Strategic Staffing? How Performance Pressures Affect the Distribution of Teachers within Schools and Resulting Student Achievement

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Abstract
School performance pressures apply disproportionately to tested grades and subjects. Using longitudinal administrative data, including achievement data from "untested" grades, and teacher survey data from a large urban school district, we examine schools' responses to those pressures in assigning teachers to high-stakes and low-stakes classrooms. We find that teachers with higher performance measures in both tested and untested classrooms are more likely to be placed in a tested grade-subject combination in the following year. The relationship between prior performance and assignment is stronger in schools with low state accountability grades and where principals have more influence over assignments. In elementary schools, this strategic response has the consequence of disadvantaging achievement in early grades, concentrating less effective teachers in K–2 classrooms, which in turn produces lower math and reading test score gains for those students. Further evidence suggests this lower achievement persists into tested grades as well.

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Evidence abounds that schools respond strategically to the pressures of high-stakes accountability systems in both productive and unproductive ways. Researchers have documented a long list of unintended responses to these pressures, including gaming the composition of the population by suspending low achievers during the testing window or reclassifying them as learning-disabled (e.g., Figlio, 2006; Jacob, 2005), focusing school resources away from lower achievers towards those near proficiency cutoffs (Booher-Jennings, 2005), or cheating by altering students' responses to test items (Jacob & Levitt, 2003). More productively, accountability pressures push schools to increase instructional time, focus teacher attention on core subjects, provide supplemental educational services for struggling students, and expand time for teacher collaboration (see Dee, Jacob, & Schwartz, 2013; Hannaway & Hamilton, 2008; Jacob & Lefgren, 2004; Rouse, Hannaway, Goldhaber, & Figlio, 2007). Some recent evidence suggests that strategic behavior seeking to improve student test performance may also extend to how schools make decisions about their teacher workforce. For example, in interviews principals

report engaging in strategic hiring, assignment, development, and dismissal practices with the goal of improving their schools' average test performance (Cohen-Vogel 2011). Research documenting these behaviors systematically or linking them explicitly to accountability pressures, however, is scarce.

In this article, we focus specifically on one area of strategic staffing Cohen-Vogel (2011) identified: assignments of teachers to students and classes. While a long literature has examined the sorting of teachers across schools—and repeatedly documented the matching of better qualified teachers towards higher achieving students (e.g., [removed for peer review]; Clotfelter, Ladd, & Vigdor, 2006)—a small literature has begun to consider teacher assignment decisions within schools as well. For example, despite research demonstrating that beginning teachers are less effective (Nye et al., 2004; Rockoff, 2004), schools systematically assign less experienced teachers to lower performing students, though evidence also suggests that this tendency is less pronounced in high-growth schools ([removed for peer review]). Decisions about how schools deploy existing teacher resources likely impact student achievement levels and gaps among students, given that matching a student to an effective teacher is a primary means whereby a school can affect his or her outcomes (e.g., Aaronson, Barrow, & Sander, 2007). Assignment decisions are also likely more amenable to direct influence from school leaders than some other areas of personnel management, such as teacher hiring, which may rest more heavily on factors (e.g., the quality of the applicant pool) that are beyond school leader control.[1] Thus, by understanding and adjusting patterns of teacher assignment across classrooms, we may be able to improve outcomes for students and reduce gaps in access to high-quality teachers.

[1] Of course, if a school has only been able to hire ineffective teachers, for example, the scope for strategic assignment behavior will be limited as well, though we note that studies find within-school variation in teacher quality to be substantial (e.g., Clotfelter, Ladd, & Vigdor, 2006; Hanushek, Kain, O'Brien, & Rivkin, 2005), suggesting many school leaders have room to staff classrooms strategically.

Because accountability systems measure school performance using student achievement test scores from some grades and subjects but not others, accountability pressures are felt disproportionately in some classrooms. Under No Child Left Behind (NCLB), in most states—including in Florida, the context for the present study—elementary schools were evaluated on the basis of math and reading achievement performance in grades 3, 4, and 5, a requirement that continues under the Every Student Succeeds Act (ESSA). In Cohen-Vogel's (2011) interviews, principals reported reassigning teachers from these "high-stakes" classrooms if their students showed inadequate test score performance to "low-stakes" assignments in grades K–2. Such a strategic move may improve student performance in the tested grade (and thus *measured* school performance) in the short term, particularly if a more effective teacher is available to fill the reassigned teacher's position. Longer term effects on school performance are less clear. They could be positive if, for example, the move results in a better match of a teacher's skills to his or her students or the content, or they could be negative if that match is poor, or if the move is to an assignment that is low-stakes but that has important effects on later learning, as might be the case for an ineffective third-grade teacher moved to an untested position in first grade (Claessens, Duncan, & Engel, 2009; Fuller & Ladd, 2013). Evidence on the importance of early-grades learning for later life outcomes suggests that a system that pushes schools to concentrate ineffective teachers in the earliest grades could have serious unintended consequences (Chetty et al., 2011; Schweinhart et. al., 2005).

Using detailed administrative and survey data from Miami-Dade County Public Schools (M-DCPS), we begin by asking whether the test performance of a teacher's students is associated with the likelihood that a teacher remains in or is moved out of a tested grade or subject in a subsequent year, and how these patterns vary by school characteristics, such as accountability

grade. This analysis is a replication of analysis by Chingos and West (2011), who showed that Florida teachers with lower value-added scores were less likely to be reassigned to tested classrooms, and Fuller and Ladd (2013), who found similar results in North Carolina. We then significantly extend prior analyses in several important ways. First, we draw on data from a survey that we conducted with M-DCPS teachers to characterize class assignment policies in each school and test whether the relationship between teacher performance and where they are subsequently assigned varies by the participants that have higher perceived influence over assignments (e.g., the principal, parents). Second, we make use of a low-stakes test given in early grades in M-DCPS, the Stanford Achievement Test, Version 10 (SAT-10), to estimate value-added for early-grades teachers and test whether high performers are more likely to be moved into grades tested for accountability purposes, a pattern suggested by Fuller and Ladd's (2013) analysis of reassignment of K-2 teachers by measures of teacher qualifications (e.g., licensure exam scores). Finally, we assess whether a strategic school response to accountability pressure that moves low-performing teachers from high- to low-stakes classrooms is likely to have negative effects on student learning in grades in which the accountability pressures are weaker, focusing specifically on elementary schools. We estimate achievement gains on the SAT-10 for first and second graders taught by teachers reassigned from tested elementary grades, then further investigate whether there are indirect consequences for achievement when these students move into grades tested under the accountability regime.

The next section reviews what we know about strategic responses to accountability pressures, including the small body of research on strategic personnel assignments. We then detail our data and methods before turning to a presentation of the results. We conclude with a discussion of the implications of the study for school and district policy and for future research.

Strategic Responses to Accountability Pressures

Test-based accountability systems, such as those imposed by NCLB and ESSA, create incentives for schools to improve student outcomes and sanctions for schools that fail to do so. Prior research has documented the effects of accountability policy on the behaviors of teachers and school leaders. The types of strategies identified by these studies can be grouped into two categories: behaviors that increase average test scores without improving productivity and those that create changes in the ways that schools deliver education that generate meaningful improvements in student achievement.

There are several examples in the literature that describe educators' attempts to "game the system" as a means of increasing average student test scores. Jacob and Levitt (2003), for example, estimate that a minimum of 4–5 percent of elementary school teachers in Chicago Public Schools cheat on state tests by systematically altering students' responses to test items. The frequency of cheating increased when the incentives to do so increased (via grade retention policies tied to minimum test score cut-offs and threats to reconstitute low-performing schools). Figlio (2006) shows that schools differentially punish low-achieving students for misbehavior, particularly during testing periods, as a way of removing them from the testing pool. He compares incidents involving more than one student that was suspended. He finds that schools always tend to assign harsher punishments to low-performing students than to high-performing students but that this gap grows during the testing period of the school year. Moreover, these patterns are only evident in tested grades. There is also evidence that some schools respond to accountability pressure by differentially reclassifying low-achieving students as learning-disabled so as to exclude their scores from the formula that determines schools' accountability

ratings. Figlio and Getzler (2006), for example, use student fixed-effects models and find increases in reclassification rates for low-income and previously low-performing students to disabled after the introduction of Florida's testing regime. Such behaviors were concentrated among low-income schools on the margin of failing to meet the accountability standards.

Such practices may increase schools' average test scores—all important for high-stakes accountability systems—but have little impact on actual student learning. Other studies, however, suggest that schools also respond to accountability pressures in educationally meaningful ways. Rouse et al. (2007), for example, find that student achievement increases in response to accountability pressure and that changes to school policy explain at least some of these increases. In their study, increased accountability pressure was associated with increased focus on low-performing students, increasing the amount of the school day spent on instruction, increasing the resources available to teachers and decreasing the amount of control held by the principal. Dee, Jacob, and Schwartz (2013) similarly find that NCLB increased the allocation of instructional time to math and language arts, which may partially account for achievement gains associated with the law (Dee & Jacob, 2011). Cohen-Vogel's (2011) study shows that school leaders engage in a variety of personnel policies in hopes of increasing student achievement, which she terms "staffing to the test." In interviews, principals reported hiring, developing, and dismissing teachers in an effort to improve their schools' average test performance. For example, principals described selecting teacher candidates in part by looking at their past student outcomes data in hopes of ensuring that they are hiring more effective teachers.

Strategic Assignment of Personnel

Principals report using student test scores when making decisions to reassign teachers within their schools ([removed for peer review]; Cohen-Vogel, 2011). This strategic approach to human resource decisions is especially evident in lower performing schools, where some principals report moving effective teachers to tested grades (Cohen-Vogel, 2011). In keeping with the principals' reports, Chingos and West (2011) find that effective teachers are more likely to remain in grades and subjects where high stakes testing takes place and that this relationship is strongest in schools receiving lower ratings from the state's accountability system. Similarly, Fuller and Ladd (2013), in an examination of the distribution of elementary teacher credentials across grades in North Carolina, show that NCLB pushed schools to move more qualified early grades teachers to higher grades and less qualified upper elementary teachers to early grades.

The strategic allocation of staff described by these prior studies aligns with the large body of literature demonstrating that there is wide variability in teacher effectiveness and that teachers are one of the most important resources available to schools to improve student learning outcomes (Aaronson, Barrow, & Sander, 2007; Kane, Rockoff, & Staiger, 2008; Nye, Konstantopoulos, & Hedges, 2004; Rivkin, Hanushek, & Kain, 2005; Rockoff, 2004; Sanders & Rivers, 1996). Test-based accountability systems focus on student achievement in certain grades and subjects while placing less emphasis on others. School leaders, therefore, have clear incentives to keep their more effective teachers in tested grades and subjects while reassigning less effective teachers to positions that will not influence the school's accountability rating.

It is not clear, however, what effects on students or schools this type of strategic reallocation of low-performing teachers to low-stakes classrooms has over the long term, particularly if those low-stakes classrooms are in earlier grades that feed into later high-stakes classrooms. One on hand, the skills necessary to be successful in earlier grades may not be the

same as those required to teach older children effectively, and reassignment may positively impact a teacher's performance if it leads to a better match with that teacher's skills. In this case, student achievement will be positively affected. On the other hand, if an ineffective teacher in later grades is also ineffective in earlier grades, such reassignment may have negative longer-run consequences for both students and the school, particularly if student-learning trajectories are affected by the foundations laid in earlier grades. Certainly learning is a cumulative process, and student learning in early grades are strong predictors of achievement in later schooling (e.g., Claessens, Duncan, & Engel, 2009; Perry, Guidubaldi, & Kehle, 1979; Watts et al., 2014). As one principal in a high-growth school interviewed by Cohen-Vogel (2011) put it, "you can't say you want your higher achieving teachers in grades three, four, five. If you have high achieving teachers in K, one, and two, then you are going to be okay with three, four. . . . You need strong teachers everywhere" (494).[2] Relocating an ineffective teacher to a grade prior to the onset of high-stakes testing may allow for the placement of a more effective teacher in the tested grade, but gains from that replacement may be undercut in subsequent years if there are deleterious effects on student learning in the earlier grade associated with the ineffective teacher that cannot be fully remediated. Moreover, student learning in early grades may affect post-schooling outcomes as college attendance and earnings, even if gains made in early grades do not show up in differences in achievement scores in later grades (Chetty et al., 2011).

