



Research paper

Linking school organizational characteristics and teacher retention: Evidence from repeated cross-sectional national data[☆]

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HIGHLIGHTS

- Some school organizational characteristics can potentially influence teacher turnover.
- Better administrative support, stronger teacher cooperation and more effective principals may help to retain teachers.
- School factors have a more pronounced relationship with turnover in low-income schools than more affluent schools.
- These results are robust to a variety of modeling choices.

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ABSTRACT

Teacher labor markets have strong implications for learning outcomes and equity for students, and yet schools that need teachers the most often face high turnover. Using repeated cross-sectional nationally representative data, this study examines the relationships between school organizational characteristics and teacher turnover and identifies what may be done to positively influence the teacher workforce. I find school organizational characteristics may indeed reduce teacher turnover, but this varies based on the type of organizational characteristic as well as the specific form of turnover. Policy and practical implications from the study are discussed.

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1. Introduction

Teacher labor markets have strong implications for learning outcomes and equity for students. The evidence accumulated through decades of research indicates teacher effectiveness is the most influential school factor in student achievement, and yet, researchers have documented the most disadvantaged schools, schools that need effective teachers the most, are often the hardest to staff and often face high teacher turnover (Boyd et al., 2011; Guarino, Santibanez, & Daley, 2006; Ingersoll, 2001). As such, policy makers have spent a considerable amount of time working to

ensure classrooms are staffed with qualified teachers (Hanushek, Kain, & Rivkin, 2004; Ingersoll, 2001; Loeb, Kalogrides, & Béteille, 2012). For instance, ensuring every teacher is highly qualified is a key requirement of the No Child Left Behind Act and Every Student Succeeds Act. Substantial evidence indicates an important facet of the large variations in quantity and quality of the teacher workforce among schools and districts is the attrition rates in certain schools and districts, and scholars have concluded we need to better address the uneven distribution of quantity and quality of teachers (Guarino et al., 2006; Ingersoll, 2001; Lankford, Loeb, & Wyckoff, 2002). Moreover, high teacher turnover is costly to schools and districts as large urban districts may spend from \$10,000 to \$26,500 to replace each teacher who leaves the district (Barnes, Crowe, & Schaefer, 2007; DeFeo, Tran, Hirshberg, Cope, & Cravez, 2017). In short, teachers represent a critical part of public education and there is compelling interest in retaining quality teachers, particularly for disadvantaged schools. This has increasingly led researchers and policy makers to develop strategies to retain

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teachers.

In particular, researchers and policy makers are greatly interested in policies and reforms at the school and district levels that may be used to positively affect the teacher work force (e.g., [Educate Kansas, n.d.](#); [Tennessee Education Research Alliance, n.d.](#)). They are interested in examining school organizational characteristics such as administrative support, teacher cooperation, the effectiveness of principals, and principal-teacher race/gender congruency, for policy relevant insights because these factors are highly linked with teacher turnover. For instance, [teachers are less likely to leave teaching in schools with stronger administrative support](#) ([Boyd et al., 2011](#); [Ingersoll, 2001](#); [Smith, 2006](#)) or with higher levels of teacher collaboration ([Boyd et al., 2011](#); [Kraft et al., 2016](#); [Smith & Ingersoll, 2004](#)). Recent research also suggests [effective principals can keep teachers from leaving](#) ([Grissom & Bartanen, 2019](#)) and that principal-teacher race/ethnicity match can reduce teacher attrition ([Grissom, 2011](#)). As such, there is increasing interest in this area of research from both researchers and policy makers.

Most studies on teacher turnover focus on either teachers leaving the profession (leavers) or teachers leaving the current school (which combines teachers leaving the profession or teachers switching, or movers) or but not teachers switching schools (switchers) ([Borman & Dowling, 2008](#); [Nguyen, Pham, Crouch, & Springer, 2020](#)). However, it is likely the factors that influence each form of turnover would vary depending on the form of turnover. It is important to know both what keeps teachers in teaching and what keeps them in the school where they are. Thus, in addition to analyzing how school organizational characteristics drive teacher turnover, scholars should also pay more attention to the specific form of turnover. This study aims to address the extent to which school organizational characteristics influence teacher turnover, with respect to movers, leavers, and switchers. More specifically, this study examines the following research questions:

- (1) To what extent are school organizational characteristics associated with teacher turnover?
- (2) Do these relationships vary based on the specific form of teacher turnover?
- (3) To what extent do these relationships differ in high- and low-income schools?

This study makes several contributions to the scholarly study of teacher attrition and retention. First, leveraging all the available waves of the School and Staffing Survey (SASS), the study uses repeated cross-sectional nationally representative data instead of short-term district- or state-level data over a short period of time to provide a more thorough analysis of teacher turnover nationally and over time. This may overcome the idiosyncratic nature of using short-term district or state-level data, and the results are more generalizable. In particular, this study is able to account for temporal shocks, such as the 2007–2008 Recession, while other studies using similar SASS data without having multiple waves of SASS would not be able to do. Second, a rich set of covariates in teacher characteristics and school characteristics and the use of fixed effects alleviate some concerns of omitted variable bias in estimating the relationships between school organizational characteristics and teacher turnover. For instance, I am able to control for teacher qualifications, such as whether they have standard certification or if they teach special education, and the levels of disciplinary issues and safety at the school. Third, the paper is able to differentiate between teachers who move away from their current school (movers or the combined form of switching and leaving), those who switch from one school to another (switchers), and those who leave the teaching profession (leavers). Since the factors associated

with each form of turnover are analyzed separately, I am able to pinpoint organizational characteristics that educational systems may take to retain teachers in teaching (i.e., principal-teacher race/ethnicity congruence) and those that principals and administrators may take to retain teachers in their schools (i.e., administrative support). The study also examines if the influences of the factors of teacher turnover are consistent over time. Lastly, the study is able to examine the extent to which the associations of school organizational characteristics with teacher turnover differ in high-income and low-income schools.

1.1. Literature review

According to the empirical literature, teacher characteristics, school characteristics, and school organization characteristics are principal factors that influence teacher retention and attrition ([Borman & Dowling, 2008](#); [Guarino et al., 2006](#); [Macdonald, 1999](#); [Nguyen, Pham, Crouch, & Springer, 2020](#)). As the literature of teacher turnover advances, there has been a shift from examining teacher and school characteristics to school organizational characteristics as school organizational characteristics represent crucial levers that may be used to positively impact the teacher workforce at the national, regional, and school levels ([Nguyen, Pham, Crouch, & Springer, 2020](#); [Tennessee Education Research Alliance.](#)).

For instance, [Kraft and colleagues \(2016\)](#) use five years of data (2008–2012) from New York (U.S.) and establish that school organizational characteristics can influence teacher turnover, but their results may have limited generalizability and they do not examine how these relationships may vary for the various forms of turnover. Similarly, [Sims \(in press\)](#) has examined how school organizational characteristics are associated with teacher retention in England, but they only measure teacher intentions and not actual turnover. In short, while we generally know that school organizational characteristics do matter for teacher mobility, we have limited knowledge on which characteristics may matter more and how they vary depending on the forms of turnover. As such, this paper pushes to provide evidence of how important school organizational characteristics may matter for turnover and whether they have differential relationships for movers, switchers, and leavers.

Moreover, prior research has shown teacher qualifications, experiences, and turnover vary greatly in high- and low-income schools ([Mason-Williams, 2015](#); [Nguyen & Redding, 2018](#)), and that educational resources provided to students in low-income schools are usually lower than affluent schools ([Goldhaber, Lavery, & Theobald, 2015](#)). Relatedly, schools with more traditionally underserved students in low-income schools tend to have more challenging working conditions such as lower levels of collegial supports and less supportive administrators ([Kraft et al., 2016](#)). As such, we also need to consider how school organizational characteristics may play differential roles across high- and low-income school contexts. As teacher characteristics and school characteristics are important factors to account for to reduce possible bias in estimating school organizational characteristics and teacher mobility, I briefly discuss them below.

