

The Impact of Principal Attrition and Replacement on Indicators of School Quality

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Abstract

Transitions to a new principal are common, especially within urban public schools, and potentially highly disruptive to a school's culture and operations. We use longitudinal data from New York City to investigate whether the effect of principal transitions differs by whether the incoming principal was hired externally or promoted from within the school. We take advantage of variation in the timing of principal transitions within an event-study approach to estimate the causal effect of principal changes. Changing principals has an immediate negative effect on student test scores that is sustained over several years regardless of whether hired internally or externally. However, externally hired principals lead to an increase in teacher turnover and a decline in perceptions of the school's learning environment, whereas transitions to an internally promoted principal have no such effects. This pattern of results raises important questions about leadership transitions and the nature of principal effects on school quality.

Keywords: Leadership Transitions, Principals, School/Teacher Effectiveness, Learning Environment

1 Introduction

Each year, roughly 20% of schools change their principal (Bartanen, Grissom, & Rogers, 2019; Henry & Harbatkin, 2019), and mobility rates are higher within urban public school systems (Goldring & Taie, 2018). Though the independent effect that specific school leaders have on student outcomes is notoriously difficult to estimate (Branch, Hanushek, & Rivkin, 2009), there is little doubt that effective principals are essential for developing high-quality public schools. Recent studies have found evidence that disruptions from transitioning between principals cause reductions in student achievement and increase teacher turnover within a school in the few years following the change (Bartanen et al., 2019; Henry & Harbatkin, 2019; Miller, 2013). Yet the full range of the effect of principal transitions remain an understudied component of school leadership policy (Henry & Harbatkin, 2019; Bartanen, 2019). Questions remain about whether principal transitions are inherently disruptive or if the impact of changing principals depends on the context surrounding the outgoing or incoming principal.

We use longitudinal data from New York City, the nation’s largest public school district, to make at least two key contributions to the budding literature on the impact of principal mobility on public schools and the nature of principal effects. First, in addition to test score growth and teacher turnover, we look at the impacts of principal changes within the school as measured by a rich set of school environment and climate indicators. Such analyses are especially important for understanding principal impacts given that, relative to teachers, principals most likely have indirect impacts on students but broader impacts across the school by influencing some combination of activities such as staffing, providing administrative support, and developing the school’s culture (Hallinger & Heck, 1996; Bossert, Dwyer, Rowan, & Lee, 1982).

Second, we evaluate the extent to which the impact of a principal transition depends on whether the principal was hired from outside of the school or was promoted internally. There are many reasons to suspect different impacts from transitioning to a principal with or without prior experience in a school, but it is not immediately obvious which type of hire, if any, should be preferred. For example, internal promotions might be less disruptive

for the school because the new principal is already acquainted with the staff, teachers, and students, yet externally-hired principals might bring a broader set of innovative ideas into the school than would an internal candidate.

Consistent with other recent studies, we find evidence that principal transitions, on average, cause an immediate decline in student test scores, and the effect is similar whether the principal was hired externally or promoted from within the school. However, we find that the two types of transitions have substantially different impacts on teacher turnover and measures of the school's learning environment. Transitioning to new a principal hired from outside of the school leads to increased teacher turnover and a decline in the perceived quality of the school's environment. But transitioning to an internally-promoted new principal has no significant effect on these measures, despite leading to a similar reduction in student performance. This pattern of results is borne out both for a composite measure of the school's environment and a variety of survey indicators measuring teacher perceptions of school discipline and order, trust between teachers and principals, and indicators of the principal's vision for the school.

Our findings raise important questions about leadership transitions and the nature of principal effects. On the one hand, one might interpret the fact that the school's environment does not change following a within-school promotion as suggesting that internal transitions are less disruptive than bringing in a new principal from the outside. On the other hand, that both internal and external principal hires nonetheless lead to similar short-run reductions in student academic progress calls into question the extent to which the negative effect of principal turnover, and indeed the impact of principals in general, is driven by a principal's influence on the school's environment and culture.

The remainder of the paper proceeds as follows. Section 2 describes the prior research on principal effectiveness and the impact of principal turnover. Section 3 describes the data used for the analyses. We describe the empirical method in Section 4. Section 5 describes our results. Finally, Section 6 concludes.

2 Previous Research

Prior examinations of principal effectiveness have posited that principals have an indirect relationship to student outcomes, and that their influence is channeled largely through pathways related to staffing decisions and workplace conditions. Through staffing decisions, they can effectively influence school quality by hiring and retaining more effective teachers while also dismissing ineffective teachers (Grissom & Bartanen, 2019). Through their managerial effectiveness and other school policies, principals may also influence school climate, school discipline, and provide instructional support in ways that enhance working and learning conditions that positively affect teachers' productivity and satisfaction, as well as improve the learning environment for students and the school community (Bacher-Hicks, Billings, & Deming, 2019; Ingersoll, 2001; Johnson, Kraft, & Papay, 2012; Kraft, Marinell, & Shen-Wei Yee, 2016; ?, ?). Thus far, existing research has tended to employ administrative data on teacher turnover and student achievement. Only recently have researchers also probed the effects on school climate within a causal framework (Bartanen et al., 2019).

In theory, principal turnover could have both positive and negative effects. The short-term disruptive effects of turnover may be countered by longer-term positive replacement effects if incoming principals have superior leadership qualities compared to their predecessors (Bartanen et al., 2019). Thus far, the effects of turnover on student achievement and teacher turnover have been largely consistent across a number of studies. Examining the effects of principal turnover on student achievement in North Carolina, Miller (2013) found that principal departures were followed by downturns in student achievement that returned to average levels within 5 years. Rowan and Denk (1984) similarly found negative effects for principal turnover in schools with higher proportions of students in poverty, though as the percentage of students in poverty decreased the effects turned positive. More recently, Henry and Harbatkin (2019) used data from North Carolina and found that principal turnover leads to temporary decreases in student achievement and increases in teacher turnover. Béteille, Kalogrides, and Loeb (2012), using data from Miami-Dade County Public Schools, similarly found that principal turnover has a negative relationship with student achievement and

increases teacher turnover.

Extensions of this research into other outcome areas include Weinstein, Schwartz, Jacobowitz, Ely, and Landon (n.d.), who focused on principal changes in New York City and found that having a new principal is related to lower graduation rates. Bartanen et al. (2019), employing data from Missouri and Tennessee, confirm the findings from earlier studies regarding negative effects on student achievement and increases in teacher turnover while also examining the impact of principal turnover on teacher quality (measured as teacher value-added in math and reading) and school climate (measured by a single index of teachers' survey satisfaction indicators).

Analyzing data from teacher surveys is particularly important given what is often described as principals' indirect relationship to student outcomes that are hypothesized to be mediated through teacher effectiveness (Buckman & Tran, 2018; Kraft et al., 2015, 2016; Ross & Gray, 2006) New Y. Though the literature regarding the effect of principal turnover on teacher turnover has largely found consistent effects, little empirical work has shed light on the mechanisms. We can, however, look to studies regarding teacher working conditions and teacher turnover to provide some insights (Blase & Blase, 1999; Ingersoll, 2001; Shen, 1997; Supovitz, Sirinides, & May, 2010). For example, Kraft et al. (2016), leveraging teacher survey data from New York City middle schools, found that improvements in school leadership, teacher relationships, and school safety are associated with reductions in teacher turnover. A related review of the literature on teacher turnover identified strong evidence of a relationship between teacher turnover rates and school context measures such as school climate and quality leadership indicators (Simon & Johnson, 2015). Such indicators are related to the organizational contexts of schools and are likely ones that principals have some control over. Thus, if principal turnover negatively affects such school climate indicators, this could be a central mechanism through which principal turnover also affects teacher turnover and student achievement.

There are also strong reasons to suspect that a principal's background with a school may moderate the effects of turnover. Though related studies have found little evidence

that principal effectiveness is tied to their educational backgrounds (Clark, Martorell, & Rockoff, 2009), correlational studies have shown that greater experience is related to higher effectiveness (Bartanen, 2019; Bartanen et al., 2019; Béteille et al., 2012; Branch et al., 2009; Clark et al., 2009; Eberts & Stone, 1988). Observational studies also suggest that prior experience as an assistant principal in the same school may matter, particularly for inexperienced principals (Clark et al., 2009). It is likely that firsthand familiarity with the institutional culture, staff, and students that comes with in-school promotions eases the disruptive effects of principal transitions. In-house promotions retain institutional memory and may leverage existing relationships to ameliorate the negative effects of transitioning to a new principal (Béteille et al., 2012). It is also likely the case that promoting internal candidates may be more efficient in terms of time and cost. On the other hand, recruiting externally offers the potential to “clean the slate,” which may be important in struggling schools with entrenched dysfunction.