Data

Our analysis of strategic assignment uses data from administrative files on all staff, students and schools in the Miami-Dade County Public School (M-DCPS) district from the

[2] To this same point, another pointed out: "if you don't teach your children to read in first and second grade, you cannot make that up in third, fourth and fifth grade. . . . So, I have always hired my strongest teachers and put them in that first and second configuration" (Cohen-Vogel, 2011, 494).

2003-04 through the 2013-14 school years. We also use data from a web-based survey of 8,000 M-DCPS teachers we conducted in 2011.[3] M-DCPS is the largest public school district in Florida and the fourth largest in the United States, trailing only the school districts in New York City, Los Angeles, and Chicago. In 2010, M-DCPS enrolled 347,000 students, more than 225,000 of whom were Hispanic. Nearly 90 percent of students in the district are either black or Hispanic, and 60 percent qualify for free or reduced priced lunches.

Administrative data come from three different files provided by the district: test score and basic demographic information for all students in the district, course-level data that link students to each of their teachers in each year, and a staff-level file with information on all district employees. The student-level files include student race, gender, free/reduced price lunch eligibility, number of times the student was absent that year, and the number of days the student missed school due to suspensions that year. The test score data include FCAT math and reading scores. The FCAT is given in math and reading to students in grades 3–10. We also obtained spring SAT-10 scores for students in grades kindergarten, 1, and 2. The second grade SAT-10 scores are available from spring 2004 to 2014, but M-DCPS began administering the test to kindergartners and first graders later; first grade scores are available from 2009 to 2014, and kindergarten scores from 2011 to 2014. The staff database includes demographic measures, prior experience in the district, current position, and highest degree earned for all district staff from the 2003-04 through the 2013-14 school years.

In our 2011 survey, we asked teachers which actors were involved in the assignment of students to their classroom that year (i.e., 2010-11). We provided the teachers with a list of possible actors, including themselves, other teachers in their grade, the principal, and parents, and the respondents indicated involvement with a binary response of *yes* or *no*. Next, we

[3] The response rate for this survey was 38%.

presented teachers with the same set of actors and asked how much influence each one had over the assignment of students to their classroom that year. We recorded responses were on a scale of 1 (*not involved/no influence*) to 5 (*a lot of influence*). Note that not all survey respondents were asked each of these assignment factor items; to reduce respondent burden, teachers were presented with a random set of influence items (within a broader module on class assignments). Although we still have approximately 3,000 responses to each of these items, the individual teachers differ. Partly for this reason, in our analyses we aggregate teachers' responses to the school level.[4]

We combine the survey data with the administrative data to create a teacher-level file with teachers' survey responses, demographic information from administrative data, and characteristics of the students in teachers' courses generated by matching teachers to student course-level data. We determine whether teachers teach tested grades and subjects by matching students to each of their teachers via course-level data. We code a teacher as teaching in a tested grade or subject if more than 50 percent of his or her students in a given year are in grades 3–10 and are enrolled in math or English/reading courses with that teacher. Note that in our data elementary school students also have course-level data but their teacher is generally the same across most subjects. Florida schools test students in grades 3 through 10. In K–5 elementary schools, therefore, kindergarten, first, and second grades are untested grades while third, fourth and fifth grades are tested grades. For middle and high schools, we consider math and English/reading in grades 6 through 10 to be tested grades/subjects. We code a teacher as

[4] Teachers' perceptions of who influenced teacher-student assignments show greater within- than between-school variation for every item. The reliabilities of the school-level means of these items varies from a low of 0.27 (parents) to 0.88 (counselors), though all but two (parents and myself) are above 0.5, and four (teachers in the grade below, assistant principals, principals, and counselors) are above 0.7. We also collected data on what factors teachers perceived to be important in class assignments as part of the randomized survey module, but discovered that school mean reliabilities for these items were low to support their use in the empirical models.

teaching in a tested classroom if at least half of the students they teach are in a tested grade or grade/subject combination.

Table 1 provides the mean and standard deviations of the main variables used in our analyses. The first three columns show descriptive statistics for teachers in the administrative data and the final three columns show descriptive statistics for teachers that responded to our survey. The characteristics of our survey sample looks remarkably similar to the characteristics of the district as a whole. Survey respondents are similar to the district population of teachers in terms of race/ethnicity, gender, highest degree earned, total years of experience, and whether they teach in a tested grade or subject. Teachers average about 11 years of experience in the district; they are predominately female (80 percent); roughly 45 percent are Hispanic; 25 percent are black; and nearly 40 percent have a master's degree or higher. The average teachers' class is 28 percent black, 9 percent white and includes approximately 70 percent of students receiving free/reduced priced lunches.

Table 1 also shows basic descriptive statistics for teacher reports of stakeholder involvement in class assignments in the survey. Sixteen percent of survey respondents report that they themselves participate in the class assignment process at their school. Teachers report more involvement from principals, assistant principals and counselors, with 51, 64, and 38 percent, respectively, reporting involvement from these three types of personnel. Seven percent of teachers also report that students and parents play some role in determining class assignments.

Methods

Our analysis comprises multiple components. First, we examine whether principals engage in strategic staffing when making teacher assignments to high-stakes classrooms. We do

so by estimating the relationship between teacher effectiveness and assignments to tested grades and subjects. We test whether teachers in tested areas are more likely to be moved into a non-tested area following a year that their students perform poorly on state tests. For teachers who teach in a tested area in year *t* we predict whether they remain in a tested area in year *t+1* as a function of a measure of their performance and control variables:

$$\Pr(tested\ classroom\ at\ t+1)_{it} = \beta_0 + PERFORMANCE_{it}\beta_1 + T_{it}\beta_2 + \delta_{st} + \varepsilon_{ist} \qquad (1)$$

Equation (1), which we estimate as a linear probability model, models the probability of remaining in a high-stakes classroom next year as a function of teacher performance, teacher-level characteristics *T* (gender, race, highest degree, years in current school), and a school-by-year fixed effect that isolates the association between assignment and performance to be within school and year combinations, i.e., makes comparisons among teachers at the same school at the same time. These models are run at the teacher level, with standard errors clustered at the teacher level as well.

We use three measures of teacher performance: (a) the average math and reading test scores of students in a teacher's class(es) in year *t* ; (b) the proportion of students in a teacher's class(es) scoring proficient or higher in math and reading; and (c) teacher's value-added to math and reading achievement in year *t*.[5] Each are entered separately. Correlations among the measures are shown in Appendix Table 1. The first two sets of measures capture whether principals consider the distribution of achievement of teachers' students when determining class assignments, while the third measure captures whether principals consider (adjusted) achievement gains, which likely is a better proxy for teacher effects. Both average test

[5] Teacher value-added is computed by predicting student math test scores in the current year as a function of math and reading scores in the prior year, student, school and class-level control variables, grade and year indicators and a teacher-by-year fixed effect. The teacher-by-year fixed effect, which we shrink to account for measurement error using the empirical Bayes method, is our measure of value-added.

performance and test score gains are considered in Florida's accountability formula, so principals have incentives to consider both kinds of metrics in teacher placement decisions. Importantly, however, we do not argue that principals necessarily use these *particular* measures when making class assignment decisions because the measures likely are returned to schools after such decisions are made ([removed for peer review]). Instead, we anticipate that principals make use of a range of other information that correlates with these measures, such as benchmark assessment results or their own classroom observations, in their decision processes.

In the second stage of our analysis, we assess whether the association between student test performance and the probability that a teacher remains in a tested area varies across schools with different characteristics. This analysis of heterogeneous responses is motivated by the likelihood that school differ in both the strength of their incentives to improve test scores and their capacity to respond to the incentives they face. In most cases, this analysis simply includes appropriate interaction terms in the estimation of Equation 1, though in the case of one characteristic, school level, we re-estimate Equation 1 separately for elementary, middle, and high schools, given differences in the accountability context at each school level. For example, in middle schools, all grades are tested, so in general the only way a middle school teacher can be switched out of a tested area is if they change subjects or switch schools. In high schools, higher grades with more advanced course content are generally preferred by teachers (Neild & Farley-Ripple, 2008), so principals may feel pressured to assign their best or more experienced teachers to those (untested) grades.

We then test interactions between teacher performance and school accountability grades, which are assigned on a five-point scale of A (5) to F (1).[6] Here, we expect that schools facing

[6] School grades are determined by a formula used by the district that weighs the percentage of students meeting high standards across various subjects tested, the percentage of students making learning gains, whether adequate

more accountability pressure—presumably, those with low grades—feel more compelled to engage in strategic staffing as a means of improving their school's performance (Chingos & West, 2011). In a third analysis, we test for an interaction with school value-added.[7] School value-added captures the average adjusted achievement gains associated with a school in a year. We hypothesize that schools with low value-added may have less organizational capacity, including capacity to behave strategically. Thus, we expect that school value-added will be a positive moderator between teacher performance and the probability of future assignment to a tested classroom.

We next include interactions of the teachers' student achievement level and value-added with teacher reports of who influences their class assignments. We use school-average ratings of the amount of influence of the following personnel over assignments (on a scale of 1 to 5): the teacher themselves, other teachers in their grade, teachers in the grade below, other teachers, principals, assistant principals, counselors, parents, and students. In particular, if principals' strategic considerations are driving associations between teacher performance and future assignments to tested grades—as opposed to, for example, a desire of low-performing teachers to avoid high-stakes classrooms—we expect a significant positive interaction with principal influence. Although we collected these measures in 2011, when collapsing them to the school-level and combining them with administrative data from other years, we treat them as a time-invariant feature of schools.

We also test whether student learning gains in early grades are affected when students are taught by a (presumably less effective) teacher reassigned from a high-stakes grade. For this

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progress is made among the lowest 25 percent of students, and the percentage of eligible students who are tested. For more information, see: http://schoolgrades.fldoe.org/pdf/0708/2008SchoolGradesTAP.pdf

[7] School value-added is estimated from student FCAT scores using a model comparable to the one used to estimate teacher value-added, only replacing the teacher-by-year fixed effect with a school-by-year fixed effect.

analysis, we estimate student growth models, separately for math and reading, using student scores on the SAT-10 in those subjects in grades 1 and 2. These models take the form:

$$A_{it} = \beta_0 + A_{it-1}\beta_1 + High\_to\_Low\_Reassigned_{it}\beta_2 + Low\_to\_Low\_Reassigned_{it}\beta_3 + First\_Year\_Teacher_{it}\beta_4 + X_{it}\beta_5 + C_{ct}\beta_6 + \delta_{sgt} + \varepsilon_{icgt} \quad (2)$$

In this model, student *i*'s achievement at time *t* is a function of his or her prior-year achievement A_{t-1} (i.e., in grades K or 1), a vector of student characteristics *X* (student race, gender, free lunch eligibility, and limited English proficiency status), and the aggregate of those variables to the classroom level (*C*), plus a school-by-grade-by-year fixed effect δ. The variable of interest in Equation 2, *High_to_Low_Reassigned*, is set equal to 1 if the student's teacher at time *t* was reassigned from grade 3, 4, or 5 (i.e., a high-stakes classroom) to grades 1 or 2 at the end of the prior year. Since all teachers that are new to a grade might exhibit lower student performance, we also include *Low_to_Low_Reassigned*, which is set equal to 1 if the student's teacher at time *t* was teaching a different K–2 grade in the prior year, and *First_Year_Teacher*, which is set to 1 if the teacher is in their first year in teaching. If teachers reassigned from high- to low-stakes classrooms are associated with lower average learning gains, the coefficient β_2 will be negative, and potentially larger in magnitude (i.e., more negative) than β_3 and β_4. We cluster standard errors at the teacher level.