1.2. Teacher characteristics

Teacher characteristics facilitate the understanding of how teacher background characteristics influence attrition and retention. For instance, one consistent finding is that attrition is high for young and new teachers ([Guarino et al., 2006](#); [Redding & Nguyen, 2020](#)). In terms of race/ethnicity, previous works have found White teachers are more likely to leave than minority teachers ([Borman & Dowling, 2008](#)). A number of studies have examined the relative

attrition rates between teachers with a graduate degree and those with an undergraduate degree or less and generally find that teachers with graduate degrees tend to leave more often (Clotfelter, Glennie, Ladd, & Vigdor, 2008; Imazeki, 2005). Other studies (Imazeki, 2005; Ingersoll, 2001; Nguyen & Redding, 2018) have found the attrition rates for teachers with specialties such as STEM and special education are higher. There has also been recent work examining attrition for those who are alternatively certified (Donaldson & Johnson, 2010; Redding & Smith, 2016). Teacher ability or scholastic achievement and teacher experience also play an important role in influencing teacher attrition and retention (Boyd, Lankford, Loeb, & Wyckoff, 2005). Generally, these studies have found that training, experience, ability/achievement, and specialty all influence teacher attrition and retention. Lastly, studies of teacher salary on attrition have found that salary plays an important role. For instance, researchers have found that higher earnings were negatively associated with attrition (Podgursky, Monroe, & Watson, 2004). Elsewhere, others have found that salary increases were associated with teachers' decisions to move schools (Hanushek et al., 2004; Lankford et al., 2002).

1.3. School characteristics

School characteristics are one of the most studied areas of teacher attrition and retention, but the findings are often mixed. For instance, there is mixed evidence of the turnover rate at urban and rural schools (Clotfelter, Ladd, & Vigdor, 2011; Djonko-Moore, 2016). Similarly, the effect of school size and enrollment are significant but practically small (Imazeki, 2005; Smith, 2006). Contrary to expectation, Borman and Dowling (2008) do not find that, on average and across a number of studies, the school's socioeconomic composition greatly influences teacher attrition. Instead, they find that, on average, teachers who worked in high-poverty schools were just as likely to leave as teachers who worked in low-poverty schools. However, recent evidence suggests that teachers, on average, prefer schools with higher proportions of White and Asian students and that their preferences vary systematically according to their own demographic characteristics (Engel, Jacob, & Curran, 2014; Horng, 2009). Relatedly, there is some suggestive, but limited, evidence that teachers were more likely to leave schools where the majority of students were minority students (e.g., Carroll, Reichardt, Guarino, & Mejia, 2000; Hanushek et al., 2004). In short, the evidence around student body characteristics at the school level is mixed and deserves further attention.

1.4. School organizational characteristics

Under this umbrella of school organizational characteristics, I consider several factors, namely administrative support, teacher cooperation, principal effectiveness, and principal-teacher race/gender congruence, as they are of particular importance to researchers, policy makers, and administrators. Moreover, there are recent works suggesting these factors can have substantial influence on teacher mobility. Generally, these studies provide evidence that school organizational characteristics are significantly associated with turnover, but most studies do not examine how these relationships may differ for the various forms of turnover or for high-versus low-income schools.

Administrative support. First, in terms of administrative support, across several studies teachers who experience higher levels of administrative support or perceive that there is more administrative support are much less likely to leave teaching (Boyd et al., 2011; Brown & Wynn, 2009; Ingersoll, 2001; Ladd, 2011; Luke, 2014; Shen, Leslie, Spybrook, & Ma, 2012; Smith, 2006). For instance, Anderson (2007) finds that teachers who reported high

levels of administrative support are less likely to leave teaching. Boyd et al. (2011) finds one standard deviation increase in administrative support is associated with a 31 percent reduction in the odds of teachers leaving New York City. Supporting these quantitative findings, Brown and Wynn (2009) find that principals who provide more administrative support, whether through more awareness of issues affecting new teachers, taking a proactive approach in supporting new teachers, or by being committed to providing professional growth for themselves and their teachers, are able to retain teachers at higher rates than their peers. In short, there is strong evidence that administrative support is highly associated with teacher turnover, and it is robust to the various ways that it can be operationalized.

Teacher cooperation. Prior research has consistently found that teachers who have better collaboration and cooperation with other teachers are also less likely to turn over (Boyd et al., 2011; Fuller, Waite, & Torres Iribarra, 2016; Kraft, Marinell, & Shen-Wei Yee, 2016; Smith & Ingersoll, 2004; Yesil, 2012). For instance, using structural equation modeling Fuller and colleagues (2016) find teacher cohesion and collaboration strongly predict the likelihood of remaining at one's school. In a seminal study using older SASS data, Smith and Ingersoll (2004) also find that teacher collaboration plays an influential role in predicting teacher turnover. Similarly, Kraft et al. (2016) find teacher relationship and cooperation is highly predictive of teacher turnover under various conditions and assumptions. In particular, one standard deviation increase in teacher relationship and collaboration is associated with a 0.8 percentage point decrease in the probability of turnover. These studies provide consistent and robust evidence that teacher cooperation can and does play an important role in teacher attrition. However, most of these studies do not consider how teacher cooperation may influence switchers and leavers separately.

Principal effectiveness. Likewise, the evidence is building that experienced and effective principals can keep teachers in school (Beteille, Kalogrides, & Loeb, 2009; Grissom, 2011; Redding & Smith, 2016). In one of the earliest studies on principal effectiveness and teacher turnover, Beteille et al. (2009) find that higher principal effectiveness can decrease attrition for teachers with high value-added scores. Similarly, Grissom (2011) and Redding and Smith (2016) report that higher principal effectiveness may be associated with decreased likelihood of teacher attrition, but these results are statistically insignificant. Most recently, researchers have found more effective principals are able to retain more teachers, particular high performing teachers (Grissom and Bartanen, 2019). The current evidence tentatively suggests principal effectiveness can decrease teacher attrition, but more studies are needed to bolster these findings.

Principal-teacher gender and race/ethnicity congruence. A recent development in school organizational characteristics is teacher-principal race/ethnicity and gender congruence, which comes from the relational demography and representative bureaucracy literature (Fairchild et al., 2012; Grissom, Kern, & Rodriguez, 2015; Mueller, Finley, Iverson, & Price, 1999) where both sets of literature indicate gender and race/ethnicity congruence may influence people's perceptions of each other as well as their ability to work together. For instance, Tsui and colleagues argue demographically similar people would unconsciously regard and treat each other more favorably since they derive a positive social identity from belonging to that demographic group (Tsui, Egan, & O'Reilly, 1992; Tsui & O'Reilly, 1989). In other words, the degree of similarity between a person and the people they work with influences their attitudes and behaviors. Consequently, scholars have examined teacher's satisfaction and turnover when there is a congruence between race/ethnicity and gender (Grissom & Keiser, 2011). Using the 2003–2004 SASS Grissom and Keiser

(2011) find teachers have higher job satisfaction and are less likely to leave teaching when they are of the same race/ethnicity as the principal. Relatedly, Grissom, Nicholson-Crotty, and Keiser (2012) finds teachers are less likely to attrit when they are of the same gender as the principal. Generally, this developing literature indicates teacher-principal gender or racial/ethnic congruence is associated with positive outcomes, while incongruence is associated with negative outcomes.

Moreover, given research showing positive academic and behavioral outcomes for minority students when there is a student-teacher racial/ethnic match (Redding, 2019), many educational systems, particular those with diverse student populations, have been making a concerted effort to recruit and retain minority teachers to better serve their students (Educate Kansas, n.d.; Tennessee Education Research Alliance.), including diversifying administrators to better match and represent the teachers they work with (Bartanen & Grissom, 2019). The current evidence suggests principal-teacher gender and race/ethnicity congruence may contribute to teacher turnover, but this needs further examination, particularly with a rich set of data and the ability to account for temporal shocks that may influence these relationships.

