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## Technical Appendices

# Early Grade Retention and Student Success Evidence from Los Angeles

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# Appendix A. Data Description

This report uses administrative data provided by the Los Angeles Unified School District (LAUSD) on kindergarten to third-grade students.<sup>1</sup> The records begin with kindergartners in 2001, first-graders in 2002, second-graders in 2003, and third-graders in 2004 and include all LAUSD students in grades K–3 for 2004 to 2008.<sup>2</sup> Altogether, the raw data file has grade promotion information on over 490,000 students in just over 500 schools between 2001 and 2008. We complement the LAUSD data with several school-level variables from the California Department of Education (CDE) for 2001 to 2008. Specifically, we use the Academic Performance Index (API) data file and the California Basic Education Data System (CBEDS) to construct measures of school performance, enrollment, and teacher characteristics. The CDE data are available at [www.cde.ca.gov/ds/](http://www.cde.ca.gov/ds/).

LAUSD provided records at the student level, allowing us to explore how the characteristics of individual students and their schools relate to their grade progression and academic achievement. The district has a large and diverse population, making it advantageous for studying early grade retention patterns in California. The district serves about 12 percent of the state’s K–3 enrollment and about 15 percent of the state’s K–3 English learner (EL) population. It is also home to large numbers of economically disadvantaged students.

## Variables

The LAUSD data contain information on student outcomes, demographic characteristics, peer characteristics, and such school-level variables as availability of full-day kindergarten programs. Appendix Table A1 lists the analysis variables, with additional description given in the paragraphs below. The outcome variables describe grade progression and academic performance. We measure grade progression with a binary variable for whether or not a student was ever not promoted (i.e., retained) from K–2 grades to the next grade level at the end of a given school year (1 = ever not promoted K–2; 0 = promoted all K–2 grades).

The academic performance measures consist of scores on grade-level assessments. For kindergarten and the first grade, we use the mid-year and end-of-year Open Court Reading curriculum skills assessments. LAUSD teachers administer reading-skills assessments every six to eight weeks to monitor student progress. Open Court is the only available measure of kindergarten and first-grade student learning across the time period we study. The mid-year kindergarten assessment gauges skills in recognizing uppercase letters, lowercase letters, rhyming words, and high-frequency words. This is the first data point available for reading skills in our data, and we use it as a covariate in our regression analyses. The first-grade assessments, used as an outcome measure, cover average reading fluency, reading comprehension, spelling, and word reading at both mid-year and the end of year. Because the assessments cover different topics, they are not directly comparable between grades. We calculate percentage scores (score achieved divided by highest score possible) on each individual assessment and then an overall average score

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<sup>1</sup> The PPIC Institutional Review Board (IRB) approved security procedures concerning use of LAUSD data.

<sup>2</sup> We refer to school years by the end year (i.e. 2000–01 refers to 2001).

across all assessments in a school year.<sup>3</sup> We use the overall average scores in the analysis for school years 2004 through 2008.<sup>4</sup>

For the second grade, we analyze student proficiency levels on the California Standards Tests (CSTs) in math and English language arts. The CSTs assess the knowledge and skills that second-graders are supposed to have according to California's education standards.<sup>5</sup> There are five proficiency levels: advanced, proficient, basic, below basic, and far below basic. The levels are important for school accountability purposes. Schools administer CSTs annually in the spring but only starting in the second grade. The CSTs are not directly comparable with Open Court skills assessments.

Previous researchers have identified several risk factors for early grade retention, which constitute our key independent variables. In addition to academic performance, these variables include gender, participation in the free or reduced-price meal program, English learner designation, race/ethnicity, and age. The Asian race/ethnicity category includes Filipino students. The meal program is a family income proxy, because student eligibility is capped at 185 percent of the federal poverty line. We determine age through three binary variables. The first indicates children born in September through November; the second indicates children born in December through February; and the third indicates children born in March through August. Because children are eligible to start school if they turn age five by December 2 of a school year, the youngest students in each class are usually born in the fall and the oldest are usually born in the winter. Our age variables measure expected entry ages based on the eligibility criteria rather than actual kindergarten entry ages, which academic redshirting can affect.

The analysis incorporates several additional student, class, and school-level controls as well. Specifically, we include indicators for parent education levels and an indicator for being redshirted. The peer-level controls include class size and the following percentages of peers within a student's class: meal program participants, English learners, Latinos, and those with college-educated parents. School-level independent variables include total enrollment, API rank,<sup>6</sup> full-day kindergarten availability, Reading First program availability, and the following teacher characteristics: percentage fully credentialed, percentage authorized to teach EL students, and percentage with at least five years of experience. Last, we include indicator variables for each school entry year in our analysis. All independent variables apply to a child's initial kindergarten year.

