



## Putting the K in Rank: How Kindergarten Classrooms Impact Short and Long-Run Outcomes

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# Putting the K in Rank: How Kindergarten Classrooms Impact Short and Long-Run Outcomes

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## Abstract

A student's class rank has important short and long-term effects on important educational outcomes. Despite our growing understanding of these rank effects, we still do not know how early in a child's academic career they begin. To address this, I use data from the Tennessee STAR project, which randomly assigned over 6,323 kindergarteners to classroom environments, to study the impact of kindergarten class rank on a host of short and long-run outcomes. I find a strong, causal relationship between one's kindergarten classroom rank and subsequent test scores, high school achievement and performance on college entrance exams. I also find that having a higher rank in kindergarten causes an increase in study effort, value of school and initiative in the classroom. I also leverage the design of project STAR to test various mechanisms and address several outstanding issues in the rank literature, including the role of tracking, parental effort and teacher-level characteristics in driving the effects of class rank.

*Key Words:* Rank, Education, Human Capital, Race

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# 1 Introduction

Recent work in economics finds that where a student ranks within their school cohort has long-lasting impacts on their lives, including their educational attainment, health, and labor market earnings. These rank effects have been identified in elementary (Murphy and Weinhardt, 2020; Denning et al., 2021), high school (Elsner and Isphording, 2017, 2018) and college settings (Elsner et al., 2021). Central to our understanding of these rank effects, however, is determining how early in a child’s academic career they begin. Due to data limitations, previous work on class rank has only been able to study students as early as third grade, when students are typically eight or nine years old (Denning et al., 2021). Most students in the U.S., however, begin schooling by kindergarten, typically when the child is five or six years old. Because of this, we know very little about how a child’s rank at the very beginning of their educational career impacts on their academic futures.

To study the relationship between early-life rank on short and long-run educational outcomes, I use data from the Tennessee Student Teacher Achievement Ratio (STAR) experiment, which randomly assigned over 6,323 kindergarteners enrolled across several schools to different classroom environments.<sup>1</sup> My identification strategy exploits this random assignment of students to kindergarten classrooms as part of the STAR experiment to study the effect of class rank.

To demonstrate my identifying variation, I show that conditional on your own kindergarten test score, there is a great deal of variability in where your rank within your classroom cohort. As a result of being assigned to different kindergarten classrooms within the same school, students with similar kindergarten scores will have different ranks in their classroom, purely by chance. Conceptually, my goal is to compare the outcomes of students with similar kindergarten test scores, but who have different classroom ordinal rank. By flexibly

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<sup>1</sup>The number reported here is for the math rank. The number for the reading rank is 5,789. I use both numbers when calculating short and long term rank variables.

controlling for how underlying ability maps onto future academic outcomes and including classroom fixed effects, this random assignment of students to kindergarten classrooms allows me to study the causal effects of classroom rank on several outcomes. I also avoid any potential endogenous classroom formation affecting my results as students were assigned to kindergarten classroom randomly.

I find that having a higher rank in one's kindergarten classroom has a large impact on children's educational futures. Specifically, I show that a decile increase in one's kindergarten classroom percentile rank (eg. from 10th to 20th) causes a 1.0 - 2.7 percentage point increase in overall rank on tests in the years directly following kindergarten (grades 1-3). Having a higher kindergarten *reading* rank also causes a 1.2 - 1.8 point increase in test score rank in subsequent years (grades 4-8) and increases the likelihood students graduate with a higher GPA in HS by 0.038 sd. I also show that classroom rank impacts outcomes measured over a decade after students leave their kindergarten classroom. Having a higher reading or math rank increases whether students take a college entrance exam, such as the SAT or ACT, by 0.021 - 0.026 sd and increases ACT performance by 0.044 - 0.084 sd.

I also find that these effects are influenced by important student-level and teacher-level characteristics. Specifically, early-life rank in *reading* plays a much more important role for female students than male students, while kindergarten *math* rank has much stronger effects for male students. These results point to potential mechanisms behind well-documented math and science gender gaps that develop during a student's academic career ([Niederle and Vesterlund, 2007](#); [Gunther et al., 2010](#)). I also find evidence that rank effects are stronger for higher income and white students than for low income and black students. When considering whether rank effects are more prominent for students found below or above the median, I find that they typically are stronger for higher ranked rather than lower ranked students. Students above the median in their kindergarten classroom experience positive effects not only on test scores, but on HS GPA and SAT/ACT taking as well.

While I find little evidence of classroom size impacting rank effects, I do find that teacher experience and qualifications do have an impact on how early-life rank influences future outcomes. Having an experienced or less qualified teacher appears to increase the effect of class rank, although this pattern does not hold for all outcomes. Lastly, sharing the same race with your kindergarten teacher increases the effect of rank on HS GPA, SAT/ACT taking and ACT score while having a teacher with a different race impacts 8th grade test scores and graduation from HS.

I also leverage unique data collected through the STAR experiment to test whether kindergarten rank has an effect on any of multiple non-cognitive outcomes. I find evidence that these rank effects cause an increase in students' value of schooling, as well as effort and initiative in their studies. As part of the experiment, students were also meant to stay in their classroom assignments for four years, up until third grade, greatly restricting schools' abilities to move students between classrooms. This allows me to test whether rank effects arise through ability tracking in schools (Elsner and Isphording, 2017). As I find large effects of kindergarten class rank on exams scores in grades 1-3, I can rule out tracking as a potential driver of early-life rank effects. I can also test whether kindergarten rank effects operate through changes in parental effort. The project STAR data contain information about student absences in grades one and three which are important proxies of parental effort, particularly for parents of kindergarten students. Similar to previous literature studying rank effects Murphy and Weinhardt (2020), I fail to find evidence of this mechanism.

The STAR experiment also presents a unique opportunity to study the impacts of *classroom* rank, as I am able to observe not only the schools students are enrolled in, but also their kindergarten classroom assignments. Most other studies in the rank literature use large administrative data sets that only allow researchers to observe a student's rank with a grade-year pair (Murphy and Weinhardt, 2020; Denning et al., 2021). When ranking students at

the grade/school level, I find that class rank leads to larger rank effects when compared to those measured at the classroom level. This confirms work found in [Murphy and Weinhardt \(2020\)](#) which finds that rank effects from schools with a single classroom lead are smaller when compared to those with several classes.

Lastly, I explore how kindergarten reading rank impacts math outcomes and vice-a-versa. I find that kindergarten reading rank has as strong an effect, if not stronger, on subsequent *math* performance as it does reading performance. In contrast, kindergarten math rank has virtually no impact on reading outcomes. This result highlights the importance of early-life reading rank at a time when children are extremely young and developing foundational human capital ([Cuhna and Heckman, 2007](#)).

This paper contributes to the growing rank literature. In a seminal study, [Murphy and Weinhardt \(2020\)](#) show that changes in cohort rank causes increases in achievement and confidence in England among primary school students. [Elsner and Isphording](#) use data from the addHealth survey to study the academic ([Elsner and Isphording, 2017](#)) and health outcomes ([Elsner and Isphording, 2018](#)) of rank. They find similar effects on academic outcomes and reductions in drug use as a result of higher rank. When studying how students who are randomly assigned to college discussion sections, [Elsner et al. \(2021\)](#) show that having a higher ordinal position in your class can lead to better grades and increases in college graduation. [Denning et al. \(2021\)](#) study how idiosyncratic changes to student's school rank influences long-run outcomes. They document that increases in third grade rank cause increases elementary test scores, HS graduation, college attendance and even labor market earnings.

This paper makes several contributions to this literature. I first provide clear evidence that rank effects begin as early as kindergarten, often when students are making their first contact with schools. Second, I can trace the effect on outcomes long after students leave their kindergarten classroom. I observe test score outcomes until 8th grade and have measures

for overall performance in HS, graduation and SAT/ACT taking and ACT score. Up until now, only [Denning et al. \(2021\)](#) have documented the long-run effects of rank. I also test several policy-relevant heterogeneous treatment effects of classroom rank. I am able to study how classroom size, teaching experience and teaching credentials influence the impact of kindergarten rank. I also provide evidence against mechanism of early-life rank effects. I test whether parental effort or ability tracking are driving how rank impacts outcomes. Lastly, I can also study the relationship between how classroom rank differs from school-grade rank. Previous work has used schools with only one classroom per grade as a proxy for classroom rank ([Murphy and Weinhardt, 2020](#)). Here, I leverage the features of the STAR experiment to test how classroom rank differs from school-grade rank.

The rest of the paper is structured as follows; section 2 provides a brief overview of the STAR experiment; section 3 discusses the data used in this paper and presents the descriptive results; section 4 describes my identification strategy; section 5 presents my main results, discusses treatment heterogeneity and mechanisms; section 6 performs robustness checks and some additional analyses; section 7 discusses the main findings and places them within the existing literature; section 8 concludes.

## 2 The Tennessee STAR Experiment

During the 1985-1986 school year, the state of Tennessee implemented a large-scale field experiment in which 6,325 kindergarten students enrolled in 79 participating schools were randomly assigned to classrooms. This study, called the Student Teacher Achievement Ratio (STAR) project, was designed primarily to study the effect of class size on academic performance.<sup>2</sup> The design of project STAR was to perform a within-school field experiment,

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<sup>2</sup>This implies that teachers were randomly assigned to classrooms as well. [Dee \(2004\)](#) uses this random assignment of teachers to study the effect of having a same-race teacher on student achievement. I leverage this random assignment of students to teachers later in the paper when studying how students and teachers sharing the same race influences the effect of classroom rank.

where each participating school would include each treatment arm. To participate in the study, schools agreed to host three different types kindergarten classrooms. As part of the experiment, incoming students were randomized into either a small classroom (between 13 and 17 students), a large classroom (between 22 and 25 students) and a normal classroom with a teacher's aide.<sup>3</sup> Schools were also required to ensure that students would stay in their assigned classroom up until third grade, at which point all students in the experiment would be enrolled in normal classrooms and the experiment would end. Because of the experiments scale and it's length, the STAR experiment has been studied extensively by social scientist investigating a wide array of topics, including class size, peer effects, teacher quality and teacher race (Krueger, 1999; Krueger and Whitmore, 2001; Dee, 2004; Chetty et al., 2011; Bietenbeck, 2020).

There are a few important features of the experiment worth highlighting here. Firstly, despite the intention for all students to remain in the classroom type assigned to them in kindergarten, not all did so. It is reported that parents of students assigned to regular-sized kindergarten classrooms switched their children into small classrooms instead (Word et al., 1990). Unfortunately, data was only collected for initial kindergarten classroom enrollment, not for kindergarten classrooms assignments. Using doubly collected and entered data from 18 different participating STAR schools, however, Krueger (1999) estimates show that about 0.3 percent of students had switched classrooms in kindergarten, indicating a low switch rate. Secondly, parents often advocated that their child be moved to a specific classroom type after kindergarten. I show later in the robustness section that while this type of switching did occur, it was minimal. Also, as I am studying the impact of kindergarten rank, this moving between classroom types does not impact my main findings. Thirdly, as described above,

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<sup>3</sup>Most work studying project STAR combines the normal classroom with a teachers aid into the normal classroom group. Most classrooms already had a teachers aid of some sort (Word et al., 1990). When exploring heterogeneous treatment effects by class size, I combine both types of classroom types.

there was a substantial amount of attrition from project over the study period.<sup>4</sup> As I discuss in the robustness section, I also find that kindergarten classroom rank is not statistically related with likelihood to leave the STAR sample.<sup>5</sup>

Lastly, almost half of the students that ultimately participated in project STAR were added to the experiment *after* kindergarten. While I do not use these students as part of my explanatory rank variable, they are contained in measures of my outcomes.<sup>6</sup> The protocol for students entering participating schools was to be randomized to classrooms. As post-kindergarten students enrollment into classrooms was virtually random, including them in my outcomes variables does not impact my results.

### 3 Data and Descriptive Results

Data collection for the STAR project began with baseline information about children’s demographic characteristics and their kindergarten classrooms, including their teachers. This information included gender, race, age and low-income (free/reduced lunch-eligible) status for students, while for teachers it included teaching experience, qualifications and teacher race.<sup>7</sup> At the end of the first year of the experiment, kindergarteners were assessed using the Stanford Achievement Test, which is a norm referenced multiple choice exam that tested students in both math and reading.<sup>8</sup> Students were assessed again using the same exam in grades one through three, at which point the main phase of the experiment ended.<sup>9</sup> Data

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<sup>4</sup>Krueger (1999) finds that this attrition is not related to the random assignment to classrooms.

<sup>5</sup>The relatively high attrition rate from the STAR sample is due to several reasons artificially. If any students was held back, skipped a grade or switched schools, they were automatically excluded from the STAR sample.

<sup>6</sup>These include all test score outcomes from grades one to eight for both subjects. HS and SAT/ACT outcomes do not suffer from this problem because they are either numerical outcomes or indicator variables.

<sup>7</sup>Teacher gender was also recorded, but according to the public-use files, all of the teachers in my analysis are female.

<sup>8</sup>The Stanford test was specifically used as a metric in project STAR. More details are contained in the project STAR report after it was completed (Word et al., 1990).

<sup>9</sup>One might be concerned that since ability measures are not available when students entered kindergarten, rank measures using results from test scores collected at the end of kindergarten may contain measurement

was later collected on project STAR participant’s performance in both math and reading on Tennessee’s Comprehensive Test of Basic Skills (CTBS). Results from this exam are available from grades four through eight.<sup>10</sup>

The state of Tennessee also collected information on HS GPA and HS graduation. HS GPA is measured on a four point scale and HS graduation is measured as an indicator variable. The sample averages for HS GPA and graduation rates 3.34 are 82%. Further information was also collected by [Krueger and Whitmore \(2001\)](#) on ACT and SAT performance of project STAR participants, including an indicator for whether the student ever took either the SAT or ACT, as well as overall performance each exam. These data have since become part of project STAR’s public data files. The average score on the SAT/ACT is a 19 (35 point scale) while about a third of students in the sample took either the SAT or ACT.

Several non-academic measures were also collected as part of project STAR. Data on school absences are available in grades one and three. Beginning in fourth grade, teachers provided evaluations multiple non-cognitive skills for a random subset of project STAR students. These include measures of student effort, how much the student valued school, levels of student initiative and student discipline ([Bietenbeck, 2020](#)). These measures were not subject-specific when initially collected in fourth grade, although when they were elicited again in eighth grade on a new subset of students, they were measured for both reading and math (eg. effort in math). For comparability between variables, all of the non-cognitive variables are measured on a scale of 0-5.

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error because of the effect of class size on student achievement in kindergarten. By using the available test score collected at the end of kindergarten, we simply change the time frame by nine months, subsuming all changes in ability that happened during kindergarten in the mapping of test scores onto future outcomes. We would then assume that rank effects are the consequence of mechanisms that occurred at the end of the year, rather than the beginning of the year. We can view this as the result of a learning process, where students, parents, teachers or any other agents through which rank effects could operate learn the rank of each student in their kindergarten classrooms.

<sup>10</sup>There were four universities that agreed to analyse the data once it was collected; Tennessee State University; Memphis State University; the University of Tennessee; and Vanderbilt University.

To measure the effect of classroom rank on my test score outcomes, I create a variable that ranks students within the overall sample for each grade. I do this for both reading and math exam outcomes. To make test score ranks comparable between grades, I also restrict the variable's range to be between 0 and 1. This is the typical approach when studying the project STAR test score outcomes (Krueger, 1999; Chetty et al., 2011). Of the 6,325 children who received classroom assignments at the beginning of kindergarten, only 5,789 and 5,871 have reading and math kindergarten test results, respectively. I also drop 18 students that are missing at least one piece of demographic information from my main analysis.<sup>11</sup> There was also a high level of attrition out of project STAR over the study period. Of the 5,789 students for whom there are valid kindergarten reading test results, 4,010 have test results from first grade, 3,250 in second, 2,827 in third and 3,225 in eighth. Only 39 percent of students found in kindergarten have data from high school.

Table 1 provides descriptive statistics for three samples; all students for whom we have test score data in kindergarten; students for whom we also have data on eighth grade test scores; students for whom we also have data on HS outcomes.<sup>12</sup> The sample is slightly more male in kindergarten. This switches slightly as students become older. About half of kindergarteners are low-income, although, this number drops to about one third when looking at the HS sample.<sup>13</sup> Initially, about two thirds of students are white, while the remaining one third are black.<sup>14</sup> By HS, the share of white to black students becomes nearly eighty to twenty percent. In contrast to these other measures, average classroom size in kindergarten remains incredibly stable over all three samples.

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<sup>11</sup>A t-test confirms that there is no significant relationship between missing demographic information and one's kindergarten classroom rank.

<sup>12</sup>Here I use data for students who have reading test score results in kindergarten.

<sup>13</sup>Because of the way the experiment was administered, low-income-serving schools were over sampled as part of the survey.

<sup>14</sup>The project STAR data contain information on Black, white, Hispanic, Asian and Native American students. Without restricting the sample, Hispanic, Asian and Native American students comprise no more than a third of one percent of the entire sample.

Table 2 shows the results from balance tests that study whether observable characteristics vary by kindergarten classroom rank. Out of 10 tests, only one variable (reading - gender) is statistically significantly different than zero, no more than what we would expect by pure chance. A joint F-test confirms there is statistically significant relationship between kindergarten rank and baseline demographic or classroom information. To ensure that any potential differences are not playing a role in explaining my main results, in all of my specifications, I control for gender along with all student and kindergarten classroom level characteristics.

## 4 Empirical Strategy

In discussing my empirical strategy, I will first describe how I construct the classroom rank variable and then show that, when conditioning on one's kindergarten test score, there remains a great deal of variation in this rank variable. My approach is similar to [Elsner et al. \(2021\)](#) who study the effect of classroom rank among college students who have been randomly assigned to different sections within the same course. As I cannot observe the actual enrollment into kindergarten classrooms, but rather can only observe where they were randomly assigned, these estimates should be interpreted as an intent-to-treat.