In sum, the literature examining school organizational characteristics would suggest that more positive or stronger school organizational characteristics are associated with reduction in various forms of teacher turnover. This study will examine the extent to which these relationships are true using nationally representative data over time and how these relationships vary based on the specific form of teacher turnover.

1.5. Data

This paper uses data from the Schools and Staffing Survey (SASS) and its supplement, the Teacher Follow-Up Survey (TFS). SASS, administered by the National Center for Educational Statistics (NCES), consists of nationally representative samples of districts, schools, principals, and teachers for public schools in the United States. SASS uses a stratified probability sample design with the use of the Common Core of Data, which reflects the population of public schools (including charter schools). Schools are selected using a probability proportional to the size of the school within grade level strata within state strata. Within each sampled school, a sample of teachers is selected based on selected characteristics for state and national representation. On average, about 35,000 teachers in 6000 schools in 4000 districts are selected in each wave. For this study, all four iterations of SASS and TFS where teacher turnover data can be generated are utilized. More specifically, I use the 1999–2000, 2003–2004, 2007–2008, and 2011–2012 SASS waves with their respective TFS along with the sampling weights to make the results nationally representative. I focus on traditional public schools since charter schools are operated differently (however including charter schools does not change the overall results). These surveys include detailed comprehensive data on teacher characteristics, school characteristics, and school organizational characteristics. As such, these data are ideal for exploring the factors that influence teacher retention and attrition nationally and over time. However, as there are little to no questions on expenditures in SASS, I supplement the SASS data with Common Core of Data (CCD), which includes expenditure information at the district level.

1.6. Measures of attrition and school organizational characteristics

The main dependent variables for this study come from the principal report of teachers' employment status in the follow-up year following the baseline survey year. I categorize teacher status into one of three categories: stayers, switchers, and leavers.

Stayers are teachers who remained in the same school in the baseline year, switchers are teachers who switched to a new school, and leavers are teachers who left the teaching profession. I also combine switchers and leavers into a single group called movers. This is done mainly from the perspective of the school where what matters is that the teacher is no longer teaching in the same school the next year.

The main independent variables include administrative support, teacher cooperation, principal effectiveness, and principal-teacher race/ethnicity and gender congruence, all of which are reported at the teacher level. Administrative support is the teacher's report on if the school administration's behavior toward the staff is supportive and encouraging, while teacher cooperation is the teacher's report on the level of cooperative effort among staff members. Principal effectiveness is a factor consisting of teacher reports on principal enforcement of school rules, principal communication to the staff, and staff recognition for accomplishments (similar to Redding & Smith, 2016). These items making up the principal effectiveness remain the same throughout the four waves of SASS. The Cronbach alpha, a measure of internal consistency of how these items are related to each other as a group, is fairly consistent from wave to wave, ranging from 0.78 to 0.80. The response categories for administrative support, teacher cooperation, and the individual items of principal effectiveness are originally on a scale of 1 (strong disagree) to 4 (strongly agree). For ease of interpretation and comparison, I have standardized these variables.¹ Principal-teacher gender and race/ethnicity congruence are dichotomous variables where a 1 indicates there is a match between the principal's and teacher's gender and a match between their race/ethnicity respectively. More information can be found in Appendix Table 1.

1.7. Measures of teacher characteristics and school characteristics

I include a number of teacher characteristics such as gender, race/ethnicity, age, teacher experience, graduate degree(s), whether the teacher teaches math or science (STEM) or special education, certification status, reported annual salary, and union membership. In terms of school characteristics, I consider the school's urbanicity, enrollment size, secondary or elementary level, the percent of students with free and reduced price lunch (FRPL) eligibility, percent minority, percent individualized education program (IEP), and percent limited English proficiency (LEP). A complete description of the variables used in this study is provided in Appendix Table 1.

As the educational resources, including assignment to high-quality teachers, provided to students attending low-income schools tend to lag behind more affluent schools (Goldhaber et al., 2015), I separate the results between teachers working in high-income and low-income schools. I follow Ingersoll (2001) in operationalizing underserved schools with a majority FRPL indicator for teachers in schools with 50 percent or more students eligible for free-and-reduced-price-lunch.

2. Methods

I use ordinary-least square (OLS) regression models to estimate the turnover probabilities for moving schools (movers), switching schools (switchers) and leaving the profession (leavers) for each teacher. More specifically, the main equation to estimate this relationship is:

¹ I note the results are substantively similar when I do not standardize administrative support and teacher cooperation.

$$Y_{ijt} = \beta_0 + \beta_1 SOC_i + T_i \beta_2 + S_j \beta_3 + \lambda_k + \gamma_t + \varepsilon_{ijt} \quad (1)$$

Y represents the three forms of turnover (switching, moving, and leaving) for teacher i from school j in year t . SOC is a vector of school organizational variables, namely administrative support, teacher cooperation, principal effectiveness, and principal-teacher gender and race/ethnicity match. T is a vector of teacher characteristics and S is a vector of school characteristics. λ_k is school fixed effects to account for unobserved heterogeneity across schools. The pooled model also includes wave fixed effects, γ_t , to account for time-specific correlates of teacher turnover, such as the 2008 recession. In other words, the pooled model can account for temporal shocks that may be specific to particular years. Wave-specific models do not include wave fixed effects. Lastly, ε_{ijt} is a random error term. I also conduct separate analyses for high- and low-income schools.

All models include teacher and school covariates but the results are suppressed to focus only in the variables of interest. I employ heteroskedastic-robust standard errors in all regression models. While these models may be estimated using logistic and multinomial logistic regression models, for ease of interpretation, the main model is estimated as a linear probability model (discussed further below). I note there is little to no evidence of multicollinearity for the individual or pooled models. Nationally representative weights are employed for each wave in the main analysis. I standardize administrative support, teacher cooperation, and principal effectiveness variables to have mean zero and standard deviation one in each wave after accounting for sampling weights.

While the main analysis is not causal, to the greatest extent possible these analyses attempt to isolate the relationship between school organizational characteristics and attrition outcomes by controlling for a host of teacher characteristics and school characteristics that may vary with both school organizational characteristics and the outcome and employing wave and school fixed effects. To push this work closer to an underlying causal relationship, I also engage in a variety of robustness checks to see whether the results are robust to different modeling assumptions. While these models may be estimated using logistic and multinomial logistic regression models, for ease of interpretation, this model is estimated as a linear probability model. However, I illustrate the results are substantively similar when using logistic and multinomial logistic regression as well as the marginal effects from these models (Appendix Table 2 and Appendix Table 3. In particular, I replicate the main analysis using logistic and multinomial logistic regression along with the corresponding marginal effects as well as a series of OLS models that utilize no controls, only teacher and school characteristics, state fixed effects and district fixed effects. The results are robust to these different modeling choices, which I discuss fully below.

3. Results

To start, I provide the background information on the teacher characteristics and school conditions in which teachers work. Table 1 provides the nationally representative descriptive statistics of teacher mobility, teacher characteristics, and school characteristics for each wave. On average, most variables remain fairly stable across time. Consequently, I focus the discussion with the pooled data in Model 5.

First, in terms of mobility (Panel A of Table 1), I find, similar to other studies that use SASS, the total attrition rate is about 14–15 percent (Panel A shows proportions for consistency with the rest of the tables). For both switchers and leavers, the rate of attrition peaks in 2004, at nearly 16 percent, and drops back to 14 percent in

2008, which is likely due to the economic recession of 2007–2008 (NBER, n.d.). In 2012, the rate of attrition for leavers has dropped further to 6.53 percent while the rate of attrition for switchers has climbed back up to 7.17 percent. This basic trend in mobility suggests the use of year or wave fixed effects would be particularly appropriate to account for these temporal shocks.