Building on this research, our study makes a number of important contributions. First, we add to this body of literature by employing a panel data set from a large urban school district. Second, in addition to examining the effects of principal transitions on teacher turnover and student achievement, we utilize a range of school environment and climate indicators measuring teacher perceptions of school order and safety, teacher-principal relationships and trust, and the principal’s involvement and vision related to learning at the school. Finally, we differentiate between the effect of transitioning to a new principal who came from outside or inside of the school.

3 Data

3.1 Administrative Staffing Data

The primary data comes from the New York City Department of Education (NYCDOE). From the NYCDOE, we obtained longitudinal administrative data that contain staffing characteristics for all principals during the 2006–2007 to 2017–2018 school years. For each prin-

principal, the data contain information regarding how many years she has been a principal at the same school, an assistant principal at the same school, or a teacher at the same school. Additional variables document how long each principal has served in these roles at any other school in the district. These data also contain information about principals' characteristics such as gender, race/ethnicity, appointment date, years of total experience, teacher years of experience, and principal years of experience. The average principal in our data has 9.3 years of experience as a teacher, though this ranges from a minimum of 0 to a maximum of 34 years. Similarly, while they have an average of 4.1 years of experience as a principal, this ranges from 0 to 48.6 years. We report additional descriptive statistics for the full sample of schools and principals in the Online Appendix.

We classify new principals as having been hired either from within or from outside of the school. We define as an external hire those incoming principals who had never previously worked within the school, and we classify as a promoted hire those who have worked within the school as either a teacher or an assistant principal. We exclude from the analysis a small number of principals who previously worked as a principal at a different New York City public school, and also worked as a teacher within the current school.

Table 1 describes principal turnover within the district overall and based on the school's decile according to the percentage of students who are non-White in the school.¹ On average, New York City schools replace about 9.5% of public school principals each year. More than half of entering principals never previously worked as a principal within New York City, and about a third are promoted from within the school. There are no meaningful differences in the turnover rate or type of new hire across quartile for economic need.

3.2 Teacher Turnover Data

We merge the principal data file with longitudinal school report card data from the New York State Education Department (NYSED) that contains the teacher turnover rate within

¹See the Online Appendix for descriptive statistics for the full sample and separated by the school's decile according to the percentage of students who receive free or reduced-priced lunch.

each school by year from 2006 through 2014. The turnover rate is based on the proportion of teachers in the prior school year who did not return to a teaching position in the district in the current school year, and thus might be thought of as a one-year lagged measure for our purposes. For example, if 95 of the 100 teachers within a school during the 2010–2011 school year returned to a teaching position within the school for the 2011–2012 school year then the data would record a turnover rate of 5% for 2011–2012.

[Table 1 About Here]

3.3 New York City Progress Report Metrics

For some analyses we use as the dependent variable a school’s component scores on the New York City Progress Report, which previously served as the city’s primary accountability system. These data elements are available only from 2009 through 2014. Each public and charter school in the district was assigned an A through F letter grade based on the weighted average from three reporting metrics: school learning environment (15% of total score), student performance (30%), and student progress (55%). We measure the effect of principal transitions on the school’s score on each of these three reporting metrics. Though the underlying calculations changed slightly over time, the three reporting metrics were constant throughout the period. We account for the differences in the calculation by standardizing each reporting metric by year and by incorporating a year fixed effect in the regression analyses. Thus, such changes will only bias our estimates if they lead to changes in the relative performance of schools in a way that is also related to the likelihood that the school changes principals in a particular year.²

Each reporting metric is a composite of factors associated with the relevant construct. The school learning environment includes student attendance and collected responses from parent, teacher, and student surveys to questions associated separately with safety

²The state also adjusted the content and scaling of its math and English Language Arts exams over time, and thus use of mean scale scores on the tests as an outcome requires the same assumption.

and respect, academic expectations, engagement, and communication.³ The student performance metric provides a snapshot of student performance levels within the school and is based on the percentage of students scoring proficient or above and the median score on the state math and ELA tests. The student progress metric measures how student proficiency changed within the school during the year and includes factors such as the percentage of students making at least 1 year of progress on the state tests, the average change in student proficiency, and, in later years, an adjusted student growth percentile.

A school's final score on each reporting metric was adjusted to account for its performance relative to the citywide average over the previous 3 years (one third of the school's score) and relative to a group of peer schools with similar demographic characteristics and average incoming standardized test scores over the previous 3 years (two thirds of the school's score). Thus, the outcome measures themselves have already been adjusted to account for student characteristics as would be applied in a regression analysis using student-level data.

3.4 Learning Environment Surveys

The last set of outcome measures we employ come directly from teacher responses to the NYCDOE's School Survey. Though these surveys have been consistently administered annually over our study period, the individual items have varied. In order to gain the most traction from these data, we first compiled all 348 survey items that have appeared in the teacher surveys from 2007–2017. Next, we removed items that were not related to workplace conditions and teacher-principal relationships. From this, we identified 31 items that could reasonably be expected to provide some meaningful teachers' assessment of principals' leadership. We next screened out items that were not consistent over time or were not administered for a sufficient number of years. In some rare cases we retained items when question wording was modified slightly but qualitatively measured the same concept. This resulted in a final

³Analyses of NYCDOE's School Surveys find high rates of consistency and reliability, as well as high validity rates demonstrated by significant correlations between the survey measures and other indicators of school quality (Rockoff & Speroni, 2008).

set of 16 questions that we deemed appropriate for our analysis. For ease of interpretation and to reduce the likelihood of Type I error, we have thematically condensed the individual survey items into the three conceptual scales of order and discipline (e.g., order and discipline are maintained at my school), instructional leadership and vision (e.g., school leaders give me regular and helpful feedback about my teaching), and relationships and trust within the school (e.g., the principal has confidence in the expertise of teachers). The groupings have high internal consistency, with Cronbach’s alphas of 0.85, 0.97, and 0.92, respectively. Each scale is composed of the average of positive responses to individual survey items and standardized by year to facilitate comparisons across domains (Kraft et al., 2016). The final column of Table 1 shows that survey response rates do not differ across deciles of non-White student enrollment. The Online Appendix provides regression results for each individual survey question item used to create the scales.

4 Method

Our goal is to reveal the causal effect of a school transitioning from one principal to another, relative to having an “established” principal, on a variety of school outcomes and environmental characteristics. Simply comparing changes within schools that recently experienced a principal transition to those that did not may be biased because it is likely there are school attributes associated with both the probability that a school changes principals and its later outcomes. We address the potential for selection bias by leveraging cross-school variation in the timing of principal changes to difference out variation resulting from fixed school attributes and variation over time that is shared among New York City schools.

The primary regression model takes the form:

$$y_{st} = \alpha + \delta_s + \phi_t + \sum_{p=-3+}^{-1} \lambda_p M_{stp} + \sum_{q=0}^4 \beta_q N_{stpq} + \epsilon_{st} \quad (1)$$

Where y_{st} is an outcome for school s in year t , δ_s and ϕ_t are school and year fixed effects. The vector M includes separate indicators for whether the observation occurs the year prior,

2 years prior, or 3 or more years prior to the current principal leaving school, and N includes separate indicators for whether the observation occurs within each of the first 5 years following the current principal entering the school, such that time period 0 indicates the new principal’s first year. In addition to evaluating the effect of principal changes overall, we also estimate models that differentiate between transitions to a principal who was hired from within or outside of the school by incorporating interactions between each of the pre- and post-period indicators and the type of incoming principal.

Equation (1) takes the form of an event study by parsing out school outcomes in particular years preceding or following a principal change. To aid differentiation, the omitted reference for both M and N is the period immediately before a principal transition. The estimate for each β_q represents the average difference in the outcome for a school that is q years within a principal’s tenure relative to its outcome in a year prior to a principal transition, holding constant whether a school is 2 years or 3 or more years from experiencing a transition. And each λ_p represents the school’s outcome when p years prior to a principal transition relative to the year before a principal transition, holding constant if the school experienced a transition within each of the previous 5 years. Figures A1 and A2 in the Online Appendix show that the results for the post-transition years are very similar when we exclude the controls for individual years leading to a transition. Thus, while the use of the prior year controls allow us to evaluate the plausibility that the parallel trends assumption holds, they have no meaningful impact on our estimate for the impact of principal transitions on the outcomes of interest.