I construct my rank variable by comparing scores on both math and reading skills taken in kindergarten among students within the same classrooms from the Stanford Achievement Test. This implies that I create two measures of classroom rank; a rank for math ability and another for reading ability. For both ranks, I create a classroom rank variable within each subject that places better performing students higher up and worse performing students lower down. To make my rank variable comparable across classrooms of different sizes, I create a classroom percentile rank  $r_i$  by dividing this overall rank variable by the number of students in the respective classroom, such that:

$$r_i = \frac{\text{classroom rank}_i - 1}{\text{number of test takers}_c - 1}$$

This percentile rank variable is uniformly distributed and bounded between zero and one for all students. These kindergarten reading and math percentile rank have means of 0.488 and 0.492 and standard deviations of 0.270 and 0.270 respectively. Figures 1 and 2 show the distribution of kindergarten classroom rank for both reading and math conditional on kindergarten exam performance. Here we can see the wide range of values that classroom rank can take for any given kindergarten exam score. This is the primary source of identifying variation I use to estimate the causal effects of classroom rank. Previous work studying class rank has relied on idiosyncratic variation in classroom rank to identify the effects of rank (Elsner and Isphording, 2017; Murphy and Weinhardt, 2020; Denning et al., 2021). As noted above, project STAR randomly assigned kindergarteners to classrooms, ensuring that the distribution of rank conditional on test score is random.

To study the effect of kindergarten rank, I estimate the following statistical model:

$$y_{i,c,s} = \alpha + \beta r_{i,c} + g(a_i) + X_i \psi + C_{c,s} \rho + \gamma_c + \epsilon_{i,c,s} \quad (1)$$

where  $y_i$  is an outcome of interest,  $r_i$  is a child’s percentile rank in their kindergarten classroom,  $X_i$  is a vector of student-level demographic controls including gender, race, and age and  $C_i$  is a vector of classroom-level controls, such as school urbanicity, and class-size. Here,  $g(a_i)$  is a function of the child’s kindergarten test scores. I follow [Elsner et al. \(2021\)](#) and model this function as a third order polynomial in a child’s kindergarten Stanford Achievement Test. This allows me to control for potential non-linearities in how a child’s ability maps onto future outcomes. Lastly,  $\epsilon_{i,c}$  is a random error term that allows for correlations within school-level disturbance terms as parents selected into schools, but not classrooms.<sup>15</sup>

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<sup>15</sup>This implies that I cluster at the classroom level. Tests that change the level of clustering (eg. school-level) do not change the main implications of the results.

The  $r_i$  variable is also scaled so that  $\beta$  captures the effect on each outcome that corresponds to a decile increase in a child’s kindergarten classroom rank.<sup>16</sup> I also include classroom fixed effects  $\gamma_c$  which control for any differences in observable or unobservable classroom characteristics such as teacher or non-rank peer effects. It also captures characteristics of the classroom ability distribution, such as the effect on outcomes that arise from classroom *mean* ability. As a result,  $\beta$  is identified off of difference in rank that arise from the shape of the ability distribution in different kindergarten classrooms. Conceptually, identification comes from comparisons of students with similar ability but from sections with different variance or higher order moments of the ability distribution.

As noted in [Elsner et al. \(2021\)](#), in order for  $\beta$  to be identified, the following assumption must hold:

$$cov(\epsilon, r_i | g(a_i), X_i, C_{c,s}, \gamma_c) = 0$$

This implies that after controlling for student and classroom characteristics and including classroom fixed effects,  $g(a_i)$  fully accounts for how underlying ability influences subsequent outcomes. This would make classroom rank as good as randomly assigned. In the robustness section, I change the functional form of  $g(a_i)$  to ensure that my results do not depend on how this function is chosen. As I discuss, modeling  $g(a_i)$  as a third-order polynomial is actually more conservative than other methods that are used in the rank literature, such as including ventile indicators that capture a child’s rank in the sample ability distribution in kindergarten. This assumption is further bolstered by the random assignment of students to classrooms as part of the STAR experiment. This ensures there is no potential endogeneity that arises from selecting into classrooms based on the potential outcomes of classroom rank.<sup>17</sup>

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<sup>16</sup>To do this, I multiply a student’s kindergarten percentile classroom rank by 10.

<sup>17</sup>A great discussion of identification of rank effects can be found in [Delaney and Devereux \(2022\)](#).

## 5 Results

### 5.1 The Effect of Rank on Academic Outcomes

I first investigate how kindergarten classroom rank impacts subsequent exam performance. Figures 3 and 4 present results of estimates from equation (1) looking at exams taken in grades one through eight for both reading and math.<sup>18</sup> For each exam outcome, I use the rank derived from the corresponding subject in kindergarten (eg. when looking at math test scores, I study the effect of students' kindergarten math rank). Following previous work that studies the STAR project data, test score outcomes are measured as percentage rank points within the overall *sample* distribution for that corresponding grade. This implies that treatment effects measure how a student's rank in the overall distribution for that subject in grades 1-8 changes as a result of a decile increase in a student's kindergarten classroom rank in that same subject.

Looking at reading test scores in grades 1-3, I find that a child's kindergarten classroom rank has large and statistically significant impacts on subsequent exam performance. The effects also increase over this period, starting at 1.8 in first grade, to 2.7 in third grade. All effects are significant at the 1% level. Looking at results from the CTBS in grades 4-8 grade, the effect of kindergarten classroom rank dissipates slightly, but remain significant. Effects range from 2.7 in 4th grade to 1.6 in 5th grade.<sup>19</sup> As a result of a decile increase in kindergarten classroom rank, a student's rank on their 8th grade reading exam increase by 1.2 rank points (p value < .5). When studying math rank, I find similar effects for grades 1-3. Treatment effects start at 1.0 (p value < .05) in first grade and then peak at 1.9 rank points in third grade (p value < .01). Treatment effects again diminish, as effects for grades

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<sup>18</sup>I estimate results that look at a fourth order polynomial in terms of test scores. They show similar results to those found here.

<sup>19</sup>One reason for this is that the number of exams recorded for fifth grade decreases to 1,410, after 2,822 for fourth grade and 3,318 for sixth grade.

four through eight are much smaller (ranging between 0.4 for eight grade and 1.3 in sixth grade) and not statistically significant.<sup>20</sup>

I now turn to studying the effect of kindergarten rank on high school outcomes. These include high school GPA and high school graduation. Tables 3 and 4 presents results for all outcomes. A decile increase in kindergarten reading rank increases one's HS GPA by 0.01 points, or 0.038 sd, and is significant at 5% level. There is no effect of kindergarten math rank on HS GPA. Neither kindergarten reading or math rank have any impact on HS graduation.

Finally, I examine the effect of class rank on ACT/SAT outcomes, including whether the student ever took either exam and how they performed on the exams themselves. As only 13 percent of students in the STAR experiment who took either of these college entrance exams took the SAT, I present results focusing on the ACT when studying exam performance. We see that one's Kindergarten classroom rank in both reading and Math rank have a positive effect on whether you take the SAT or ACT over a decade after kindergarten. A decile increase in you kindergarten classroom rank in reading increases the likelihood you take either of these exams by 1.3 percentage points, or about 3% of the control mean. I find a similar effect for one's math rank (1.0 percentage points), although this results is only marginally significant. A decile increase in your kindergarten classroom rank in reading also causes a 0.38 point (0-35 scale) increase in your overall ACT score (p value < .01), representing a 0.08 standard deviation increase. The effect is slightly smaller for math rank (0.20 point increase) but is still statistically significant (p value < .05).

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<sup>20</sup>The exception here is kindergarten math rank on 6th grade math rank, which is 1.3 rank points and is significant at the 1% level.

## 5.2 Student-Level Heterogeneity

The project STAR data contain several variables to explore potential heterogeneity of kindergarten rank effects. Because of the many outcomes, I will only present the long-run outcomes here. For those interested in short-run outcomes, please see section in the appendix. I first explore how student-level demographic variables, such as gender, free and reduced-lunch eligibility and race influence the effects of kindergarten rank. Table 5 displays the effects of  $\beta$  from equation (1) above after restricting the data set to the respective subset under study (e.g., female vs male students).

Looking at effects by student gender, we see striking patterns. Kindergarten reading rank appears to be more important overall for female students than male students. Rank effects for HS GPA, SAT/ACT taking and ACT score are especially large for this group. Reading ranks appear to be less important for male students. Math rank effects, on the other hand, appear to be more important for male students compared to female students. Math rank effects are large for SAT/ACT-taking and ACT score for males. These early-life rank effects by gender and subject may be important factors in influencing the well-documented gender gaps seen in college and in the labor market (Niederle and Vesterlund, 2007; Gunther et al., 2010).

I next explore whether being reduced-lunch eligible (low-income) while in kindergarten impacts early-life rank effects. Surprisingly, considering the previous literature, I see rank is more impact for higher income kindergarteners compared to low-income students. Effects are all stronger for 8th grade test scores (reading and math) as well as ACT scores (reading and math). I also study whether a student's race plays a significant role in shaping long-run rank effects. As noted earlier, about 25 percent of kindergarteners in the project STAR sample are black, while nearly 75 percent are white. I see strong effects for white students for how students *perform* (8th grade exam, HS GPA, ACT score), while effects for Black students are strong for the academic *decisions* they make (HS grad, took SAT/ACT).

Lastly, I examine whether a child’s kindergarten rank impacts long-run outcomes more or less based on whether they are above or below the median student in their kindergarten classroom. The linear rank effects captured by  $\beta$  in equation (1) may come about via a constant effect across the rank distribution, or more local rank effects that occur above or below the middle of the rank distribution.<sup>21</sup> I find that rank effects ACT score (math rank) are found below instead of above the median student. This implies that there may be a discouragement effect driven by kindergarten classroom rank for this outcome. Kindergarten classroom rank effects in general, however, are more likely to appear exclusively above the median student. Rank effects on 8th grade test scores, HS GPA and SAT/ACT taking are all driven by students above the median, implying that rank effects provide a benefit to higher ranked students rather than discouraging lower-ranked ones.

### 5.3 Classroom/Teacher-Level Heterogeneity

One of the strengths of using the STAR data is observing important classroom and teacher characteristics, such as classroom size, years of teaching experience, highest degree earned and teacher race. Previous work studying the long-term effects of class rank has been unable to explore potential heterogeneity along these classroom-level dimensions as most papers have relied on administrative data sets which do not contain information below the grade-year level (Murphy and Weinhardt, 2020; Denning et al., 2021).

To address this, I first explore whether the effect of class rank has a differential impact depending on whether one is in a small or large classroom. Again, project STAR offers an ideal setting to answer such a question, as it contains data at the classroom level and students

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<sup>21</sup>In the case of constant rank effects, as well as rank effects that occur below the median student, a positive effect may indicate that rank effects are driven by lower-ranked students becoming discouraged upon learning they are near the bottom of the class. In the case of rank effects that occur exclusively above the median student, however, rank may be increasing the confidence of higher ranked students. Understanding how these rank effects operate in a classroom context can help policy-makers decide when and how they should intervene.

were randomly assigned to small or large classrooms as part of the experiment. This rules out any other, potentially endogenous, factor driving variation in classroom size. Table 6 shows that there are minimal differences in the effect of rank based on class size. Being in a small kindergarten classroom, however, increases the effect of reading rank on SAT/ACT taking, relative to being in a large classroom. Being in a larger kindergarten classroom, on the other hand, increases the effect of math rank on one's ACT score.

I next study the effects by teacher qualifications, including teaching experience and whether the teacher holds a bachelors degree. As students were randomly assigned to kindergarten classrooms and therefore to teachers as well, we can rule out any potential endogeneity when exploring teacher characteristics. Kindergarten teachers in the project STAR sample have 9.2 years of teaching experience on average. I therefore create a variable that captures whether a teacher has above or below average experience. Similar to class size, the role of having a more experienced teacher on early-life rank effects is ambiguous, *ex ante*. Less experienced teachers may place more attention on the top-performing students, at the expense of their classmates, accelerating rank effects. More experienced teachers might, in contrast, teach to the median student, depressing rank effects. There may also be reasonable theories why this effect could operate in the other direction (eg. less experience teachers leads to weaker rank effects). My results are mixed in differentiating between these theories. We see in table 6 that having a kindergarten teacher with below average teaching experience increases the effect of class rank on 8th grade reading scores, SAT/ACT-taking (reading) and ACT score (math). More experienced teachers, on the other hand, increase the effect of kindergarten class rank on HS GPA (reading), HS graduation (math) and SAT/ACT taking (math).

Along with teaching experience, teacher qualifications may also influence early-life rank effects. About 65 percent of kindergarten teachers in the STAR sample have only a bachelors degree, 31 percent have a masters degree, and fewer than three percent have a higher than

a masters. Once again, it is difficult to know how teacher qualifications might moderate classroom rank effects. Table 6 shows that lower-qualification teachers increase the effect of reading rank on SAT/ACT taking and one's ACT score (both reading). Having a kindergarten teacher with more than a bachelors degree, however, increases the effect of math rank on ACT scores (math). While this is not definitive evidence that less qualified teachers increase early-life rank effects, particularly reading ranks, it is the first suggestive evidence of how a potential teacher-level characteristic that can be influenced by policy moderates classroom rank effects.

Previous research has shown that having a same-race teacher has positive impacts on student achievement [Dee \(2004\)](#). Kindergarten teachers involved in the STAR experiment are classified using two racial groups; black and white. They represent 15 and 85 percent of kindergarten teachers, respectively. I therefore create an indicator for whether the teacher and student share the same race. About 77% of students have a kindergarten teacher with the same race as them, with 83% of these students being white and the remaining 17% being black. Of those who do not share their race with their kindergarten teacher, 86% are black while 14% are white. We see that sharing a race with your kindergarten teacher impacts HS GPA (reading), SAT/ACT taking and ACT score (both math). Table 6 shows that having a race that is different from your kindergarten teacher, however, increases the effect of classroom rank for both eighth grade test scores and likelihood of graduating HS (reading).

## 5.4 Mechanisms

The project STAR data provide several opportunities to study mechanisms behind early-life rank effects. I first explore how both kindergarten reading and math rank impact teacher's evaluations of children's non-cognitive skills in both fourth and eighth grade. Follow-up data on the project STAR participants were collected along four dimensions non-cognitive skills;

effort, initiative, value and discipline (non-participatory behavior). These four indices come from teacher reports several years after students first entered kindergarten from a random subset of participants. In fourth grade, measures for each of the four indices were collected for students overall, while in eighth grade, they were collected for both reading and math. Tables 7-10 presents results for all non-cognitive outcomes.

We see that kindergarten reading rank causes large and significant increases in teacher-reported initiative, effort, and value. Estimates on disruptive behavior are negative for both reading and math rank, but imprecise. Results for kindergarten math rank are less clear. In some cases (effort, value), effect sizes are similar to those for reading rank, although in none of the cases are the effects statistically significant. Moving to the results on non-cognitive skills in eighth grade, we see that effects appear to fade over time. Here, the only positive effect comes from reading rank on 8th grade reading effort ( $p < .10\%$ ). Interestingly, having a higher kindergarten math rank decreases teacher reports of effort in math in eighth grade ( $p < 0.10$ ). All other effects are far more noisy and not significant.

Another potential mechanism through which class rank could affect future outcomes is through parental effort. Previous work has found that parents beliefs about the ability of their child are shaped in great part by their child's position within their school ([Kinsler and Pavan, 2021](#)). One measure of parental effort, particularly at early grades, is how often students are absent from school. The project STAR data contain data on absences in both first and third grade. Table 11 shows that neither one's kindergarten math nor reading rank cause any changes in absences in either first or third grade. It is therefore unlikely that parental effort plays much of a role in explaining rank effects in this setting.

Finally, it may be the case that rank effects operate through ability tracking in schools ([Elsner and Isphording, 2017](#)). Here, higher ranked students would be placed in classes with higher performing peers or more engaging curricula and would therefore experience benefits in future achievement. A similar phenomenon based on lower ranked students being excluded

from certain opportunities is also possible.

An important feature of the STAR experiment is that students were meant to stay in the classroom type they were assigned in kindergarten through the fourth grade. For some students, this meant that they remained with the same set of peers as there was little opportunity to move students around within classroom type in a given school. This was not the case for students in the regular classrooms (regular and + aid) after kindergarten, as they were re-randomized going into other regular classrooms in first grade. Table 10 shows the distribution of classroom *type* switching between the years. Along with the re-randomization after kindergarten, the rate of switching is quite low.

To isolate students who could not switch classes, I study the test score outcomes in grades 1-3 of students enrolled schools who were only able to hold one of each different treatment classroom. To ensure that the re-randomization did not factor into the student's reassignment, I restrict the sample to students who were originally assigned to the small classroom. This leaves 256 students for our main regression. Because there are so few students, I suppress the classroom fixed effects in the analysis. Given the limited ability to manipulate which classroom students were in years directly following kindergarten, if ability tracking is a mechanism through which class rank effects influence outcomes, we should not find rank effects in subsequent grades. Table 12 presents the results. Here I see effects that are larger than my main findings for grades 1-3 in both reading and math. Therefore, it is very unlikely that ability tracking is driving classroom rank effects in this setting.

## 6 Robustness Checks and Additional Analyses

To test the robustness of my main findings, I perform several tests. First, I study the role attrition plays in my main findings. As mentioned earlier, nearly half of the 6,000 original participants who were randomly assigned to kindergarten classrooms leave the sample by

the end of the initial study period (up to third grade). Previous work has documented that assignment to any of the initial treatment arms is not related to attrition ([Krueger, 1999](#)), but this may not be the case with kindergarten classroom rank.