We do not include special education status in our models for two reasons. First, the data we obtained from LAUSD were not complete. Second, many of the disabilities identified in early grades are speech and language impairments, which are not necessarily related to retention rates. Most learning disabilities, which become the predominant disability category in later grades, are not identified until later in elementary school. In other words, they may not be deterministic for explaining patterns of early grade

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<sup>3</sup> For kindergarten, this average is for mid-year skills only. For the first grade, it is for both mid-year and the end of year. We drop children with more than one missing assessment score. There is no predetermined maximum score on the first-grade reading fluency assessment. We set the maximum at the 95<sup>th</sup> percentile level and assign a 100 percent score to students at the top 5 percent.

<sup>4</sup> For the first grade, we do not include the 2003 school year, when Open Court assessments are first available in our data, because of large numbers of missing observations.

<sup>5</sup> For more information on the CST, see [www.cde.ca.gov/ta/tg/sr/resources.asp](http://www.cde.ca.gov/ta/tg/sr/resources.asp).

<sup>6</sup> The API represents a school's performance on statewide testing. It ranges from 200 to 1,000 and is calculated by assigning API points to each student's CST assessment score and averaging across students. The state API ranking indicates where a school's API falls on a scale of 1 to 10, with 10 being the highest. The Open Court assessment is not part of the API calculation.

retention. Indeed, several of the principals we spoke with indicated that they would consider referring a student for special education if retention were not effective.

## Analysis Samples

This report uses two main samples from the raw LAUSD data. The first sample includes almost all students in the raw file to describe district-wide retention trends accurately (see Figure 1). The only restrictions are that we exclude a small number of children attending special education schools and children with missing grade promotion data. In many cases, we are able to fill in missing promotion data for students using their information in subsequent years. Similarly, we adjust LAUSD's promotion data in a few cases where it appears inaccurate (e.g., a student is not promoted but enters the next grade the following year). Altogether, 92 percent of observations have valid promotion data. This sample includes about 490,000 children in grades K–3 at about 500 LAUSD schools. Table 1 uses the 2008 school year of this sample.

The second sample is our main analysis sample. It includes children who start at LAUSD as first-time kindergartners and whom we can follow to what is expected to be the second-grade year, assuming normal progress (i.e., three school years). We use this sample to examine factors related to higher and lower retention probabilities before the third grade in the report's second main section. The criteria for sample inclusion are described below with the number of excluded students shown in parentheses. First, students cannot attend a special education school in any year (903 students) and must be attending kindergarten in LAUSD (90,180 students). We then exclude the entering class of 2001 and 2002, because of missing kindergarten Open Court assessment scores (118,857 students). We also exclude children entering kindergarten in 2007 and 2008, because they do not reach the second grade by 2008 (102,668 students). Next, we exclude children with a missing school code for kindergarten (10,550 students) and children who appear to be in multiple grades in the same academic year or do not have grade progression in ascending order (383 students). Of the remaining students, we remove those whom we cannot follow for three years, for example, because they leave LAUSD before second grade (30,248 students). Finally, we exclude students with missing values of the independent variables (36,188 students). The final sample consists of 147,628 first-time kindergartners starting between 2003 and 2006.<sup>7</sup> Figure 3 uses this sample.

Using two-tailed hypothesis testing and a significance level of 0.05, we have tested whether students who were excluded from the analysis differ from those who were included and we find that they differ in several statistically significant ways. On average, the students excluded from our analysis sample appear to be somewhat more disadvantaged by certain measures. They are more likely to be Latino (83% excluded vs. 77% included), English learners (62% vs. 53%), in the subsidized meal program (87% vs. 83%), and in a lower-API rank school (mean of 3.12 vs. 3.68). The excluded students are also more likely to be younger (28% vs. 26%), to have a lower kindergarten reading composite score (72% vs. 79%), and to have ever been retained in the first three years of school (11% vs. 7%).

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<sup>7</sup> A handful of students in our sample appear to repeat a grade more than once or repeat two grades. For the analysis of retention probability by the third grade, they are counted only once because the variable is if a student is ever retained. For the repeaters' skills improvement analyses, they are included if they have scores for both times in grade.

Table A1 shows descriptive statistics for this second analysis sample by all students and by kindergarten entry cohort year. The table reports means for the outcome and independent variables. Most LAUSD students are meal program participants, English learners, and/or Latino. Within student classrooms, only a small fraction of peers has a parent with a college degree. However, because the number of students is so large, even groups that make up a small share of our sample are composed of thousands of students. For example, our sample includes almost 8,500 white students who are not EL and not meal program participants, almost 1,300 white students who are EL and meal program participants, and 2,700 Asian students who are not EL and not meal program participants. On average, LAUSD schools rank low on the statewide API scale.