We are interested in the pattern of the β_q ’s both relative to the comparison group and relative to each other. If principal transition has an impact relative to an “established” principal, we would expect to see deviation in the effect in years immediately following the principal change that then trend towards zero in later years as the principal becomes the status-quo administrator.

Causal interpretation of β_0 through β_4 hinges on the so-called parallel-trends assumption, which requires that the trend in the respective outcome for schools that have

not experienced a change in principal within the previous 5 years serves as an accurate counterfactual for the trend among schools that did experience a principal change in that time-frame (Kahn-Lang & Lang, 2019). The plausibility that this assumption holds is improved by the fact that schools experience principal changes at different time periods and thus the treatment is not likely to be associated with policy changes or other factors that affect all New York City schools at once. Nonetheless, it is feasible that schools are more likely to experience a principal transition following periods in which they are struggling, and thus any post-change effects might simply reflect previously existing relationships. Indeed, some prior studies observe such a dip in performance 1 or 2 years prior to a principal’s departure (Bartanen et al., 2019; Miller, 2013). We can evaluate the plausibility of the common-trends assumption by evaluating the estimates for λ_{-3+} through λ_{-1} , which compare the outcomes of schools that are p years from experiencing a principal transition relative to schools that are further from experiencing a transition, holding constant whether the school experienced a principal transition within the previous 5 years.

5 Results

We begin our description of the results by considering the effect of principal transitions on student performance and student progress metrics under the city’s accountability system as well as teacher turnover. We then explore the impact of principal transitions on the school environment metric and teacher responses to questions on the NYC School Survey, which we group into three constructs of interest.

We present results visually in order to better observe pre- and post-transition trends and aid interpretation across outcomes and transition type. Tables reported in the Appendix provide detailed coefficient estimates, standard errors, and number of observations for each of these analyses. For each coefficient, the first line represents the estimate of any principal transition, the second line represents the effect of transition to a principal hired from outside the school, and the third line represents the effect of transition to a principal promoted from

within the school. The separate effects from an external or promoted hire are estimated within the same regression. Coefficients for a particular number of years pre- or post-transition are relative to the year prior to a transition.

5.1 Effect of Principal Transitions on Student Test Scores and Teacher Turnover

The top two panels of Figure 1 illustrate the impact on our measure of student test score growth (student progress score) and the level of student proficiency within the school (student performance score), measured in standard deviation units at the school level. The results are quite consistent across the types of principal transitions. For both outcomes, and for each type of principal transition, the coefficients comparing school scores in years leading up to the transition are not different from the (omitted) comparison year immediately prior to the transition, suggesting that there was not a systematic trend in the outcome as schools approached a principal transition. We then observe a sharp drop during a new principal's first year on both metrics. The decline in the student progress measure fades within 3–5 years, while the drop in the level of student performance appears to hold for up to 5 years following the transition.

[Figure 1 About Here]

The magnitude of the effect of principal transitions on the measures of school test score outcomes is meaningful. The decline in the student progress score in the first 2 years following a principal transition is about 0.163 standard deviations on the metric in the overall regression, and the decline on the student performance measure is about 0.108 standard deviations.

The bottom two panels illustrate the estimated impact of changing principals on teacher turnover overall and among teachers with 5 or fewer years of experience. The scale for the y-axis is now percentage points, rather than standard deviation units. Recall that the turnover measure is somewhat lagged in that it indicates the percentage of teachers from the

prior year who did not return to teach in the fall. Finally, it is important to note that the teacher turnover regressions include a larger set of years (from 2006 through 2014) because they are not constrained by when the city employed its Progress Report system.⁴

As in the test score analyses, we again see no evidence of a prior trend in teacher turnover leading up to principal transitions, regardless of the type of transition. We also do not see a change in teacher turnover during the first year following a principal transition, which is expected because such turnover would have occurred prior to the beginning of the new principal's first year. We then see in the new principal's second year a significant and substantial increase in teacher turnover both overall and among teachers with 5 or fewer years of experience following a transition to an externally-hired principal. However, we do not observe a change in teacher turnover following a transition to an internally promoted teacher.

5.2 School Environment

The northwest panel of Figure 2 illustrates the estimated effect of a principal transition on the school learning environment score. Similar to prior results, we do not find a significant trend in the environment score prior to the transition, which is consistent with our primary identifying assumption. As was the case for teacher turnover, a principal transition on our measure of overall school environment differs by whether the incoming principal was hired externally or promoted from within. There is a large drop of about 0.26 standard deviations in the school environment score after a school transitions to a principal hired from outside of the school. This effect dissipates somewhat over time, but just narrowly misses statistical significance at the 5% level up to 5 years later. In contrast, promoting a principal from within the school has no distinguishable effect on the school's environment. Indeed, the direction of the estimate in the years immediately following the transition is positive, though not

⁴Figures A4 and A3 in the Online Appendix show that results on the outcomes that are not part of the accountability system — teacher turnover and the responses to teacher survey items—are very similar to those reported when the sample is restricted to include only years in which we also observe the metrics of the accountability system.

statistically different from zero.

[Figure 2 About Here]

The pattern of results on the teacher survey constructs is consistent with the outcomes for the school's overall learning environment score and for teacher turnover. Relative to the year prior to the principal change there is a sharp drop in teacher responses to questions related to trust (-0.174 standard deviations), order (-0.163), and vision (-0.244) that dissipates over the next few years within schools that transitioned to a principal who was hired from outside of the school. But transitioning to an internally promoted principal has no effect on these measures.

There does appear to be some potential for a trend in teacher survey responses for each of the metrics, which is cause for some caution for giving a causal interpretation to these estimates. However, the difference in the pattern of the outcomes for the two types of principal transitions is also notable for interpreting the results. For each of the survey constructs, the estimates for the years leading to the principal transition are very similar for the two types of transitions. Then, in the year of the principal change, the coefficients on the two types of transitions diverge sharply, with a clear negative pattern for schools that hired an external principal and a positive swing for schools that promoted the new principal from within the school. Thus, even if one were to discount the estimates as a truly causal effect of either type of transition on the survey measures, it is clear from this pattern of results that the two types of transitions do not have the same impact.

6 Summary and Conclusion

We apply an event-study approach to longitudinal administrative data from New York City in order to estimate the causal effect of principal transitions on measures of school effectiveness and quality of learning environment. We expand the understanding of the nature of principal turnover by evaluating whether the effect of the transition differs according to whether the

new principal is an externally hired newcomer or someone promoted internally within the school.

Our results suggest that principal turnover has a similar negative impact on student performance regardless of whether the new principal had previously worked within the school, but whether a school transitions to an externally hired or internally promoted principal has very different impacts on a school's learning environment, at least from the perspective of teachers. Transitioning to a new principal who has not previously worked in the school leads to increased teacher turnover and a decline in positive teacher responses to survey questions associated with the level of trust, order, and vision within the school. Transitioning to a new principal who was previously working in the school, however, has no significant impact on teacher turnover or teacher perceptions of the school's learning environment.

The pattern of our results is surprising given the conventional expectation that a principal's impact on student achievement is primarily driven by their impact on the school's working environment. It is difficult to fully square why teachers perceive externally hired new principals as disruptive while viewing internally hired principals as fairly innocuous or even positive for the school environment, yet in both cases we observe similar negative impacts on students' academic performance. These results suggest a need for additional research on the nature of principal impacts. In particular, our evidence from New York City suggests that a principal's impact on student learning could be distinct from their effects on working conditions for teachers within the school.

When considering results on the survey items and school environment, it should be kept in mind that we do not observe actual behaviors within the school. Rather, we observe teacher perceptions as collected on the city's survey. Given that teachers' perceptions could be influenced by any number of factors linked with a new principal, it is at least feasible that principal transitions affect teachers' perceptions of the school's environment but do not accurately reflect the principal's actual impact on the environment. Nonetheless, that the pattern of results on the environmental measures is similar to the pattern for teacher turnover gives some indication that the environmental measures are capturing something

real about teachers' perceptions.