To study this further, I create a variable that captures whether a student left the STAR sample by the time each outcome of interest was recorded. I then estimate equation (1) where the dependent variable is likelihood to attrit for each outcome. Table X presents the results. We see here that of all the 24 primary outcomes (reading and math scores from grades 1-8, HS and SAT/ACT effects), only four are significant, namely sixth and eighth grade reading scores and both reading and math ACT scores. To address this, I replace all scores for all students who were in their original kindergarten classrooms but who are missing their respective scores from grades 1-8 with first the median and secondly the mean score for each grade. Figures 5-8 shows that there is little difference compared to my main results. I next restrict the sample in kindergarten to students who remain in the sample at the time the outcome was measured. This implies that when creating the classroom rank variable in kindergarten, students are ranked among students who remain in the sample. Figures 9-10 presents results. We see that when we exclude those students who exit the sample, sixth and eighth grade reading exams remain significant. Studying ACT scores, I find the effect from reading rank remains significant, while the effect from math rank becomes insignificant. This would imply that only one outcome suffers from attrition bias. While this is not definitive evidence against the effect from attrition, it offer some reassurance against attrition bias driving my results.

I next study whether changing the functional form of  $g(a_i)$  influences the results. Following [Elsner et al. \(2021\)](#), I create kindergarten reading and math score decile indicators that capture where the student is in the universal kindergarten distribution for each exam. I then use the decile indicators as controls for ability in kindergarten. Table 11-12 shows that rank effects derived from this specification are extremely similar to my main findings. Results

actually become more significant for some outcomes. As a further check, I also estimated models that include a fourth-order polynomial in the student's kindergarten score. Figures 13-14 show that the main pattern of the results remain the same.

The project STAR data also allow me to study whether classroom-level rank has a different impact on future performance than rank derived from the student's school-grade cohort. As mentioned above, previous work studying the long-term effects of class rank have relied on measures of class rank at the *school-grade*, rather than *classroom* level. It is ambiguous, *ex ante*, which rank measure will have a more prominent effect on future outcomes. On one hand, one's classroom rank may capture a more salient reference group from which students form their self-perceptions; those students they spend the vast majority of their time with. On the other hand, being highly ranked within your school, and not just your classroom, may provide a larger effect on a student's self-perceptions and therefore subsequent academic performance. Comparing these two ranks provide a unique test of the "big fish-little pond" effect [Marsh \(1987\)](#), as I can rank students both within their classroom (little pond) as well as within their school (big pond).

To study this, I create a new variable that captures a student's percentile rank within their *school-level* kindergarten cohort. Figures 15-16 plot the difference between this school-level rank variable and the classroom rank variable. We see that while the distributions share a similar midpoint, there is a large variation in differences between these two different measures of class rank. The standard deviation of this difference variable is 12 rank places (for both reading and math ranks). I next estimate the effect of one's school-level rank on my primary outcomes. Table X presents results for test score, HS and ACT outcomes. We see here that the effect of school-level rank is stronger when considering reading rank, but not math rank. For test scores, effect sizes are almost twice as large. Effects on HS GPA, SAT/ACT taking and ACT score or all now more precise, as well.

My results studying the effect of kindergarten rank on subsequent exam performance,

HS, and SAT/ACT outcomes show that reading rank may be more important than math rank. While many of the effects based on reading rank are economically and statistically significant, this is not the case with math rank. Reading rank also has a significant impact on several important non-cognitive measures, while math rank does not. Given these effects of early-life reading rank, it may have impacts on academic outcomes in other subjects as well. To explore this further, I test how kindergarten reading rank influences *math* test scores. Figures 17-18 presents results from equation (1) where test score outcomes are results from math tests in grades 1-8, but the rank variable uses one's kindergarten reading rank.<sup>22</sup> Here we see that kindergarten reading has a significant effect on subsequent math performance. Effects are all significant and comparable to effects of reading rank on reading exam performance. In fact, kindergarten reading rank not only has a larger effect on eighth grade math performance than kindergarten math rank, it is also has a comparable effect to those for eighth grade reading performance. In contrast, table X also shows how one's kindergarten math rank has no significant impact on subsequent reading exam performance. These results further demonstrate the importance of early-life reading rank in both short run and long run outcomes.

Lastly, I also create kindergarten classroom rank variables that rank students within their gender. Previous work has also studied whether rank effects based on comparisons within students' gender are important for academic outcomes ([Elsner et al., 2021](#); [Delaney and Devereux, 2019](#)). Table X shows there are little if any differences between rank effects based on gender-specific ranks and gender-neutral ranks.<sup>23</sup>

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<sup>22</sup>In this analysis, the  $g(a_i)$  function is modeled as a third-order polynomial of the test results of the same subject as the rank variable is measured. For example, when studying how kindergarten reading rank impacts math test results, the fourth order polynomial is in kindergarten reading scores.

<sup>23</sup>Results available from the author upon request.

## 7 Discussion of Results and Previous Literature

My results contribute to a growing literature studying rank effects in education. In a similar paper to mine, [Denning et al. \(2021\)](#) studies the effect of elementary school rank on subsequent exam performance and other long-run outcomes. Using data from Texas, the authors rank students based on third grade math performance and measures how rank within their school influences several outcomes. They find that having a higher rank in third grade causes increases in eighth grade test scores, AP course taking, HS graduation, college enrollment, and labor market earnings. They report that a movement from the 25th percentile to the 50th percentile in third grade rank increases eighth grade exam performance by 2.5 percent.

Comparing this effect to my results, my estimate of the effect of kindergarten reading rank on eighth grade test scores is 1.2 percentage rank points. This happens as the result of increasing one's kindergarten rank by a decile (ten rank points). To match the [Denning et al. \(2021\)](#) results, I multiply this coefficient by 2.5 to mimic a change of 25 percentile rank points in kindergarten. This yields an effect size of 2.6 percentile rank points in eighth grade, a result is very similar to [Denning et al. \(2021\)](#). This both corroborates earlier estimates of the effect of rank on later academic outcomes, as well as documenting that rank effects that begin several years before third grade have similarly sized effects. This result also matches well with [Murphy and Weinhardt \(2020\)](#), who use data from England to study how class rank measured when students are 10 or 11 years old impacts academic performance several years later. An important point of contrast between the present study and both [Denning et al. \(2021\)](#) and [Murphy and Weinhardt \(2020\)](#) is that the effects I find are the result of rank effects derived from within the student's kindergarten *classroom*, while effects from the other papers study rank effects within a student's school-grade.

Multiple papers studying the effect of class rank also study important measures of self-perception and student motivation. Using data from the addHealth survey, [Elsner and](#)

[Isphording \(2017\)](#) find that having a higher rank in HS increases student’s self-concept, expectations for their future and effort in school. It also decreases student’s mental distress. Similarly, [Elsner et al. \(2021\)](#) find that having a higher rank in your section of a college course causes students to have higher expectations of their academic performance. Again, using data from England, [Murphy and Weinhardt \(2020\)](#) also show that student confidence increases as a result of higher class rank. Studying class rank in an elementary school setting in China, [Han \(2020\)](#), finds that having and even perceiving you have a high rank increases students’ confidence and expectations about going to college. These results solidify students’ self-perceptions and beliefs about schooling as important mechanisms behind rank effects. I find that having a higher kindergarten reading rank causes increases in student effort, value for schooling, and initiative in the classroom four years later. Similar to [Murphy and Weinhardt \(2020\)](#), I also find that parental effort is unlikely an important factor in explaining early-life rank effects.

## 8 Conclusion

In this paper, I use data from the Tennessee STAR experiment to study the effect of one’s kindergarten rank on short-run and long-run educational outcomes. I show that having a higher rank in kindergarten causes a significant increase in future exam performance in grades one through eight, especially early-life reading rank. I also find that higher early-life classroom rank causes increases in HS GPA. I also observe that kindergarten rank influences outcomes that take place a decade later, such as taking a college entrance exam and actual performance on the ACT.

I also find that kindergarten reading rank is more important for female students, while math rank has a greater effect for male students, highlighting potential mechanisms for troubling gender gaps in math and science. Early-life rank is also more important for students

who are not low income and white. Teacher characteristics, such as teaching experience or qualifications and sharing a race with students appear to play a modest role in mediating classroom rank effects.

I also observe increases in students' non-cognitive skills such as increases in effort, value and initiative in school. I also leverage the fact that students were intended to stay in their classroom type up until third grade as part of the initial experiment to rule out ability tracking as an important driver of these effects. Using data on school absences, I can also rule out parental effort as mechanism of early-life rank effects. Comparing the effect of classroom rank to school rank effects, I find that effects based on school cohort ranks are likely to be larger than those based on classroom comparisons. Early-life reading rank also appears to be much more important than early-life math rank in general, as reading ranks causes increases in both subsequent reading and math exam performance.

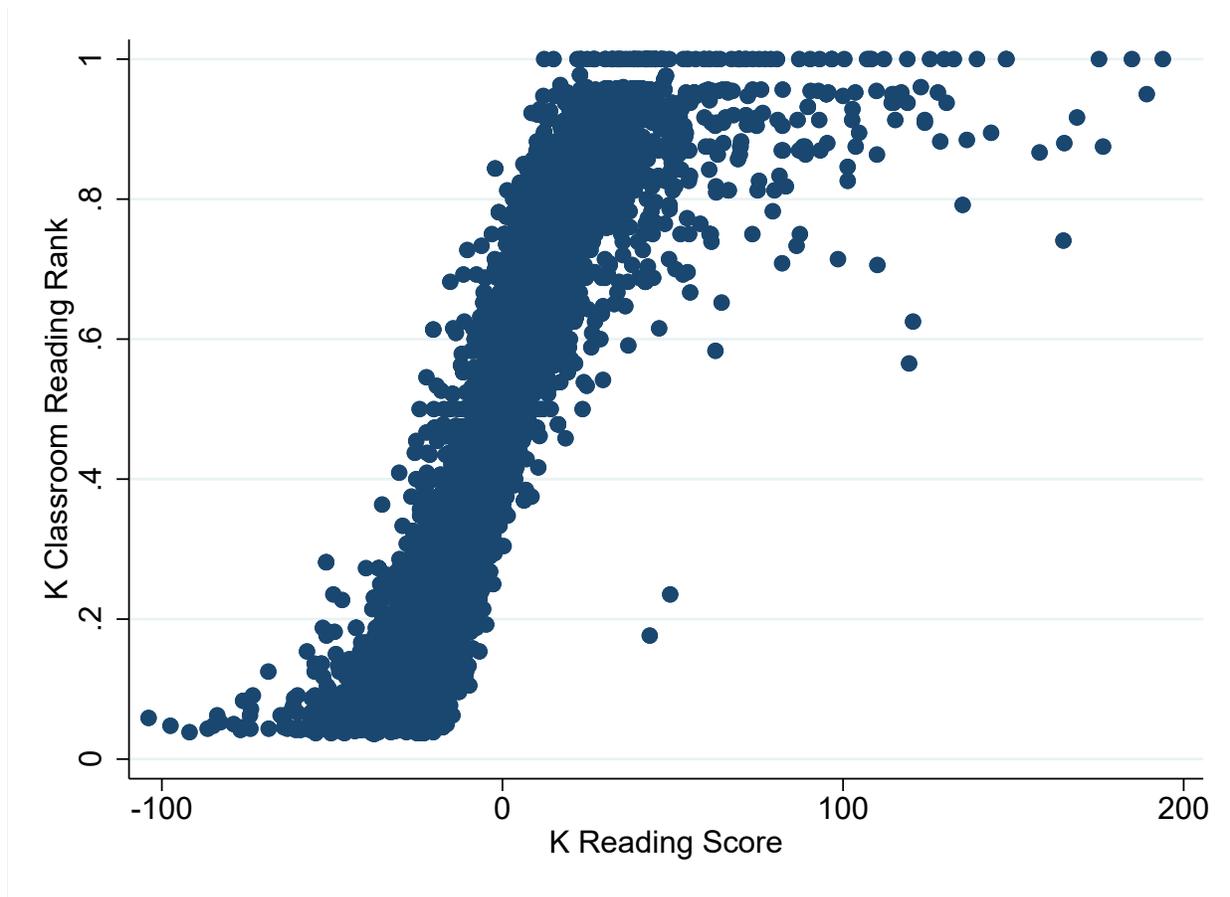
This paper contributes to a growing literature identifying the short and long term effects of class rank on academic outcomes. While previous work has studied the role of rank effects beginning as early as third grade, this study finds that these rank effects appear at a time when most students have their first contact with educational institutions; in their kindergarten classroom. Efforts to understand and influence these ranks effects must begin at very early ages. Kindergarten reading rank also appears to play a much more prominent role than math rank in impacting both short, long-run and non-cognitive outcomes, including effort and value for schooling. Cultivating confidence in reading at this age may therefore prove to be an important goal for educators, parents and policy-makers going forward.

## References

BIETENBECK, J. (2020): "The Long-Term Impacts of Low-Achieving Childhood Peers: Evidence from Project STAR," *Journal of the European Economic Association*, 18, 392–

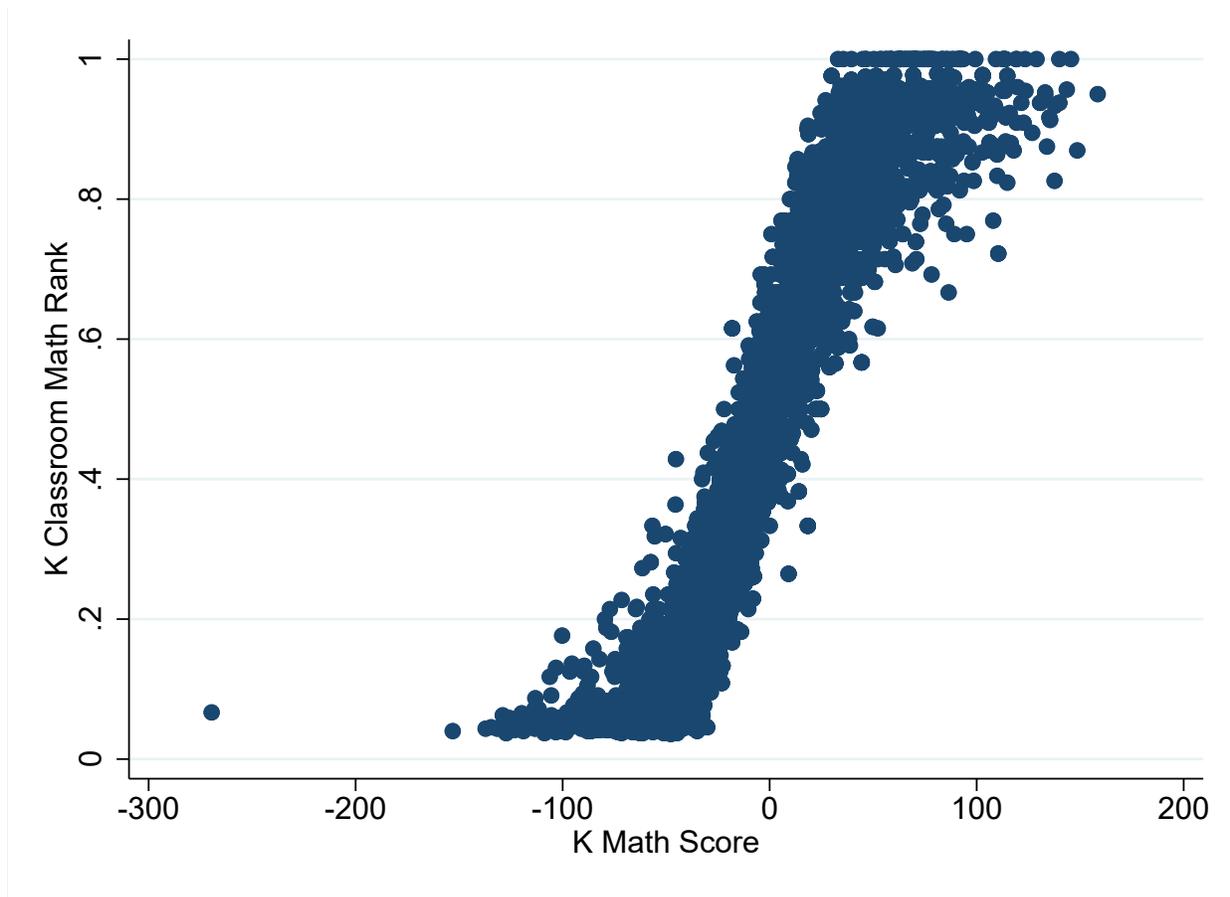
- CHETTY, R., J. N. FRIEDMAN, N. HILGER, E. SAEZ, D. W. SCHANZENBACH, AND D. YAGAN (2011): “How Does Your Kindergarten Classroom Affect Your Earnings? Evidence from Project STAR,” *Quarterly Journal of Economics*, 126, 1593–1660.
- CUHNA, F. AND J. HECKMAN (2007): “The Technology of Skill Formation,” *American Economic Review*, 97.
- DEE, T. S. (2004): “Teachers, Race, and Student Achievement in a Randomized Experiment,” *Review of Economics and Statistics*, 86, 195–210.
- DELANEY, J. AND P. DEVEREUX (2019): “High School Rank in Math and English and the Gender Gap in STEM,” *Labour Economics*, 69.
- (2022): “Rank Effects in Education: What Do We Know So Far?” *UCD Center for Economic Research Working Paper Series*.
- DENNING, J., R. MURPHY, AND F. WEINHARDT (2021): “Class Rank and Long Run Outcomes,” *Review of Economics and Statistics*.
- ELSNER, B., I. ISPHORDING, AND U. ZÖLITZ (2021): “Achievement Rank Effects Performance and Major Choices in College,” *Economic Journal*, 131, 3182–3206.
- ELSNER, B. AND I. E. ISPHORDING (2017): “A Big Fish in a Small Pond: Ability Rank and Human Capital Investment,” *Journal of Labor Economics*, 35, 787–828.
- (2018): “Rank, Sex, Drugs and Crime,” *Journal of Human Resources*, 53, 356–381.
- GUNTHER, C., N. A. EKINCI, C. SCHWIEREN, AND M. STROBEL (2010): “Women Can’t Jump? An Experiment on Competitive Attitudes and Stereotype Threat,” *Journal of Economic Behavior and Organization*, 75, 395–401.