Note that the sample we use to generate the cumulative retention rates in Figure 2 includes children starting kindergarten between 2002 and 2005 whom we can follow to the third grade. The cumulative rate for 2006 comes from first-time kindergartners whom we can follow to what is normally the second grade. We construct cumulative rates for the 2007 cohort (to first grade) and the 2008 cohort (kindergarten only) analogously. Figure 2 sample sizes are larger than our main analysis sample, because we do not exclude the 2002 cohort or students who are missing an independent variable.

## Descriptive Statistics

**TABLE A1**  
**Description of the LAUSD analysis sample**

	Cohort mean statistics				
	All	2003	2004	2005	2006
<b>Outcomes</b>					
Retained ever in first three years of school	0.072	0.076	0.072	0.069	0.070
First-grade reading composite score (% correct)*	0.70	0.69	0.70	0.71	0.72
Second-grade CST - ELA proficiency level*	3.22	3.05	3.19	3.27	3.36
Second-grade CST - math proficiency level*	3.55	3.45	3.57	3.57	3.63
<b>Student-level covariates</b>					
Boy	0.51	0.50	0.50	0.51	0.51
Meal program participant	0.83	0.85	0.85	0.84	0.79
English learner	0.53	0.59	0.52	0.50	0.51
Latino	0.77	0.77	0.77	0.76	0.77
White	0.09	0.09	0.08	0.09	0.09
African American	0.09	0.09	0.09	0.09	0.09
Asian	0.05	0.05	0.05	0.05	0.05
Other race	0.01	0.01	0.01	0.01	0.01
Relatively younger (September–November birthday)	0.26	0.25	0.26	0.26	0.26
Relatively middle (March–August birthday)	0.49	0.50	0.49	0.49	0.49
Relatively older (December–February birthday)	0.25	0.25	0.25	0.25	0.25
Mid-year kindergarten reading composite score (% correct)	0.79	0.75	0.77	0.80	0.83
Less than high school degree	0.25	0.25	0.26	0.25	0.24
High school degree or some college	0.33	0.32	0.32	0.33	0.33
College degree or graduate education	0.13	0.12	0.12	0.13	0.14
Missing parent education information	0.30	0.32	0.30	0.28	0.30
Redshirt	0.02	0.02	0.02	0.02	0.02
<b>Peer-level and school-level covariates</b>					
Class size	19.13	19.20	19.06	19.09	19.19
Fraction of classmates enrolled in meal program	0.83	0.84	0.84	0.84	0.79
Fraction of classmates who are English learners	0.52	0.58	0.51	0.49	0.50
Fraction of classmates who are Latino	0.76	0.76	0.77	0.76	0.76
Fraction of classmates with parents with B.A. degrees	0.12	0.11	0.12	0.13	0.14
School enrollment (100s)	9.69	10.51	10.44	9.47	8.36
State API rank*	3.68	3.67	3.70	3.61	3.74
Full-day kindergarten class	0.27	0	0	0.31	0.78
Reading First program at school	0.27	0	0	0.54	0.56
Fraction of fully credentialed teachers in school	0.88	0.80	0.82	0.93	0.96
Fraction of teachers authorized to teach English learners	0.69	0.65	0.65	0.72	0.73
Fraction of teachers with five years of experience	0.76	0.71	0.73	0.78	0.82
No. of observations	147,628	36,167	37,764	36,498	37,199

NOTES: All covariates are measured in the kindergarten year. API ranks are 1 = lowest to 10 = highest; CST proficiency levels are 1 = lowest to 5 = highest; and ELA = English language arts. Cohort mean values for the first- and second-grade academic performance outcomes include the first-time score for grade repeaters but not their second-time score.

## Appendix B. Study Methods

### Retention Outcome

We use a logit model to estimate statistical relationships between our retention outcome and student, peer, and school characteristics. Equation 1 shows the empirical model.

$$y_{ist} = \alpha + K_{ist}\beta + O_{ist}\gamma + T_t + F_s + \varepsilon_{ist} \quad (1)$$

In Equation 1,  $i$  represents individuals,  $s$  represents schools, and  $t$  represents kindergarten entry years. The dependent variable, denoted by  $y_{ist}$ , is an indicator for retention experience by the third grade. There are two sets of explanatory variables.  $K_{ist}$  is a vector that includes student characteristics (i.e., indicators for gender, meal program participation, English learner status, race/ethnicity, expected entry age, parent education level, and redshirt status, along with mid-year kindergarten reading performance). The vector  $O_{ist}$  includes peer characteristics (i.e., class averages excluding student  $i$ ) and time-varying school and teacher characteristics. The model also includes school year fixed effects,  $T_t$ , and an error term,  $\varepsilon_{ist}$ . We report clustered standard errors at the school level. The values for each explanatory variable are from the initial kindergarten year for each student.

Additionally, we include interaction effects for our models used to predict retention probabilities by subgroups (Table C2). We chose interactions between risk factor variables that we theorized could affect the probability of retention. Namely, we included interactions between racial/ethnic groups and meal program participation, along with interactions between expected entry age categories and each of the following: meal program participation, English learner status, racial/ethnic groups, and the mid-year kindergarten reading score.