The event-study approach we take in this paper is limited relative to other quasi-experimental techniques that take advantage of exogenous variation to estimate causal effects (Kahn-Lang & Lang, 2019). There is at least anecdotal reason to suspect that the timing of principal transitions are not as-good-as random, which would imply the potential for selection bias. Nonetheless, the pattern of estimates appears to be generally consistent with the parallel trends assumption on which causal interpretation of our results hinges. There is some evidence that the assumption could be violated in the case of the teacher surveys. However, even in those cases the pattern of results clearly indicates a different impact from the two types of principal transitions we explore.

We caution that our results do not necessarily imply that a given school that hired an external candidate to fill its principal position would have experienced a different outcome had they instead promoted someone internally. While we are able to extend the identifying logic within our examination of schools that hired internal or external principals separately, the comparison might not hold across such schools because their choice may reflect differences in the pool of available candidates. For example, schools in our analysis that hired an external candidate may have done so at least in part because they did not have a strong internal candidate for the position. Thus, the counterfactual potential internal hire for this school may not be the same as for schools that did hire an external candidate.

Our findings have at least three practical implications. First, our results demonstrate that principal transitions are disruptive to student learning generally, regardless of the type of hire. Second, our results suggest that schools that transition to an externally hired principal tend to experience a decline in working conditions for teachers, which manifests in an increase in teacher turnover. Third, the fact that schools that promoted an internal candidate experienced a decline in student achievement, but no change in teacher turnover and potentially an improvement in the reported environment, calls into question the link between those factors and school quality, as well as the mechanisms of principal impacts on student learning. These findings both shed new light on the nature of principal transitions

and open several avenues for additional research.

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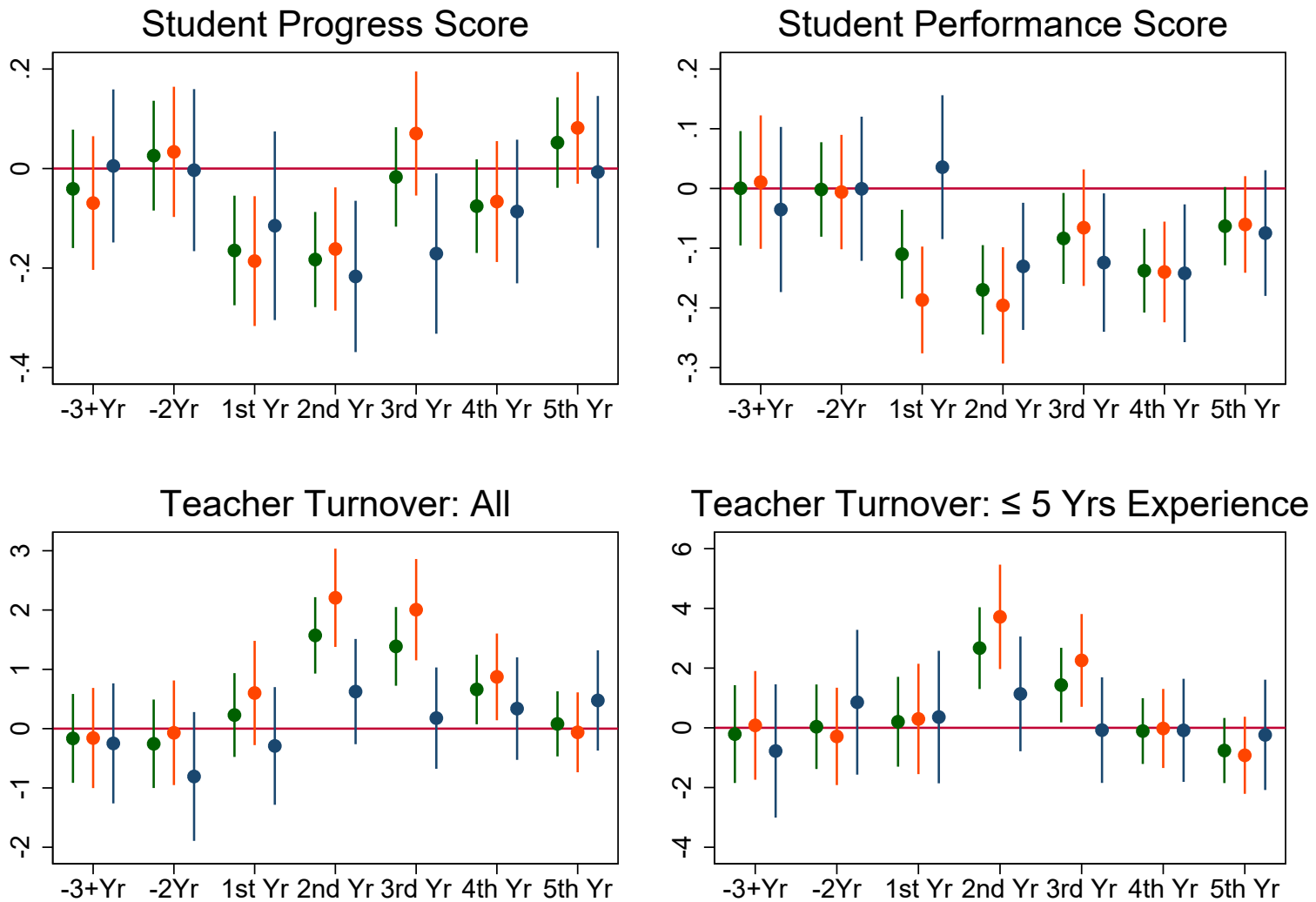
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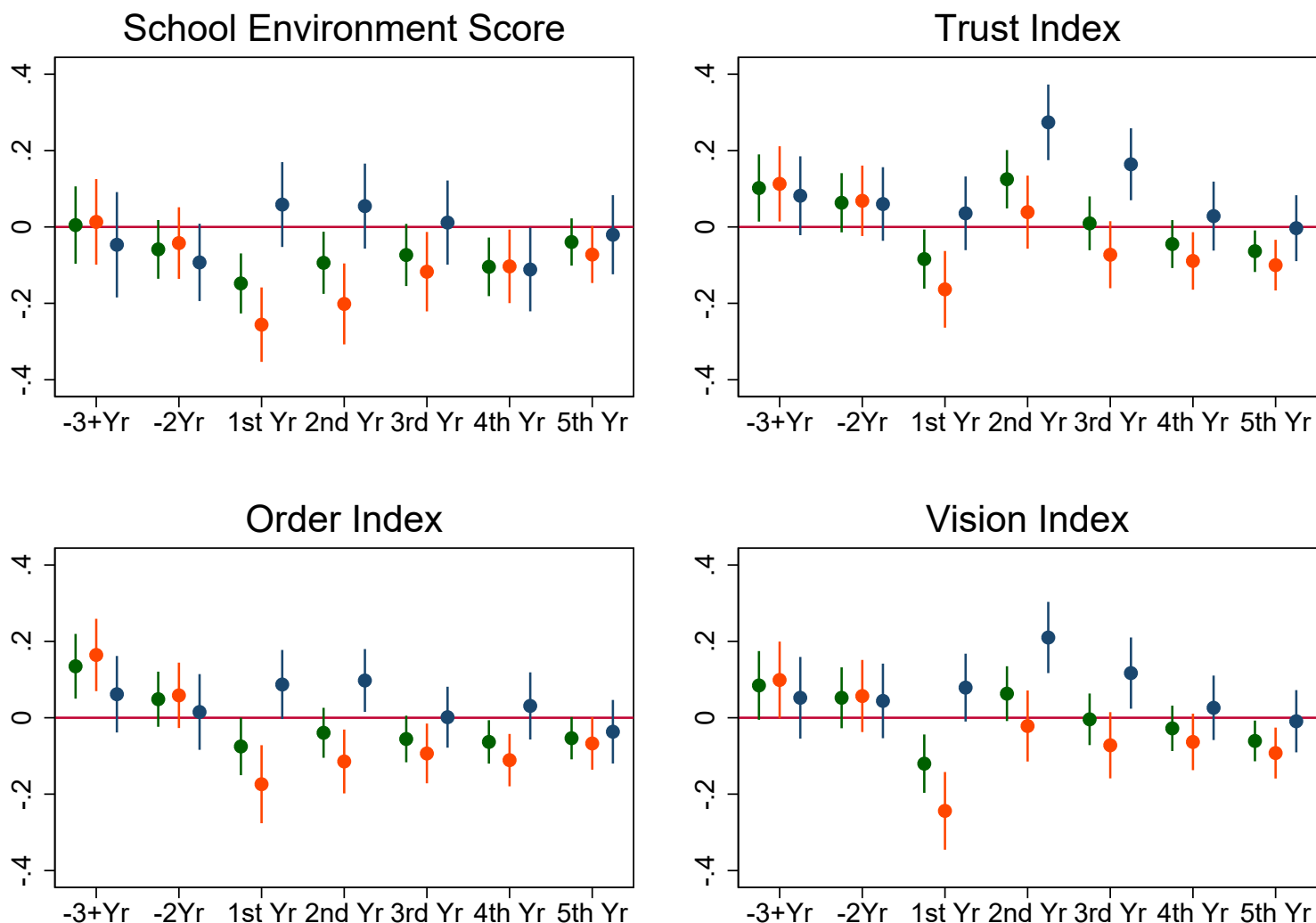
7 Tables and Figures