- HAN, Y. (2020): “Am I the Big Fish? The Effect of Ordinal Rank on Student Academic Performance in Middle School,” *Journal of Economic Behavior and Organization*, 176.
- KINSLER, J. AND R. PAVAN (2021): “Local distortions in parental beliefs over child skill,” *Journal of Political Economy*, 129.
- KRUEGER, A. (1999): “Experimental Estimates of Education Production Functions,” *Quarterly Journal of Economics*, 114, 497–532.
- KRUEGER, A. AND D. M. WHITMORE (2001): “The Effect of Attending a Small Class in the Early Grades on College-Test Taking and Middle School Test Results: Evidence from Project STAR,” *Economic Journal*, 111, 101–128.
- MARSH, H. W. (1987): “The Big-Fish-Little-Pond Effect on Academic Self-Concept,” *Journal of Educational Psychology*, 79, 280–295.
- MURPHY, R. AND F. WEINHARDT (2020): “Top of the Class: The Importance of Ordinal Rank,” *Review of Economic Studies*, Forthcoming.
- NIEDERLE, M. AND L. VESTERLUND (2007): “Do Women Shy Away From Competition? Do Men Compete Too Much?” *Quarterly Journal of Economics*.
- WORD, E., J. JOHNSTON, H. BAIN, D. D. FULTON, J. B. ZAHARIAS, C. M. ACHILLE, M. N. LINTZ, J. FOLGER, AND C. BREDI (1990): “The State of Tennessee’s Student/Teacher Achievement Ratio (STAR) Project,” *Nashville: Tennessee State Department of Education*.



**Figure 1**  
*Notes: Kindergarten Reading Rank and De-meaned Reading Score*

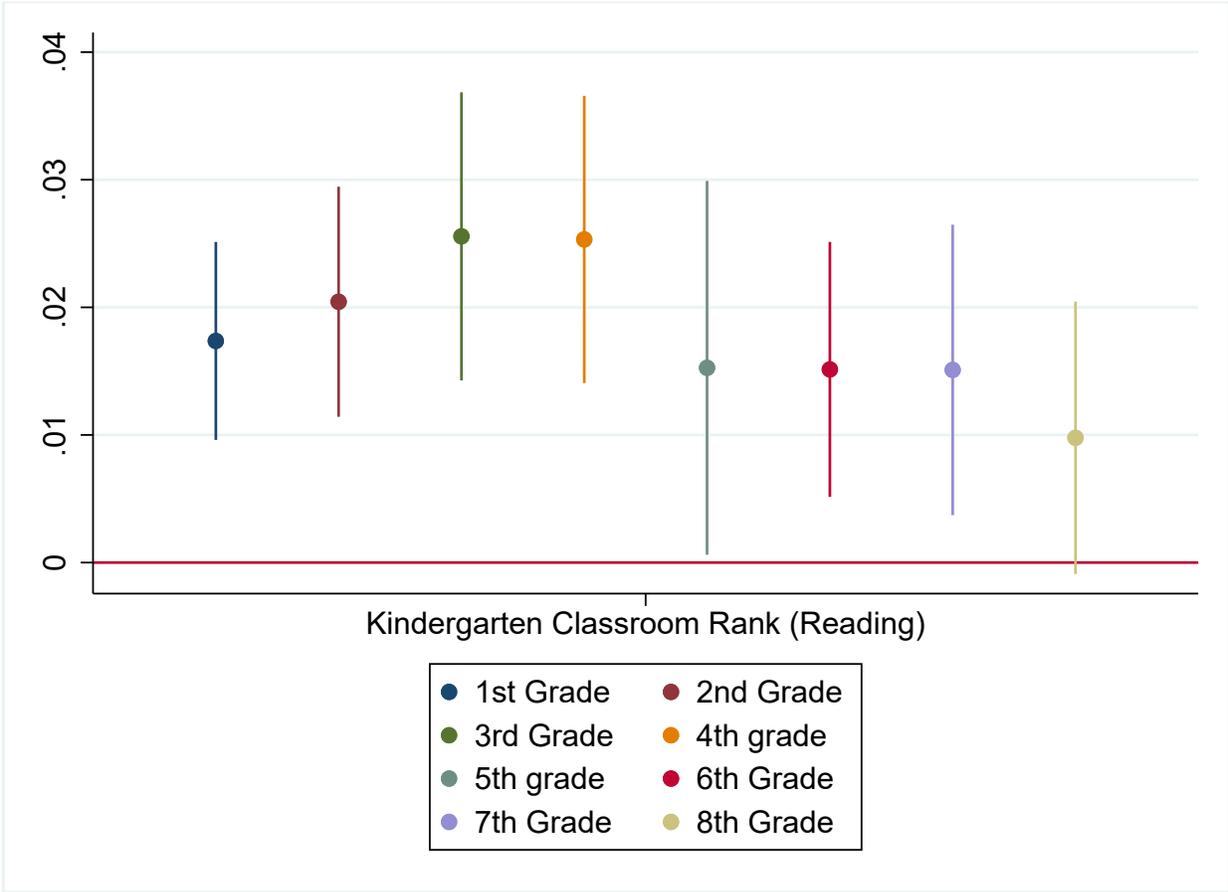
Note: This figure plots students' de-meaned kindergarten reading score against where they rank in terms of reading scores their kindergarten classroom. The sample consists of 5,789 kindergarten students with valid kindergarten reading scores. The kindergarten Stanford Achievement Test in reading has values that range between 315 and 627. The de-meaned SAT reading score ranges between -103.88 and 193.87.



**Figure 2**

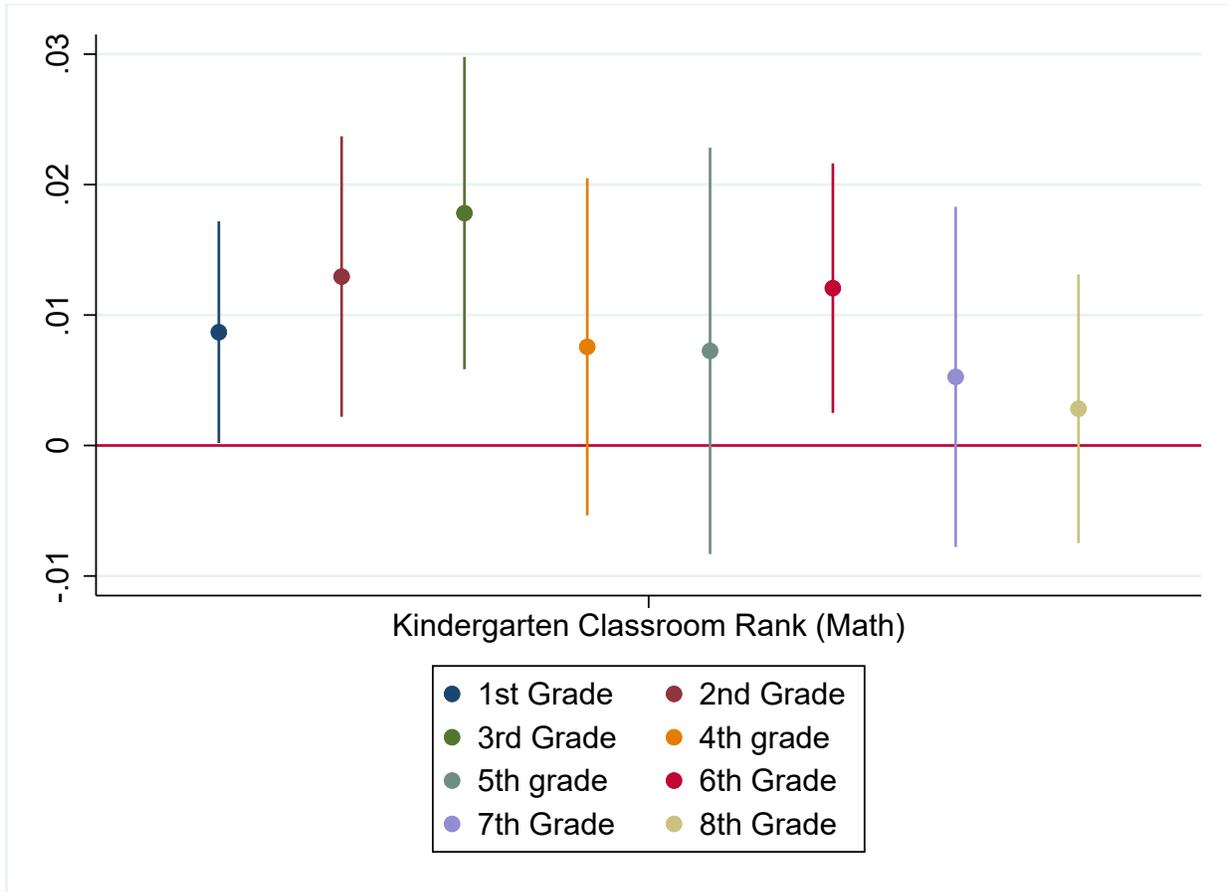
*Notes: Kindergarten Math Rank and De-meaned Math Score*

Note: This figure plots students' de-meaned kindergarten math score against where they rank in terms of math scores in their kindergarten classroom. The sample consists of 5,871 kindergarten students with valid kindergarten reading scores. The kindergarten Stanford Achievement Test in reading has values that range between 288 and 626. The de-meaned SAT reading score ranges between -269.53 and 158.47.



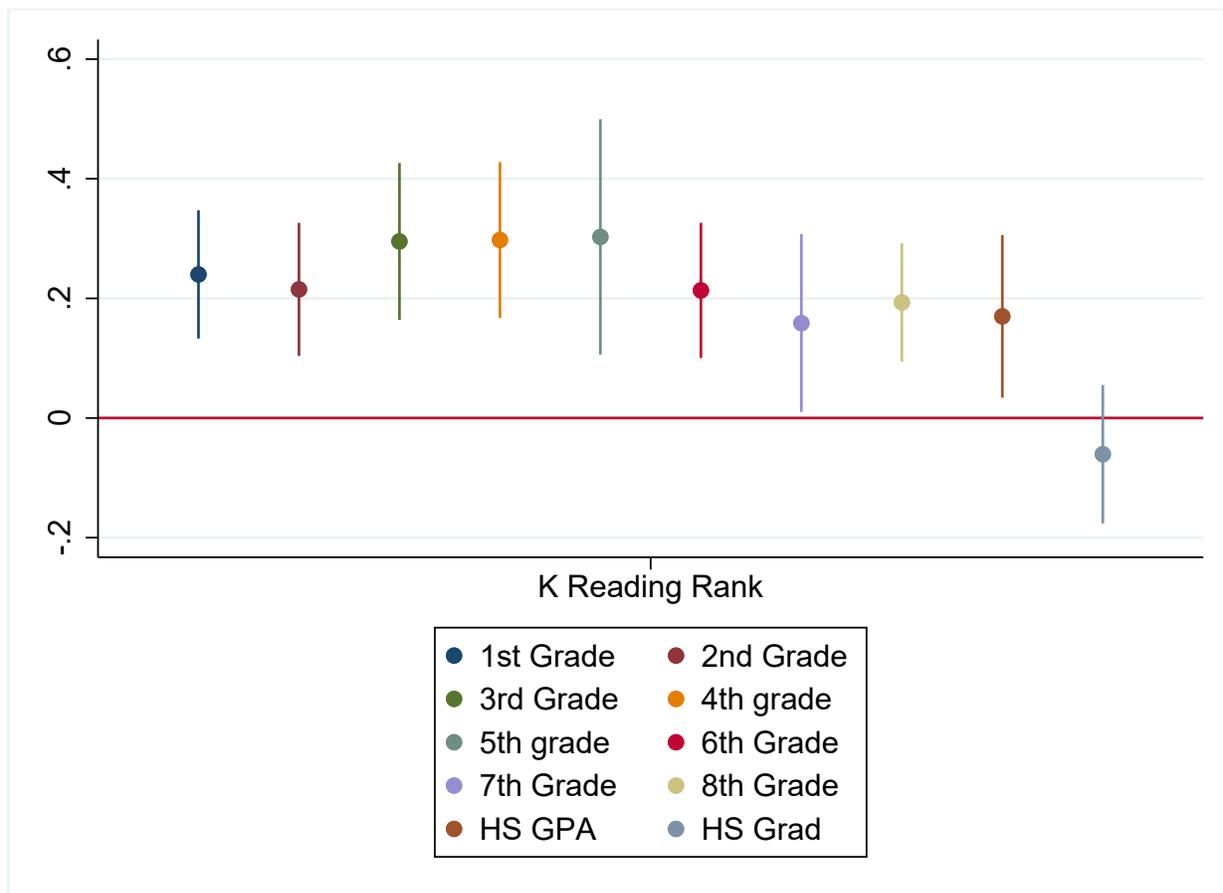
**Figure 3**  
*Kindergarten Reading Rank and Reading Test Score Outcomes*

Note: This figure plots treatment effects studying how kindergarten classroom rank in reading affects subsequent academic outcomes. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in reading. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten reading Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



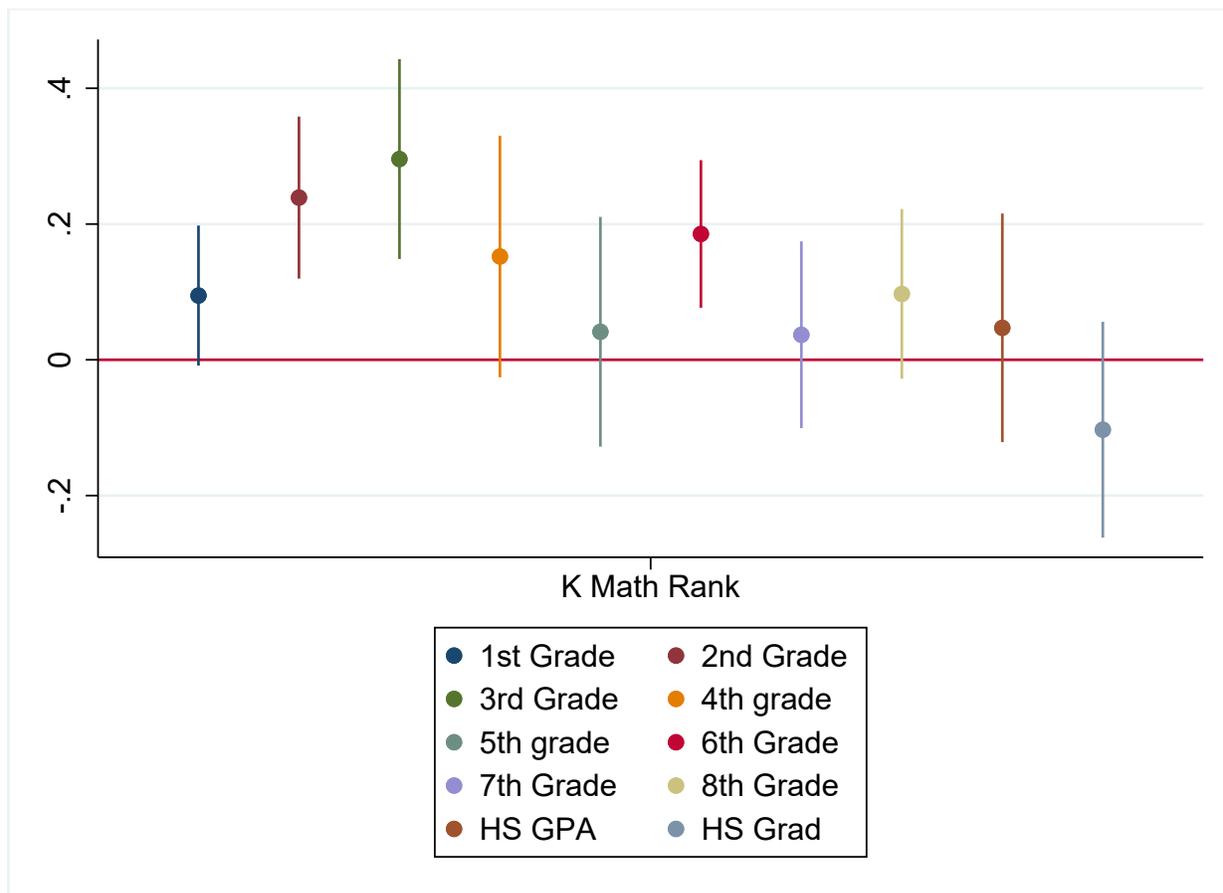
**Figure 4**  
*Kindergarten Math Rank and Math Test Score Outcomes*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten math Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