We examine specifications for retention cumulatively before the third grade for all students and then by gender (Table C1). The results show statistical relationships controlling for other factors, not causal effects. We interpret Equation 1 as helping to identify risk factors for early retention. Specifically, we examine the characteristics of students in kindergarten and see which ones relate to retention probability by the third grade. To provide additional detail, models stratify the sample by gender to explore whether some relationships are stronger for boys than for girls (Tables C1–C3). We also stratify the sample by low and high school API rank (Table C3).

Our covariates are based on a student's kindergarten year, because that is before any retention has occurred. Including peer- and school-level covariates for the first and second grades would be incorrect if retention occurred before the covariate was measured. As a robustness check, we tested models that examine grade-specific retention probabilities (i.e., retention in the first or second grade) and used contemporaneous peer- and school-level covariates to see if results differed from models using a student's kindergarten year covariates. Results were the same between models.

We also tested models that include controls for whether a child's school is in Program Improvement (PI) or at-risk for entering PI the following academic year, to explore the sensitivity of retention decisions to school accountability pressure. We found little evidence of a strong relationship. The additional controls did not change our interpretation of the estimates on our variables of interest.

## Achievement Outcomes

We use a regression framework as above with included interactions to examine whether some retained students improve more than others do. In these analyses, the data include retained children in a given grade for whom we observe both the first- and second-grade scores on given assessments. For the first grade, the outcome variable is the percentage correct on the Open Court reading-skills composite score the second time as compared to the first time (Table C4). Because this is a continuous measure, we use ordinary least squares (OLS) rather than a logit model. For the second grade, the outcome is either an improvement of at least one ELA or math CST proficiency level (Table C5) or an indicator for change to CST proficient status in the repeated year (Table C6). We use a logit model with interactions in these latter two sets of analyses. For second-grade outcomes, we also include the first-time proficiency level as a control variable, because moving up a level or changing to proficient may depend on the starting level.

The student achievement analyses in Tables C4 to C6 include fewer interaction variables and exclude students with Asian or other race/ethnicity on account of small sample sizes among certain groups of retained students in LAUSD. The interaction terms we include are between meal program and white race, meal program and African American race, and younger relative age and each of the following: meal program participation, English learner status, and the mid-year kindergarten reading score.

We also compare second- and third-grade CST proficiency rates in math and ELA for nonretained and retained children who entered school as first-time kindergartners in 2004. Students entering in 2004 and who are retained in K–2 will reach the third grade in 2008, the last year of our data. Table 2 presents these findings. Table B1 shows comparable findings to those in Table 2 for second-grade CST proficiency rates among first-time kindergartners in 2005.

**TABLE B1**  
**Second-grade CST proficiency rates, by grade retained, 2005 cohort**

Row	Grade retained	ELA percentage proficient	Math percentage proficient
1	Kindergarten	19.1	34.0 <sup>a</sup>
2	First grade	17.4	36.3 <sup>a</sup>
3	Second grade (before repeating)	1.4 <sup>a</sup>	7.6 <sup>a</sup>
4	Second grade (after repeating)	19.7	42.7
5	Ever retained K–2	18.5 <sup>b</sup>	37.3 <sup>b</sup>
6	Never retained K–2	48.7	58.6

NOTES: Proficiency rates in the “ever retained” category use second-time scores for second-grade repeaters.

Rows 3 and 4 include students with valid scores in both the initial and repeat years. About 2,400 students were ever retained K–2 in our sample, and about 32,800 students were never retained.

<sup>a</sup>Statistically significant differences at the 5 percent level relative to row 4.

<sup>b</sup>Statistically significant differences relative to row 6.



## School Principal Interviews

We conducted 20 interviews with school principals to gather qualitative information on practices and policies surrounding early grade retention at the school level. Using LAUSD administrative data, we stratified schools by low, medium, or high retention rates compared to the district average. We then randomly selected 20–21 schools within each strata to contact via email or fax, depending on school preference, to explain our study and request a 20-minute interview with the principal or other appropriate person (a total of 61 contacts attempted). We provided the list of questions we intended to ask in that initial contact and informed administrators that responses would be confidential, they would not be viewed outside the study team, and no persons or schools would be named in any written products or verbal communications outside the study team. We conducted at least two follow-up emails or phone calls to request participation from schools that did not respond.

