fact that the measurement of EL status changed in 2003. (ii) All models include indicators for year and whether meal code data is non-missing, and school fixed effects.
* $p < 0.10$.
** $p < 0.05$.
*** $p < 0.01$.

the estimated coefficients on each proximate age variable) changes by only plus or minus 2 percentage-points between each specification suggesting that the age of entry effects are largely robust.

5. Conclusions and policy implications

There is wide consensus that young English learners need to gain proficiency quickly in order to perform well in school, and ultimately in the labor market and society (e.g. Bleakley and Chin, 2004; Grenier, 1984; White and Kaufman, 1997;

Rumberger and Larson, 1998). There is also solid evidence that most English learners who enter the U.S. as children eventually become proficient in English (Carliner, 2000; Portes and Schauffler, 1994; US DOE, 2001). The question posed in this paper is how quickly they acquire English and whether the age at which learning begins alters the trajectory of learning and the likelihood of obtaining proficiency.

The results suggest that approximately one-quarter to one-third of all EL entrants reach basic proficiency in English within the first year after entry into the school system, and approximately half reach proficiency within three years after entry. The results also indicate, however, that the time that students need to become proficient increases the older they are when they enter the school system. Over 40 percent of 5-year-old entrants are proficient within one year after entry compared to only 14 percent of 10-year-old entrants. In addition, the median time to proficiency increases from 1.69 for 5-year-old entrants to 3.78 for 10-year-old entrants. The negative effect of age of school entry on English proficiency acquisition is partially explained by the fact that older students tend to enter the school system with lower levels of proficiency. However, the age of entry effect is remarkably unchanged by adjustments for differences in students' initial proficiency level; their economic, demographic, and disability characteristics; and the schools they attend. The findings also hold up to several robustness checks. Finally, students who are white, non-poor, female, and not disabled tend to reach proficiency more quickly than other students.

The results speak directly to NCLB, which places a three year time limit on exemptions from standardized English reading exams for new EL students. This policy may be appropriate for students who enter the school system when they are quite young, particularly those who enter at the age of 5 or younger. Yet the results also lend support to linguistic theories regarding the ability of older students to pick up the basics of a new language. Students who begin learning at older ages may be developmentally constrained in their ability to learn English quickly, irrespective of their families' human capital or the schools they attend. Given the heavy weight now placed on students' performance on standardized reading and exams, requiring them to take the exams when they are not yet proficient may put them at a disadvantage. It also puts schools that receive large numbers of older EL students at a disadvantage relative to schools that receive predominantly younger EL students. The results suggest that proposals regarding reforms of NCLB consider age-specific time limits on exemptions from standardized test-taking for EL students. The findings also call attention to the outcomes of non-white, poor, male, and disabled EL students who may be at risk for long-term EL status and who may also be disproportionately harmed by taking the academic proficiency exams too early.

Comparisons of the four year of entry cohorts revealed a notable increase in the speed with which young EL learners became proficient over time: the median time to proficiency decreased from a high of 3.03 among 1996 entrants to a low of 2.19 among 1999 entrants (reflecting a shorter amount of time in EL status). The explanation for this decline is unclear. One possibility is that the entering students became increasingly easier to educate over the years. New entrants in 1999 were less likely to be poor, Hispanic, participating in special education, and had higher initial LAB scores than new entrants in 1996. Another possibility is that the district improved the quality of instruction or changed the population eligible to be tested yet there is no documented evidence of such district-level policy changes. To the extent that this reduction in median time to proficiency among new entrants reflects real improvements in the rate at which students' acquire basic English, the trend is promising.

More research is called for in a number of areas. This paper estimates the rate at which students acquire a minimum level of proficiency in English, arguably, the minimum that they need to begin taking academic reading proficiency exams. The next step is to explore how long it takes students to become competitive with native-English speakers on these academic exams. Another next step is to explore how the schools and the English language services that students receive alter their time to English proficiency. Clearly, some schools, programs, or teachers may do a better job than others at promoting English language proficiency either because of the type of English language services they provide (e.g. bilingual education, English-as-a-Second-Language, or dual language) or because of the quality of the staff, the students, and other school investments. In future work, I plan to estimate time to proficiency models as a function of the types of English language services students receive in each year.

Finally, New York City is an ideal locale for this research given that it is a major port of entry for immigrants to the U.S. and the largest school district in the country. However, New York City EL students, and the district policies regarding EL students, may uniquely affect their time to proficiency and age of entry variation. For instance, New York City has a substantially active advocacy community on behalf of immigrants and English learners that may attract a selected group of immigrants or educators. New York City immigrants might be more or less linguistically isolated in their communities than immigrants in other localities, and this isolation may differentially affect their time to proficiency. In addition, New York City uses a particular measure for identifying EL students that differs from measures used by other districts. Further research using students in other areas, including emerging immigrant communities and more homogeneous communities, are necessary to determine whether these findings are representative of the nation.

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Appendix A

See Appendix Tables 1 and 2.

Appendix Table 1
Mean characteristics of English learners in New York City schools by year of entry

	1996	1997	1998	1999
LAB score upon entry	7.51	7.96	8.24	8.18
Student characteristics				
Free lunch	NA	0.877	0.845	0.807
Reduced-lunch	NA	0.046	0.042	0.046
Female	0.483	0.479	0.479	0.477
Foreign-born	0.710	0.707	0.715	0.694
Hispanic	0.620	0.572	0.524	0.551
Black	0.058	0.060	0.065	0.061
Asian	0.199	0.225	0.268	0.264
White	0.124	0.143	0.143	0.124
Spanish at home	0.596	0.552	0.506	0.534
Chinese at home	0.045	0.051	0.050	0.049
Russian at home	0.068	0.076	0.067	0.046
Bengalese at home	0.027	0.038	0.038	0.040
Haitian at home	0.021	0.017	0.023	0.018
Korean at home	0.009	0.013	0.015	0.032
English at home	0.047	0.043	0.035	0.037
Other non-English language at home	0.187	0.210	0.267	0.243
Part-time special education	NA	0.021	0.008	0.002
School characteristics				
Enrollment	1060	1075	1065	1068
Total per-pupil expenditures	$7065	$6993	$7690	$8273
Proportion of teachers with more than 5 years experience	0.699	0.683	0.620	0.613
Proportion of teachers with master's degrees	0.751	0.898	0.799	0.809
Number of Observations	9919	8976	7394	7417
Number of Schools	712	699	694	677

Notes: Data on free and reduced-price lunch status and part-time special education status were not available for 1996.

Appendix Table 2
Estimated median years to proficiency by student characteristics, 1997 entrants

	Number of students	Estimated median years to proficiency
Subsidized meal		
Ineligible for subsidized meal	394	<1.00
Free lunch	7872	2.91
Reduced-lunch	410	1.36
Gender		
Female	4296	2.69
Male	4680	2.80
Nativity status		
Native-born	2630	2.33
Foreign-born	6346	2.86
Race/ethnicity		
Hispanic	5132	3.45
Black	542	2.34
Asian	2016	2.29
White	1286	1.22
Language at home		
Spanish	4956	3.49
Chinese	456	2.34
Russian	682	<1.00
Bengalese	338	2.05
Haitian	156	2.98
Korean	113	1.06
English	389	1.73
Other non-English language	1886	2.17
Part-time special education		
Yes	190	3.67
No	8786	2.70

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