In terms of teacher characteristics (Panel B of Table 1), I observe about ten percent are new teachers, about 13 percent of teachers are 28 years old or younger, and three out of four teachers are female. In terms of race/ethnicity, more than 80 percent of teachers are White, seven percent are Black, seven percent are Hispanic, and two percent are Asian. For teacher qualifications, only one percent of teachers have doctoral degrees and two percent have advanced graduate certification, while almost fifty percent have master degrees. The vast majority of teachers, eighty-nine percent, have standard or regular certification. Fourteen percent and twelve percent of teachers teach STEM subjects and special education subjects respectively. For school resources, adjusted for inflation, teachers' salary is about \$52,500 in constant 2012 dollars.

In terms of school characteristics (Panel C of Table 1), about a quarter of the schools are urban and about half are suburban. Three out of four teachers nationally have union membership. On average, teachers teach at schools that enroll about 800 students and about 31 percent of the schools are secondary schools and four percent are combined elementary and secondary schools. The average expenditure per student is about \$10,000, although there is significant variation around this mean. Unlike the other variables, I observe the most substantial shifts in the student body characteristics. The average percent of students eligible for free and reduced price lunch (FRPL) is about 41.4 percent, but the average has increased substantially since 1999–2000 where 34.7 percent of students are FRPL relatively to 47.7 percent in 2011–2012. Similarly, the percent of minority students has increased from 33.4 percent in 1999–2000 to 42.9 percent in 2011–2012. Reflecting this shift, schools where the majority of students are Black or Hispanic have increased from 23 percent to 30 percent. The percent of students with IEP has remained around 12–13 percent, while the percent of students with LEP has increased steadily from 5.7 percent to 8.3 percent from 1999 to 2000 to 2011–2012.

With regards to school organizational characteristics, I note administrative support, teacher cooperation, and principal effectiveness are standardized by wave accounting for nationally representative weights (see Appendix Table 1). This allows us to examine how one standard deviation increase or decrease in these variables will be associated with teacher mobility. On average, about half the teachers are of the same gender as their principal and about three out of five teachers are of the same race/ethnicity as their principal.

In Table 2, I examine teacher mobility patterns and school organizational characteristics for low-income and high-income schools, illustrating their differences, all of which are highly statistically significant. In particular, I find teachers are more likely to stay in high-income schools than low-income schools (86.3 percent versus 83.9 percent respectively). In a moderately size education system of twenty to thirty thousand teachers, this difference amounts to hundreds of teachers that have to be replaced. With prior works estimating that the cost of replacing a single teacher ranging from \$10,000 to \$26,500, this means a difference of a million dollar or more to replace hundreds of teachers in low-income schools who are more likely to leave than those in high-income schools, further whittling away resources from the resource-constrained school systems. Similarly, teachers tend to report more administrative support, better teacher cooperation, and higher principal effectiveness in high-income schools. Lastly, in high-income schools 45 percent of teachers match their principal's

Table 1
Descriptive statistics of teacher mobility, teacher characteristics and school characteristics.

Variables	(1)	(2)	(3)	(4)	(5)
	Wave: 2000	Wave: 2004	Wave: 2008	Wave: 2012	Pooled
Panel A: Teacher attrition and retention					
Stayer	.85	.84	.85	.86	.85
Switcher	.07	.08	.07	.07	.07
Leaver	.08	.08	.08	.07	.08
Panel B: Teacher Characteristics					
New teacher	0.11	0.10	0.11	0.07	0.10
Young teacher (age ≤ 28)	0.14	0.14	0.15	0.12	0.13
Female	0.75	0.75	0.76	0.76	0.76
White	0.85	0.84	0.85	0.84	0.84
Black	0.08	0.08	0.07	0.07	0.07
Asian	0.02	0.02	0.02	0.02	0.02
American Indian	0.01	0.01	0.01	0.01	0.01
Hispanic	0.05	0.06	0.07	0.08	0.07
Has PhD	0.01	0.01	0.00	0.01	0.01
Has Master Degree	0.46	0.47	0.50	0.54	0.49
Advanced Graduate Cert.	0.02	0.02	0.02	0.02	0.02
Teach STEM subjects	0.13	0.13	0.14	0.15	0.14
Teach special ed.	0.10	0.13	0.12	0.13	0.12
Has standard/reg cert.	0.87	0.88	0.89	0.91	0.89
Teacher salary per \$1000	52.11 (17.03)	53.02 (16.58)	52.11 (16.06)	52.74 (16.74)	52.51 (16.60)
Salary satisfaction	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)
Panel C: School characteristics					
Principal has PhD	0.11	0.10	0.10	0.12	0.11
Principal has MA/specialist degree	0.88	0.89	0.89	0.87	0.88
Urban school	0.26	0.28	0.25	0.27	0.26
Suburban school	0.51	0.53	0.55	0.50	0.51
School enrollment	807	800	821	818	812
Union member	0.79	0.78	0.76	0.74	0.77
Secondary school	0.33	0.29	0.31	0.31	0.31
Combined elem/sec	0.02	0.05	0.04	0.06	0.04
Expenditure per student	9002.33 (2814.81)	10030.93 (3539.34)	10754.77 (4028.07)	10667.87 (6911.09)	10148.17 (4686.82)
Percent FRPL	34.67 (28.14)	41.15 (29.26)	41.36 (28.39)	47.65 (28.98)	41.41 (29.07)
Percent minority	33.41 (32.34)	37.79 (33.45)	39.05 (32.60)	42.89 (31.92)	38.43 (32.76)
Majority Black/Hispanic	0.23	0.28	0.28	0.30	0.27
Percent IEP	12.30 (9.57)	13.72 (11.72)	13.00 (11.45)	12.68 (10.08)	12.95 (10.79)
Percent LEP	5.65 (12.77)	7.35 (14.68)	7.96 (14.41)	8.26 (13.43)	7.36 (13.91)
Observations	36,770	38,380	32,780	31,770	139,700

Note. Nationally-representative weights are employed. Salary and expenditure have been adjusted to constant 2012 dollar. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

gender while 65 percent match their principal's race/ethnicity relative to 51 percent and 52 percent in low-income schools. In short, these descriptive results indicate substantial differences between high-income and low-income schools.

3.1. School organizational characteristics

To address the first two research questions, Table 3 presents the results for movers, switchers, and leavers, Panels A, B, and C respectively, for each wave of SASS (Models 1–4) as well as the pooled model (Model 5). The pooled model is my preferred specification, but I present the wave specific results for two reasons. First, this allows me to examine whether the association between a factor and teacher attrition is stable over time. Second and relatedly, this may provide some insights into whether the relationship between a factor and teacher attrition is consistently significant

and not time-specific as the pooled model with wave fixed effects enables us to account for time-specific heterogeneity in the data.

Movers. After controlling for a host of teacher and school characteristics and accounting for heterogeneity among states and across years, I observe school organizational characteristics still play a significant role with respect to teacher mobility in most waves, particularly in the mover model where both switching and leaving are combined (Panel A of Table 3). I find administrative support, teacher cooperation, and principal effectiveness have substantial relationships with turnover (Model 5). In particular, I find one standard deviation increase in administrative support is associated with reducing the probability of turning over by 1.3 percentage point. Similarly, one standard deviation increase in teacher cooperation and principal effectiveness decreases the probability of turning over by 0.9 and 0.8 percentage point respectively. Surprisingly I find there is little to no evidence

Table 2

Descriptive statistics of teacher mobility and school organizational characteristics for low-income and high-income schools.