Figure (1) Effect of Principal Transition on Student Test Scores and Teacher Turnover



Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Omitted comparison group — not shown on the figure — is the year prior to a principal change. Dependent variable for student progress and student performance are measured in standard deviation units. Dependent variable for teacher turnover measured in percentage points. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

Figure (2) Effect of Principal Transition on School Environment and Teacher Survey Responses



Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Omitted comparison group — not shown on the figure — is the year prior to a principal change. Dependent variable is measured in percentage points of positive response. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

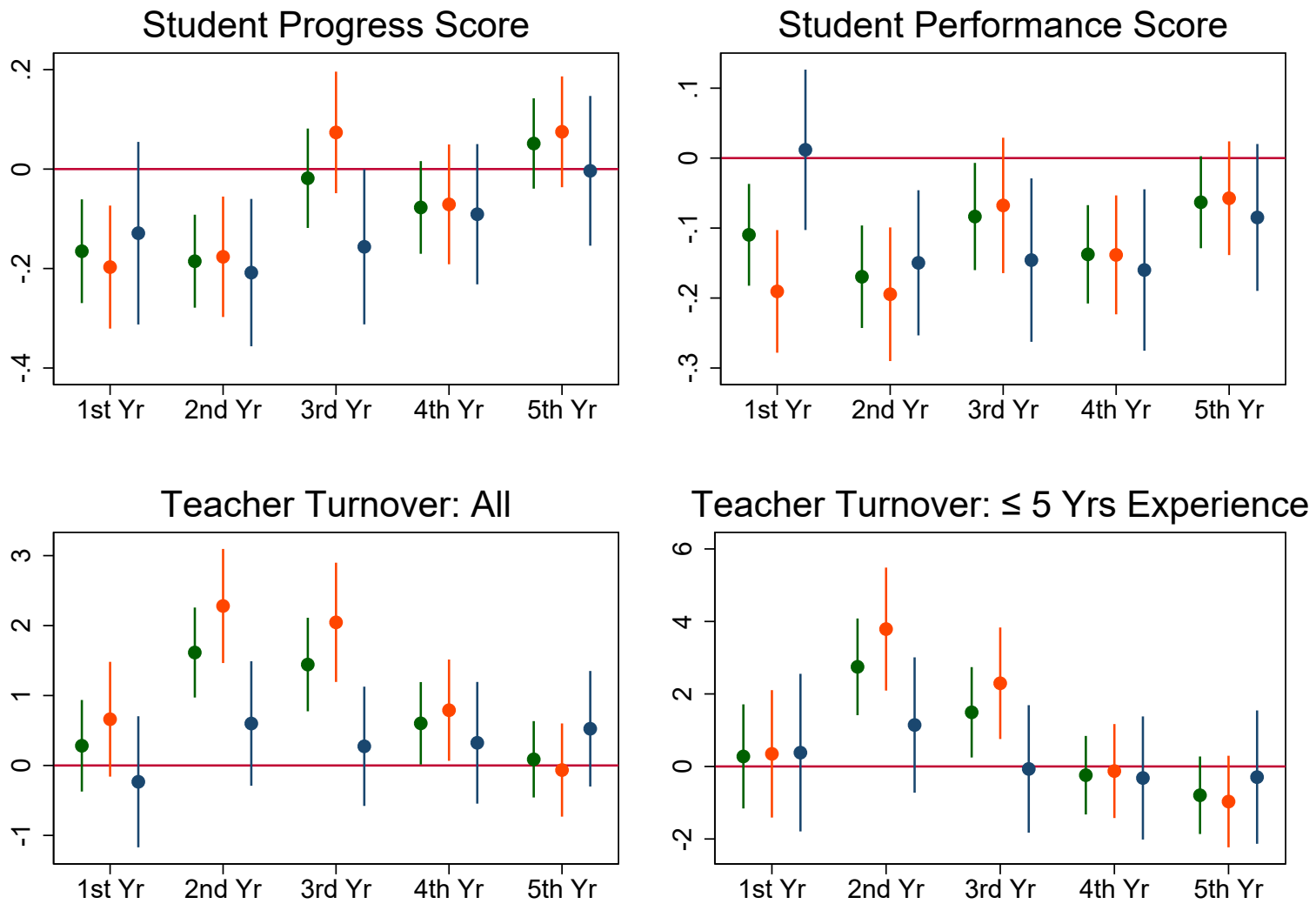
Table (1) Principal Turnover Rate and Replacement Type by School Low-Income Enrollment

	Turnover rate	Type of hire		Response rate
		External	Promoted	
All schools	0.095 [0.293]	0.751	0.237	0.839 [0.168]
Lowest decile	0.088 [0.093]	0.708	0.266	0.848 [0.159]
2nd decile	0.088 [0.093]	0.669	0.297	0.839 [0.169]
3rd decile	0.115 [0.124]	0.767	0.233	0.844 [0.176]
4th decile	0.102 [0.116]	0.861	0.139	0.839 [0.161]
5th decile	0.099 [0.110]	0.779	0.214	0.830 [0.185]
6th decile	0.100 [0.100]	0.776	0.217	0.846 [0.143]
7th decile	0.101 [0.109]	0.793	0.197	0.836 [0.160]
8th-10th deciles*	0.081 [0.086]	0.693	0.295	0.850 [0.157]

Note. Student enrollment percentages are from 2012. In cases where a school is missing student enrollment data for 2012, we report results from the closest year for which student enrollment is available. The 8th-10th deciles cannot be separated because approximately 23% of schools have 100% poverty enrollment.