We conducted semistructured individual phone interviews based on a common list of open-ended questions for all schools. These questions focused on learning about the school’s practices or policies, the role of parents in decisions, specific interventions that are targeted before and after retention decisions, and personal opinions on grade retention’s effectiveness. We completed interviews with three principals in the low-retention stratum (i.e., 1 percent or less retention among K–2 students in recent school years); ten interviews with principals in the medium-retention stratum (i.e., 4 to 7 percent retention among K–2 students), two of which were written responses rather than through a phone conversation; and seven interviews in the high-retention stratum (i.e., 8 percent or more retention among K–2 students). In most cases, one person conducted the phone interview and took handwritten notes, which were then typed up for team review. For five schools, two persons conducted the interview and final notes were agreed on by both interviewers. We then analyzed the responses for commonalities or differences across schools and any similar themes that emerged.

## Appendix C. Regression Results

This section presents findings for the student-level covariates in the regression models described in Appendix B. Table C1 presents the main logit model retention estimates for our analysis sample—first-time kindergartners who stay in LAUSD at least three years. The outcome variable in column 1 is an indicator for any retention experience before the third grade for all students. Columns two and three separately examine relationships with retention for boys and girls during the same period. We report marginal effects that hold the values of characteristics at their means.

Table C2 presents findings from specifications such as those in columns 2 and 3 of Table C1 except that they also include the interaction terms described in Appendix B. We use these results in calculating the predicted values in Figure 3. The table reports logit coefficients, because marginal effects are not computed correctly for logit interaction models in Stata.

Table C3 subsamples students from columns 2 and 3 of Table C1 who attend schools with low- and high-API ranks. For this purpose, schools with a rank of 1 or 2 are considered low-ranked schools, and schools with a rank of 7 through 10 are considered high-ranked schools. The top category includes four ranks rather than two, because of limited numbers of students in our sample who are in schools with ranks of 9 or 10. We extend the number of ranks to ensure sufficient sample size for analysis. The table includes four columns of data, one for each combination of gender and API (high/low) grouping. We report marginal effects in this table because the specifications do not include interaction terms.

Table C4 presents the student achievement results for first-grade repeaters. We examine both their percentage correct score on the first-grade Open Court reading-skills composite score during their first time in grade and their percentage correct score during their second time in grade. The specifications include the interaction terms described in Appendix B and are estimated by OLS.

Tables C5 and C6 present the student achievement results for second-grade repeaters, examining improvements from their first CST assessment in the second grade to their repeated year assessment. We report logit coefficients. The outcomes in Table C5 are an increase in ELA and math proficiency levels for second-grade repeaters, by gender. The outcomes in Table C6 measure changes to proficient status in ELA and math, by gender. We use these results in calculating the predicted values in Figure 5.

**TABLE C1**  
**Retention before third grade logit probability results, marginal effects**

	Retained before third grade	Boys ever retained before third grade	Girls ever retained before third grade
	[1]	[2]	[3]
<b>Student-level covariates</b>			
Mid-year kindergarten reading	-0.159*** (0.006)	<b>-0.190***</b> (0.007)	<b>-0.132***</b> (0.006)
Boy	0.016*** (0.001)		
Meal program participant	0.007*** (0.002)	0.010*** (0.003)	0.005** (0.002)
English learner	0.005*** (0.002)	0.006*** (0.002)	0.004** (0.002)
Race/ethnicity (omitted Latino)			
White	-0.006** (0.003)	-0.005 (0.004)	-0.008** (0.003)
African American	0.010*** (0.003)	0.012** (0.005)	0.008** (0.004)
Asian	-0.024*** (0.002)	<b>-0.025***</b> (0.004)	<b>-0.024***</b> (0.002)
Other race	0.012* (0.007)	0.008 (0.010)	0.016* (0.009)
Expected entry age (omitted March–August birthday)			
Relatively younger (September–November birthday)	0.024*** (0.001)	0.031*** (0.002)	0.017*** (0.002)
Relatively older (December–February birthday)	-0.017*** (0.001)	-0.021*** (0.002)	-0.012*** (0.002)
Parent education (omitted less than high school)			
High school diploma	-0.006*** (0.002)	-0.008*** (0.003)	-0.004** (0.002)
College degree	-0.017*** (0.002)	-0.021*** (0.003)	-0.013*** (0.002)
Missing parent education	-0.003 (0.003)	-0.003 (0.003)	-0.004 (0.002)
Redshirt	-0.038*** (0.002)	<b>-0.050***</b> (0.002)	<b>-0.027***</b> (0.002)
Sample size	147,628	74,608	73,020

NOTES: Estimates are marginal effects from a logit model. Boldface indicates a significant difference between gender coefficients, calculated using logit coefficients. Clustered standard errors at the school level are in parentheses. Additional covariates in the models include those listed in Appendix A. Each model includes students entering kindergarten from 2003 through 2006 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.