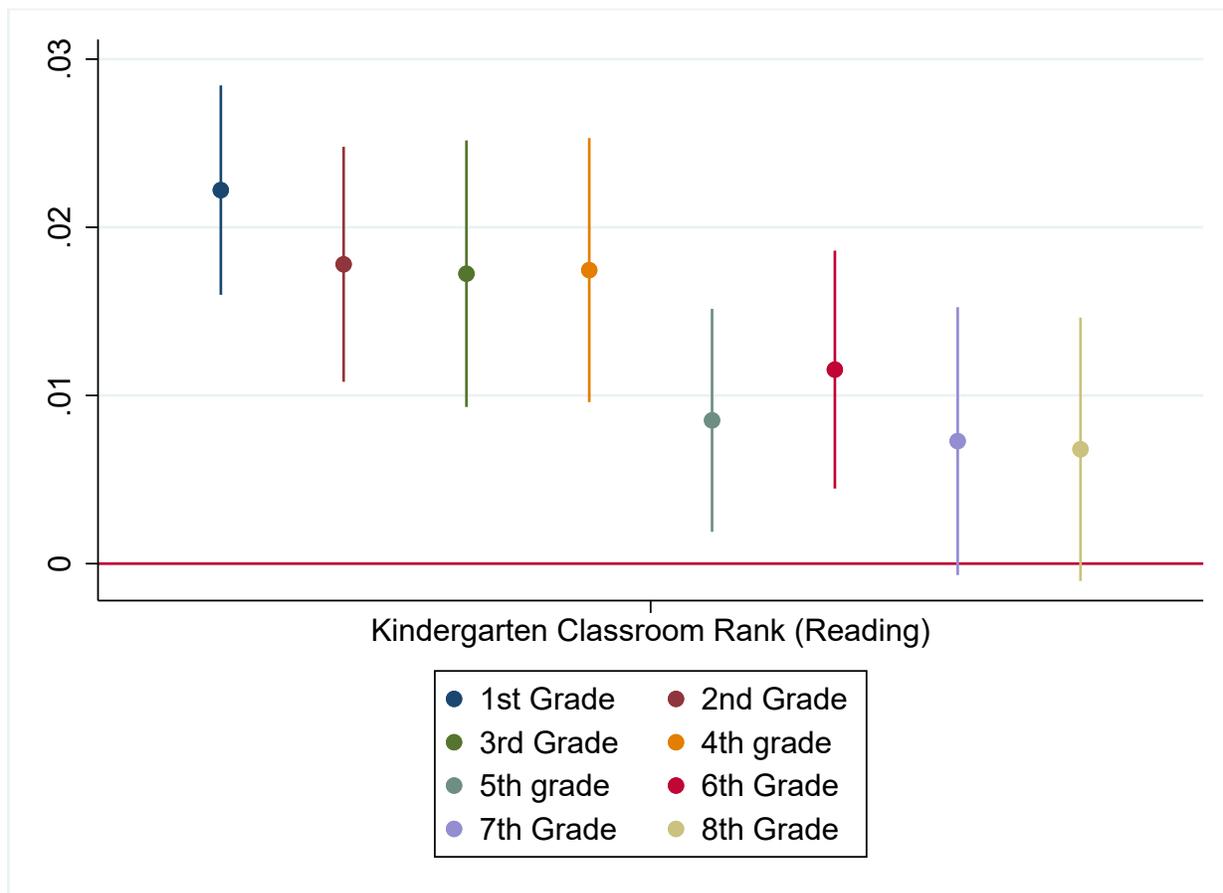
**Figure 5**  
*Kindergarten Reading Rank and Test Score Outcomes (Non-Attritors)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in reading affects subsequent academic outcomes for students who remained in the sample up to the point when the outcome was measured. In order to do this, I created a variable that equals one if the student is captured in the data at the time the outcome was measure. I then run my primary specification conditioning on this variable for each outcome. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in reading. Controls include child’s gender, race, classroom size, classroom fixed effects and a cubic in the students’ kindergarten reading Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



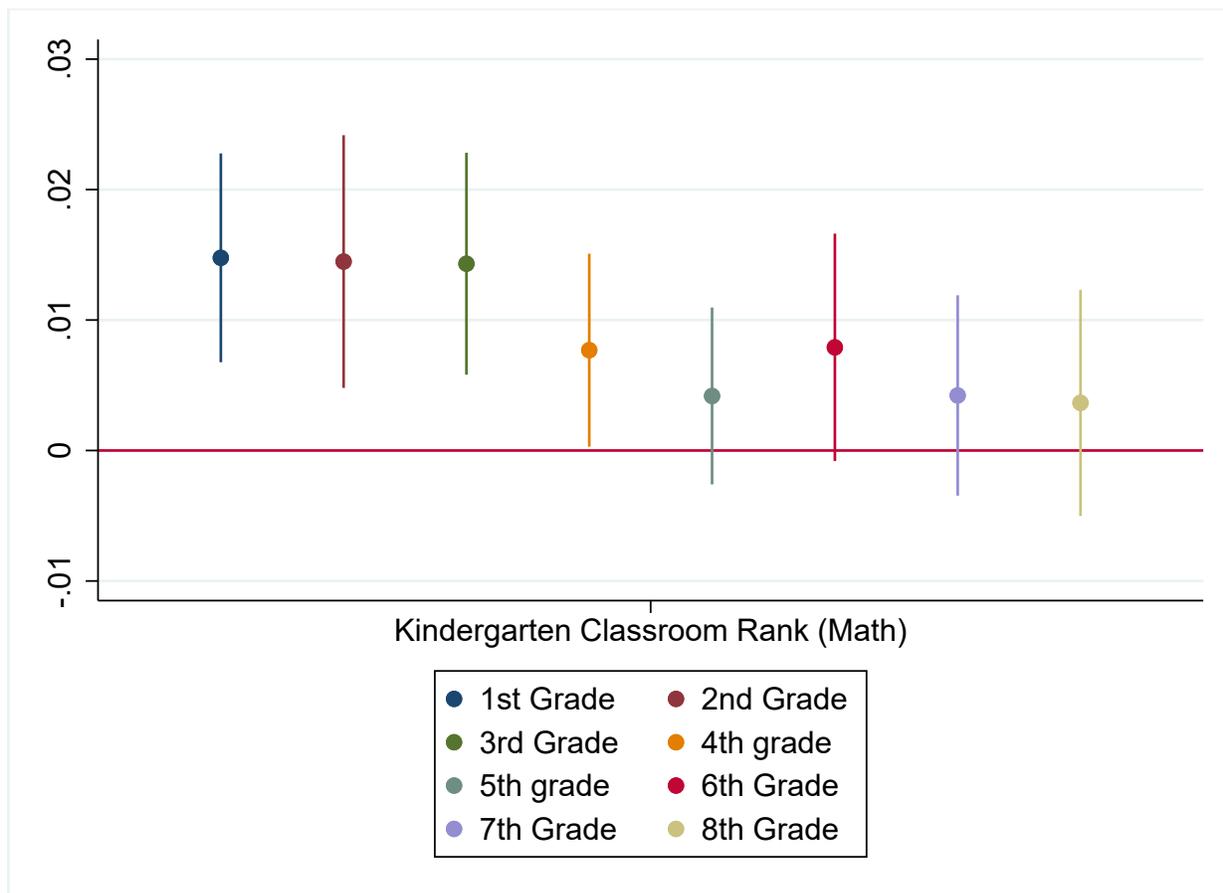
**Figure 6**  
*Kindergarten Math Rank and Test Score Outcomes (Non-Attritors)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes for students who remained in the sample up to the point when the outcome was measured. In order to do this, I created a variable that equals one if the student is captured in the data at the time the outcome was measure. I then run my primary specification conditioning on this variable for each outcome. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten reading Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



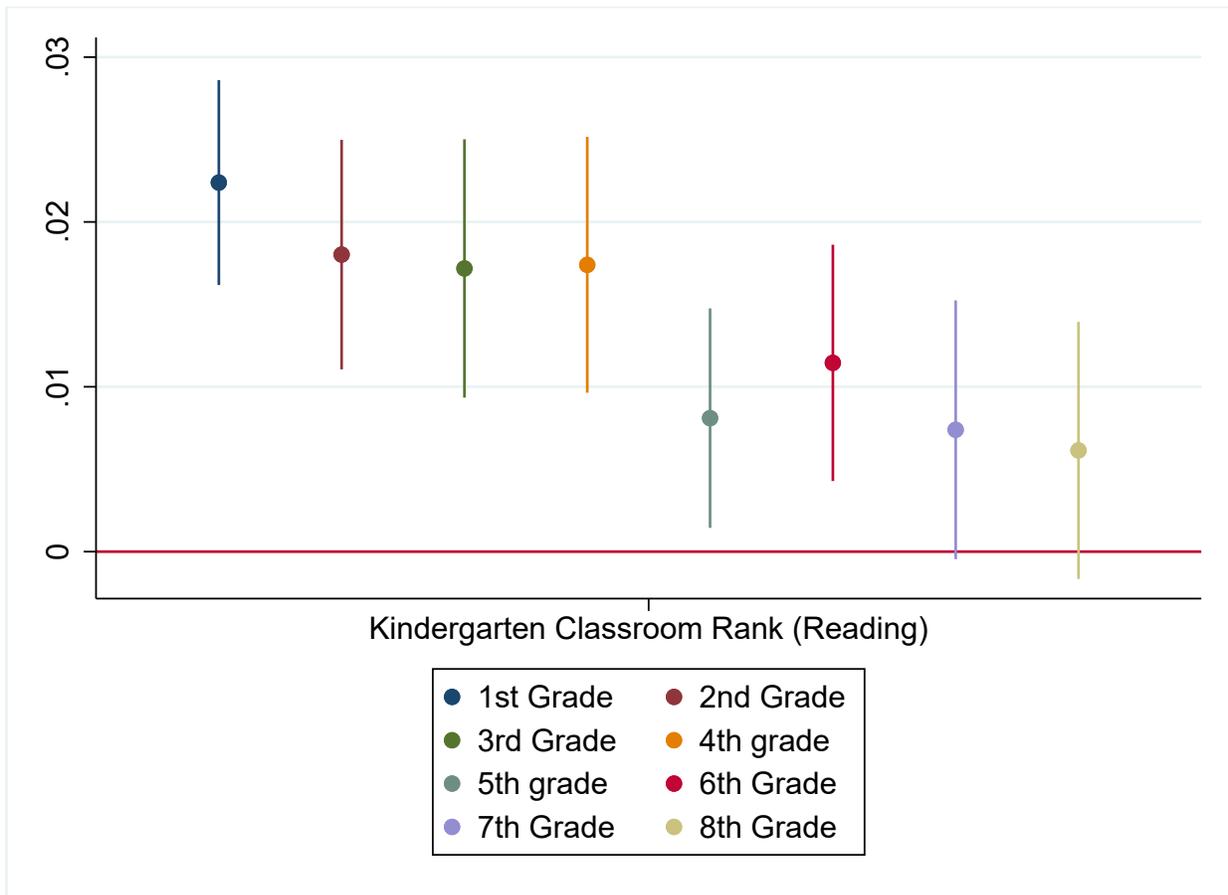
**Figure 7**  
*Kindergarten Reading Rank and Test Score Outcomes (Mean Imputation)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in reading affects subsequent academic outcomes, after those who are in the kindergarten sample but not in the outcome sample have their outcome value replaced with the sample average (mean). The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten reading Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



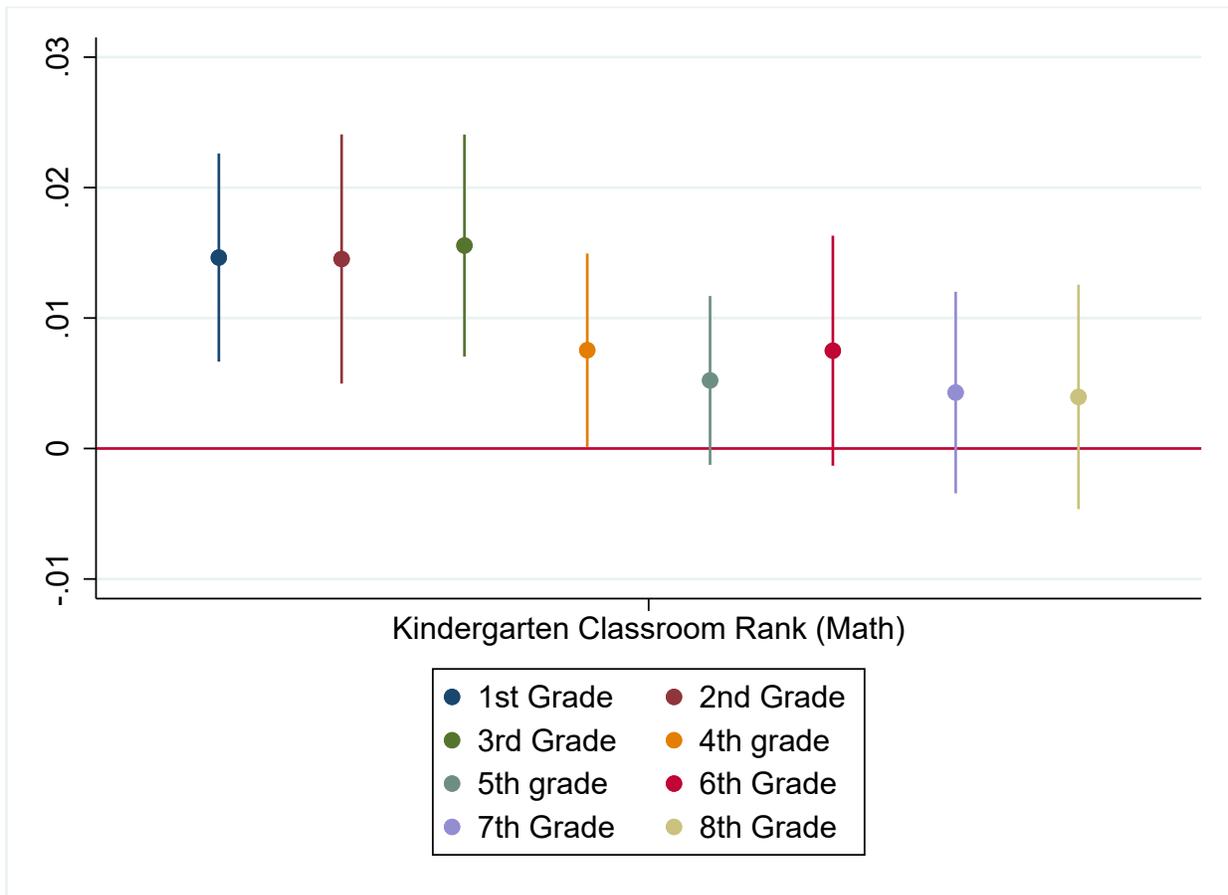
**Figure 8**  
*Kindergarten Math Rank and Test Score Outcomes (Mean Imputation)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes, after those who are in the kindergarten sample but not in the outcome sample have their outcome value replaced with the sample average (mean). The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten math Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



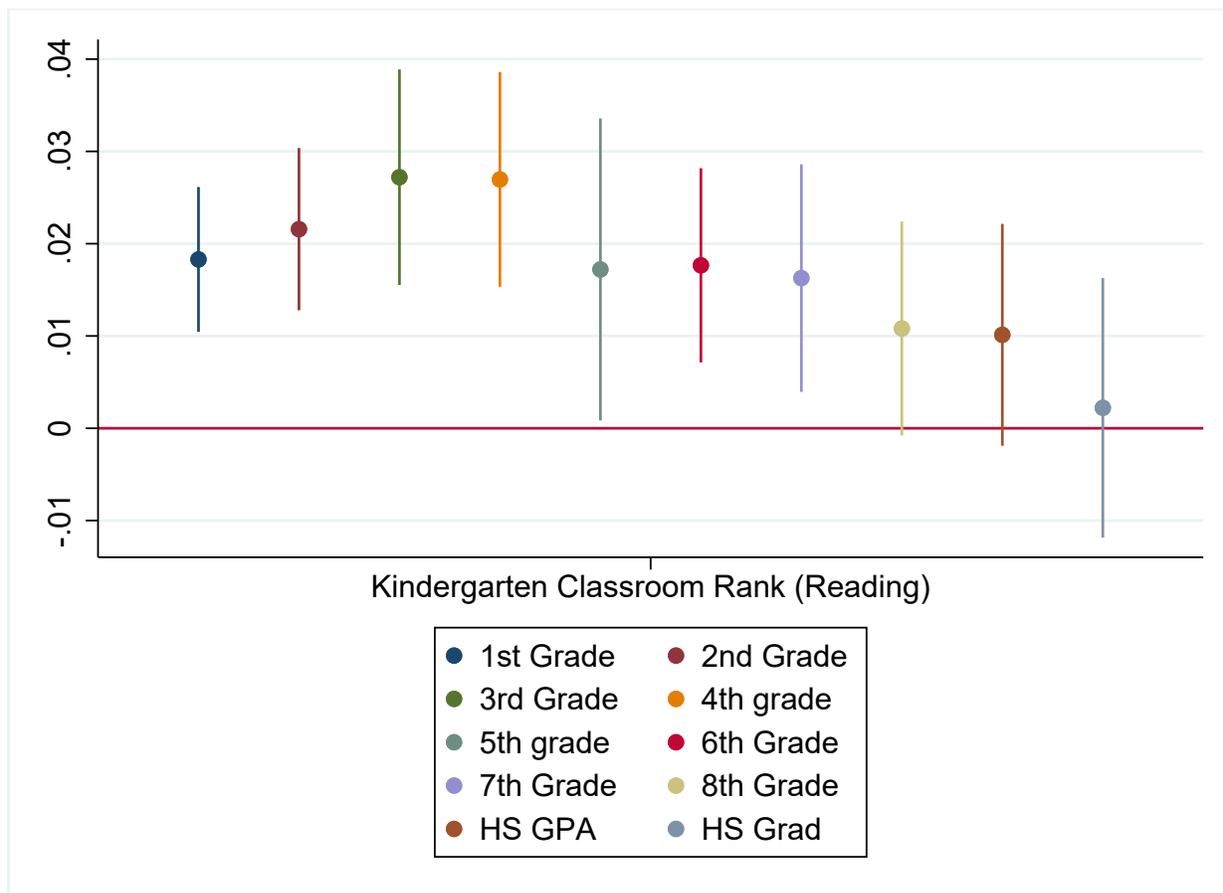
**Figure 9**  
*Kindergarten Reading Rank and Test Score Outcomes (Median Imputation)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes, after those who are in the kindergarten sample but not in the outcome sample have their outcome value replaced with the sample median score. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten math Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