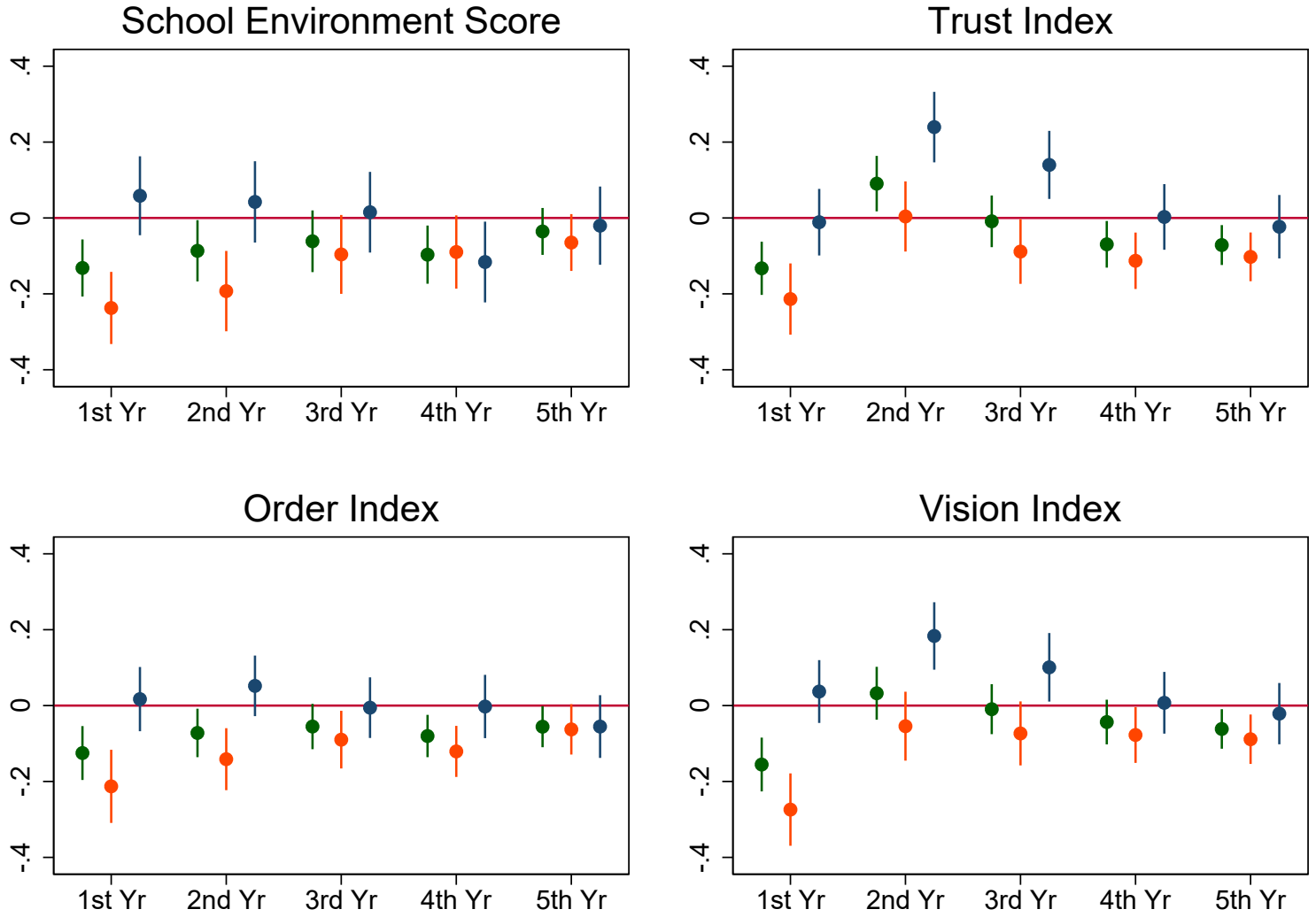
A Appendix Tables and Figures

Figure (A1) Effect of Principal Transition on Student Test Scores and Teacher Turnover: No Controls for Years Prior to Transition



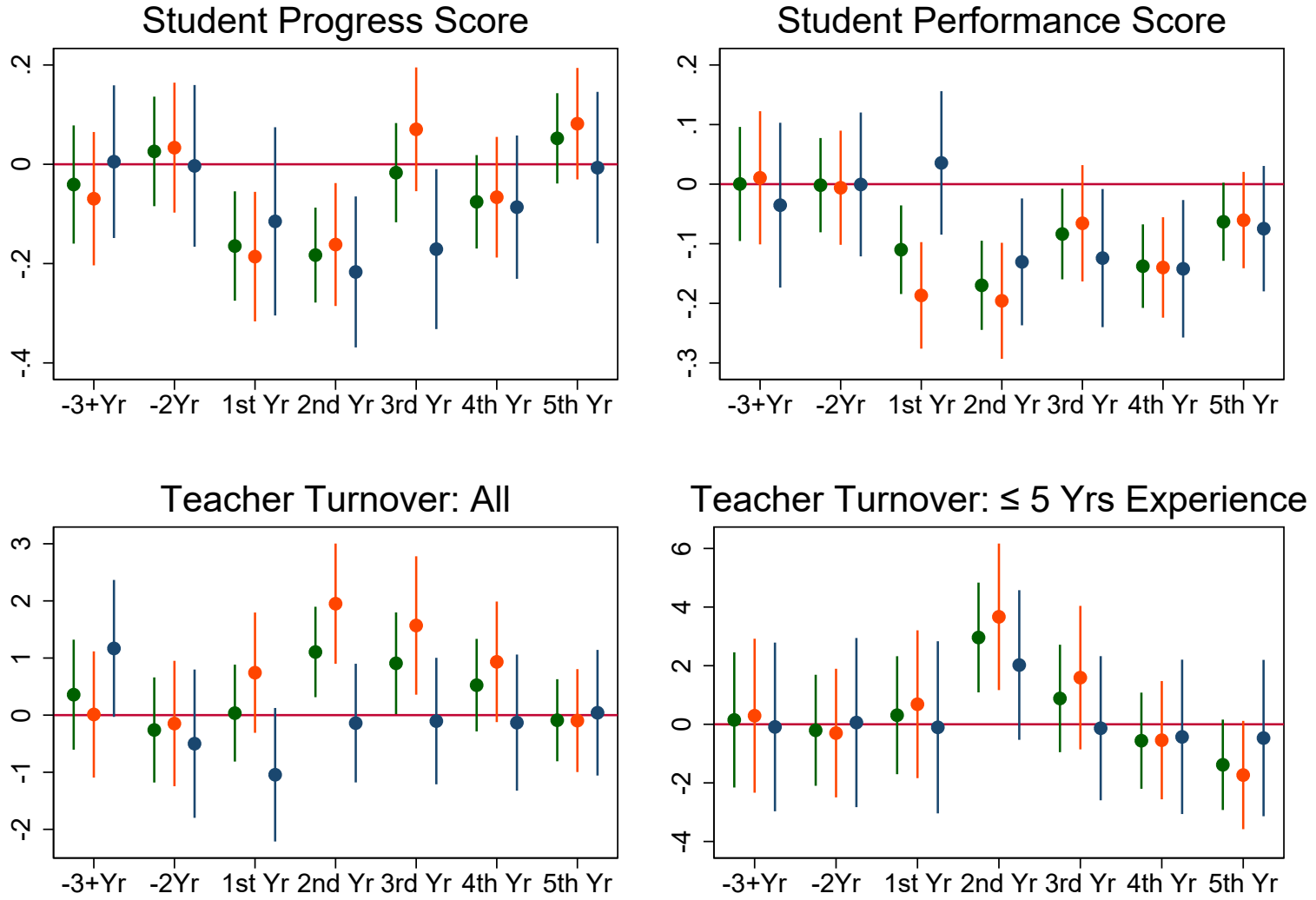
Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Dependent variable for student progress and student performance are measured in standard deviation units. Dependent variable for teacher turnover measured in percentage points. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

Figure (A2) Effect of Principal Transition on School Environment and Teacher Survey Responses: No Controls for Years Prior to Transition



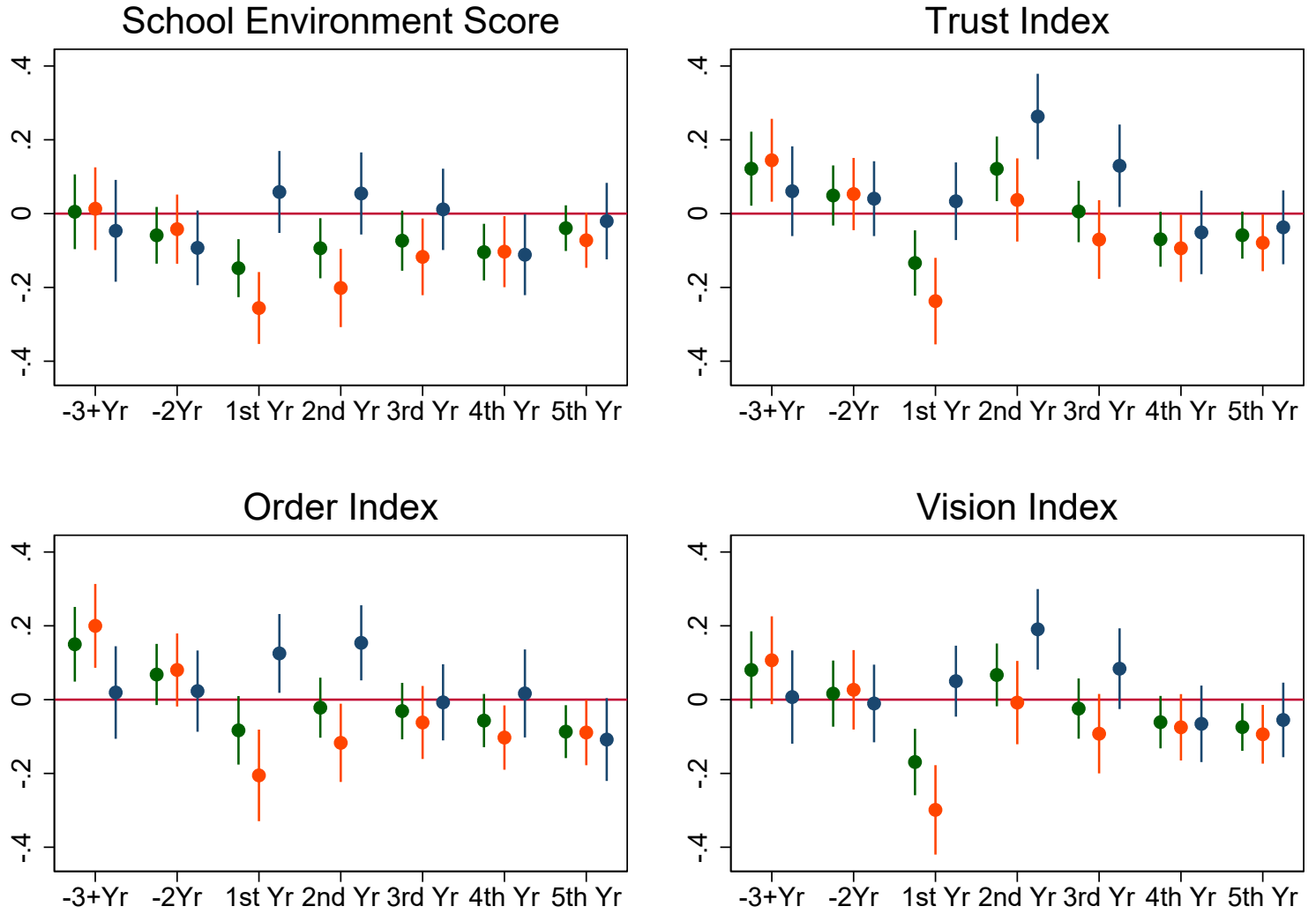
Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Dependent variables are measured in standard deviation units. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