**TABLE C2**  
**Retention before third grade logit with interactions results, coefficients**

	Boys ever retained before third grade	Girls ever retained before third grade
	[1]	[2]
<b>Student-level covariates</b>		
Mid-year kindergarten reading	-3.668*** (0.091)	-4.014*** (0.112)
Meal program participant	0.133 (0.088)	0.111 (0.116)
English learner	0.122** (0.052)	0.135* (0.073)
Race/ethnicity (omitted Latino)		
White	-0.488*** (0.145)	-0.618*** (0.185)
African American	-0.102 (0.168)	-0.038 (0.200)
Asian	-0.893*** (0.198)	-1.205*** (0.332)
Other race	-1.291*** (0.494)	-0.011 (0.435)
Expected entry age (omitted March–August birthday)		
Relatively younger (September–November birthday)	0.601*** (0.137)	0.406** (0.187)
Relatively older (December–February birthday)	-0.798*** (0.182)	-0.667*** (0.243)
Parent education (omitted less than high school)		
High school diploma	-0.156*** (0.049)	-0.123** (0.049)
College degree	-0.446*** (0.073)	-0.428*** (0.080)
Missing parent education	-0.063 (0.064)	-0.104 (0.072)
Redshirt	-2.009*** (0.175)	-1.349*** (0.201)
<b>Interactions</b>		
Younger and meal program	-0.246** (0.109)	-0.259* (0.146)
Older and meal program	0.359** (0.156)	0.229 (0.203)
Younger and English learner	-0.086 (0.074)	-0.109 (0.091)
Older and English learner	0.151 (0.097)	0.143 (0.131)
Younger and white	0.292* (0.150)	0.099 (0.201)
Younger and African American	-0.039 (0.125)	-0.124 (0.134)
Younger and Asian	0.177 (0.200)	0.130 (0.352)
Younger and other race	-0.112 (0.391)	0.526 (0.414)
Older and white	0.253 (0.203)	0.010 (0.267)
Older and African American	0.167 (0.154)	-0.100 (0.222)
Older and Asian	0.289 (0.305)	-0.527 (0.601)
Older and other race	-0.318 (0.580)	0.630 (0.538)

	Boys ever retained before third grade	Girls ever retained before third grade
	[1]	[2]
Younger and mid-year kindergarten reading	0.288*** (0.108)	0.570*** (0.144)
Older and mid-year kindergarten reading	-0.160 (0.128)	-0.027 (0.165)
Meal program and white	0.404** (0.160)	0.602*** (0.202)
Meal program and African American	0.341** (0.169)	0.351* (0.200)
Meal program and Asian	0.195 (0.201)	0.103 (0.304)
Meal program and other race	1.806*** (0.532)	0.096 (0.448)
Constant	-1.026* (0.568)	-1.300* (0.666)
Sample size	74,608	73,020

NOTES: Estimates are coefficients from a logit model that includes several interaction terms, as listed in the table. Clustered standard errors at the school level are in parentheses. Additional covariates in the models include those listed in Appendix A. Each model includes students entering kindergarten from 2003 through 2006 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.

**TABLE C3**  
**Retention before third grade logit probability results, by API ranks, marginal effects**

	Boys ever retained before third grade API 1–2	Boys ever retained before third grade API 7–10	Girls ever retained before third grade API 1–2	Girls ever retained before third grade API 7–10
	[1]	[2]	[3]	[4]
<b>Student-level covariates</b>				
Mid-year kindergarten reading	<b>-0.182***</b> (0.010)	<b>-0.157***</b> (0.013)	<b>-0.129***</b> (0.008)	<b>-0.112***</b> (0.011)
Meal program participant	0.005 (0.006)	0.005 (0.004)	-0.005 (0.007)	0.004 (0.003)
English learner	0.010*** (0.004)	0.006 (0.005)	0.006 (0.003)	-0.003 (0.003)
Race/ethnicity (omitted Latino)				
White	0.023 (0.024)	-0.001 (0.004)	-0.008 (0.014)	-0.004 (0.003)
African American	<b>0.025***</b> (0.007)	<b>-0.006</b> (0.006)	<b>0.020***</b> (0.007)	<b>-0.005</b> (0.005)
Asian	<b>-0.034***</b> (0.010)	<b>-0.017***</b> (0.005)	-0.013 (0.008)	<b>-0.017***</b> (0.003)
Other race	0.003 (0.024)	-0.008 (0.011)	0.056** (0.029)	0.025 (0.016)
Expected entry age (omitted March–August birthday)				
Relatively younger (September–November birthday)	<b>0.023***</b> (0.003)	<b>0.038***</b> (0.005)	<b>0.015***</b> (0.003)	<b>0.021***</b> (0.004)
Relatively older (December–February birthday)	<b>-0.017***</b> (0.003)	<b>-0.023***</b> (0.003)	<b>-0.014***</b> (0.002)	<b>-0.009***</b> (0.003)
Parent education (omitted less than high school)				
High school diploma	-0.008** (0.003)	-0.004 (0.005)	<b>-0.004</b> (0.003)	<b>-0.012***</b> (0.003)
College degree	-0.015*** (0.006)	-0.018*** (0.006)	<b>-0.007</b> (0.005)	<b>-0.016***</b> (0.004)
Missing parent education	-0.001 (0.005)	-0.005 (0.006)	<b>-0.002</b> (0.004)	<b>-0.010***</b> (0.003)
Redshirt	<b>-0.049***</b> (0.004)	<b>-0.044***</b> (0.004)	<b>-0.022***</b> (0.004)	<b>-0.026***</b> (0.003)
Sample size	30,783	11,393	30,134	10,911