Finally, we test whether students taught by a reassigned teacher in grade 2 have lower achievement in grades 3 and 4. If reassigned teachers are less effective, then students with reassigned teachers may learn less in second grade which may contribute to lower achievement in later grades. For this analysis, we predict student achievement on the FCAT in third and fourth grade, separately for math and reading. The following equation describes the model:

$$A_{ik} = \beta_0 + SAT10_{i1}\beta_1 + High\_to\_Low\_Reassigned_{i2}\beta_2 + Low\_to\_Low\_Reassigned_{i2}\beta_3 + First\_Year\_Teacher_{i2}\beta_4 + X_{it}\beta_5 + C_{ct}\beta_6 + \delta_{sgt} + \varepsilon_{icgt} \quad (3)$$

Similar to equation 2, in this model, student *i*'s achievement in grade k = 3 or 4 is a function of his or her SAT-10 test score in grade 1, a vector of student characteristics *X* (student race, gender, free lunch eligibility, and limited English proficiency status), and the aggregate of those variables to the classroom level (*C*), plus a school-by-grade-by-year fixed effect. The variable of interest in Equation 2, *High_to_Low_Reassigned*, is set equal to 1 if the student's teacher at in grade 2 was reassigned from grade 3, 4, or 5 (i.e., a high-stakes classroom) at the end of the year before the student was in their class. Again, since all teachers that are new to a grade might exhibit lower student performance, we also include *Low_to_Low Reassigned*, which is set equal to 1 if the student's teacher in second grade was teaching grade K or 1 in the year before the student was in their class. Finally, *First_Year*_Teacher is set to 1 if the student's second grade teacher was in their first year when the student was in their class. If having a reassigned teacher in second grade has negative effects on third grade achievement, the coefficient β_2 will be negative and potentially larger in magnitude than β_3 and β_4. For these analyses, standard errors are clustered at the second grade teacher level.

Results

Teacher Effectiveness and Assignment to Tested Students

We first examine the relationship between the test performance of a teacher's students and whether he or she remains in a tested area in a subsequent year. Approximately 70% of "tested" teachers in our sample remain in a tested grade/subject in the same school in the following year. Thirteen percent move within the same school to an untested classroom, while

7% move to a different school (5% to a tested classroom, 2% to an untested one). The remaining 10% exit the sample. We drop exiters from our analytic sample.

For teachers in a tested grade/subject in year *t,* we predict the probability that they stay in a tested grade/subject in *t+1* in three samples: all tested teachers, all tested teachers who remained in the same school, and all tested teachers who changed schools. Comparing estimates for the second and third samples provides suggestive evidence about whether teacher performance is as important in determining assignments to tested/non-tested areas for teachers that switch schools as those who do not.

Table 2 describes the results of these models.[8] The first row in each panel shows average effects across all school levels. Coefficients on covariates are omitted for brevity but shown in Appendix Table 2.

Across different teacher performance measures, the first model in each group shows a strong positive relationship between teacher performance and the probability that a teacher remains in a tested area. For example, model 1 in Panel A shows that a one standard deviation increase in students' math test scores predicts an 8 percent increase in the probability that a teacher remains in a tested area in the following year. For reading (model 4), the corresponding probability is 7 percent. Results are consistent when using the proportion of their students scoring proficient (Panel B) and teachers' value-added (Panel C) instead of class average achievement.[9] These results suggest that principals or others may consider both status measures

[8] All models employ complete-case analysis. Item-level missingness in the M-DCPS administrative data files is minimal, so given large sample sizes, we do not impute data. Sample sizes do vary substantially across models according to which teacher performance measure is used because value-added can only be estimated for a fraction of teachers. A version of Table 2 that limits all estimation samples to the subsample of teachers with value-added scores yielded very similar results.

[9] Because the scales for mean achievement, value-added, and proficiency are not the same, a direct comparison of the relative magnitudes of the results for the different performance metrics is difficult. The high correlation between mean achievement and proficiency rate (0.9 for math and 0.8 for reading) suggests that, if rescaled, the results likely would be quite similar.

(average test scores or proficiency rates of a teacher's students) and adjusted growth measures (teacher's value-added) when moving teachers across grades within schools. The value-added result holds despite the fact that the district only began providing value-added estimates to principals as part of teacher evaluations in the last two years of the data stream, suggesting that principals make use of other information about teachers' impacts on students, such as informal classroom observations, rather than on formal value-added estimates when making placement decisions.[10]

Interestingly, while coefficients are systematically larger in the samples of teachers who remain their schools, the positive relationship between the performance measures and remaining in a tested grade generally holds up even among teachers who switch schools (value-added is the exception, though these models have much smaller samples). This result lines up with those from prior (qualitative) studies that find that many principals use information on the test performance of teachers' students when making hiring decisions and when assigning transferring teachers ([removed for peer review]; Cohen-Vogel, 2011).[11]

We also ran models relaxing the assumption of linearity in the association between the performance measures and the probability of remaining in a tested classroom. In particular, if a teacher in a tested classroom is performing at a very high level and thus is more likely to performing significantly above his or her peers, we would it expect it to be less likely that further increases in test scores or value-added would impact the probability of transitioning to a low-stakes classroom. Appendix Table 4 shows the result of including a squared term in the main

[10] The value-added results are largely unchanged if we limit the sample to years prior to the 2011 change to teacher evaluation policies that formalized the use of value-added scores for summative evaluation purposes.
[11] The estimates in Table 2 are from linear probability models (LPMs). We also ran a version of Table 2 using logistic regression, shown as Appendix Table 3. Substantively, the two versions yield very similar results. We opted to report LPMs in the main text because they more easily accommodate fixed effects and are more straightforward to interpret in the context of interactions in subsequent tables.

models in Table 2. Consistent with expectations, across models this term is negative, suggesting that the probability of staying in a tested grade increases as student performance increases but does so at a declining rate.

Heterogeneity by School Characteristics

The secondary panels of Table 2 re-estimate Equation 1 separately by school level. In general, the coefficients are similar across school levels, though somewhat smaller in magnitude, on average, in middle and high schools than in elementary schools. Smaller coefficients for middle schools make sense because middle school teachers cannot be moved away from tested classrooms without switching subjects, which we discuss further below. While we do not know why the results are less strong for high school, it is possible that in high schools teacher effectiveness data is less central in assignments decisions or that effective teachers' preferences for teaching 11^{th} and 12^{th} grade students are stronger than the desire on principals' part to keep experienced and/or effective teachers in tested grades (9^{th} and 10^{th} grade). In addition, high school students take some end-of-course exams, which, while not important for NCLB-driven accountability, may factor into teacher assignment decisions. Still, patterns indicate that high-performing teachers, regardless of how performance is measured, tend to be reassigned to tested classrooms in all three school levels.

In Table 3, we examine whether the relationship between student performance and staying in a tested area varies by school accountability grade and school value-added. School grades of A and F are entered as indicators (with grades of B, C, and D omitted) to test for possible nonlinearities. We show results for all teachers and for those who remained in the same school at time *t+1*; we have little reason to expect accountability grade or school value-added of

the "sending" school to moderate the performance-assignment relationship for school-switchers, so we omit that subsample.[12]

Results from Panel A provide evidence in support of the hypothesis that schools with lower grades might feel greater external accountability pressure that leads them to keep high-performing teachers in tested classrooms. Although among all teachers there is no evidence of an interaction for either subject (models 1 and 3), when the sample is limited to teachers who do not switch schools, we see that the association between student achievement and the probability of remaining in a tested classroom is higher in F schools than other schools in both math and reading (models 2 and 4). Results from model 2 indicate that a 1 standard deviation increase in the mean math achievement of a teacher's students would be associated with an 11 percent increase in the probability of returning to a tested classroom the next year among teachers staying in a school with a grade of B, C, or D, compared to a 10 percent increase in an A school and a 17 percent increase in an F school. Accountability grade results for proficiency in Panel B are similar to those in Panel A and suggest that each 10 percent of students who achieve proficiency in either math or reading is associated with an additional increase of about 2 percent in that teacher's probability of remaining in a tested grade in an F school beyond what is expected in other schools.

Panel C, in which the performance measure is teacher value-added, also shows evidence of differential activity in F schools, at least in math (model 18). Here, a 1 s.d. increase in teacher value-added is associated with a 12 percent increase in the probability of teaching in a tested classroom next year in an F school, compared to just 6 percent in schools with higher grades.

[12] Preliminary estimates from the school-switcher subsample indeed showed no consistent evidence that school accountability or school value-added moderated this association.

Turning instead to school value-added as a moderator, Panel A shows that teachers whose students have higher achievement (in math and reading) are even more likely to remain in a tested classroom in schools with higher value-added, particularly when they remain in the same school (models 5 through 8). In a school with average value-added, a 1 s.d. increase in student math performance is associated with an 8 percent increase in the probability of teaching in a tested classroom the following year, compared to 9.5 percent in schools whose value-added is 1 s.d. above the mean. Proficiency results (Panel B) are again very consistent with mean achievement results.

When the performance measure is teacher value-added (Panel C), we again find that higher school value-added moderates the association between performance and returning to a tested classroom among school-stayers in reading but not math. The reading result may indicate that higher value-added schools have greater capacity for strategic personnel action.

As shown in Table 4, we also find that the strength of the relationship between teacher performance and remaining in a tested area varies across teachers' reports of who influences teacher-student assignments.[13] In particular, the relationship consistently is magnified in schools where teachers say principals exercise more influence; in fact, principal influence is the only positive, statistically significant moderator in all six models. In some cases, it is also magnified where teachers report that other teachers—particularly those in the same grade—influence assignments. In contrast, the association between performance and likelihood of remaining in a tested classroom is attenuated in schools where other stakeholders, especially students and

[13] We also investigated how teacher reports of influence correlated with school performance measures. In general, status measures (e.g., average performance) are only weak predictors of teacher reports, with no correlation above 0.2, though the patterns generally suggest greater involvement of parents and teachers as achievement increases and little evidence of an association with other stakeholders. Correlations with school value-added are higher. For example, for math value-added, higher gains are associated with greater involvement by principals (r = 0.33) and other teachers (r ranges from 0.26 to 0.35) and less involvement by counselors (-0.47), parents (-0.18), and students (-0.48). Results for reading are similar.

counselors, have more influence. The finding that principal influence moderates this association is consistent with the expectation that strategic behavior on behalf of school administrators, perhaps resulting from external accountability pressures, to improve measured school performance contributes to the propensity of high-performing teachers to stay in tested classrooms.

Reassignments of Teachers that Switch

Our next set of analyses builds on the models in Table 2 and shows descriptively how value-added for teachers in tested classrooms at time *t* varies by what grade and subject they teach at time *t+1*. Samples are restricted to teachers who stay in the same school from time *t* to *t+1*.

Table 5 shows the results. For elementary school teachers, we show mean math and reading value-added estimates for tested teachers (i.e., those in grades 3–5) who move the next year to kindergarten, first grade, second grade, or another tested grade (i.e., moves from fourth to fifth grade), compared to those who stay in the same grade. The asterisks indicate the results of simple two-sided *t*-tests of the hypothesis that the value-added of a given group is the same as that of teachers who do not switch grades. Note that the largest group of teachers who switch to an untested grade move to second grade (63%), followed by first grade (22%) and kindergarten (13%).[14]

For both reading and math, we find that teachers in tested classrooms who subsequently switch to early grades have substantially lower value-added than those who remain in the same grade. Estimates of the difference range in math from 0.43 s.d. (second grade) to 0.50 s.d. (first

[14] Very few teachers move to pre-kindergarten or to another kind of untested classroom, so we do not show those cells in the table.

grade) and in reading from 0.32 s.d. (first grade) to 0.45 s.d. (kindergarten). Teachers who switch among grades 3–5 also have lower value-added than those who remain in the same grade, but the differences in both subjects (0.06 to 0.14 s.d.) are much smaller than for those who switch to K–2; for reading, in fact, the difference is not statistically distinguishable from zero.

In middle schools, every grade is a tested grade, so teachers remaining within the same school can only be moved out of a tested classroom by moving to an assignment teaching an untested subject, such as social studies. Comparing mean value-added of this small group of teachers (N = 123) to those who stay in a tested subject in the same grade, we again find large differences, ranging from 0.34 s.d. in reading to 0.45 s.d. in math. Teachers who continue to teach middle school math or reading but who switch grades also have lower value-added than non-movers, but as with elementary schools, the differences are much smaller.