Variables	(1)	(2)
	High-income schools	Low-income schools
Panel A: Teacher attrition and retention		
Stayer	.86**	.83
Switcher	.07**	.08
Leaver	.07**	.09
Panel B: School organizational characteristics		
Administrative support (std)	2.31** (0.85)	2.25 (0.89)
Teacher cooperation (std)	2.19** (0.79)	2.14 (0.82)
Principal effectiveness (std)	0.02** (0.98)	−0.03 (1.03)
Principal-teacher gender congruence	0.45**	0.51
Principal-teacher race congruence	0.65**	0.52
Observations	96,000	43,700

Note. Nationally-representative weights are employed. Observations have been rounded to the nearest 10 per IES compliance. Administrative support, teacher cooperation, and principal effectiveness were standardized for each wave accounting for sampling weights. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS) + $p < 0.10$, * $p < 0.05$, ** $p < 0.01$.

Table 3

Regression estimates of the factors of movers, switchers and leavers.

Variables	(1)	(2)	(3)	(4)	(5)
	Wave: 2000	Wave: 2004	Wave: 2008	Wave: 2012	Pooled
Panel A: Movers					
Administrative support	−0.019**	−0.007	−0.013**	−0.012*	−0.013**
Teacher cooperation	−0.012**	−0.004	−0.012**	−0.011**	−0.009**
Principal effectiveness	−0.005	−0.008	−0.007	−0.015**	−0.008**
Princ-Tch gender congr	0.015+	−0.020*	0.003	0.001	0.003
Princ-Tch race congr	−0.009	−0.038**	−0.037	−0.009	−0.004
N	36,770	38,380	32,780	31,770	139,700
Panel B: Switchers					
Administrative support	−0.015**	−0.003	−0.005	−0.010**	−0.009**
Teacher cooperation	−0.011**	−0.008*	−0.013**	−0.010**	−0.010**
Principal effectiveness	0.001	−0.006	−0.003	−0.005	−0.003
Princ-Tch gender congr	0.001	−0.019**	−0.002	−0.007	0.000
Princ-Tch race congr	0.013	−0.021+	−0.017	−0.019	−0.001
N	33,910	35,250	29,960	29,570	128,690
Panel C: Leavers					
Administrative support	−0.006+	−0.004	−0.009*	−0.004	−0.006**
Teacher cooperation	−0.004	0.003	−0.002	−0.004	−0.001
Principal effectiveness	−0.007+	−0.005	−0.007	−0.012*	−0.007**
Princ-Tch gender congr	0.014*	−0.007	0.004	0.008	0.003
Princ-Tch race congr	−0.023+	−0.023+	−0.035	0.006	−0.003
N	34,190	35,380	29,910	29,650	129,130

Note. Nationally-representative weights are employed. All models include school fixed effects and control for teacher and school characteristics. The pooled models also include wave fixed effects. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

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

between the combined form of turning over (movers) and principal-teacher gender and race/ethnicity congruence.² In short, when teachers perceive better administrative support and more effective principals, they are less likely to turn over. Next I examine whether these relationships vary when turnover is separated into the specific form of switching schools or leaving the profession.

Switchers. In general, I find the delineation of the specific form

of turnover is important and that what is associated with overall turnover does not necessarily translate to the same relationship with respect to switchers and leavers. In particular, I observe a one standard deviation increase in administrative support reduces the probability of teachers switching from their school by 0.9 percentage point. Similarly, increasing teacher cooperation by one standard deviation decreases the odds of switching by 1.0 percentage point. Similar to the results from Panel A, I find some suggestive evidence of a relationship between principal effectiveness and teacher turnover, but little to no evidence of an association between switching and principal-teacher gender and race/ethnicity congruence. These relationships are fairly consistent from wave to

² The main findings discussed in these sections remain significant even after accounting for multiple hypothesis testing. The marginally significant findings, however, become insignificant. As such, I do not focus on discussing marginally significant findings.

wave (Models 1 through 4) except for the mixed findings on principal-teacher gender and race/ethnicity congruence. This indicates the importance of having data over time, and the implications of this finding will be discussed further in the Discussion section.

Leavers. In Panel C of Table 3 and I examine how school organizational characteristics are associated with teachers leaving the profession. I observe, similar to the switcher results, an increase in one standard deviation in administrative support is associated with reducing the probability of teachers leaving the profession by 0.6 percentage point, while one standard deviation increase in principal effectiveness is associated with a reduction of 0.7 percentage point. There is little to no evidence of a significant relationship between teachers leaving the profession and teacher cooperation, and principal-teacher gender and race/ethnicity congruence.

3.2. High- and low-income schools

To address research question three, in Table 4 and I separate the analysis by high- and low-income schools as underserved schools tend to experience higher rates of turnover and the working conditions also tend to differ substantially. In Panel A, when comparing low-income and high-income schools, I observe the associations between school organizational characteristics and turnover tend to be more elevated in low-income schools than in high-income schools. For instance, a one standard deviation increase in teacher cooperation, *ceteris paribus*, is associated with a decrease of 0.5 percentage point in turnover in high-income schools relative to a decrease of 1.7 percentage points in low-income schools. Furthermore, while principal effectiveness, on average, has a significant relationship with overall turnover, this relationship is marginal in high-income schools and it is significant and pronounced in low-income schools. This pattern of school organizational

characteristics being more pronounced in low-income schools rather than high-income schools is consistent for the different forms of turnover (Panels A, B, and C). In particular, the association between principal effectiveness and turnover is clearest for leavers in low-income schools. In short, even though some school organizational characteristics are associated with various forms of turnover, these relationships tend to be more elevated or significant in low-income schools relative to high-income schools. In other words, school organizational characteristics seem to matter more in low-income schools than high-income schools.

3.3. Robustness checks

First, since the SASS nationally representative sampling frame includes charter schools, there may be concerns that the exclusion of charter schools in the sample would not then strictly be nationally representative. Charter schools are excluded because they operate very differently in many ways than traditional public schools and scholars do not expect teachers to be influenced by various factors in the same way at charter and traditionally public schools (Crouch & Nguyen, 2020). However, to alleviate the concerns that the findings are not truly nationally representative, I include charter schools in the sample in a set of separate models. These results are nearly identical to the results using only traditional public schools (available upon request). As a further check, I also run a set of models without the use of any weights using only traditional public schools. These results are substantively similar to the main findings using both traditional public and charter schools (available upon request).

Even though this work is largely associational, I want to examine whether these findings are robust to a variety of modeling choices that would bring the results closer to an underlying causal relationship. In particular, there are concerns with (unobserved) omitted variables such as other unmeasured school organizational conditions and teachers' perceptions of working conditions that are correlated with the observed school organizational characteristics and attrition behaviors. So far this is partially addressed by including a rich set of teacher and school covariates and the use of year and state fixed effects. However, these covariates and these fixed effects are far from exhaustive. Following Altonji et al. (2005) and Kraft et al. (2016), I attempt to assess the potential magnitude and direction of bias by examining the degree to which the estimates change when I remove teacher and school controls and when I employ other fixed effects that leverage different variations in the data. More specifically, I replicate the pooled models in Table 3 without any controls (1), with teacher and school covariates and wave fixed effects (2), with state fixed effects (3), with district fixed effects (4), and with school fixed effects (5, which replicate the main analysis). As shown in Table 5, estimates from these models are very similar to my preferred estimates and do not appear to differ in any systematic way. If potential omitted variables, such as teachers' perceptions of their physical working environment or curriculum materials, are correlated with teacher and school characteristics or unobserved school characteristics, their omission does not appear to bias the results substantially. Similarly, I replicate this process for the high- and low-income analysis in Table 6, and the results are comparable to the results in Table 4. I also explore conditional logistic regression models where nationally-representative weights are not employed and the results are substantively similar (results available upon request).

While these results are robust to a variety of modeling choices, it does not eliminate all biases. In particular, the data limitation does not rule out the case of reverse causality where teachers who are more likely to turn over are more likely to rate school organizational factors lower. To this point, however, the SASS surveys were

Table 4
Regression estimates of the factors of movers, switchers and leavers by school status.