NOTES: API ranks are 1 = lowest, 10 = highest and are based on a student's kindergarten school. Estimates are marginal effects from a logit model. Boldface indicates a significant difference in coefficients between ranks and within gender, calculated using logit coefficients. Clustered standard errors at the school level are in parentheses. Additional covariates in the models include those listed in Appendix A except for state API rank. Each model includes students entering kindergarten from 2003 through 2006 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.

**TABLE C4**  
**First grade reading skills for retained students, OLS results**

	Boys first time % correct	Boys second time % correct	Girls first time % correct	Girls second time % correct
	[1]	[2]	[3]	[4]
<b>Student-level covariates</b>				
Mid-year kindergarten reading	0.134*** (0.012)	0.215*** (0.018)	0.126*** (0.017)	0.173*** (0.023)
Meal program participant	-0.003 (0.014)	0.006 (0.019)	0.006 (0.017)	0.033 (0.022)
English learner	-0.001 (0.007)	0.014 (0.011)	-0.009 (0.012)	-0.005 (0.013)
Race/ethnicity (omitted Latino)				
White	0.027 (0.022)	-0.027 (0.025)	0.013 (0.035)	-0.006 (0.038)
African American	0.046 (0.045)	0.020 (0.042)	0.009 (0.041)	0.061* (0.033)
Relatively younger (September–November birthday)	-0.013 (0.020)	0.022 (0.031)	-0.023 (0.030)	0.046 (0.036)
Parent education (omitted less than high school)				
High school diploma	0.000 (0.006)	-0.001 (0.010)	-0.009 (0.007)	0.002 (0.011)
College degree	0.007 (0.011)	0.018 (0.015)	-0.005 (0.016)	-0.011 (0.019)
Missing parent education	-0.011* (0.006)	-0.020** (0.010)	-0.008 (0.008)	0.005 (0.012)
<b>Interactions</b>				
Younger and meal program	-0.013 (0.020)	-0.005 (0.025)	-0.008 (0.027)	-0.028 (0.031)
Younger and English learner	0.005 (0.012)	-0.021 (0.015)	-0.006 (0.015)	-0.018 (0.018)
Younger and mid-year kindergarten reading	0.036* (0.019)	0.002 (0.030)	0.041* (0.023)	-0.001 (0.033)
Meal program and white	-0.015 (0.029)	0.048 (0.034)	-0.034 (0.041)	0.021 (0.046)
Meal program and African American	-0.054 (0.045)	-0.046 (0.045)	-0.067 (0.042)	-0.155*** (0.039)
Constant	0.305*** (0.047)	0.438*** (0.063)	0.371*** (0.058)	0.538*** (0.084)
Sample size	2,118	2,118	1,438	1,438
R-squared	0.190	0.165	0.154	0.134

NOTES: Estimates are coefficients from an OLS model that includes several interaction terms, as listed in the table. Fewer interaction terms are included than in Table C2 because of very small samples of some students with both characteristics. Additionally, students with Asian and other race/ethnicity are excluded from these models, because of very low sample sizes. Clustered standard errors at the school level are in parentheses. Appendix A provides further information on the covariates used in each model with the exception that expected entry age is a binary variable with 1 = relatively younger and 0 = not younger and Asian and other race are excluded. Each model includes students entering kindergarten from 2003 through 2006 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.