Figure (A3) Effect of Principal Transition on Reporting Metrics and Teacher Turnover: Sample Restricted to Progress Report Years



Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Omitted comparison group — not shown on the figure — is the year prior to a principal change. Dependent variable for student progress and student performance are measured in standard deviation units. Dependent variable for teacher turnover measured in percentage points. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

Figure (A4) Effect of Principal Transition on School Environment and Teacher Survey Responses: Sample Restricted to Progress Report Years



Note. Dependent variable is listed at top of each figure. Green line illustrates results from evaluating any principal transition, orange line from external hires, blue line from internal promotions. Omitted comparison group — not shown on the figure — is the year prior to a principal change. Dependent variables are measured in standard deviation units. Figure illustrates the respective coefficient and 95% confidence interval using robust standard errors.

Table (A1) Regression Results: Any Principal Change

	(1)	(2)	(3)	(4)	(5)
	Progress	Performance	Environment	Teacher_turnover	Teach_turnover_≤5yrs
-3+ yr	-0.041 (0.061)	0.001 (0.049)	0.005 (0.052)	-0.165 (0.382)	-0.211 (0.834)
-2 yr	0.019 (0.057)	-0.002 (0.041)	-0.059 (0.039)	-0.256 (0.380)	0.036 (0.721)
1st yr	-0.163*** (0.057)	-0.108*** (0.038)	-0.148*** (0.040)	0.229 (0.360)	0.202 (0.767)
2nd yr	-0.188*** (0.049)	-0.169*** (0.039)	-0.094** (0.041)	1.572*** (0.328)	2.668*** (0.698)
3rd yr	-0.010 (0.052)	-0.079** (0.039)	-0.073* (0.041)	1.387*** (0.338)	1.431** (0.637)
4th yr	-0.069 (0.048)	-0.145*** (0.036)	-0.104*** (0.039)	0.661** (0.299)	-0.109 (0.561)
5th yr	0.057 (0.047)	-0.056* (0.034)	-0.039 (0.032)	0.080 (0.280)	-0.761 (0.555)
Observations	5854	5854	5854	10984	10587
R^2	0.006	0.008	0.008	0.049	0.010

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A2) Regression Results: By Type of New Principal

	(1)	(2)	(3)	(4)	(5)
	Progress	Performance	Environment	Teacher_turnover	Teach_turnover_≤5yrs
External -3+ yr	-0.069 (0.068)	0.011 (0.057)	0.013 (0.057)	-0.158 (0.430)	0.081 (0.928)
External -2 yr	0.034 (0.067)	-0.006 (0.049)	-0.042 (0.048)	-0.070 (0.450)	-0.288 (0.831)
External 1st yr	-0.186*** (0.066)	-0.187*** (0.046)	-0.256*** (0.050)	0.601 (0.448)	0.296 (0.942)
External 2nd yr	-0.162** (0.063)	-0.196*** (0.050)	-0.201*** (0.054)	2.206*** (0.422)	3.716*** (0.891)
External 3rd yr	0.070 (0.064)	-0.066 (0.050)	-0.117** (0.053)	2.006*** (0.436)	2.257*** (0.792)
External 4th yr	-0.066 (0.062)	-0.140*** (0.043)	-0.103** (0.049)	0.873** (0.373)	-0.022 (0.675)
External 5th yr	0.082 (0.057)	-0.060 (0.041)	-0.072* (0.038)	-0.062 (0.343)	-0.921 (0.658)
Promoted -3+ yr	0.005 (0.078)	-0.035 (0.070)	-0.047 (0.070)	-0.249 (0.516)	-0.776 (1.137)
Promoted -2 yr	-0.003 (0.083)	-0.001 (0.062)	-0.093* (0.052)	-0.807 (0.554)	0.856 (1.236)
Promoted 1st yr	-0.115 (0.097)	0.036 (0.061)	0.059 (0.057)	-0.292 (0.506)	0.360 (1.131)
Promoted 2nd yr	-0.217*** (0.077)	-0.130** (0.054)	0.055 (0.057)	0.625 (0.452)	1.135 (0.979)
Promoted 3rd yr	-0.171** (0.082)	-0.124** (0.059)	0.011 (0.056)	0.178 (0.435)	-0.078 (0.901)
Promoted 4th yr	-0.086 (0.074)	-0.142** (0.059)	-0.111** (0.056)	0.338 (0.440)	-0.085 (0.880)
Promoted 5th yr	-0.007 (0.078)	-0.075 (0.054)	-0.020 (0.053)	0.476 (0.431)	-0.236 (0.941)
Observations	5941	5941	5941	10984	10587
R^2	0.008	0.011	0.014	0.051	0.011

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A3) Regression Results: Any Principal Change

	(1)	(2)	(3)
	Order_Index	Trust_Index	Vision_index
-3+ yr	0.136*** (0.044)	0.081* (0.045)	0.079* (0.046)
-2 yr	0.028 (0.036)	0.039 (0.040)	0.036 (0.040)
1st yr	-0.079** (0.039)	-0.075* (0.040)	-0.113*** (0.039)
2nd yr	-0.063* (0.034)	0.103** (0.041)	0.022 (0.038)
3rd yr	-0.061* (0.032)	0.003 (0.037)	-0.010 (0.035)
4th yr	-0.071** (0.030)	-0.057* (0.033)	-0.037 (0.031)
5th yr	-0.045 (0.029)	-0.063** (0.028)	-0.054** (0.027)
Observations	9855	9856	9856
R^2	0.006	0.007	0.005

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A4) Regression Results: By Type of New Principal

	(1) Order_index	(2) Trust_index	(3) Vision_index
External -3+ yr	0.164*** (0.048)	0.113** (0.050)	0.099* (0.051)
External -2 yr	0.059 (0.044)	0.068 (0.047)	0.057 (0.048)
External 1st yr	-0.174*** (0.052)	-0.163*** (0.051)	-0.244*** (0.052)
External 2nd yr	-0.114*** (0.043)	0.039 (0.049)	-0.022 (0.047)
External 3rd yr	-0.093** (0.040)	-0.073 (0.045)	-0.072 (0.044)
External 4th yr	-0.111*** (0.035)	-0.089** (0.038)	-0.063* (0.038)
External 5th yr	-0.067* (0.035)	-0.100*** (0.034)	-0.092*** (0.034)
Promoted -3+ yr	0.062 (0.051)	0.082 (0.053)	0.052 (0.055)
Promoted -2 yr	0.015 (0.051)	0.060 (0.049)	0.044 (0.050)
Promoted 1st yr	0.087* (0.046)	0.036 (0.049)	0.079* (0.045)
Promoted 2nd yr	0.098** (0.042)	0.274*** (0.050)	0.210*** (0.048)
Promoted 3rd yr	0.001 (0.041)	0.164*** (0.048)	0.117** (0.048)
Promoted 4th yr	0.031 (0.045)	0.028 (0.046)	0.026 (0.043)
Promoted 5th yr	-0.037 (0.042)	-0.003 (0.044)	-0.009 (0.042)
Observations	10528	10529	10529
R^2	0.009	0.014	0.012

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A5) Regression Results: Questions Related to Trust