In high schools, tested teachers are primarily those who teach ninth and tenth graders. We examine teachers of math and reading courses in grades 9 and 10 at time *t* who at time *t+1*: (1) stayed in the same subject but moved to teaching grades 11 and 12, which have few tested students; (2) moved to grades 11–12 and switched subjects; (3) stayed in the same grade, but switched to an untested modal subject; (4) continued to teach a tested subject but switched from primarily teaching 9^{th} graders to primarily teaching 10^{th} graders (or vice versa); or (5) stayed in a tested subject in the same grade (the comparison group). The vast majority (94%) of high school teachers that leave a tested grade/subject switch from teaching 9^{th} or 10^{th} grade students to teaching 11^{th} and 12^{th} grade students but remain in the same subject, which is unsurprising given subject certification requirements for high school teachers. We again find that teachers who switch to untested subjects, particularly those who stay in grades 9–10, have lower value-added. The estimate of the difference is similar in math and reading (approximately 0.47 s.d.), though

given the small sample of teachers who fall into this group, the reading difference is not statistically significant and the math difference is only significant at the 0.10 level. Teachers who switch to grades 11 and 12 have similar value-added in math but somewhat lower value-added in reading; a similar pattern holds for those who stay in tested subjects but switch from one tested grade to the other.

Given the particularly stark patterns in teacher movement in elementary schools, we further investigate the within-school sorting of teachers between and among high- and low-stakes K-5 classrooms by teacher performance measures. We first use SAT-10 data to calculate the average math achievement of early grades teachers and to estimate math value-added for those teachers using the same modeling approach as for the high-stakes standardized tests (i.e., FCAT) in prior analyses. Next, we standardize average math achievement and value-added for early grades teachers and pool teachers in early grades and those in grades 3–5. Using linear probability models, we predict where teachers work at time $t+1$ as a function of their performance at time t (based on SAT-10 or FCAT), classifying teachers as working (a) in the same grade, (b) in a different grade but still within the same early or upper primary set (e.g., a teacher who moves from second grade to first grade), or (c) in a different grade and *not* in the same early or upper primary set (e.g., a teacher who moves from second grade to third grade). We then run three different models for math and for reading, results of which are presented in Table 6. The focal variables in each model are average achievement (Panel A) or value-added (Panel B), an indicator for whether the teacher teaches in an early-grades (K–2) classroom, and the interaction between the two.

The results are generally consistent for mean achievement and value-added. Given close similarities between math and reading, we focus on the math results. The first column predicts

the probability of teaching in the same grade next year. On average, model 1 suggests that mean achievement is strongly related to the probability of teaching the same grade next year and K–2 teachers are somewhat less likely to remain in the same grade; the interaction term is not significant. The pattern is similar for value-added (model 7 in Panel B), except that high-performing K–2 teachers are considerably *less* likely than high-performing 3–5 teachers to remain in the same grade next year. The second column makes the binary comparison between teachers who teach a different grade next year but still within the lower primary or upper primary set to teachers who either remain in the same grade or switch to the opposite grade set. Here, the average math achievement and math value-added model tell the same story, which is that high-performing K–2 teachers are less likely to move to other low-stakes grades (models 2 and 8). The final column compares teachers who switch to the *other* primary grade set (i.e., switch from K–2 to 3–5 or vice versa) to those teachers who remain in the same set, either in the same grade or in a different grade. Again, the results for average math achievement and math value-added are consistent, demonstrating that teachers in high-performing K–2 classrooms are more likely to be moved to the high-stakes, upper primary grades.

A graphical illustration of the math value-added results is provided in Figure 1. For both K–2 and 3–5 teachers, the probability of staying in the same grade increases and the probability of moving to another grade within the same high- or low-stakes set decreases as teacher value-added increases. But the third panel shows the important difference between K–2 and 3–5 teachers. High value-added teachers in grades 3–5 are *less* likely to switch to grades K–2. In contrast, high-value-added K–2 teachers are *more* likely to switch to tested classrooms. All else held equal, a teacher K–2 teacher with math value-added 1 s.d. below the mean has a probability of moving to grades 3–5 of about 16%, compared to 18% for a teacher 1 s.d. above the mean;

comparable values for upper grades teachers are 13% and 5%. Alongside our earlier results, these findings are consistent with a general tendency of schools to reallocate effective teachers from across classrooms into the high-stakes (later) grades, concentrating relatively less effective teachers in classrooms with the schools' youngest students.

Unintended Consequences of Strategic Staffing

Our final analysis considers the potential impact of shifting low-performing teachers to untested grades. We focus on elementary schools, where we have test score data from a low-stakes assessment that allow us to track student performance in the classrooms of tested teachers reassigned to lower grades.

Table 7 shows the result of estimating Equation 2 for SAT-10 math and reading, pooling first and second grade students. The primary variable of interest is whether the student's teacher switched from an upper elementary (tested) grade. Panel A focuses on a switch from last year to the current year. The coefficients show that, in both subjects, being taught by a teacher recently reassigned from a high-stakes grade is associated with learning gains that are .06 to .07 s.d. lower than those attained by students in classrooms with teachers that were not reassigned. For comparison, we also included indicators for having a teacher who switched from another K–2 grade and for having a first-year teacher. In both subjects point estimates suggest that the effects of having a switcher from grades 3–5 is slightly more negative than having a switcher from another early grade, and in reading, the effects are also more negative than having a first-year teacher.[15]

[15] Tests of equality among these coefficients could not reject the null hypotheses that each of the other coefficients is the same as the one for switching from grades 3–5.

An alternative interpretation of the results in Panel A is that the negative impact of having a teacher who switched from grades 3–5 is that it is transitory and simply reflects a dip in teacher performance associated with teaching a new subject. To investigate further, Panel B shows the results of adding indicators for switching from grades 3–5 two years ago, switching from another K–2 grade two years ago, and being a second-year teacher. If the performance dip is transitory rather than reflective of lower quality of grade switchers, we might expect to see a negative coefficient for teachers who switched last year but not those who switched two years ago and thus have had an additional year of experience in the new classroom. Results suggest some reduction of the negative association in the second year—though we cannot reject the hypothesis that the coefficients are the same—but still substantially lower achievement in those classrooms than in classrooms whose teachers taught in the same grade.

Panel C provides another look at this issue. These models are similar to those in Panel A, only with an additional covariate indicating whether the teacher *ever* taught grades 3–5 in the past. The omitted group is thus K–2 teachers who did not switch grades last year and have always taught in K–2 classrooms. Coefficients demonstrate that teachers who have ever been reassigned from grades 3–5 see substantially lower achievement growth, on average, than those who have not (approximately -0.07 s.d. in math and -0.05 s.d. in reading), beyond the even lower effects they have in the first year following the switch.

Having established that having a teacher who switched from the upper primary grades is associated with lower student achievement in the lower primary grades, in our final analysis, we consider whether the apparently negative effect of being taught by a reassigned teacher in second grade is associated with lower FCAT achievement as of the end of the next two years, third grade and fourth grade, which are the first grades "counted" for accountability purposes. The results

are shown in Table 8. Panel A shows third grade achievement results, first for math, then for reading. Columns 1 and 4 show results without a control for first grade SAT-10 score. Columns 2 and 5 also omit this control but limit the models to the sample with first grade scores, which is only about one-third as large as the full sample because the first grade test has only been administered since 2009. Columns 3 and 6 show our preferred models, which include first grade scores in the models as a baseline achievement measure prior to second grade.

In all six columns, there is consistent evidence of a negative effect of having a second grade teacher who switched from grades 3–5 in the prior year, and it is of similar magnitude in math and reading. In the models that control for first grade scores, being taught by a reassigned second grade teacher is associated with third grade scores that are approximately 0.03 s.d. lower than for students whose teacher had taught second grade in the year prior to teaching the student (both coefficients significant at the 0.01 level). Generally, this coefficient is much more negative than the indicator for whether the student's second grade teacher had switched from another K-2 (i.e., low-stakes) grade the prior year (in columns 3 and 6, equality of these coefficients can be rejected at the 0.10 level), suggesting that the negative effects of having a teacher reassigned from a high-stakes grade is not simply an artifact of a performance dip from any grade switch. Instead, coefficients suggest that this effect is similar to the effect of having a first-year teacher in second grade; equality of these two coefficients cannot be rejected in any model.

Panel B turns to fourth grade achievement. With one fewer cohort of data, sample sizes are smaller. Across all six columns, coefficients are consistent with lower fourth grade achievement among students with reassigned (from 3–5) second grade teachers, though standard errors are large. Preferred results in columns 9 and 12, which include controls for first grade SAT-10 scores, suggest that having such a reassigned teacher is associated with fourth grade

scores that are about 0.02 s.d. lower in math (p = 0.12) and reading (p = 0.15), though these coefficients miss conventional cutoffs for statistical significance. These coefficients are smaller than those shown for third grade in Panel A, which is not surprising given research on the decay of teacher effects in future years (Jacob, Lefgren, & Sims, 2010; Rothstein, 2010). Still, overall the results in Table 8 suggest that reassignment of low-performing teachers to early grades may have longer term consequences for student learning trajectories.

Discussion and Conclusions

Consistent with prior studies (Chingos & West, 2011; Fuller & Ladd, 2013), our analysis of strategic staffing in tested and non-tested classrooms in a large urban school district finds that teacher effectiveness, as proxied by different measures of student test score performance, in one year is a strong predictor of whether a teacher continues to teach tested students in a subsequent year. More specifically, higher achievement levels and proficiency rates of a teacher's students make it more likely that a teacher returns to a tested classroom, as do higher value-added estimates. Although we cannot say for sure the degree to which these patterns are driven by principal strategy versus low-performing teachers seeking to avoid high-stakes classrooms, the observation that these patterns are particularly apparent in schools with low accountability ratings (where leaders presumably face greater pressure to improve test scores) and where principals have more influence are consistent with the view that principals' strategic decisions play an important role.

We also find that schools with high test score growth generally staff more strategically by this measure as well, which may indicate that concentrating effective teachers in tested classrooms may pay off if the goal is to show higher gains on standardized tests that count for

external judgments of school performance. This result may also reflect greater organizational capacity for strategic response, including greater awareness of teacher performance or the larger supply of higher performing teachers available in these schools to take the place of lower performers who are reassigned ([removed for peer review]). Also, the association between performance and assignment is strongest among school stayers in which principals (and others) are likely to have better performance information, though past performance often is predictive of subsequent assignment to a high-stakes classroom even among teachers that switch schools, suggesting that principals accepting teacher transfers utilize performance information in strategic placement decisions as well.

Importantly, however, gains from the strategic assignment of high-performing teachers to high-stakes grades have limits. Using data on student scores on the SAT-10, a low-stakes assessment administered in early grades, we show that reassignment of low-performing elementary teachers to early grades results in reduced student achievement gains in those classrooms in both math and reading as measured by a low-stakes assessment. This result is concerning from the perspectives of both schools and families if achievement in early grades provides a foundation for later learning. In responding to the acute pressures of the accountability system, schools may be disadvantaging students taught by these less effective reassigned teachers over the longer term, opening up the possibility that, by providing incentives to increase student learning by increasing teacher effectiveness in later grades, current test-based accountability systems may also be perversely incenting reduced investment in students' earliest schooling years when returns on that investment are greatest (Heckman, 2006; Hill et al., 2008).

Consistent with the idea that a student's achievement is influenced by the quality of his or her past teachers, we find evidence that lower performance in second grade among reassigned

teachers translates into lower-than-expected student achievement at the end of third grade and potentially in fourth grade as well, though data limitations prevent us from making strong claims about fourth grade outcomes. Being taught by a teacher moved from the upper elementary grades in second grade is roughly equivalent to being taught by a first-year teacher in terms of impacts on math and reading scores at the end of third grade. These results should give pause to school leaders aiming to boost school performance in the eyes of the accountability regime by focusing only on teacher effectiveness in high-stakes classrooms.