Variables	(1)	(2)
	High-income schools	Low-income schools
Panel A: Movers		
Administrative support	−0.013**	−0.010*
Teacher cooperation	−0.005*	−0.017**
Principal effectiveness	−0.005+	−0.013**
Princ-Tch gender congr	0.002	−0.002
Princ-Tch race congr	−0.001	−0.016
N	96,000	43,700
Panel B: Switchers		
Administrative support	−0.007**	−0.010**
Teacher cooperation	−0.008**	−0.015**
Principal effectiveness	−0.002	−0.004
Princ-Tch gender congr	−0.002	−0.002
Princ-Tch race congr	0.006	−0.011
N	88,870	39,820
Panel C: Leavers		
Administrative support	−0.008**	−0.001
Teacher cooperation	0.002	−0.006+
Principal effectiveness	−0.004+	−0.012**
Princ-Tch gender congr	0.003	−0.001
Princ-Tch race congr	−0.007	−0.008
N	89,350	39,790

Note. Nationally-representative weights are employed. All models include school fixed effects, wave fixed effects and control for teacher and school characteristics. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

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

Table 5

The robustness of the relationship between school organizational characteristics and teacher attrition behavior.

Variables	(1) Unadj	(2) Controls	(3) State FE	(4) District FE	(5) School FE
Panel A: Movers					
Administrative support	−0.013**	−0.015**	−0.015**	−0.015**	−0.013**
Teacher cooperation	−0.012**	−0.009**	−0.009**	−0.009**	−0.009**
Principal effectiveness	−0.002	−0.007**	−0.007**	−0.007**	−0.008**
Princ-Tch gender congr	0.012**	0.005	0.005	0.005	0.002
Princ-Tch race congr	−0.005	−0.008	−0.009+	0.003	−0.010+
N	139,700	139,700	139,700	139,700	139,700
Adjusted R ²	0.0047	0.0272	0.0284	0.0733	0.1056
F	27.491	29.001	24.944	22.626	22.789
p	<.001	<.001	<.001	<.001	<.001
Panel B: Switchers					
Administrative support	−0.007**	−0.009**	−0.009**	−0.009**	−0.009**
Teacher cooperation	−0.011**	−0.009**	−0.009**	−0.010**	−0.010**
Principal effectiveness	0.001	−0.002	−0.002	−0.003	−0.003
Princ-Tch gender congr	0.006*	0.002	0.002	−0.000	−0.000
Princ-Tch race congr	−0.003	−0.001	−0.001	0.004	−0.003
N	128,690	128,690	128,690	128,690	128,690
Adjusted R ²	0.0033	0.0262	0.0273	0.0828	0.1160
F	17.115	25.668	21.566	22.704	20.872
p	<.001	<.001	<.001	<.001	<.001
Panel C: Leavers					
Administrative support	−0.008**	−0.008**	−0.009**	−0.009**	−0.006**
Teacher cooperation	−0.003+	−0.002	−0.002	−0.002	−0.001
Principal effectiveness	−0.004*	−0.006**	−0.006**	−0.006**	−0.007**
Princ-Tch gender congr	0.008**	0.004	0.004	0.005	0.002
Princ-Tch race congr	−0.004	−0.008+	−0.010*	−0.002	−0.008+
N	129,130	129,130	129,130	129,130	129,130
Adjusted R ²	0.0028	0.0117	0.0131	0.0525	0.0969
F	14.791	10.785	9.332	7.279	8.024
p	<.001	<.001	<.001	<.001	<.001

Note. Nationally-representative weights are employed. "Unadj" does not include any control. "Controls" include teacher and school characteristics and year fixed effects. "State FE" includes state fixed effects along with all controls in the prior model. "District FE" includes district fixed effects along with all controls. "School FE" includes school fixed effects along with all controls. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

+ p < 0.10, *p < 0.05, **p < 0.01.

sent to teachers in January–February, months before the end of the school year, where teachers may not have yet solidified their intentions to turn over. Moreover, my results are comparable to Kraft et al. (2016) and Grissom and Bartanen (2019) who were able to better address these issues given the longitudinal nature of their data. I discuss this more in the next section.

4. Discussion and conclusion

Generally, the results indicate school organizational characteristics are worthy of further research. Advancing prior research that links school organizational characteristics with teacher turnover intentions (Sims, forthcoming), this study provides consistent evidence that some school organizational characteristics have significant associations with actual teacher turnover. In particular, there is robust evidence that administrative support may substantially reduce the probability of teachers moving and leaving, augmenting prior studies (Boyd et al., 2011; Ingersoll, 2001; Luke, 2014; Smith, 2006). For overall turnover, one standard deviation increase in administrative support is associated with a 1.3 percentage point decrease in turnover, which is about 9 percent of the baseline mobility rate. In other words, when teachers perceive that the school administration is more supportive and encouraging, then they are less likely to turn over. This result is comparable to Kraft et al. (2016) finding on the relationship between leadership and professional development and teacher turnover. This relationship

remains significant when I separate the results into switchers and leavers.

I also observe teachers who report higher levels of teacher cooperation at their school are less likely to turn over, specifically in the form of teachers switching schools but not leaving. These results, once again, are comparable with Kraft and colleagues' findings (2016). High levels of cooperation among teachers may keep the teachers in their current school; however, teacher cooperation does not decrease the probability of teachers leaving the profession. In other words, teachers who feel that there is good cooperation among the staff may feel more inclined to stay in their current school, but if they intend on leaving the profession, then high levels of teacher cooperation may not be enough to deter them from leaving. On the other hand, the results suggest more effective principals may be able to deter teachers from leaving the profession but not from switching schools. Similarly, Grissom and Bartanen (2019) also find more effective principals can reduce teacher turnover with comparable results and magnitudes.

However, I find inconsistent or weak evidence that principal-teacher race/ethnicity and gender congruence have a significant relationship with turnover. In particular, I observe principal-teacher race/ethnicity congruence does not seem to play a consistent role in reducing the likelihood of switching or leaving as prior literature suggests (Grissom et al., 2012; Grissom & Keiser, 2011). There are multiple explanations that may account for this finding. One explanation is omitted variable bias. Prior studies (e.g.,

Table 6

The robustness of the relationship between school organizational characteristics and teacher attrition behavior by high- and low-income schools.