	(1)	(2)	(3)	(4)	(5)
	Q1	Q2	Q3	Q4	Q5
External -3+ yr	1.330 (0.838)	2.053** (0.963)	0.918 (0.910)	1.062 (0.933)	1.843* (1.010)
External -2 yr	0.664 (0.784)	0.691 (0.940)	0.707 (0.859)	1.141 (0.888)	1.057 (0.917)
External 1st yr	-2.534*** (0.814)	-1.205 (0.984)	-1.573* (0.872)	-1.634* (0.947)	-2.433** (0.956)
External 2nd yr	0.103 (0.819)	-2.436** (0.977)	1.545* (0.827)	2.979*** (0.942)	2.587*** (0.942)
External 3rd yr	-1.564** (0.750)	-4.075*** (0.866)	-0.276 (0.777)	0.106 (0.857)	-0.862 (0.870)
External 4th yr	-2.515*** (0.663)	-4.068*** (0.807)	-0.480 (0.723)	0.142 (0.755)	-3.157*** (0.765)
External 5th yr	-1.558*** (0.596)	-2.606*** (0.689)	-1.595** (0.623)	-0.866 (0.656)	-1.542** (0.704)
Promoted -3+ yr	1.406 (0.912)	2.026* (1.096)	1.120 (1.014)	0.419 (1.077)	2.431** (1.022)
Promoted -2 yr	0.051 (0.824)	0.582 (1.156)	0.822 (0.922)	0.069 (0.990)	1.401 (1.042)
Promoted 1st yr	0.210 (0.859)	0.544 (1.056)	0.317 (0.908)	1.454 (0.992)	0.795 (1.056)
Promoted 2nd yr	4.360*** (0.859)	3.847*** (1.008)	4.597*** (0.912)	6.634*** (0.983)	6.622*** (0.924)
Promoted 3rd yr	2.956*** (0.839)	1.032 (1.121)	2.704*** (0.896)	5.133*** (0.925)	2.786*** (0.994)
Promoted 4th yr	0.615 (0.778)	0.911 (0.770)	0.131 (0.870)	1.204 (0.910)	1.363 (0.899)
Promoted 5th yr	-0.368 (0.735)	-0.357 (0.832)	-0.491 (0.849)	0.809 (0.864)	-0.052 (0.828)
Observations	11957	9149	10529	10529	10542
R^2	0.101	0.070	0.177	0.167	0.122

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A6) Regression Results: Questions Related to Order

	(1)	(2)	(3)	(4)	(5)	(6)
	Q1	Q2	Q3	Q4	Q5	Q6
External -3+ yr	4.188*** (1.059)	3.446*** (1.062)	1.609** (0.760)	-0.128 (0.736)	-0.375 (0.627)	-0.695 (0.679)
External -2 yr	2.139** (1.041)	0.909 (0.999)	0.018 (0.763)	-0.327 (0.681)	-0.077 (0.516)	0.479 (0.544)
External 1st yr	-3.391*** (1.068)	-3.106*** (1.132)	-1.391 (0.847)	-2.614*** (0.749)	-1.428** (0.645)	-1.659** (0.646)
External 2nd yr	-2.295** (0.922)	-2.534*** (0.939)	-1.294* (0.663)	-1.347** (0.655)	-1.917*** (0.594)	-0.743 (0.571)
External 3rd yr	-2.179** (0.917)	-1.948** (0.902)	-0.541 (0.674)	-1.706*** (0.631)	-1.574*** (0.561)	-0.477 (0.568)
External 4th yr	-2.655*** (0.826)	-2.084*** (0.801)	-0.791 (0.581)	-1.759*** (0.586)	-2.005*** (0.523)	-1.049* (0.551)
External 5th yr	-0.940 (0.799)	-1.214 (0.794)	-0.076 (0.604)	-1.378** (0.562)	-0.979** (0.453)	-0.715 (0.481)
Promoted -3+ yr	2.745** (1.186)	2.067* (1.136)	0.462 (0.743)	0.330 (0.832)	-0.663 (0.759)	-0.793 (0.765)
Promoted -2 yr	0.823 (1.236)	0.274 (1.242)	0.184 (0.908)	-0.145 (0.758)	-0.324 (0.643)	-0.377 (0.656)
Promoted 1st yr	1.676 (1.150)	0.985 (1.133)	0.805 (0.787)	-0.445 (0.754)	0.235 (0.614)	0.674 (0.646)
Promoted 2nd yr	1.820* (0.943)	2.136** (0.973)	1.880*** (0.621)	-0.320 (0.676)	-0.199 (0.611)	0.851 (0.602)
Promoted 3rd yr	0.195 (0.950)	0.679 (0.972)	0.878 (0.684)	-1.056 (0.687)	-1.099* (0.627)	-0.426 (0.590)
Promoted 4th yr	1.466 (1.044)	1.480 (1.031)	1.481* (0.792)	-1.109 (0.731)	-1.244** (0.605)	0.450 (0.529)
Promoted 5th yr	-1.571 (1.020)	-1.378 (1.042)	-0.127 (0.721)	0.541 (0.668)	-0.210 (0.544)	1.224** (0.585)
Observations	11955	10521	11293	10528	10528	10528
R^2	0.158	0.189	0.607	0.473	0.127	0.134

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A7) Regression Results: Questions Related to Vision

	(1)	(2)	(3)	(4)	(5)
	Q1	Q2	Q3	Q4	Q5
External -3+ yr	-0.475 (0.673)	1.629* (0.861)	2.547 (1.561)	0.262 (0.872)	1.185 (0.871)
External -2 yr	-0.033 (0.599)	0.982 (0.799)	2.148 (1.476)	0.405 (0.716)	0.802 (0.786)
External 1st yr	-3.242*** (0.725)	-3.788*** (0.840)	-2.538* (1.480)	-1.797** (0.739)	-3.777*** (0.827)
External 2nd yr	-0.783 (0.622)	-1.781** (0.774)	1.674 (1.362)	1.270* (0.701)	-1.109 (0.829)
External 3rd yr	-0.747 (0.570)	-1.851** (0.724)	1.577 (1.350)	-0.155 (0.698)	-2.121*** (0.775)
External 4th yr	-0.517 (0.536)	-2.019*** (0.631)	0.071 (1.130)	-1.037* (0.622)	-2.119*** (0.684)
External 5th yr	-0.432 (0.487)	-1.650*** (0.566)	-0.176 (1.090)	-0.784 (0.539)	-2.237*** (0.609)
Promoted -3+ yr	-0.521 (0.746)	1.570* (0.911)	1.827 (1.505)	0.427 (0.971)	1.563 (0.998)
Promoted -2 yr	-0.577 (0.652)	0.595 (0.837)	-0.207 (1.498)	0.793 (0.891)	0.884 (0.905)
Promoted 1st yr	0.088 (0.683)	1.466* (0.802)	0.136 (1.595)	0.898 (0.813)	0.742 (0.861)
Promoted 2nd yr	0.994* (0.597)	2.470*** (0.761)	7.302*** (1.523)	3.756*** (0.841)	2.924*** (0.871)
Promoted 3rd yr	0.176 (0.604)	1.094 (0.777)	4.212** (1.641)	2.630*** (0.845)	0.607 (0.905)
Promoted 4th yr	-0.012 (0.610)	-0.094 (0.707)	2.134 (1.563)	1.912** (0.780)	-0.012 (0.818)
Promoted 5th yr	-0.163 (0.585)	-0.488 (0.646)	2.051 (1.488)	0.923 (0.750)	-1.100 (0.795)
Observations	9211	11957	4209	9111	10523
R^2	0.134	0.093	0.023	0.151	0.215

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table (A8) Descriptive Statistics

	Mean	St. Dev.
<i>Schools</i>		
Percent poverty	0.822	0.204
Percent black	0.367	0.288
Percent Hispanic	0.411	0.256
Percent white	0.110	0.181
Percent ELL	0.136	0.148
Percent SPED	0.178	0.156
Elementary school	0.408	0.492
Middle school	0.200	0.400
High school	0.278	0.448
K-8 school	0.052	0.223
Other grade combination	0.062	0.241
<i>Principals</i>		
Total experience	19.304	8.253
Experience as teacher	9.168	5.242
Experience as principal	5.833	4.403

Notes: Student enrollment percentages are from 2012. In cases where a school is missing student enrollment data for 2012, we report results from the closest year for which student enrollment is available. Principal experience is from 2012.