Follow-up research with additional years of K–2 achievement data linked to a longer panel of student achievement scores in tested grades may allow for a fuller investigation of the effects of reassignment of low-performing teachers to lower grades on student performance later in school. Studies of the persistence of teacher effects suggest that effects of this kind of systematic reassignment on later outcomes may be substantial (Konstantopoulos & Chung, 2011). If teachers at the earliest stages of a child's schooling career have a disproportionately large impact on the child's learning trajectory, but policymakers have designed an accountability system that pushes schools to sort their best teachers away from those grades, the long-term consequences for student outcomes are potentially large. It is also possible, however, that given the choice between a lower quality K–2 teacher or 3–5 teacher, a school should choose the former, if more effective teachers later are better able to remediate and position a student for success in upper grades. Unfortunately, most accountability systems' focus on testing beginning in third grade further means that the kind of information on early-grades performance necessary to investigate the link between early-grades teacher quality and later performance, or optimal teacher allocation, is missing from most large-scale administrative data bases. Our results underscore the importance of education researchers bringing new data to these issues.

Our analysis faces several limitations. First, we do not have access to the same measures of teacher effectiveness principals have when making teacher assignment decisions. The kinds of performance measures we create from administrative data would not be available to principals at the time next year's assignment decisions likely are made, so principals likely instead rely on their own observations of teachers, results from interim assessments, or other information. Although principals' informal assessments of teachers tend to correlate positively with value-added and other performance measures (Jacob & Lefgren, 2008; [removed for peer review]), a broader range of data would be necessary to answer the question of which specific information is driving the assignments of teachers among tested and untested grades. The study also concerns about generalizability. M-DCPS is a very large urban district whose school settings may be very unrepresentative of those in the typical school district. Although the accountability pressures faced by M-DCPS are similar to those faced by other Florida school districts, Florida's accountability system is among the nation's most stringent, and the pressures it applies on schools—particularly low-performing schools—may elicit particularly strong responses from schools (Rouse et al., 2007). Assessment of assignment practices both in general and in the context of school accountability set in other districts or states would be useful in developing our understanding of how schools approach human capital decision-making.

Future research might also consider whether the reassignment of low-performing teachers to low-stakes classrooms might have implications for student outcomes beyond those associated with moving teachers to early grades. Evidence in Table 5 suggests that high schools move many relatively low-performing teachers to non-tested classrooms in grades 11 and 12, for example, which may affect students' preparation for postsecondary opportunities. Reassignment of

ineffective teachers to other kinds of untested classrooms (e.g., arts, non-core subjects) may similarly have consequences for student learning beyond math and reading.

References

Aaronson, D., Barrow, L., & Sander, W. (2007). Teachers and student achievement in Chicago public high schools. *Journal of Labor Economics, 25*(1), 95-135.

Booher-Jennings, J. (2005). Below the bubble: "Educational triage" and the Texas accountability system. *American Educational Research Journal, 42*(2), 231-268.

Chingos, M. M., & West, M. R. (2011). Promotion and reassignment in public school districts: How do schools respond to differences in teacher effectiveness? *Economics of Education Review, 30*, 419-433.

Claessens, A., Duncan, G., & Engel, M. (2009). Kindergarten skills and fifth-grade achievement: Evidence from the ECLS-K. *Economics of Education Review*, 28(4), 415-427.

Clotfelter, C. T., Ladd, H. F., & Vigdor, J. L. (2006). Teacher-student matching and the assessment of teacher effectiveness. *Journal of Human Resources*, 41(4), 778–820.

Cohen-Vogel, L. (2011). Staffing to the test: Are today's school personnel practices evidence based? *Educational Evaluation and Policy Analysis, 33*(4), 483–505.

Dee, T. & Jacob, B. (2011). The impact of No Child Left Behind on student achievement. *Journal of Policy Analysis and Management, 30*(3), 418-446.

Dee, T., Jacob, B, & Schwartz, N. (2013). The effects of NCLB on school resources and practices. *Educational Evaluation and Policy Analysis, 35*(2), 252-279.

Diamond, J. B., & Spillane, J. P. (2004). High-stakes accountability in urban elementary schools: Challenging or reproducing inequality? *Teachers College Record, 106*, 1145-1176.

Figlio, D. N. (2006). Testing, crime, and punishment. *Journal of Public Economics, 90*(4-5), 837-851.

Figlio, D. N., & Getzler, L. S. (2006). Accountability, ability and disability: Gaming the system? In T. J. Gronberg (Ed.), *Advances in Microeconomics*: Elsevier Science

Figlio, D. N., & Winicki, J. (2005). Food for thought: The effects of school accountability plans on school nutrition. *Journal of Public Economics, 89*(2-3), 381-394.

Fuller, S. C., & Ladd, H. F. (2013). School-based accountability and the distribution of teacher quality across grades in elementary school. *Education Finance and Policy,* 8(4), 528–559.

Guskey, T. R. (2003). How classroom assessments improve learning. *Educational Leadership, 60*(5), 6-11.

Hannaway, J., & Hamilton, L. (2008). Performance-based accountability policies: Implications for school and classroom practices. *Washington: Urban Institute and RAND Corporation*.

Hanushek, E. A., Kain, J. F., O'Brien, D. M., & Rivkin, S. G. (2005). *The market for teacher quality* (No. w11154). National Bureau of Economic Research.

Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. *Science*, 312(5782), 1900–1902.

Heilig, J. V., & Darling-Hammond, L. (2008). Accountability Texas-style: The progress and learning of urban minority students in a high-stakes testing context. *Educational Evaluation and Policy Analysis, 30*(2), 75-110.

Hill, C. J., Bloom, H. S., Black, A. R., & Lipsey, M. W. (2008). Empirical benchmarks for interpreting effect sizes in research. *Child Development Perspectives*, 2(3), 172–177.

Jacob, B. A. (2005). Accountability, incentives and behavior: The impact of high-stakes testing in the Chicago Public Schools. *Journal of Public Economics*, *89*(5–6), 761–796.

Jacob, B. A. (2010). Do principals fire the worst teachers? National Bureau of Economic Research, Working Paper #15715.

Jacob, B. A., & Lefgren, L. (2004). Remedial education and student achievement: A regression-discontinuity analysis. *Review of Economics and Statistics*, *86*(1), 226–244.

Jacob, B. A., & Lefgren, L. (2008). Can principals identify effective teachers? Evidence on subjective performance evaluation in education. *Journal of Labor Economics, 26*(1), 101-136.

Jacob, B. A., Lefgren, L., & Sims, D. P. (2010). The persistence of teacher-induced learning. *Journal of Human Resources, 45*(4), 915-943.

Jacob, B.A., & Levitt, S. D. (2003). Rotten apples: An investigation of the prevalence and predictors of teacher cheating. *Quarterly Journal of Economics, 118*(3), 843-877.

Kane, T. J., Rockoff, J. E., & Staiger, D. O. (2008). What does certification tell us about teacher effectiveness? Evidence from New York City. *Economics of Education Review, 27*(6), 615-631.

Konstantopoulos, S., & Chung, V. (2011). The persistence of teacher effects in elementary grades. *American Educational Research Journal,* 48(2), 361–386.

McMurrer, J. (2007). *Choices, changes, and challenges: Curriculum and instruction in the NCLB era*. Washington, DC: Center for Education Policy

McMurrer, J. (2008). *Instructional time in elementary schools: A closer look at changes for specific subjects*. Washington, DC: Center for Education Policy.

Neild, R. C., & Farley-Ripple, E. (2008). Within-school variation in teacher quality: The case of ninth grade. *American Journal of Education, 114*, 271-305.

Nye, B., Konstantopoulos, S., & Hedges, L. V. (2004). How large are teacher effects? *Educational Evaluation and Policy Analysis, 26*(3), 237-257.

Perry, J. D., Guidubaldi, J., & Kehle, T. J. (1979). Kindergarten competencies as predictors of third-grade classroom behavior and achievement. *Journal of Educational Psychology*, 71(4), 443–450. d

Rivkin, S. G., Hanushek, E. A., & Kain, J. F. (2005). Teachers, schools, and academic achievement. *Econometrica, 73*(2), 417-458.

Rockoff, J. (2004). The impact of individual teachers on student achievement: Evidence from panel data. *American Economic Review, 94*, 247-252.

Rothstein, J. (2010). Teacher quality in educational production: Tracking, decay, and student achievement. *Quarterly Journal of Economics*, 125(1), 175-214.

Rouse, C. E., Hannaway, J., Goldhaber, D., & Figlio, D. (2007). Feeling the Florida heat? How low-performing schools respond to voucher and accountability pressure. National Bureau of Economic Research.

Sanders, W., & Rivers, J. (1996). Cumulative and residual effects of teachers on future student academic achievement. Knoxville: University of Tennessee Value-Added Research and Assessment Center.

Schweinhart, L. J., Montie, J., Xiang, Z., Barnett, W. S., Belfield, C. R., & Nores, M. (2005). Lifetime effects: The HighScope Perry Preschool Study through age 40. (Monographs of the HighScope Educational Research Foundation, 14). Ypsilanti, MI: HighScope Press.

Watts, T. W., Duncan, G. J., Siegler, R. S., & Davis-Kean, P. E. (2014). What's past is prologue: Relations between early mathematics knowledge and high school achievement. *Educational Researcher*, 43(7), 352–360.

APPENDIX

APPENDIX TABLE 1: Pairwise Correlations among Teacher Performance Measures

		(1)	(2)	(3)	(4)	(5)	(6)
(1)	Average Math Achievement of Teachers' Current Students This Year	1.00					
(2)	Proportion of Students Proficient or Better in Math this Year	0.86	1.00				
(3)	Teacher Value-Added in Math This Year	0.57	0.46	1.00			
(4)	Average Reading Achievement of Teachers' Current Students This Year	0.90	0.83	0.38	1.00		
(5)	Proportion of Students Proficient or Better in Reading this Year	0.77	0.81	0.29	0.83	1.00	
(6)	Teacher Value-Added in Reading This Year	0.42	0.36	0.61	0.49	0.38	1.00

APPENDIX TABLE 2: Predicting Staying in a Tested Classroom between Years, with Covariates Shown

	MATH						READING					
Sample is teachers in tested classrooms at time *t* who:	Taught in any school at *t+1*		Remained in same school at *t+1*		Moved to a different school at *t+1*		Taught in any school at *t+1*		Remained in same school at *t+1*		Moved to a different school at *t+1*	
Panel A: Performance Measure is Mean Achievement of Current Students This Year												
Mean Achievement Scores of Teachers' Students	0.075	***	0.079	***	0.060	***	0.069	***	0.074	***	0.041	**
	(0.003)		(0.003)		(0.014)		(0.003)		(0.003)		(0.014)	
Female	0.000		-0.007		-0.006		0.002		-0.004		-0.001	
	(0.005)		(0.005)		(0.021)		(0.005)		(0.005)		(0.021)	
Black	0.046	***	0.017	**	0.043	+	0.042	***	0.013	*	0.040	+
	(0.006)		(0.005)		(0.024)		(0.006)		(0.005)		(0.024)	
Hispanic	0.042	***	0.003		0.054	*	0.041	***	0.004		0.054	*
	(0.005)		(0.005)		(0.022)		(0.005)		(0.005)		(0.022)	
Other Race	0.039	*	0.030	+	-0.005		0.034	*	0.022		-0.011	
	(0.015)		(0.015)		(0.051)		(0.015)		(0.015)		(0.049)	
Years of Experience in District	0.003	***	0.001	***	0.002		0.003	***	0.001	***	0.002	
	(0.000)		(0.000)		(0.002)		(0.000)		(0.000)		(0.002)	
Master's Degree or Higher	-0.004		-0.005		0.018		-0.003		-0.003		0.021	
	(0.004)		(0.004)		(0.018)		(0.004)		(0.004)		(0.018)	
Constant	0.672	***	0.849	***	0.646	***	0.658	***	0.845	***	0.632	***
	(0.007)		(0.006)		(0.026)		(0.006)		(0.006)		(0.026)	
Observations (School-Grade-Years)	3197		2876		1812		3268		2899		1832	
Observations (Total)	58373		46201		4068		60384		47032		4141	
Panel B: Performance Measure is Proportion of Teachers' Current Students Scoring Proficient or Better This Year												
Proportion of Students Proficient or Better	0.186	***	0.187	***	0.155	***	0.180	***	0.188	***	0.133	***
	(0.008)		(0.008)		(0.035)		(0.008)		(0.008)		(0.036)	
Female	-0.003		-0.010	+	-0.010		0.001		-0.005		-0.001	
	(0.005)		(0.005)		(0.021)		(0.005)		(0.005)		(0.021)	
Black	0.047	***	0.017	**	0.044	+	0.042	***	0.013	*	0.042	+