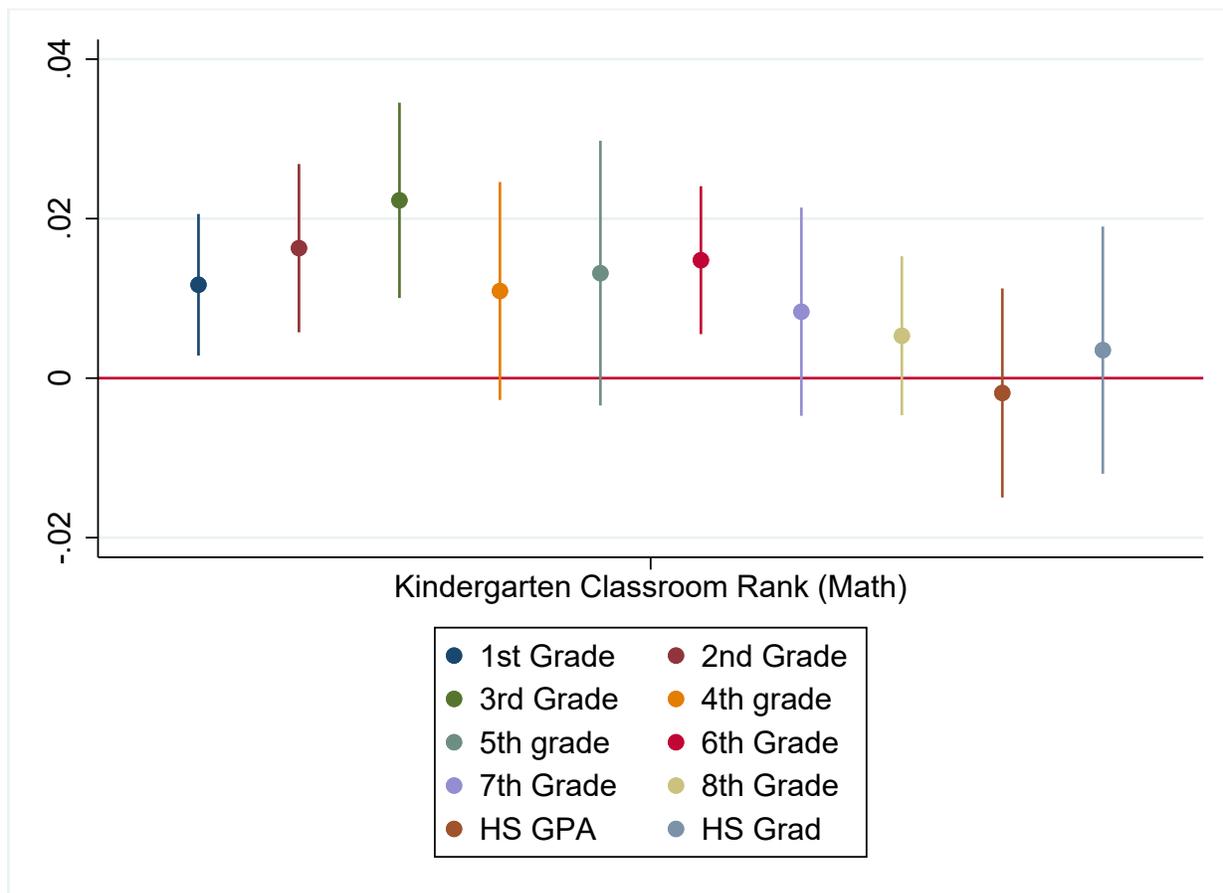
**Figure 10**  
*Kindergarten Math Rank and Test Score Outcomes (Mean Imputation)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes, after those who are in the kindergarten sample but not in the outcome sample have their outcome value replaced with the sample median score. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in the students' kindergarten math Stanford Achievement Test. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



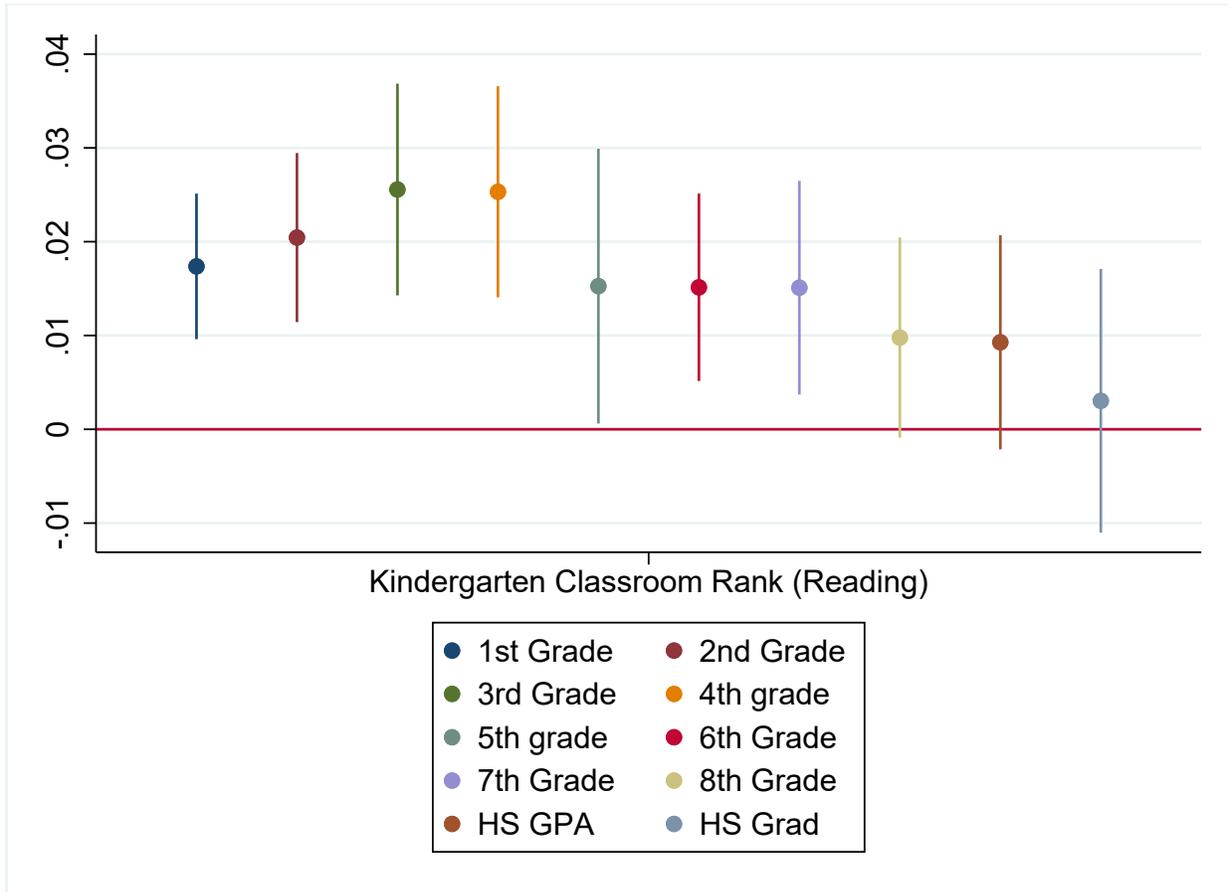
**Figure 11**  
*Kindergarten Reading Rank and Test Score Outcomes (Ventiles)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes. In these specifications, the function for how ability maps onto future outcomes is now a series of 20 indicator that represent where within the kindergarten distribution of outcomes the students' score is. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, and classroom fixed effects.. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



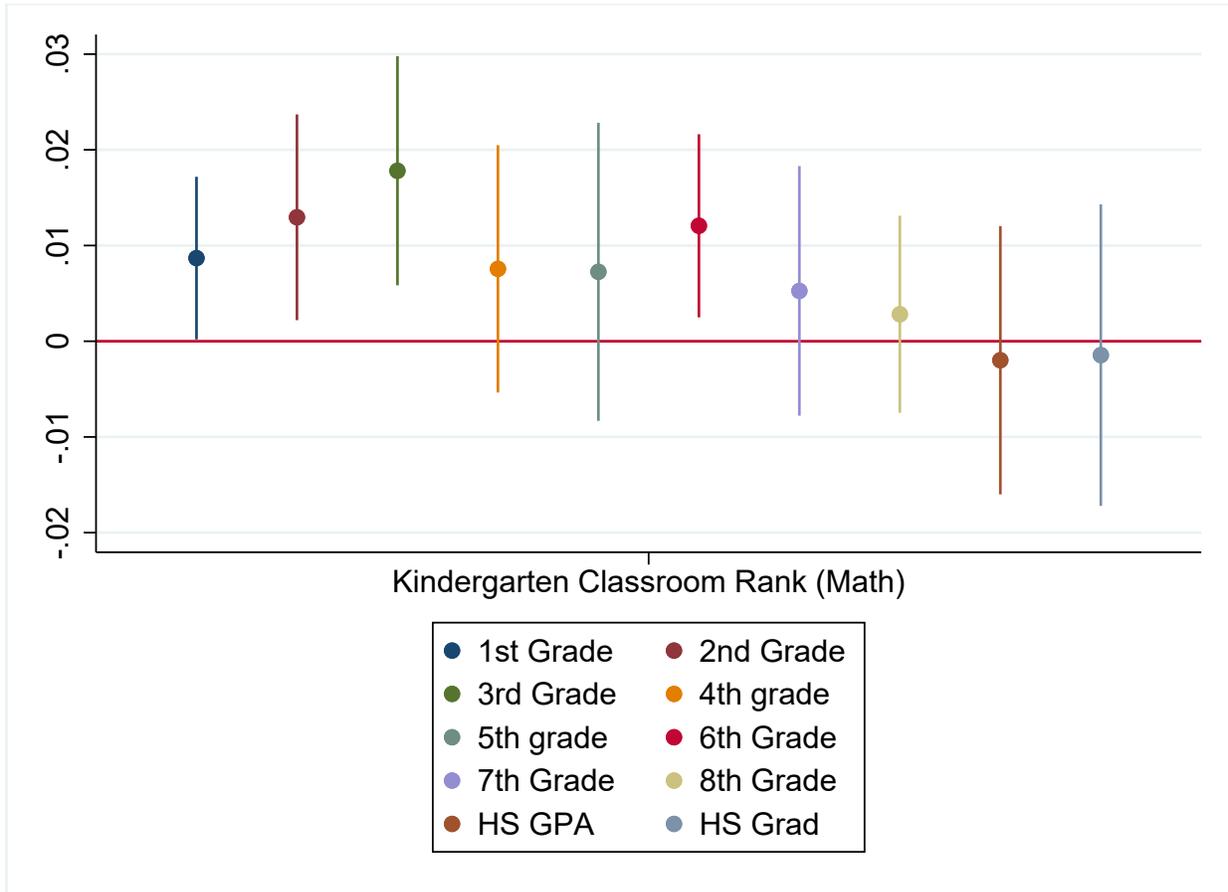
**Figure 12**  
*Kindergarten Math Rank and Test Score Outcomes (Ventiles)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes. In these specifications, the function for how ability maps onto future outcomes is now a series of 20 indicator that represent where within the kindergarten distribution of outcomes the students' score is. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, and classroom fixed effects.. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



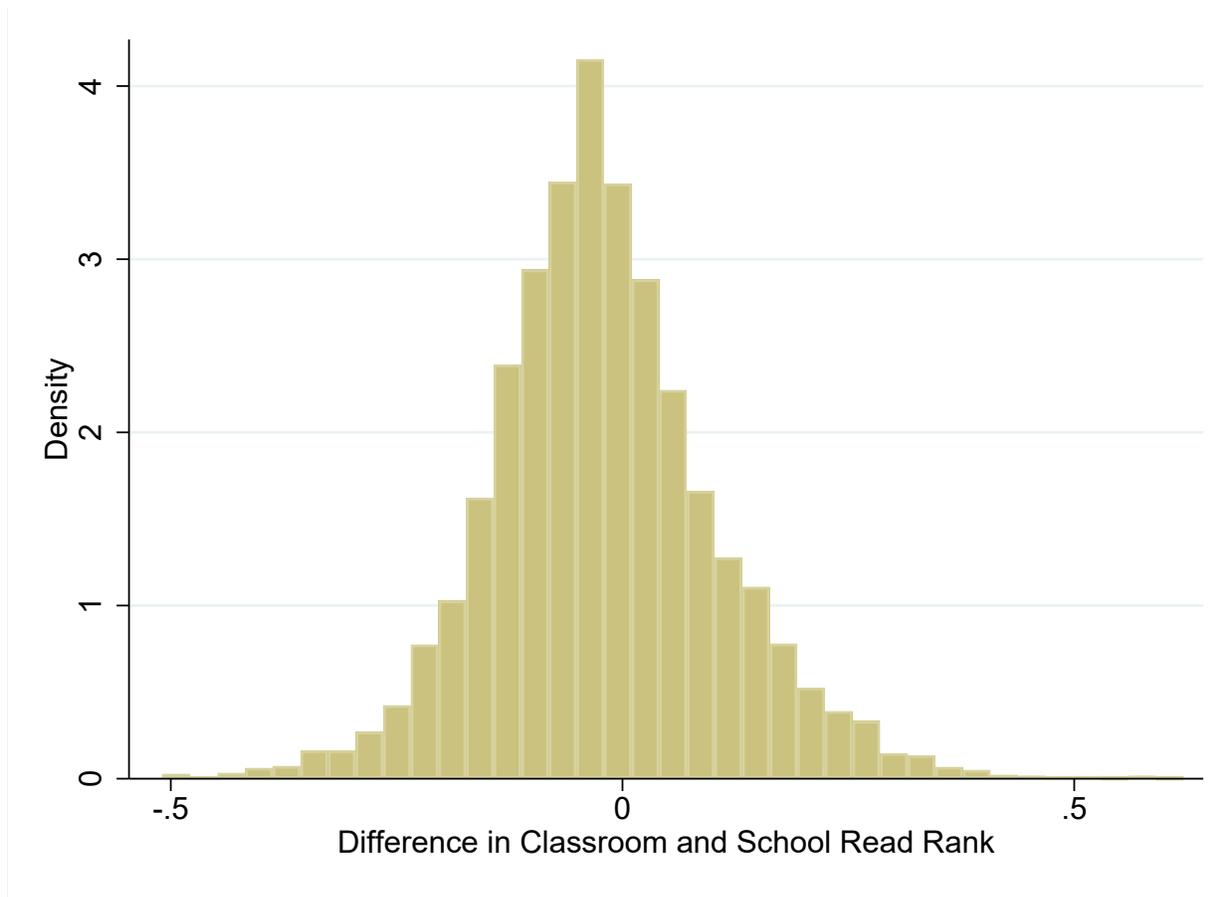
**Figure 13**  
*Kindergarten Reading Rank and Test Score Outcomes (Quartic)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes. In these specifications, the function for how ability maps onto future outcomes is now a quartic function of the child Stanford Achievement Test scores. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, and classroom fixed effects.. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



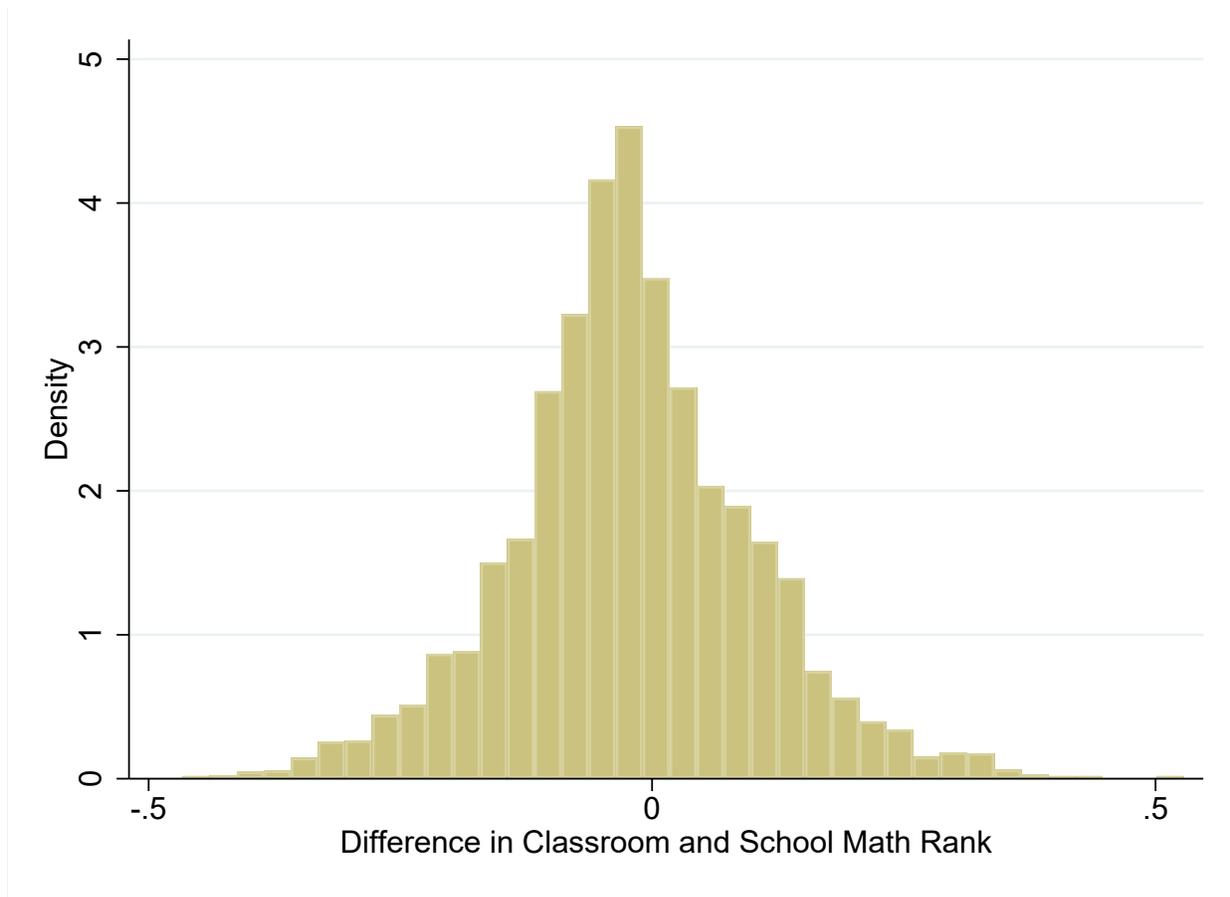
**Figure 14**  
*Kindergarten Math Rank and Test Score Outcomes (Quartic)*