Variables	Low-income					High-income				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Unadj	Controls	State FE	District FE	School FE	Unadj	Controls	State FE	District FE	School FE
Panel A: Movers										
Administrative support	−0.011**	−0.013**	−0.014**	−0.014**	−0.013**	−0.014**	−0.016**	−0.015**	−0.015**	−0.010*
Teacher cooperation	−0.008**	−0.006**	−0.006**	−0.005*	−0.005*	−0.017**	−0.014**	−0.014**	−0.015**	−0.017**
Principal effectiveness	0.000	−0.004	−0.004	−0.004	−0.005+	−0.008	−0.012*	−0.012*	−0.011*	−0.013**
Princ-Tch gender congr	0.007*	0.004	0.004	0.007+	0.002	0.015*	0.008	0.006	−0.001	−0.002
Princ-Tch race congr	0.001	−0.003	−0.003	0.006	−0.001	−0.004	−0.010	−0.012	−0.007	−0.016
N	96000	96000	96000	96000	96000	43700	43700	43700	43700	43700
Adjusted R ²	0.0022	0.0211	0.0221	0.0713	0.0827	0.0086	0.0346	0.0366	0.0909	0.1562
F	11.048	16.742	14.885	15.257	14.185	14.882	13.479	11.694	8.324	8.377
p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Panel B: Switchers										
Administrative support	−0.006**	−0.008**	−0.008**	−0.007**	−0.007**	−0.009*	−0.010**	−0.010**	−0.010**	−0.010**
Teacher cooperation	−0.009**	−0.007**	−0.007**	−0.006**	−0.008**	−0.015**	−0.013**	−0.013**	−0.014**	−0.015**
Principal effectiveness	0.002	−0.001	−0.001	−0.003	−0.002	−0.001	−0.005	−0.005	−0.004	−0.004
Princ-Tch gender congr	0.001	−0.000	−0.000	0.001	−0.002	0.010*	0.006	0.005	−0.002	−0.002
Princ-Tch race congr	0.002	0.007	0.007	0.008	0.006	−0.003	−0.006	−0.007	−0.003	−0.011
N	88870	88870	88870	88870	88870	39820	39820	39820	39820	39820
Adjusted R ²	0.0018	0.0237	0.0251	0.0854	0.0958	0.0057	0.0293	0.0311	0.1041	0.1737
F	7.859	16.185	13.929	15.966	14.069	8.781	10.749	8.918	7.565	6.817
p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001
Panel C: Leavers										
Administrative support	−0.007**	−0.008**	−0.008**	−0.009**	−0.008**	−0.009*	−0.009**	−0.009**	−0.008*	−0.001
Teacher cooperation	−0.001	−0.000	−0.000	−0.000	0.002	−0.006+	−0.004	−0.004	−0.005	−0.006+
Principal effectiveness	−0.002	−0.004+	−0.003	−0.003	−0.004+	−0.008+	−0.010*	−0.010*	−0.010*	−0.012**
Princ-Tch gender congr	0.007*	0.005	0.005	0.007*	0.003	0.008	0.003	0.002	−0.001	−0.001
Princ-Tch race congr	−0.002	−0.010+	−0.011*	−0.001	−0.007	−0.004	−0.007	−0.009	−0.006	−0.008
N	89350	89350	89350	89350	89350	39790	39790	39790	39790	39790
Adjusted R ²	0.0013	0.0074	0.0086	0.0513	0.0697	0.0055	0.0179	0.0202	0.0646	0.1459
F	6.361	6.011	5.257	4.870	4.616	8.522	5.882	5.355	3.449	3.498
p	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Note. Nationally-representative weights are employed. “Unadj” does not include any control. “Controls” include teacher and school characteristics and year fixed effects. “State FE” includes state fixed effects along with all controls in the prior model. “District FE” includes district fixed effects along with all controls in the prior model. “School FE” includes school fixed effects along with all controls. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

+ p < 0.10, *p < 0.05, **p < 0.01.

Grissom et al., 2012; Grissom & Keiser, 2011) may not have controlled for as many confounding factors and temporal shocks as this study has done. However, recent work with long panel data from 1991 to 2016 in Missouri and 2002–2017 in Tennessee (U.S.) and employing a rich set of covariates does find there is a relationship between principal-teacher race/ethnicity congruence and teacher attrition (Bartanen & Grissom, 2019), suggesting that omitted variable bias may not be a strong contender for the different findings. Relatedly, the use of different fixed effects may leverage different variations in the data. The results in this paper are robust to a variety of modeling specifications, and without similar robustness checks from other papers, it is difficult to gauge whether previous results would be susceptible to different modeling choices. Another potential explanation is that the prior results may have been idiosyncratic to a particular time and place, particularly the 2003–2004 wave (e.g. Grissom & Keiser, 2011), and they may not be generalizable to other contexts or be nationally representative. Next, many prior studies also did not consider movers separately from leavers. Moreover, current work examining principal-teacher race/ethnicity congruence indicates this relationship may be more nuanced and context dependent than previously recognized (Nguyen et al., 2019).

While examining how school organizational characteristics may function differently in high- and low-income schools, the evidence consistently suggests that school organizational characteristics are more important in low-income schools than high-income schools. In other words, even though some school organizational characteristics are associated with turnover, these relationships are more pronounced in low-income schools. In particular, a one standard deviation increase in teacher cooperation is associated with a decrease of 1.7 percentage points in low-income schools relative to a 0.5 percentage point in turnover in high-income schools. Similarly, a one standard deviation increase in principal effectiveness is associated with a one percentage point decrease in the probability that teachers would leave the teaching profession in low-income schools and is insignificant in high-income schools. Prior works have also found low-income schools are more likely to be matched to principals with less experience, less education, and who attended less selective colleges (Loeb, Kalogrides, & Horng, 2010). Moreover, Loeb et al. (2010) also find traditionally disadvantaged schools suffer from principals' systematic attrition and transfer away from these schools to more advantaged settings. Taken together, these findings suggest that low-income schools may be systemically disadvantaged, not only by the resources available to the school but also in the capabilities of its leaders and their ability to retain teachers.

Leveraging these findings, this study has policy and practical implications for several areas concerning recruitment and attrition. Better administrative support, stronger teacher cooperation and more effective principals may help to retain teachers. Better administrative support can take a variety of forms such as administrators being supportive and encouraging of the faculty, consulting with the faculty before making decisions that affect them, dealing with outside pressures that may interfere with teaching, and securing resources for the school (Boyd et al., 2011; Djonko-Moore, 2016; Ingersoll, 2001). Building high levels of teacher cooperation may also keep teachers from switching to other schools. The findings suggest when teachers feel higher levels of cooperation among themselves, they are more likely to remain in the same school as it represents a better working environment. On the other hand, effective principals that enforce school rules, communicate to the faculty regularly, and recognize the faculty for their accomplishments (Redding & Smith, 2016) may also help reduce teacher turnover rates, particularly in the form of leaving the profession. More effective principals may create environments

that allow teachers to feel their profession is worthwhile and thus to prevent them from leaving teaching. Furthermore, more time and effort should be spent in establishing better and more robust school conditions in underserved schools than affluent schools. For schools and districts, one approach to improve organizational characteristics would be to provide useable information on teachers' perceptions of organizational contexts for principals and other administrators to act upon. School systems may create and provide school-specific reports on these and other measures of organizational characteristics that may direct principals and administrators on where they can spend more of their efforts. Relatedly, echoing Kraft et al. (2016), since principals themselves can shape the organizational practices and conditions of schools (Boyd et al., 2011; Grissom, 2011), educational systems can also use measures of school organizational contexts to inform principal hiring and placement. Moreover, education systems should make concerted efforts to place more experienced and effective principals in disadvantaged schools since they may be able to retain their teachers to a greater degree, particularly in these schools where teacher stability is particularly meaningful (Grissom, 2011).

4.1. Contributions of the study

This paper makes several contributions to the study of teacher attrition and retention. First, the use of repeated cross-sectional nationally representative data instead of short-term district- or state-level data to study teacher turnover provides a more thorough picture of turnover nationally and over time. Second, the data from SASS have detailed comprehensive information on teacher characteristics, school characteristics, and school organizational characteristics, which is ideal in studying how these factors influence teacher turnover as it alleviates some concerns of omitted variable bias. Relatedly, using different modeling choices to show the robustness of the findings takes the results closer to an underlying causal relationship. Third, it is important to recognize different forms of turnover and separate overall turnover (movers) into switchers and leavers as the factors that influence switchers are not always the same as the factors that influence leavers as shown in this study. Moreover, as the majority of studies on teacher attrition focuses on teachers leaving the profession and much less on teachers switching schools (e.g., Goldhaber, Lavery, & Theobald, 2016; Grissom et al., 2012; Kukla-Acevedo, 2009), this study provides more thorough insights into what drive teachers to leave their current school but remain in teaching and what drives teachers to leave the teaching profession altogether. I find some factors that may influence switchers may not influence leavers and vice versa, which substantially adds to the empirical knowledge of the factors of teacher attrition and retention. To this point, this study also contributes to the potentially varying associations of different organizational characteristics in different educational systems (see Sims, forthcoming, for how organizational characteristics may play a role in teacher turnover in England). Sims' findings and this paper's findings are consistently showing the importance of school organizational characteristics in teacher turnover. I also find that, while the influences of most factors remain stable through time, there are some variables whose influences may have changed over the twelve-year time frame and some findings may have been idiosyncratic to a particular year. Furthermore, this study shows that it is critical to consider the context of the school in which research and policy implementations take place as some conditions are more important in underserved schools.