**TABLE C5**  
**Second-grade proficiency-level increase for retained students, logit coefficient results**

	Boys improve ELA proficiency level [1]	Girls improve ELA proficiency level [2]	Boys improve math proficiency level [3]	Girls improve math proficiency level [4]
<b>Student-level covariates</b>				
Mid-year kindergarten reading	1.634*** (0.344)	1.985*** (0.406)	0.139 (0.370)	0.490 (0.425)
Meal program participant	0.156 (0.430)	-0.426 (0.592)	0.120 (0.494)	-0.253 (0.593)
English learner	-0.002 (0.240)	-0.590** (0.269)	0.033 (0.228)	0.498** (0.253)
Race/ethnicity (omitted Latino)				
White	-0.536 (0.940)	-1.186 (0.773)	-0.836 (1.109)	-0.775 (0.728)
African American	-1.445* (0.746)	-1.406 (1.020)	-1.718** (0.780)	-1.412 (1.122)
Relatively younger (September–November birthday)	1.053 (0.743)	-1.094 (0.922)	1.595 (1.191)	0.015 (0.836)
Parent education (omitted less than high school)				
High school degree	-0.254 (0.168)	0.110 (0.206)	-0.074 (0.198)	-0.136 (0.213)
College degree	-0.203 (0.356)	0.014 (0.430)	-0.228 (0.407)	-0.301 (0.394)
Missing parent education	-0.310* (0.174)	-0.055 (0.193)	-0.318* (0.191)	-0.192 (0.219)
<b>Interactions</b>				
Younger and meal program	-0.399 (0.700)	0.580 (0.827)	-2.088* (1.126)	0.124 (0.734)
Younger and English learner	-0.636* (0.325)	0.194 (0.373)	-0.028 (0.316)	-0.121 (0.375)
Younger and mid-year kindergarten reading	-0.101 (0.512)	0.416 (0.645)	0.856 (0.574)	0.088 (0.663)
Meal program and white	-0.672 (1.031)	1.078 (1.149)	-0.031 (1.217)	0.160 (0.923)
Meal program and African American	0.605 (0.750)	0.591 (1.032)	0.475 (0.705)	1.177 (1.153)
Constant	-1.816 (1.256)	1.733 (1.444)	1.520 (1.310)	1.805 (1.698)
Sample size	1,227	951	1,237	946

NOTES: Estimates are coefficients from a logit model that includes several interaction terms, as listed in the table. Fewer interaction terms are included than in Table C2, because of very small samples of some students with both characteristics. Additionally, students with Asian and other race/ethnicity are excluded from these models, because of very low sample sizes. Clustered standard errors at the school level are in parentheses. Appendix A provides further information on the covariates used in each model with the exception that expected entry age is a binary variable with 1 = relatively younger and 0 = not younger and Asian and other race are excluded. Models also include the first-time proficiency level as a covariate. Each model includes students entering kindergarten from 2003 through 2005 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.



**TABLE C6**  
**Second grade change to proficient status for retained students, logit coefficient results**

	Boys proficient ELA [1]	Girls proficient ELA [2]	Boys proficient Math [3]	Girls proficient Math [4]
<b>Student-level covariates</b>				
Mid-year kindergarten reading	0.882** (0.371)	1.124** (0.523)	0.205 (0.313)	0.709* (0.412)
Meal program participant	-0.426 (0.476)	0.695 (0.567)	-0.063 (0.395)	-0.045 (0.530)
English learner	-0.187 (0.300)	-0.785*** (0.278)	0.065 (0.209)	0.175 (0.246)
Race/ethnicity (omitted Latino)				
White	0.194 (0.843)	0.355 (0.834)	-1.106 (0.682)	-0.125 (0.860)
African American	-1.911 (1.462)	-0.530 (1.070)	-3.539*** (0.903)	-0.133 (1.096)
Relatively younger (September–November birthday)	-1.221 (0.894)	-0.649 (1.007)	0.035 (0.668)	0.115 (0.767)
Parent education (omitted less than high school)				
High school diploma	0.050 (0.232)	0.212 (0.241)	0.173 (0.181)	-0.218 (0.219)
College degree	0.313 (0.392)	0.003 (0.389)	-0.660 (0.406)	-0.334 (0.366)
Missing parent education	-0.285 (0.247)	0.153 (0.249)	-0.450*** (0.175)	0.008 (0.189)
<b>Interactions</b>				
Younger and meal program	0.373 (0.648)	-0.286 (0.828)	-0.240 (0.582)	0.241 (0.616)
Younger and English learner	-0.303 (0.383)	0.988** (0.448)	-0.408 (0.317)	-0.069 (0.382)
Younger and mid-year kindergarten reading	1.805** (0.764)	0.276 (0.836)	1.039* (0.539)	0.033 (0.628)
Meal program and white	-1.622 (1.259)	0.362 (1.018)	0.208 (0.758)	-0.960 (1.062)
Meal program and African American	1.406 (1.483)	0.270 (1.122)	2.702*** (0.903)	-0.162 (1.177)
Constant	-5.812*** (1.761)	-2.970* (1.702)	-3.458*** (1.272)	-0.216 (1.475)
Sample size	1,227	951	1,237	946

NOTES: Estimates are coefficients from a logit model that includes several interaction terms, as listed in the table. Fewer interaction terms are included than in Table C2, because of very small samples of some students with both characteristics. Additionally, students with Asian and other race/ethnicity are excluded from these models, because of very low sample sizes. Clustered standard errors at the school level are in parentheses. Appendix A provides further information on the covariates used in each model with the exception that expected entry age is a binary variable with 1 = relatively younger and 0 = not younger and Asian and other race are excluded. Models also include the first-time proficiency level as a covariate. Each model includes students entering kindergarten from 2003 through 2005 and includes fixed effects for school years.

\*\*\*p < 0.01.

\*\*p < 0.05.

\*p < 0.10.

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