	(0.006)		(0.005)		(0.024)		(0.006)		(0.005)		(0.024)	
Hispanic	0.041	***	0.003		0.054	*	0.040	***	0.003		0.054	*
	(0.005)		(0.005)		(0.022)		(0.005)		(0.005)		(0.022)	
Other Race	0.040	**	0.032	*	-0.005		0.033	*	0.021		-0.012	
	(0.016)		(0.015)		(0.050)		(0.015)		(0.015)		(0.050)	
Years of Experience in District	0.003	***	0.001	***	0.002		0.003	***	0.001	***	0.002	
	(0.000)		(0.000)		(0.002)		(0.000)		(0.000)		(0.002)	
Master's Degree or Higher	-0.005		-0.005		0.016		-0.003		-0.004		0.020	
	(0.004)		(0.004)		(0.018)		(0.004)		(0.004)		(0.018)	
Constant	0.563	***	0.738	***	0.557	***	0.561	***	0.742	***	0.565	***
	(0.008)		(0.008)		(0.030)		(0.007)		(0.008)		(0.030)	
Observations (School-Grade-Years)	3196		2875		1812		3267		2898		1832	
Observations (Total)	58356		46186		4068		60367		47017		4141	
Panel C: Performance Measure is Teacher Value-Added This Year												
Teacher Value-Added	0.049	***	0.046	***	0.013		0.034	***	0.031	***	0.015	
	(0.003)		(0.003)		(0.016)		(0.003)		(0.003)		(0.015)	
Female	0.002		-0.004		-0.043		0.010		0.003		-0.028	
	(0.007)		(0.007)		(0.037)		(0.009)		(0.009)		(0.045)	
Black	0.036	***	0.006		0.069	+	0.038	***	0.004		0.014	
	(0.008)		(0.007)		(0.042)		(0.008)		(0.008)		(0.040)	
Hispanic	0.030	***	-0.007		0.152	***	0.043	***	0.006		0.042	
	(0.007)		(0.007)		(0.038)		(0.008)		(0.007)		(0.037)	
Other Race	0.023		0.023		0.065		0.039		0.013		-0.161	
	(0.023)		(0.021)		(0.086)		(0.025)		(0.023)		(0.104)	
Years of Experience in District	0.003	***	0.001	***	0.006	+	0.003	***	0.002	***	0.007	*
	(0.000)		(0.000)		(0.003)		(0.000)		(0.000)		(0.003)	
Master's Degree or Higher	-0.007		-0.008		0.059	+	-0.004		-0.006		0.034	
	(0.005)		(0.005)		(0.033)		(0.006)		(0.006)		(0.034)	
Constant	0.694	***	0.875	***	0.613	***	0.668	***	0.830	***	0.616	***
	(0.009)		(0.008)		(0.043)		(0.011)		(0.011)		(0.048)	
Observations (School-Grade-Years)	2806		2499		1045		2839		2522		1077	

Observations (Total)	25457	20247	1621	25404	20633	1676

Notes: All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject at time *t+1*. Standard errors are clustered at the teacher level.
***p<.001; **p<.01; *p<.05; +p<.10.

APPENDIX TABLE 3: Predicting Staying in a Tested Classroom between Years (Logistic Regression)

	MATH			READING		
Sample is teachers in tested classrooms at time t who:	Taught in any school at *t+1*	Remained in same school at *t+1*	Moved to a different school at *t+1*	Taught in any school at *t+1*	Remained in same school at *t+1*	Moved to a different school at *t+1*
Panel A: Performance Measure is Mean Achievement of Current Students This Year						
Mean Achievement Scores of Teachers' Students	0.461 ***	0.626 ***	0.296 ***	0.433 ***	0.592 ***	0.200 *
	(0.018)	(0.023)	(0.083)	(0.018)	(0.023)	(0.083)
N	53356	40239	2142	54360	41095	2191
Models Estimated Separately by School Level:						
Elementary	0.561 ***	0.776 ***	0.336 **	0.531 ***	0.752 ***	0.177
	(0.024)	(0.032)	(0.117)	(0.024)	(0.031)	(0.114)
Middle	0.433 ***	0.667 ***	0.265	0.326 ***	0.488 ***	0.294
	(0.042)	(0.056)	(0.183)	(0.043)	(0.058)	(0.186)
High	0.252 ***	0.329 ***	0.235	0.271 ***	0.345 ***	0.144
	(0.037)	(0.043)	(0.165)	(0.038)	(0.044)	(0.167)
Panel B: Performance Measure is Proportion of Teachers' Current Students Scoring Proficient or Better This Year						
Proportion of Students Proficient or Better	1.170 ***	1.550 ***	0.773 ***	1.174 ***	1.601 ***	0.650 **
	(0.047)	(0.061)	(0.209)	(0.047)	(0.062)	(0.216)
N	53341	40217	2142	54345	41073	2191
Models Estimated Separately by School Level:						
Elementary	1.433 ***	1.952 ***	0.963 ***	1.446 ***	2.057 ***	0.828 **
	(0.060)	(0.079)	(0.284)	(0.059)	(0.078)	(0.272)
Middle	0.994 ***	1.486 ***	0.259	0.689 ***	0.961 ***	0.642
	(0.113)	(0.158)	(0.474)	(0.110)	(0.150)	(0.489)
High	0.600 ***	0.759 ***	0.599	0.704 ***	0.805 ***	-0.142
	(0.099)	(0.118)	(0.433)	(0.112)	(0.131)	(0.546)
Panel C: Performance Measure is Teacher Value-Added This Year						

Teacher Value-Added	0.347	***	0.466	***	0.045		0.213	***	0.253	***	0.074
	(0.020)		(0.027)		(0.110)		(0.018)		(0.023)		(0.096)
N	20405		13055		452		21487		14713		526
Models Estimated Separately by School Level:											
Elementary	0.400	***	0.527	***	0.279	+	0.284	***	0.356	***	0.132
	(0.025)		(0.035)		(0.157)		(0.023)		(0.030)		(0.136)
Middle	0.438	***	0.812	***	-0.003		0.040		0.038		-0.126
	(0.048)		(0.079)		(0.242)		(0.040)		(0.052)		(0.203)
High	0.131	**	0.191	***	-0.481		0.180	***	0.206	***	0.068
	(0.043)		(0.053)		(0.298)		(0.038)		(0.045)		(0.216)

Notes: All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject at time *t+1*. Standard errors are clustered at the teacher level. ***p<.001; **p<.01; *p<.05; +p<.10.

APPENDIX TABLE 4: Testing for Non-Linearities in the Association between Performance and Remaining in a Tested Classroom

	MATH						READING					
Sample is teachers in tested classrooms at time *t* who:	Taught in any school at *t+1*		Remained in same school at *t+1*		Moved to a different school at *t+1*		Taught in any school at *t+1*		Remained in same school at *t+1*		Moved to a different school at *t+1*	
Panel A: Performance Measure is Mean Achievement of Current Students This Year												
Mean Achievement Scores of Teachers' Students	0.066	***	0.067	***	0.035	*	0.057	***	0.060	***	0.017	
	(0.003)		(0.003)		(0.018)		(0.003)		(0.003)		(0.018)	
Mean Achievement Scores of Teachers' Students^2	-0.014	***	-0.019	***	-0.024	*	-0.021	***	-0.026	***	-0.026	+
	(0.003)		(0.003)		(0.011)		(0.003)		(0.003)		(0.014)	
N	58373		46201		4068		60384		47032		4141	
Panel B: Performance Measure is Proportion of Teachers' Current Students Scoring Proficient or Better This Year												
Proportion of Students Proficient or Better	0.365	***	0.423	***	0.448	***	0.354	***	0.406	***	0.315	**
	(0.027)		(0.028)		(0.112)		(0.025)		(0.026)		(0.107)	
Proportion of Students Proficient or Better^2	-0.171	***	-0.223	***	-0.306	**	-0.174	***	-0.216	***	-0.196	+
	(0.023)		(0.024)		(0.107)		(0.023)		(0.023)		(0.106)	
N	58356		46186		4068		60367		47017		4141	
Panel C: Performance Measure is Teacher Value-Added This Year												
Teacher Value-Added	0.048	***	0.045	***	0.015		0.034	***	0.030	***	0.014	
	(0.003)		(0.003)		(0.015)		(0.003)		(0.003)		(0.016)	
Teacher Value-Added^2	-0.005	**	-0.007	***	0.004		-0.002		-0.004	*	-0.003	
	(0.002)		(0.002)		(0.008)		(0.002)		(0.002)		(0.009)	
N	25457		20247		1621		25404		20633		1676	

Notes: All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject at time *t+1*. Standard errors are clustered at the teacher level. ***p<.001; **p<.01; *p<.05; +p<.10.

FIGURE 1: Association between teacher value-added in math and probability of staying or switching grades

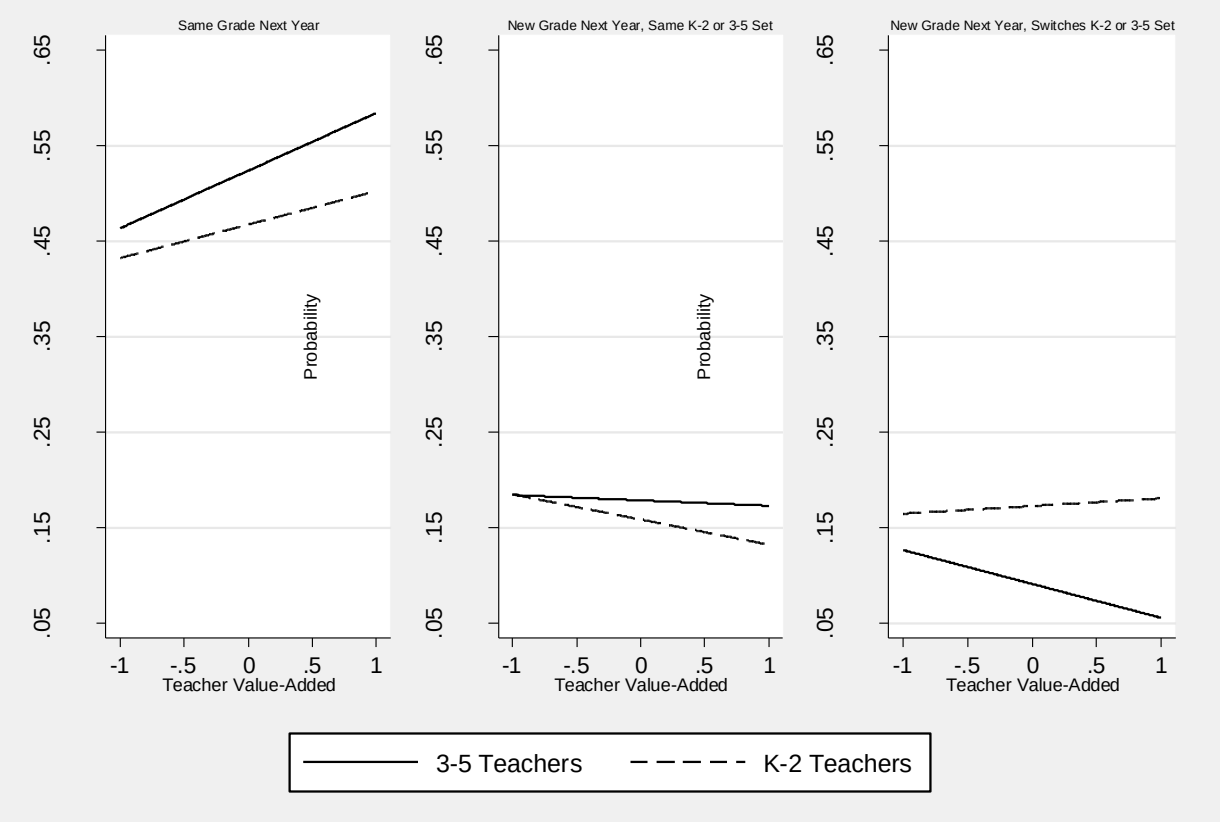

TABLE 1: Descriptive Statistics

	Administrative Data			Survey Data		
	Mean	SD	N	Mean	SD	N
Teacher Characteristics						
Female	0.77		196879	0.80		6232
White	0.27		196882	0.30		6232
Black	0.26		196882	0.25		6232
Hispanic	0.45		196882	0.43		6232
Other Race	0.02		196882	0.02		6232
MA or Higher	0.37		196882	0.40		6232
Experience in the District	10.54	9.16	196882	11.09	8.95	6232
Teaches Tested Grade	0.37		182739	0.36		5882
Switches from Tested to Non-Tested Grade Next Year[1]	0.14		61241	0.16		2104
Class Characteristics						
Average Prior Year Math Achievement	-0.13	0.71	150119	-0.11	0.71	5260
Proportion Receiving Free or Reduced Lunch	0.69	0.24	196770	0.74	0.22	6228
Proportion Black	0.28	0.32	196770	0.29	0.33	6228
Proportion White	0.09	0.12	196770	0.08	0.11	6228
Involvement in Class Assignments (Yes/No)						
Me				0.16	0.36	6568
Other Teachers in My grade				0.12	0.32	6568
Teachers in the Grade Below				0.16	0.36	6568
Other Teachers in My grade				0.11	0.32	6568
Principal				0.51	0.50	6568
Assistant Principals				0.64	0.48	6568
Counselors				0.38	0.48	6568
Parents				0.07	0.26	6568
Students				0.07	0.25	6568

[1]Restricted to teachers in a tested grade in year t-1.