Note: This figure plots treatment effects studying how kindergarten classroom rank in math effects subsequent academic outcomes. In these specifications, the function for how ability maps onto future outcomes is now a quartic function of the child Stanford Achievement Test scores. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, and classroom fixed effects.. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



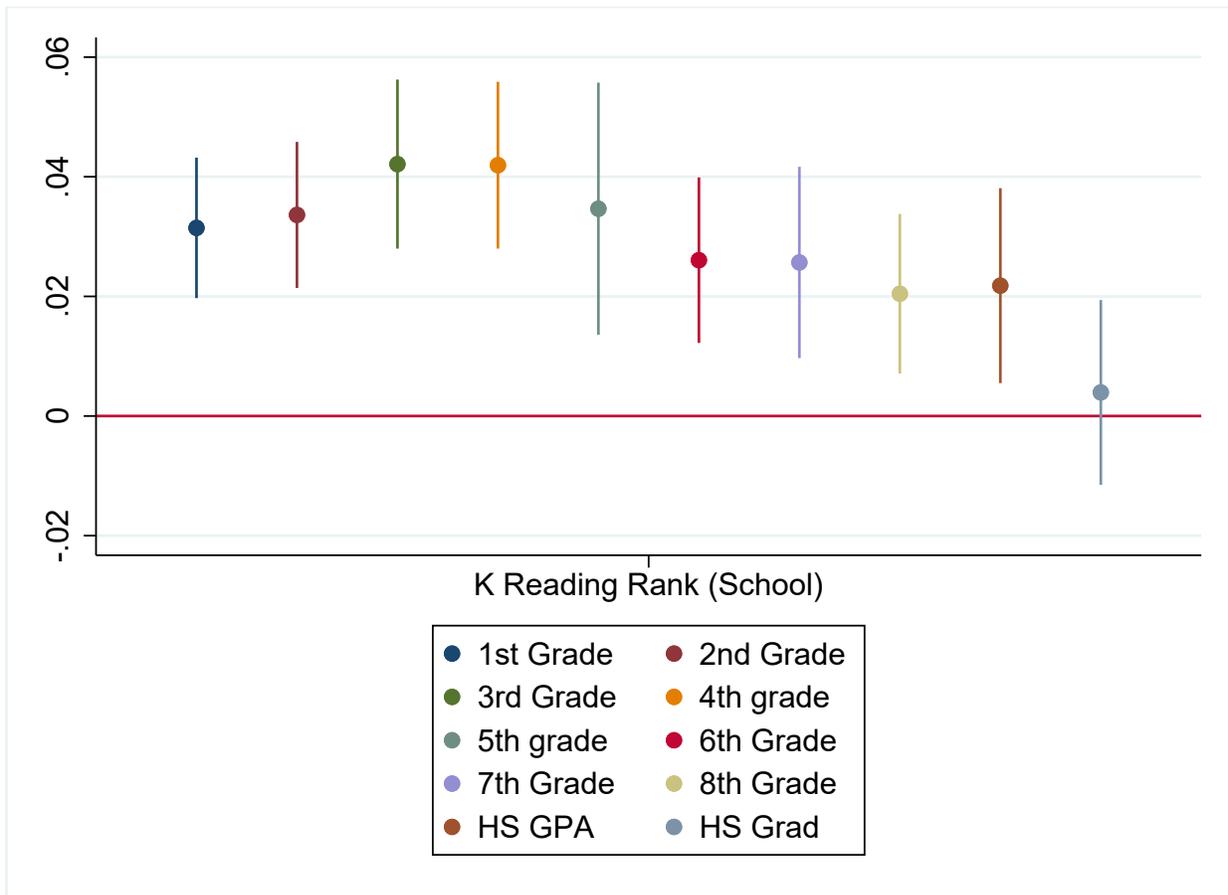
**Figure 15**  
*Difference Between Classroom and School-Grade Rank (Reading)*

Note: This figure plots the difference between a students kindergarten reading rank at the classroom level and their kindergarten reading rank at the school-grade level.



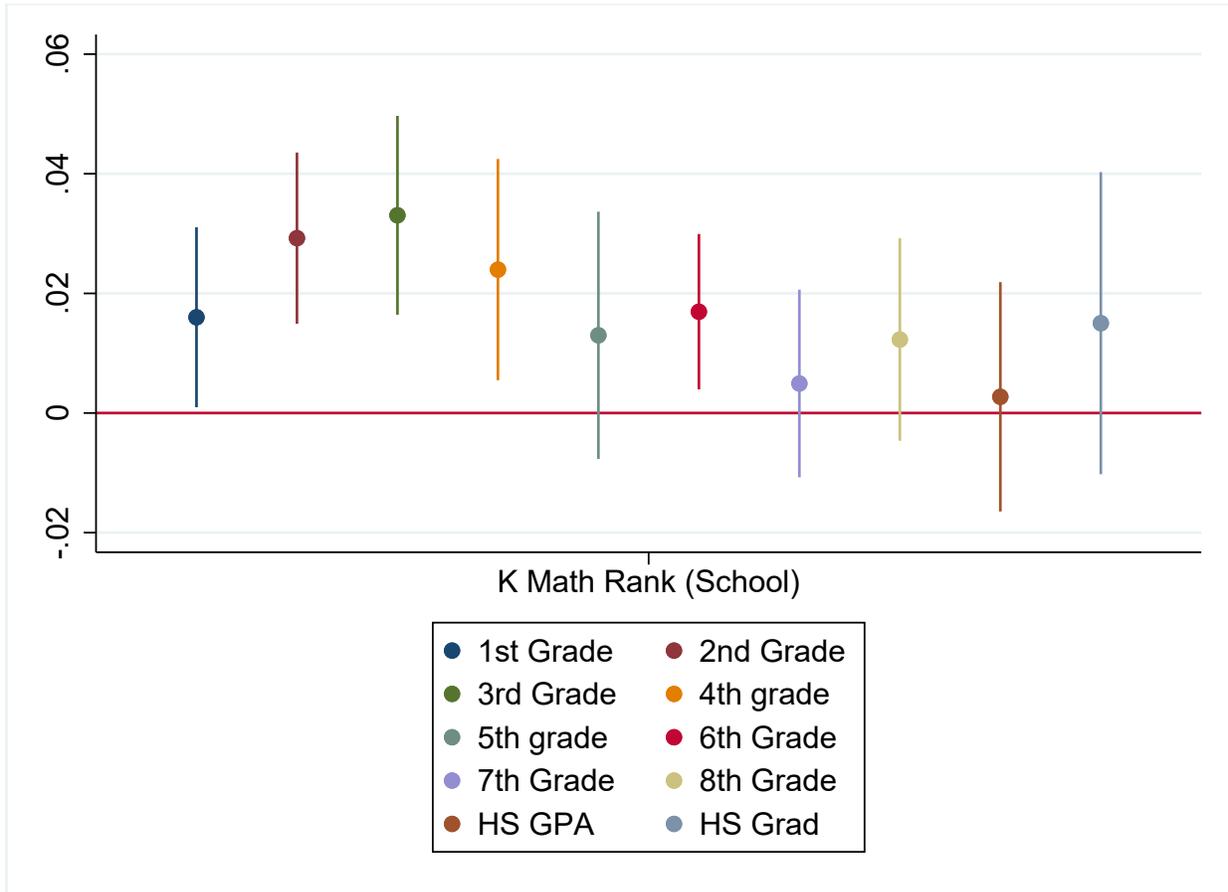
**Figure 16**  
*Difference Between Classroom and School-Grade Rank (Math)*

Note: This figure plots the difference between a student's kindergarten math rank at the classroom level and their kindergarten math rank at the school-grade level.



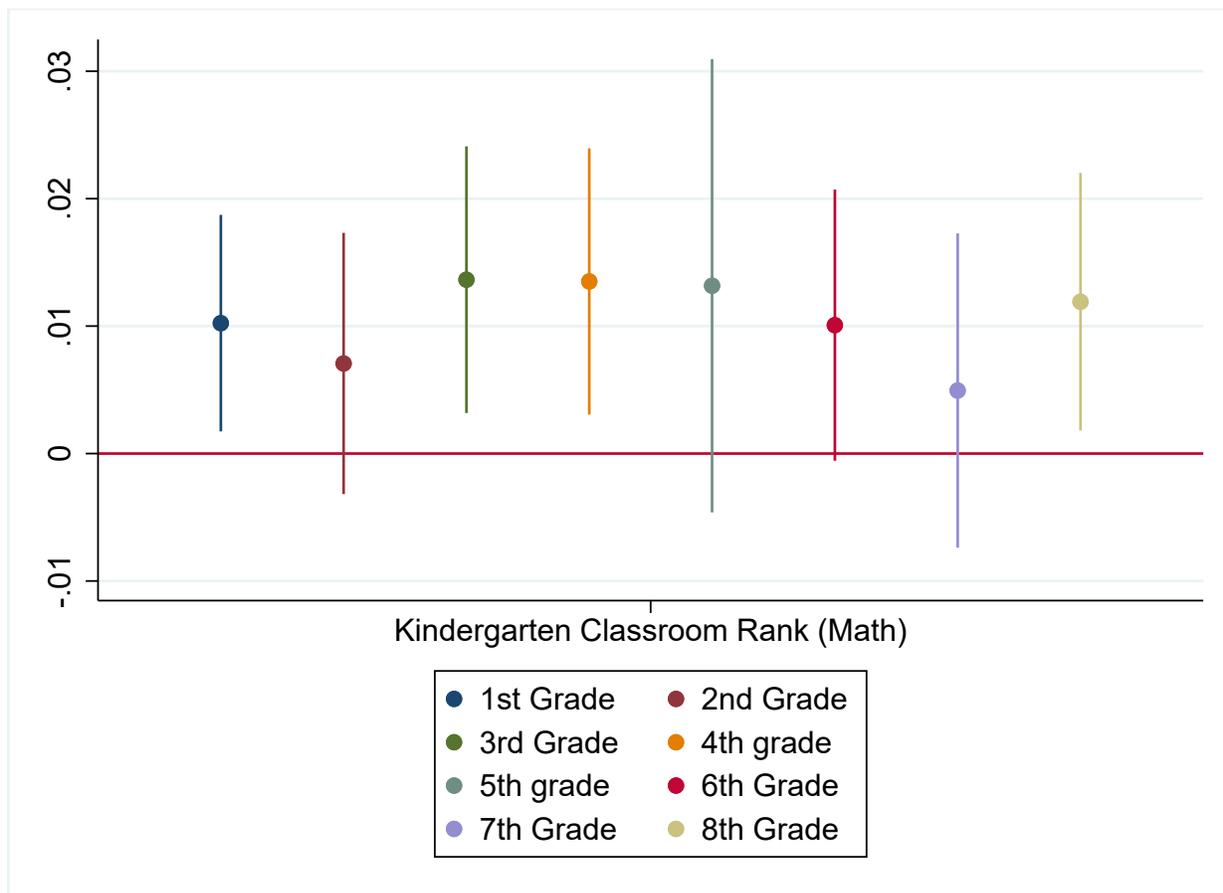
**Figure 17**  
*Kindergarten Reading Rank and Test Score Outcomes (School-Level)*

Note: This figure plots treatment effects studying how kindergarten school rank in math effects subsequent academic outcomes. To do this, I replace the child's kindergarten classroom rank with their school-level rank. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in their Stanford Achievement Test results. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



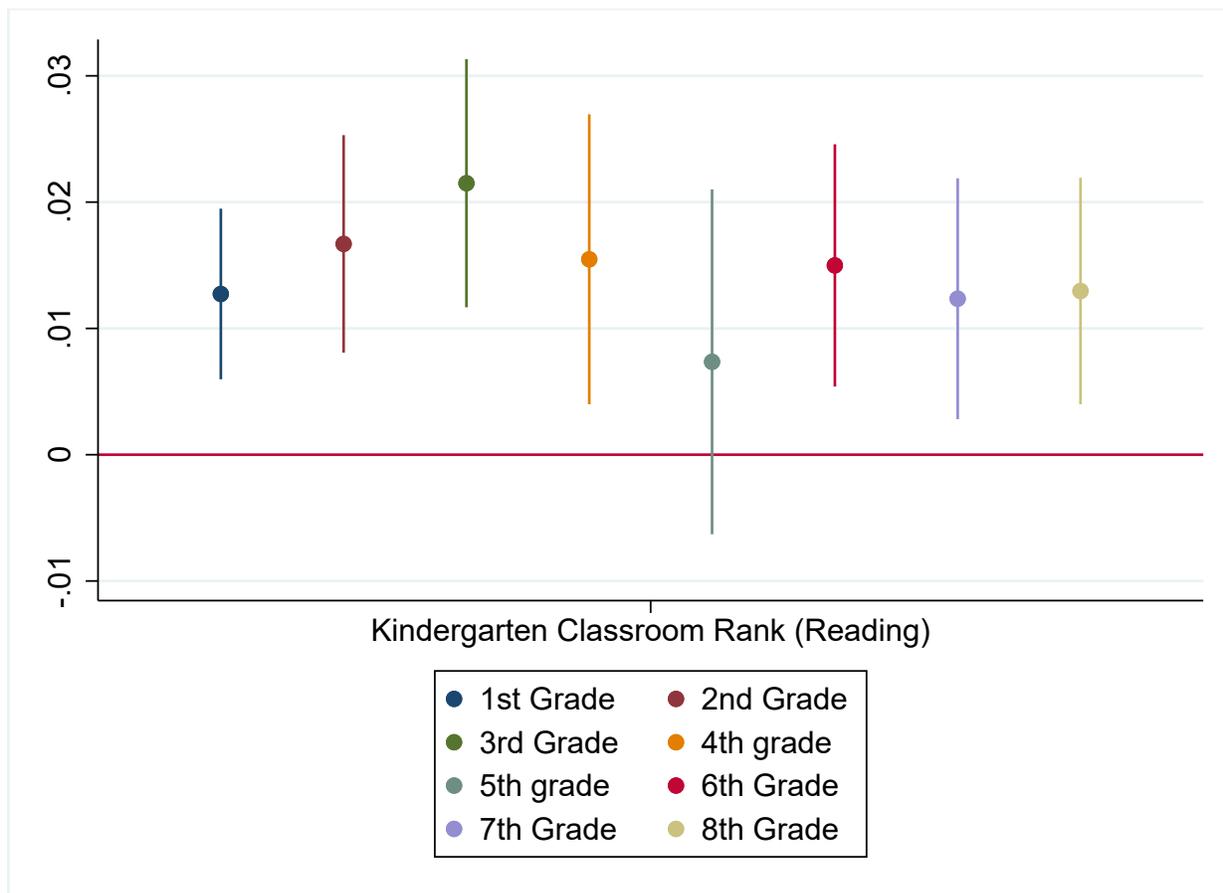
**Figure 18**  
*Kindergarten Math Rank and Test Score Outcomes (School-Level)*

Note: This figure plots treatment effects studying how kindergarten school rank in math effects subsequent academic outcomes. To do this, I replace the child’s kindergarten classroom rank with their school-level rank. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child’s gender, race, classroom size, classroom fixed effects and a cubic in their Stanford Achievement Test results. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



**Figure 19**  
*Kindergarten Reading Rank and Test Score Outcomes (Math Outcomes)*

Note: This figure plots treatment effects studying how kindergarten class rank in reading effects subsequent academic outcomes as measured in math. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in math. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in their Stanford Achievement Test results in reading. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.



**Figure 20**

*Kindergarten Math Rank and Test Score Outcomes (Reading Outcomes)*

Note: This figure plots treatment effects studying how kindergarten class rank in math effects subsequent academic outcomes as measured in reading. The outcomes here are where the child ranks within the overall distribution of the sample for grades 1-8 in reading. Controls include child's gender, race, classroom size, classroom fixed effects and a cubic in their Stanford Achievement Test results in math. Standard errors are clustered at the school level to control for shocks observed across classrooms at the same school.

**Table 1**  
*Descriptive Statistics - K/8th Grade/HS Samples*

	(1) K Sample	(2) G8 Sample	(3) HS Sample
Female	0.487 (0.500)	0.552 (0.497)	0.536 (0.499)
Free Lunch/Low-Income	0.483 (0.500)	0.395 (0.489)	0.343 (0.475)
White	0.674 (0.469)	0.719 (0.450)	0.785 (0.411)
Black	0.321 (0.467)	0.276 (0.447)	0.212 (0.409)
Avg K Class Size	20.295 (3.959)	20.201 (3.896)	20.167 (3.902)
Old For Age	0.242 (0.428)	0.253 (0.435)	0.238 (0.426)
Observations	5789	3225	2259

Notes: The three columns in this table represent three different samples; (1) is the students in the 8th grade sample; (2) represents those in the HS sample; and (3) represent those in the SAT/ACT outcomes sample. Each column represent the average for the respective variable in that sample. These variables constitute those used in my main estimation sample for each set of outcomes. While the number of observations does not equal the bottom row for each sample, it offers a good approximation of the data used in the sample.

**Table 2**  
*Balance Tests*

	(1) Reading	(2) Math
Female	0.060* (0.029)	-0.000 (0.026)
White	-0.124 (0.252)	-0.028 (0.166)
Black	-0.099 (0.266)	0.029 (0.170)
Free Lunch/Low-Income	-0.018 (0.041)	0.009 (0.032)
Old For Age	0.036 (0.043)	0.033 (0.025)
Observations	5767	5849

Notes: Each column represents a different model studying balance of the control variables. The left column represents the result from a regression of control variables onto kindergarten classroom reading rank. The same is done for the right hand model but for kindergarten math. The regression contains an indicator for being female, black, white, free/reduced lunch and whether the child is old for their age. Standard errors are in the parentheses.

**Table 3***Kindergarten Reading Rank on HS and SAT/ACT Outcomes*

	(1)	(2)	(3)	(4)
	HS GPA	HS Grad	Took SAT/ACT	ACT Score
Kindergarten Classroom Rank (Reading)	0.011*	0.002	0.013*	0.084***
	(0.005)	(0.007)	(0.006)	(0.019)
White	-0.096	-0.091*	0.080	0.081
	(0.233)	(0.039)	(0.140)	(0.444)
Black	-0.163	-0.028	0.136	-0.420
	(0.241)	(0.047)	(0.147)	(0.467)
Female	0.113***	0.037*	0.138***	-0.081
	(0.015)	(0.014)	(0.012)	(0.042)
Free Lunch/Low-Income	-0.089***	-0.116***	-0.213***	-0.086
	(0.018)	(0.021)	(0.017)	(0.056)
Avg K Class Size	0.257***	0.197***	-0.275***	0.497
	(0.047)	(0.052)	(0.038)	(0.256)
Old For Age	0.000	-0.049**	-0.022	-0.174***
	(0.015)	(0.016)	(0.014)	(0.046)
(K Read Score) <sup>3</sup>	-0.000	0.000**	-0.000*	-0.000**
	(0.000)	(0.000)	(0.000)	(0.000)
(K Read Score) <sup>2</sup>	0.000	-0.000**	0.000	0.001**
	(0.000)	(0.000)	(0.000)	(0.000)
K Read Score	-0.028	0.100**	-0.040	-0.362**
	(0.028)	(0.031)	(0.029)	(0.128)
Observations	2254	2841	5766	2255

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and HS and SAT/ACT outcomes.They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses. star(\* 0.10 \*\* 0.05 \*\*\* 0.01)

**Table 4***Kindergarten Math Rank on HS and SAT/ACT Outcomes*

	(1)	(2)	(3)	(4)
	HS GPA	HS Grad	Took SAT/ACT	ACT Score
Kindergarten Classroom Rank (Math)	-0.005 (0.007)	0.005 (0.007)	0.011* (0.006)	0.046** (0.021)
White	-0.111 (0.208)	-0.104* (0.046)	0.053 (0.133)	-0.090 (0.434)
Black	-0.159 (0.218)	-0.034 (0.052)	0.123 (0.142)	-0.492 (0.456)
Female	0.122*** (0.015)	0.036* (0.014)	0.146*** (0.012)	-0.039 (0.045)
Free Lunch/Low-Income	-0.101*** (0.019)	-0.123*** (0.022)	-0.223*** (0.018)	-0.068 (0.049)
Avg K Class Size	0.269*** (0.046)	0.146** (0.046)	-0.311*** (0.034)	0.532* (0.217)
Old For Age	-0.012 (0.015)	-0.051** (0.016)	-0.034* (0.014)	-0.205*** (0.050)
(K Math Score) <sup>3</sup>	-0.000* (0.000)	-0.000 (0.000)	-0.000*** (0.000)	-0.000** (0.000)
(K Math Score) <sup>2</sup>	0.000* (0.000)	-0.000 (0.000)	0.000*** (0.000)	0.000** (0.000)
K Math Score	-0.068* (0.030)	0.005 (0.032)	-0.055*** (0.015)	-0.244** (0.076)
Observations	2280	2873	5848	2284

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and HS and SAT/ACT outcomes.They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses. star(\* 0.10 \*\* 0.05 \*\*\* 0.01)

**Table 5**  
*Heterogenous Effects of Rank (Student Outcomes)*

	G8 Scores		HS GPA		HS Grad		Took SAT/ACT		ACT Score	
	(1) Read	(2) Math	(3) Read	(4) Math	(5) Read	(6) Math	(7) Read	(8) Math	(9) Read	(10) Math
Female	.010	.004	.016*	.002	.012	.008	.016*	.001	.060**	.066**
	.006	.007	.008	.011	.010	.008	.008	.009	.025	.030
Male	.013	.006	.002	-.009	-.011	-.004	.009	.017*	.138***	.048
	.008	.011	.010	.011	.010	.014	.008	.009	.039	.053
Low-Income	.003	-.009	.010	-.003	-.000	.015	.012	.009	.07	.012
	.008	.007	.014	.015	.017	.016	.008	.007	.009	.051
Medium/High-Income	.016**	.012*	.009	-.004	.010	.003	.009	.011	.081***	.052*
	.006	.006	.006	.007	.006	.006	.007	.009	.025	.029
Black	-.001	-.004	.000	-.000	.027	.034*	.014	.016	.096**	.010
	.007	.011	.018	.017	.019	.020	.008	.010	.044	.041
Non-Black	.015**	.008	.018*	-.005	-.006	-.005	.012*	.007	.072***	.061**
	.006	.006	.005	.007	.006	.006	.007	.008	.023	.027
Below-Median	.003	-.005	.001	-.011	-.006	-.024	.019	-.009	.105	.043
	.017	.016	.016	.019	.019	.023	.012	.008	.073	.056
Above-Median	.019**	.003	.025	.001	.017	.010	.016	.017	.107**	.048
	.008	.008	.016	.014	.012	.014	.014	.010	.044	.030

Notes: This tables represents results from regressions that restrict the sample to only contain the sub-population mentioned in the row. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 6***Heterogenous Effects of Rank (Classroom/Teacher Outcomes)*

	G8 Scores		HS GPA		HS Grad		Took SAT/ACT		ACT Score	
	(1) Read	(2) Math	(3) Read	(4) Math	(5) Read	(6) Math	(7) Read	(8) Math	(9) Read	(10) Math
Small Class	.013**	.000	.015	.000	-.001	.005	.022**	.013	.053*	-.058*
	.006	.010	.010	.011	.011	.012	.009	.011	.029	.034
Regular Class	.011**	.006	.008	-.007	.004	.004	.008	.010	.104***	.094***
	.005	.006	.008	.008	.010	.006	.007	.027	.027	.027
Teacher BA	.014**	.007	.012	-.007	.002	.007	.017**	.0114	.112***	.025
	.006	.005	.007	.006	.009	.009	.006	.007	.027	.029
Teacher MA	.011	.000	.011	.002	.002	.000	.005	.007	.027	.074*
	.007	.007	.009	.012	.010	.012	.008	.012	.0339	.037
Teacher Low-Exp	.021***	.011	.003	.001	.002	-.011	.018**	.004	.080***	.089***
	.006	.007	.007	.008	.011	.010	.008	.009	.024	.0307
Teacher High-Exp	.005	-.001	.018**	-.005	-.000	.007	.014*	.079***	.079***	.007
	.007	.006	.010	.007	.010	.007	.008	.028	.028	.031
Teacher Same Race	.009	.008	.011*	-.005	-.004	.004	.011	.012*	.063***	.057**
	.005	.006	.005	.007	.006	.007	.007	.007	.023	.026
Teacher Not Same Race	.020*	-.011	-.004	.016	.038*	.020	.019*	.0077	.165***	.034
	.010	.012	.022	.028	.021	.024	.009	.014	.057	.065

Notes: This tables represents results from regressions that restrict the sample to only contain the sub-population mentioned in the row. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 7***Kindergarten Reading Rank on Non-Cognitive Outcomes (4th Grade)*

	(1) Participation	(2) Initiative	(3) Value	(4) Effort
Kindergarten Classroom Rank (Reading)	-0.012 (0.026)	0.070*** (0.023)	0.032* (0.018)	0.065** (0.025)
White	-1.239* (0.512)	-0.299 (0.428)	0.340 (0.755)	-0.653** (0.244)
Black	-1.106* (0.543)	-0.221 (0.441)	0.286 (0.767)	-0.668* (0.253)
Female	-0.531*** (0.067)	0.204*** (0.055)	0.291*** (0.037)	0.329*** (0.045)
Free Lunch/Low-Income	0.103 (0.062)	-0.162** (0.059)	-0.089* (0.042)	-0.146* (0.055)
Avg K Class Size	-0.088 (0.238)	-0.521** (0.188)	-0.474*** (0.137)	0.136 (0.191)
Old For Age	0.011 (0.066)	-0.110 (0.059)	-0.105* (0.051)	-0.088 (0.057)
(K Read Score) <sup>3</sup>	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
(K Read Score) <sup>2</sup>	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
K Read Score	-0.161 (0.124)	-0.022 (0.117)	0.039 (0.092)	0.026 (0.124)
Observations	1575	1575	1575	1575

Notes: Each column represents a different model studying balance of the control variables. The left column represents the result from a regression of control variables onto kindergarten classroom reading rank. The same is done for the right hand model but for kindergarten math. The regression contains an indicator for being female, black, white, free/reduced lunch and whether the child is old for their age. Standard errors are in the parenthesis.

**Table 8**  
*Kindergarten Math Rank on Non-Cognitive Outcomes (4th Grade)*

	(1) Participation	(2) Initiative	(3) Value	(4) Effort
Kindergarten Classroom Rank (Math)	-0.034 (0.028)	0.009 (0.027)	0.020 (0.019)	0.036 (0.025)
White	-1.265** (0.519)	-0.293 (0.381)	0.329 (0.750)	-0.669*** (0.217)
Black	-1.187** (0.547)	-0.157 (0.398)	0.309 (0.762)	-0.601** (0.234)
Female	-0.546*** (0.065)	0.233*** (0.049)	0.308*** (0.037)	0.356*** (0.043)
Free Lunch/Low-Income	0.113* (0.064)	-0.200*** (0.062)	-0.109** (0.041)	-0.175*** (0.054)
Avg K Class Size	0.121 (0.232)	-0.423** (0.212)	-0.487*** (0.155)	0.140 (0.191)
Old For Age	0.028 (0.068)	-0.144** (0.061)	-0.121** (0.053)	-0.113* (0.057)
(K Math Score) <sup>3</sup>	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
(K Math Score) <sup>2</sup>	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
K Math Score	-0.052 (0.167)	-0.048 (0.114)	0.086 (0.101)	0.076 (0.108)
Observations	1592	1592	1592	1592

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and non-cognitive outcomes. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 9***Kindergarten Reading Rank on Non-Cognitive Outcomes (8th Grade)*

	(1) Participation	(2) Initiative	(3) Value	(4) Effort
Kindergarten Classroom Rank (Reading)	-0.021 (0.022)	0.017 (0.023)	0.032 (0.025)	0.035* (0.018)
White	-0.439*** (0.105)	0.451 (0.640)	0.601* (0.361)	0.335*** (0.088)
Black	-0.096 (0.160)	0.563 (0.623)	0.515 (0.369)	0.263* (0.137)
Female	-0.371*** (0.043)	0.239*** (0.056)	0.473*** (0.071)	0.385*** (0.041)
Free Lunch/Low-Income	0.036 (0.051)	-0.144** (0.066)	-0.064 (0.082)	-0.169*** (0.051)
Avg K Class Size	-0.281 (0.198)	0.294 (0.197)	0.215 (0.319)	0.544*** (0.170)
Old For Age	-0.023 (0.043)	-0.103* (0.054)	-0.032 (0.074)	-0.023 (0.050)
(K Read Score) <sup>3</sup>	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
(K Read Score) <sup>2</sup>	-0.000 (0.000)	0.001 (0.000)	-0.000 (0.000)	-0.000 (0.000)
K Read Score	0.046 (0.136)	-0.260 (0.175)	0.072 (0.192)	0.024 (0.118)
Observations	1654	1654	1654	1654

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and non-cognitive outcomes. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 10**  
*Kindergarten Math Rank on Non-Cognitive Outcomes (8th Grade)*

	(1) Participation	(2) Initiative	(3) Value	(4) Effort
Kindergarten Classroom Rank (Math)	-0.024 (0.021)	-0.016 (0.031)	-0.025 (0.032)	-0.042 (0.024)
White	-0.781*** (0.094)	0.156 (0.688)	1.078*** (0.217)	0.470 (0.384)
Black	-0.490** (0.175)	0.035 (0.687)	0.889** (0.272)	0.308 (0.426)
Female	-0.276*** (0.045)	0.192** (0.061)	0.325*** (0.059)	0.288*** (0.046)
Free Lunch/Low-Income	0.054 (0.045)	-0.046 (0.064)	-0.131 (0.075)	-0.059 (0.057)
Avg K Class Size	-0.357 (0.205)	-0.263 (0.285)	-0.430 (0.265)	0.600* (0.243)
Old For Age	-0.016 (0.041)	-0.144* (0.068)	-0.083 (0.057)	-0.092 (0.051)
(K Math Score) <sup>3</sup>	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
(K Math Score) <sup>2</sup>	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
K Math Score	-0.045 (0.088)	-0.089 (0.136)	0.054 (0.157)	0.043 (0.106)
Observations	1680	1680	1680	1680

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and non-cognitive outcomes. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 11**  
*Attrition Tests*

	(1) Reading	(2) Math
1st Grade Score	0.0039 (0.0062)	0.0063 (0.0066)
2nd Grade Score	-0.0061 (0.0072)	-0.0049 (0.0068)
3rd Grade Score	-0.0082 (0.0069)	0.0004 (0.0075)
4th Grade Score	-0.0091 (0.0069)	0.0029 (0.0072)
5th Grade Score	-0.0067 (0.0060)	-0.0033 (0.0067)
6th Grade Score	-0.0133* (0.0067)	-0.0054 (0.0072)
7th Grade Score	-0.0113 (0.0071)	-0.0030 (0.0067)
8th Grade Score	-0.0157** (0.0075)	-0.0107 (0.0076)
HS GPA	-0.0054 (0.0054)	-0.0025 (0.0073)
HS Grad	-0.0022 (0.0064)	0.0011 (0.0071)
Took SAT/ACT	0.0001 (0.0002)	0.000 (0.000)
ACT Score	-0.0129** (0.0056)	-0.0119* (0.0062)

Notes: Each column represents a different model studying the attrition rate at the time the outcomes was measured. The left column represents the result from a regression of whether a student is present at the time the outcome was measured focusing on reading rank. The same is done for the right hand model but for kindergarten math. The regression contains an indicator for being female, black, white, free/reduced lunch and whether the child is old for their age. Standard errors are in the parentheses.

**Table 12**  
*Kindergarten Rank on 1st and 3 Grade Absences*

	G1 Absences		G3 Absences	
	(1) Read	(2) Math	(3) Read	(4) Math
Kindergarten Classroom Rank (Reading)	-0.010 (0.095)		0.103 (0.120)	
Kindergarten Classroom Rank (Math)		0.139 (0.113)		0.089 (0.123)
White	3.741*** (0.942)	3.659*** (0.876)	4.470** (2.112)	4.409** (2.075)
Black	2.028* (1.120)	1.822* (1.053)	3.424 (2.134)	3.317 (2.099)
Female	0.435* (0.230)	0.430* (0.229)	0.246 (0.286)	0.205 (0.283)
Free Lunch/Low-Income	1.339*** (0.278)	1.284*** (0.272)	1.338*** (0.310)	1.325*** (0.310)
Avg K Class Size	-2.322*** (0.747)	-2.939*** (0.723)	-1.531 (1.021)	-1.274 (0.889)
Old For Age	0.141 (0.222)	0.152 (0.223)	0.667** (0.316)	0.643** (0.314)
Observations	4120	4163	2926	2952

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and how many times the student was absent at the designated time. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.

**Table 13**  
*Kindergarten Rank on Ability Tracking*

	1st Grade		2nd Grade		3rd Grade	
	(1) Read	(2) Math	(3) Read	(4) Math	(5) Read	(6) Math
Kindergarten Classroom Rank (Reading)	0.028** (0.011)		0.028*** (0.010)		0.033*** (0.009)	
Kindergarten Classroom Rank (Math)		0.021* (0.010)		0.024* (0.012)		0.027** (0.011)
White	-0.089 (0.123)	0.084 (0.070)	-0.305*** (0.074)	-0.018 (0.093)	-0.224*** (0.072)	0.010 (0.106)
Black	-0.057 (0.152)	0.142* (0.080)	-0.228*** (0.054)	-0.038 (0.073)	-0.126** (0.057)	-0.062 (0.097)
Female	-0.075** (0.028)	-0.044 (0.030)	-0.002 (0.027)	-0.040* (0.021)	-0.036 (0.029)	-0.026 (0.029)
Free Lunch/Low-Income	-0.015 (0.036)	0.010 (0.040)	-0.013 (0.033)	-0.010 (0.029)	-0.035 (0.024)	-0.046** (0.021)
Avg K Class Size	-0.021 (0.013)	-0.028* (0.015)	-0.041** (0.018)	-0.045** (0.018)	-0.035** (0.013)	-0.021 (0.014)
Old For Age	-0.030 (0.046)	-0.002 (0.041)	-0.038 (0.024)	-0.021 (0.025)	-0.019 (0.037)	-0.035 (0.035)
Observations	197	195	256	261	218	219

Notes: This tables represents results from four different regressions studying the relationship between classroom rank and outcomes mentioned in the column headers. The models here restrict data to all schools where there are no other types of classes for students to switch in to. They each regress kindergarten classroom rank, indicators for whether the student is Black or white, female, free/reduced lunch, average kindergarten class size and whether the child is old for their cage onto each non-cognitive outcome. It also includes three variables to capture how underlying ability maps onto each outcome. These include a third-degree polynomial in the child kindergarten score. Standard errors clustered at the school level are reported in the parentheses.