TABLE 2: Linear Probability Models Predicting Staying in a Tested Grade from Current Year to Next Year

	MATH			READING		
Sample is teachers in tested classrooms at time *t* who:	Taught in any school at *t+1*	Remained in same school at *t+1*	Moved to a different school at *t+1*	Taught in any school at *t+1*	Remained in same school at *t+1*	Moved to a different school at *t+1*
Panel A: Performance Measure is Mean Achievement of Current Students This Year						
	(1)	(2)	(3)	(4)	(5)	(6)
Mean Achievement Scores of Teachers' Students	0.075 ***	0.079 ***	0.060 ***	0.069 ***	0.074 ***	0.041 **
	(0.003)	(0.003)	(0.014)	(0.003)	(0.003)	(0.014)
N	58373	46201	4068	60384	47032	4141
Models Estimated Separately by School Level:						
Elementary	0.082 ***	0.084 ***	0.066 ***	0.078 ***	0.082 ***	0.035 +
	(0.004)	(0.004)	(0.019)	(0.004)	(0.004)	(0.018)
Middle	0.070 ***	0.078 ***	0.053 +	0.050 ***	0.055 ***	0.058 +
	(0.007)	(0.008)	(0.029)	(0.007)	(0.008)	(0.031)
High	0.056 ***	0.064 ***	0.052 +	0.055 ***	0.066 ***	0.034
	(0.009)	(0.009)	(0.031)	(0.008)	(0.009)	(0.033)
Panel B: Performance Measure is Proportion of Teachers' Current Students Scoring Proficient or Better This Year						
	(7)	(8)	(9)	(10)	(11)	(12)
Proportion of Students Proficient or Better	0.186 ***	0.187 ***	0.155 ***	0.180 ***	0.188 ***	0.133 ***
	(0.008)	(0.008)	(0.035)	(0.008)	(0.008)	(0.036)
N	58356	46186	4068	60367	47017	4141
Models Estimated Separately by School Level:						
Elementary	0.213 ***	0.211 ***	0.189 ***	0.213 ***	0.222 ***	0.166 ***
	(0.009)	(0.009)	(0.045)	(0.009)	(0.009)	(0.044)
Middle	0.150 ***	0.154 ***	0.061	0.103 ***	0.104 ***	0.124
	(0.018)	(0.018)	(0.075)	(0.018)	(0.018)	(0.076)
High	0.129 ***	0.142 ***	0.133	0.133 ***	0.147 ***	-0.025
	(0.023)	(0.024)	(0.084)	(0.023)	(0.026)	(0.110)

Panel C: Performance Measure is Teacher Value-Added This Year													
	(13)			(14)			(15)			(16)			(17)			(18)
Teacher Value-Added	0.049	***		0.046	***		0.013			0.034	***		0.031	***		0.015
	(0.003)			(0.003)			(0.016)			(0.003)			(0.003)			(0.015)
N	25457			20247			1621			25404			20633			1676
Models Estimated Separately by School Level:																
Elementary	0.052	***		0.046	***		0.049	*		0.040	***		0.035	***		0.024
	(0.003)			(0.003)			(0.020)			(0.003)			(0.003)			(0.019)
Middle	0.054	***		0.057	***		0.020			0.007			0.006			-0.017
	(0.006)			(0.006)			(0.027)			(0.008)			(0.008)			(0.036)
High	0.028	**		0.034	***		-0.097	*		0.037	***		0.038	***		0.015
	(0.009)			(0.009)			(0.038)			(0.008)			(0.008)			(0.038)

Notes: All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject at time *t+1*. Standard errors are clustered at the teacher level. ***p<.001; **p<.01; *p<.05; +p<.10.

TABLE 3: Linear Probability Models Predicting Staying in a Tested Grade between Years, By School Performance

	MATH				READING			
Sample is teachers in tested classrooms at time *t* who:	Taught in any school at *t+1*		Remained in same school at *t+1*		Taught in any school at *t+1*		Remained in same school at *t+1*	
Panel A: Performance Measure is Mean Achievement of Current Students This Year								
School Accountability Grade Interaction	(1)		(2)		(3)		(4)	
Mean Achievement Scores of Teachers' Students	0.082	***	0.111	***	0.066	***	0.093	***
	(0.009)		(0.010)		(0.010)		(0.011)	
Mean Achievement Scores of Teachers' Students × **A** Grade	-0.000		-0.011	+	0.009		-0.003	
	(0.006)		(0.006)		(0.006)		(0.006)	
Mean Achievement Scores of Teachers' Students × **F** Grade	0.003		0.064	**	0.007		0.054	*
	(0.021)		(0.024)		(0.023)		(0.026)	
N	56430		44713		58416		45537	
School Value-Added Interaction	(5)		(6)		(7)		(8)	
Mean Achievement Scores of Teachers' Students	0.071	***	0.079	***	0.067	***	0.075	***
	(0.004)		(0.004)		(0.004)		(0.004)	
Mean Achievement Scores of Teachers' Students × School Value-Added	0.011	**	0.015	***	0.011	**	0.016	***
	(0.004)		(0.004)		(0.004)		(0.004)	
N	46079		36092		46729		36622	
Panel B: Performance Measure is Proportion of Teachers' Current Students Scoring Proficient or Better This Year								
School Accountability Grade Interaction	(9)		(10)		(11)		(12)	
Proportion of Students Proficient or Better	0.172	***	0.182	***	0.159	***	0.181	***
	(0.011)		(0.012)		(0.011)		(0.012)	
Proportion of Students Proficient or Better × **A** Grade	0.028	+	0.003		0.038	*	0.010	
	(0.015)		(0.016)		(0.015)		(0.016)	
Proportion of Students Proficient or Better × **F** Grade	0.044		0.179	*	0.075		0.215	*
	(0.064)		(0.072)		(0.083)		(0.091)	
N	58356		46186		60367		47017	
School Value-Added Interaction	(13)		(14)		(15)		(16)	
Proportion of Students Proficient or Better	0.181	***	0.192	***	0.175	***	0.193	***

	(0.009)		(0.009)		(0.009)		(0.009)	
Proportion of Students Proficient or Better × School Value-Added	0.032	***	0.039	***	0.036	***	0.052	***
	(0.009)		(0.010)		(0.009)		(0.010)	
N	46065		36080		46715		36610	
Panel C: Performance Measure is Teacher Value-Added This Year								
School Accountability Grade Interaction	(17)		(18)		(19)		(20)	
Teacher Value-Added	0.050	***	0.064	***	0.043	***	0.040	***
	(0.009)		(0.009)		(0.009)		(0.009)	
Teacher Value-Added × **A** Grade	-0.005		-0.008		-0.010	+	-0.011	*
	(0.005)		(0.005)		(0.005)		(0.005)	
Teacher Value-Added × **F** Grade	-0.004		0.058	*	-0.022		-0.019	
	(0.023)		(0.024)		(0.021)		(0.022)	
N	24862		19777		24886		20247	
School Value-Added Interaction	(21)		(22)		(23)		(24)	
Teacher Value-Added	0.050	***	0.049	***	0.035	***	0.031	***
	(0.003)		(0.003)		(0.003)		(0.003)	
Teacher Value-Added × School Value-Added	0.003		0.003		0.008	*	0.009	**
	(0.003)		(0.003)		(0.003)		(0.003)	
N	22528		17855		22039		18096	

Notes: All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject at time *t+1*. Standard errors are clustered at the teacher level. p-values are not adjusted for multiple comparisons. ***p<.001; **p<.01; *p<.05; +p<.10.

TABLE 4: Linear Probability Models Predicting Staying in a Tested Grade between Years, By Influence Over School Assignment Processes

	Mean Achievement Models				Proficiency Models				Value-Added Models			
	Mean Achievement Scores of Teachers' Students		Mean Achievement Scores of Teachers' Students × Assignment Factor		Proportion of Students Proficient or Better		Proportion of Students Proficient or Better × Assignment Factor		Teacher Value-Added		Teacher Value-Added × Assignment Factor	
Panel A: Math												
Me	0.077	***	-0.004		0.181	***	0.015		0.051	***	-0.005	
	(0.005)		(0.011)		(0.013)		(0.028)		(0.004)		(0.009)	
Other Teachers in My Grade	0.069	***	0.023	*	0.162	***	0.088	***	0.048	***	0.003	
	(0.004)		(0.011)		(0.011)		(0.027)		(0.004)		(0.009)	
Teachers in the Grade Below	0.070	***	0.011		0.168	***	0.042	*	0.050	***	-0.002	
	(0.005)		(0.007)		(0.012)		(0.019)		(0.004)		(0.007)	
Principals	0.060	***	0.009	*	0.141	***	0.025	**	0.035	***	0.008	*
	(0.008)		(0.004)		(0.019)		(0.009)		(0.007)		(0.003)	
Assistant Principals	0.073	***	0.001		0.179	***	0.004		0.051	***	-0.001	
	(0.009)		(0.004)		(0.023)		(0.011)		(0.007)		(0.003)	
Counselors	0.081	***	-0.007	+	0.208	***	-0.026	**	0.054	***	-0.005	
	(0.004)		(0.004)		(0.011)		(0.010)		(0.004)		(0.003)	
Parents	0.083	***	-0.050	**	0.207	***	-0.131	**	0.053	***	-0.023	
	(0.004)		(0.019)		(0.011)		(0.048)		(0.004)		(0.016)	
Students	0.083	***	-0.072	***	0.210	***	-0.234	***	0.054	***	-0.049	*
	(0.004)		(0.020)		(0.009)		(0.053)		(0.003)		(0.019)	
N for all models in group	58,300				58,283				25,431			
Panel B: Reading												
Me	0.065	***	0.009		0.163	***	0.045		0.034	***	-0.000	
	(0.005)		(0.011)		(0.013)		(0.028)		(0.004)		(0.009)	
Other Teachers in My Grade	0.059	***	0.035	**	0.145	***	0.122	***	0.032	***	0.007	

	(0.004)		(0.011)		(0.011)		(0.027)		(0.004)		(0.009)	
Teachers in the Grade Below	0.061	***	0.018	*	0.154	***	0.059	**	0.029	***	0.010	
	(0.005)		(0.008)		(0.012)		(0.019)		(0.004)		(0.007)	
Principals	0.052	***	0.009	*	0.130	***	0.027	**	0.017	*	0.009	**
	(0.008)		(0.004)		(0.019)		(0.009)		(0.007)		(0.003)	
Assistant Principals	0.065	***	0.002		0.154	***	0.013		0.043	***	-0.005	
	(0.009)		(0.004)		(0.023)		(0.010)		(0.008)		(0.004)	
Counselors	0.077	***	-0.009	*	0.208	***	-0.035	***	0.039	***	-0.007	+
	(0.004)		(0.004)		(0.011)		(0.010)		(0.004)		(0.003)	
Parents	0.073	***	-0.026		0.191	***	-0.074		0.030	***	0.027	
	(0.004)		(0.019)		(0.011)		(0.046)		(0.004)		(0.017)	
Students	0.075	***	-0.062	**	0.200	***	-0.214	***	0.037	***	-0.036	*
	(0.004)		(0.020)		(0.009)		(0.052)		(0.003)		(0.018)	
N for all models in group	60,305				60,288				25,378			

Notes: Each row reflects estimates from 3 separate models. Teacher responses to our 2011 survey items on class assignments are aggregated to the school level and then treated as a time-invariant school characteristic. All models contain teacher covariates and school-by-year fixed effects. Samples are restricted to teachers who teach students tested in math or reading in a given year. The outcome is a binary indicator for whether a teacher remains in a tested grade/subject in the same school at time t+1. Standard errors are clustered at the teacher level. ***p<.001; **p<.01; *p<.05; +p<.10.

TABLE 5: Mean Value-Added Among Teachers in Tested Grades in Year *t*, by Status in Year *t*+1

	Math Value-Added		**Reading Value-Added**		**Percent of those who move overall**		**Percent of those who move out of tested classroom**
					Percent	N	
Elementary School							
Moves to K from Grades 3-5	-0.409	***	-0.429	***	5%	783	13%
Moves to 1st from Grades 3-5	-0.457	**	-0.293	***	8%	1,320	22%
Moves to 2nd from Grades 3-5	-0.393	***	-0.365	***	23%	3,725	63%
Stays in 3-5, but Changes Grades	-0.100	***	-0.037		64%	10,355	
Stays in 3-5, Same Grade *[comparison group]*	0.039		0.022				
Middle School							
Different Subject, Grades 6-8	-0.232	***	-0.198	*	4%	123	100%
Stays in Math/Reading in Grades 6-8, but Changes Grades	-0.020	***	0.035	*	94%	3,135	
Stays in Math/Reading, Same Grade *[comparison group]*	0.217		0.145				
High School							
Same Subject, Grade 11-12	-0.067		-0.110	***	51%	1,653	94%
Different Subject, Grade 11-12	-0.038		-0.123		2%	74	4%
Different Subject, Grade 9-10	-0.451	+	-0.365		1%	38	2%
Stays in Math/Reading in Grades 9-10 but Changes Grade	0.009		-0.137	***	46%	1,482	
Stays in Math/Reading, Same Grade *[comparison group]*	0.019		0.115				

Values shown are means. Asterisks indicate results of two-sided *t*-tests comparing value-added for teachers that switch grades/subjects to the value-added of teachers that remain in the same grade and subject in the following year. + p<.1, * p<.05, ** p<.01, *** p<.001. Analysis is restricted to teachers that teach in tested areas in year *t* and that stay in the same school in year *t+1*.

TABLE 6: Comparing Movement of K–2 and 3–5 Teachers by Measures of Performance

	MATH						READING					
Assignment Next Year:	Same Grade		Different Grade in the Same K-2 or 3-5 Set		Different K-2 or 3-5 Set		Same Grade		Different Grade in the Same K-2 or 3-5 Set		Different K-2 or 3-5 Set	
Panel A: Performance Measure is Mean Achievement of Current Students This Year												
	(1)		(2)		(3)		(4)		(5)		(6)	
Mean Achievement Scores of Teachers' Students	0.097	***	-0.021	***	-0.041	***	0.096	***	-0.024	***	-0.038	***
	(0.004)		(0.003)		(0.003)		(0.004)		(0.003)		(0.003)	
K-2 Teacher	-0.012	**	-0.066	***	0.087	***	-0.012	**	-0.067	***	0.087	***
	(0.004)		(0.003)		(0.003)		(0.004)		(0.003)		(0.003)	
Mean Achievement*K-2 Teacher	0.008		-0.033	***	0.029	***	0.011	+	-0.032	***	0.027	***
	(0.006)		(0.005)		(0.004)		(0.006)		(0.005)		(0.004)	
Constant	0.357	***	0.247	***	0.165	***	0.358	***	0.246	***	0.165	***
	(0.006)		(0.005)		(0.005)		(0.006)		(0.005)		(0.005)	
N (School by Year Observations)	2412		2412		2412		2412		2412		2412	
N (Total Observations)	77733		77733		77733		77730		77730		77730	
Panel B: Performance Measure is Teacher Value-Added This Year												
	(7)		(8)		(9)		(10)		(11)		(12)	
Teacher Value-Added	0.060	***	-0.006	*	-0.036	***	0.044	***	-0.003		-0.029	***
	(0.004)		(0.003)		(0.002)		(0.003)		(0.003)		(0.002)	
K-2 Teacher	-0.056	***	-0.020	**	0.082	***	-0.066	***	-0.011		0.083	***
	(0.009)		(0.007)		(0.006)		(0.009)		(0.007)		(0.006)	
Teacher Value-Added*K-2 Teacher	-0.025	**	-0.021	**	0.044	***	-0.016	+	-0.016	*	0.032	***
	(0.008)		(0.006)		(0.005)		(0.008)		(0.006)		(0.005)	
Constant	0.523	***	0.178	***	0.091	***	0.508	***	0.191	***	0.091	***
	(0.012)		(0.009)		(0.008)		(0.013)		(0.010)		(0.009)	
N (School by Year Observations)	2123		2123		2123		2123		2123		2123	
N (Total Observations)	22594		22594		22594		24417		24417		24417	

Notes: Models include teachers that teach grades K-2 and 3-5, so grade 3-5 teachers are the reference group. All models include the same control variables as in Table 2 and school-by-year fixed effects. Standard errors are clustered at the teacher level. +p<.10; *p<.05; **p<.01; ***p<.001.

TABLE 7: Achievement Gains Among First and Second Grade Students

	MATH		READING	
Panel A: Early Grades Performance in the Year After a Teacher Switch				
	(1)		(2)	
Student's Teacher Taught the Same K-2 Grade Last Year (omitted)				
Student's Teacher Switched from Grades 3-5 Last Year	-0.072	***	-0.062	***
	(0.014)		(0.011)	
Student's Teacher Taught Different K-2 Grade Last Year	-0.050	***	-0.051	***
	(0.014)		(0.011)	
Student's Teacher is a First-Year Teacher	-0.097	***	-0.045	*
	(0.025)		(0.022)	
N (School by Year by Grade Cells)	2,177		2,172	
N (Students)	86,920		85,766	
Panel B: Early Grades Performance Multiple Years After a Teacher Switch				
	(3)		(4)	
Student's Teacher Taught the Same K-2 Grade Last Year (omitted)				
Student's Teacher Switched from Grades 3-5 Last Year	-0.097	**	-0.090	***
	(0.030)		(0.021)	
Student's Teacher Switched from Grades 3-5 Two Years Ago	-0.087	***	-0.056	***
	(0.014)		(0.011)	
Student's Teacher Taught Different K-2 Grade Last Year	-0.086	***	-0.078	***
	(0.026)		(0.020)	
Student's Teacher Taught Different K-2 Grade Two Years Ago	-0.080	***	-0.052	***
	(0.015)		(0.011)	
Student's Teacher is A First-Year Teacher	-0.134	***	-0.074	***
	(0.022)		(0.020)	
Student's Teacher is A Second-Year Teacher	-0.082	**	-0.092	***
	(0.026)		(0.020)	
N (School by Year by Grade Cells)	2,159		2,150	
N (Students)	83,630		82,537	
Panel C: Early Grades Performance of Switchers Compared to K-2 Teachers Who Have Never Taught Grades 3-5				
	(5)		(6)	
Student's Teacher Taught the Same K-2 Grade Last Year and Never Taught 3-5 (omitted)				
Student's Teacher Ever Taught Grades 3-5 (excluding last year)	-0.065	***	-0.049	***
	(0.014)		(0.010)	
Student's Teacher Switched from Grades 3-5 in Prior Year	-0.108	***	-0.083	***
	(0.017)		(0.012)	
Student's Teacher Taught Different K-2 Grade Last Year	-0.083	***	-0.071	***
	(0.017)		(0.013)	
Student's Teacher is A First Year Teacher	-0.151	***	-0.100	***
	(0.030)		(0.026)	

N (School by Year by Grade Cells)	2,197	2,200
N (Students)	90,005	89,916

Notes: The models include first and second grade students with valid test scores from the prior year. The outcome is student test scores in a given year with controls for the prior year test score, student race/ethnicity, gender, free lunch eligibility, and limited English proficiency as well as the aggregate of these student-level measures at the class-level. They also include school-by-year-by-grade fixed effects. The standard errors are clustered at the teacher level. Asterisks indicate significant differences from the omitted category. +p<.10; *p<.05; **p<.01; ***p<.001.

TABLE 8: Achievement among Third Grade Students, By Status of Second Grade Teacher

	MATH						READING					
Panel A: 3rd Grade Achievement												
	(1)	*p*	(2)	*p*	(3)	*p*	(4)	*p*	(5)	*p*	(6)	*p*
Student's 2nd Grade Teacher Switched from Grades 3-5 in Year Prior to Teaching Student	-0.023 **	ref	-0.029 *	ref	-0.031 **	ref	-0.032 ***	ref	-0.032 **	ref	-0.028 **	ref
	(0.008)		(0.013)		(0.011)		(0.008)		(0.011)		(0.009)	
Student's 2nd Grade Teacher Taught Different K-2 Grade in Year Prior to Teaching Student	-0.012	0.31	0.010	0.03	-0.006	0.10	-0.018 *	0.15	0.005	0.02	-0.005	0.08
	(0.009)		(0.014)		(0.012)		(0.008)		(0.013)		(0.011)	
Student's 2nd Grade Teacher was a First-Year Teacher	-0.037 ***	0.25	-0.050 *	0.40	-0.027	0.83	-0.033 ***	0.97	-0.031	0.96	-0.015	0.50
	(0.010)		(0.023)		(0.019)		(0.009)		(0.022)		(0.018)	
N (School by Year by Grade Cells)	2187		1001		1001		2191		1005		1005	
N (Students)	154332		49918		49918		148779		47438		47438	
Panel B: 4th Grade Achievement												
	(7)	*p*	(8)	*p*	(9)	*p*	(10)	*p*	(11)	*p*	(12)	*p*
Student's 2nd Grade Teacher Switched from Grades 3-5 in Year Prior to Teaching Student	-0.014 +	ref	-0.016	ref	-0.020	ref	-0.016 *	ref	-0.019	ref	-0.016	ref
	(0.008)		(0.014)		(0.013)		(0.007)		(0.012)		(0.011)	
Student's 2nd Grade Teacher Taught Different K-2 Grade in Year Prior to Teaching Student	-0.006	0.44	0.010	0.17	-0.013	0.66	-0.013	0.76	-0.009	0.55	-0.017	0.92
	(0.009)		(0.015)		(0.014)		(0.008)		(0.014)		(0.013)	
Student's 2nd Grade Teacher was a First-Year Teacher	-0.042 ***	0.02	-0.015	0.98	-0.001	0.41	-0.043 ***	0.01	-0.053 **	0.14	-0.039 *	0.26
	(0.010)		(0.024)		(0.021)		(0.009)		(0.020)		(0.018)	
N (School by Year by Grade Cells)	1968		759		759		1963		758		758	
N (Students)	115549		31498		31498		109408		29107		29107	
Restricted to Sample with 1st Grade Scores	No		Yes		Yes		No		Yes		Yes	
Control for 1st Grade SAT-10 Scores	No		No		Yes		No		No		Yes	

Notes: Models are restricted to 3rd and 4th grade students. Outcome is student test score in 3rd grade (Panel A) or 4th grade (Panel B). Key predictors are characteristics of students' 2nd grade teachers; the omitted category is 2nd grade teachers who also taught 2nd grade in the year prior to teaching the student. Models include controls for student race/ethnicity, gender, free lunch eligibility, and limited English proficiency, and the aggregate of these student-level measures at the class level. They also include school-by-year fixed effects. Standard errors are clustered at the 2nd grade teacher level. Values shown in the columns labeled *p* are *p*-values for a test of equality between the coefficient and the coefficient on switching from grades 3-5. +p<.10; *p<.05; **p<.01; ***p<.001.