Author statement

I, Tuan Nguyen, am the sole author and contributor of the paper.

Tuan Nguyen: Conceptualization, Methodology, Software, Validation, Formal analysis, Investigation, Writing.

Appendix Tables

Appendix U. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.tate.2020.103220>.

Table 1
Variable descriptions

Employment status	
Leavers, Switchers, Movers and Stayers	Leavers are teachers who left the teaching profession, switchers are teachers switched to a new school, movers are teachers who left their current school (leavers + switchers) and stayers are teachers who are currently teaching in same school.
School Organizational Characteristics	
Administrative support	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on the school administration's behavior toward the staff is supportive and encouraging. Measure standardized for each wave.
Teacher cooperation	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on the level of cooperative effort among the staff members. Measure standardized for each wave.
Principal effectiveness	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on the following: principal enforcement of school rules, principal communication to the staff, and teacher's satisfaction of principals recognizing staff for accomplishments; Measure standardized for each wave. ($\alpha = .775-.802$)
Principal-teacher gender congruence	A dichotomous variable where 1 = the principal's and teacher's gender match and 0 = the principal's and teacher's gender do not match
Principal-teacher race/ethnicity congruence	A dichotomous variable where 1 = the principal's and teacher's race match and 0 = the principal's and teacher's race do not match
Teacher Characteristics	
Female	A dichotomous variable where 1 = female and 0 = male.
Black	A dichotomous variable where 1 = Black and 0 = non-Black.
Asian	A dichotomous variable where 1 = Asian and 0 = non-Asian.
American Indian	A dichotomous variable where 1 = American Indian and 0 = non-American Indian.
Hispanic	A dichotomous variable where 1 = Hispanic and 0 = non-Hispanic.
White	A dichotomous variable where 1 = White and 0 = non-White.
Novice	A dichotomous variable where 1 = teacher has less than three years of teaching experience and 0 = teacher has three or more years of teaching experience.
Under 30	A dichotomous variable where 1 = teacher is 30 years of age or younger and 0 = teacher is older than 30.
Graduate degree	A dichotomous variable where 1 = teacher has graduate degree and 0 = no graduate degree.
Teaches STEM subjects	A dichotomous variable where 1 = teacher's subject is mathematics or science and 0 = other subjects.
Teaches SPED	A dichotomous variable where 1 = teacher's subject is special education and 0 = other subjects.
No certification	A dichotomous variable where 1 = teacher has no certification and 0 = teacher has any certification.
Most selective college	A dichotomous variable where 1 = teacher's undergraduate college/university has Barron's classification of most competitive or highly competitive and 0 = Barron's classification is competitive, less competitive, or noncompetitive.
Very selective college	A dichotomous variable where 1 = teacher's undergraduate college/university has Barron's classification of very competitive and 0 = Barron's classification is competitive, less competitive, or noncompetitive.
Salary (\$1000)	A continuous variable of the base teaching salary for the entire school year, scaled in \$1,000s, and in constant 2012 dollar.
Satisfy w/salary (std)	On a scale of 1 = strongly disagree and 4 = strongly agree, teachers report on how satisfied they are with their salary. Measure standardized for each wave.
Union member	A dichotomous variable where 1 = teacher is a union member and 0 = teacher is not a union member.
School Characteristics	
Urban school	A dichotomous variable where 1 = school is classified as urban by U.S. census and 0 = non-urban areas as classified by U.S. census.
Suburban school	A dichotomous variable where 1 = school is classified as sub-urban by U.S. census and 0 = non-suburban areas as classified by U.S. census.
K-12 enrollment	A continuous variable of the size of school where the teacher is teaching in the base year.
Secondary school	A dichotomous variable where 1 = the school is classified as a secondary school and 0 = the school is not classified as a secondary school.
Combined elem-sec	A dichotomous variable where 1 = the school is classified as a combined elementary and secondary (K-8) school and 0 = the school is not classified as a combined elementary and secondary school.
Percent FRPL students	Percentage of students eligible for the federal free or reduced-price lunch program.
Majority FRPL	A dichotomous variable where 1 = the majority of students at the school is eligible for federal free or reduced-price lunch and 0 = the majority of students at the schools is not eligible for federal free or reduced-price lunch (also referred to as low-income schools).
Percent minority students	Percentage of non-White students enrolled in a school.
Majority minority	A dichotomous variable where 1 = the majority of students at the school is non-White and 0 = the majority of students at the school is White.
Percent IEP	Percentage of students with Individualized Education Plans (IEP).
Percent LEP	Percentage of students classified as Limited English Proficient (LEP).
Student discip (std)	On a scale of 1 = never happens to 5 = happens daily, the principal reports of six kinds of student discipline problems: physical conflict, robbery or theft, vandalism, student use of alcohol, drug use, and possession of weapons.

Table 2
Logistic and multinomial logistic estimates of the factors of movers, switchers and leavers

Variables	(1) Wave: 2000	(2) Wave: 2004	(3) Wave: 2008	(4) Wave: 2012	(5) Pooled
Panel A: Movers (Logistic regression)					
Administrative support	0.859**	0.939*	0.893**	0.872**	0.890**
Teacher cooperation	0.896**	0.954	0.923**	0.954	0.932**
Principal effectiveness	0.969	0.960	0.952	0.898*	0.948**
Princ-Tch gender congr	1.164**	0.962	0.997	1.006	1.040
Princ-Tch race congr	0.979	0.880+	0.871	0.893	0.935+
N	36,770	38,380	32,780	31,770	139,700
Panel B: Switchers (Multinomial logistic regression)					
Administrative support	0.840**	0.973	0.888*	0.835**	0.885**
Teacher cooperation	0.874**	0.886**	0.862**	0.919+	0.884**
Principal effectiveness	0.989	0.956	0.961	0.964	0.969
Princ-Tch gender congr	1.109	0.916	1.083	1.005	1.025
Princ-Tch race congr	1.191+	0.770**	0.955	0.968	0.983
N	36,770	38,380	32,780	31,770	139,700
Panel C: Leavers (Multinomial logistic regression)					
Administrative support	0.875**	0.909*	0.952	0.906+	0.910**
Teacher cooperation	0.916*	1.019	0.971	0.986	0.974
Principal effectiveness	0.953	0.954	0.943	0.843**	0.927**
Princ-Tch gender congr	1.214**	1.001	0.879	1.009	1.035
Princ-Tch race congr	0.838+	0.965	0.724*	0.838	0.883*
N	36,770	38,380	32,780	31,770	139,700

Note. Nationally-representative weights are employed. All models include state fixed effects and control for teacher and school characteristics. The pooled models also include wave fixed effects. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

+ p < 0.10, *p < 0.05, **p < 0.01.

Table 3
Marginal probabilities using logistic and multinomial logistic estimates of the factors of movers, switchers and leavers

Variables	(1) Wave: 2000	(2) Wave: 2004	(3) Wave: 2008	(4) Wave: 2012	(5) Pooled
Panel A: Movers (Logistic regression)					
Administrative support	-0.018**	-0.008*	-0.012**	-0.015**	-0.014**
Teacher cooperation	-0.013**	-0.006	-0.009**	-0.005	-0.008**
Principal effectiveness	-0.004	-0.005	-0.005	-0.012*	-0.006**
Princ-Tch gender congr	0.018**	-0.005	-0.000	0.001	0.005
Princ-Tch race congr	-0.003	-0.016+	-0.015	-0.012	-0.008+
N	36,770	38,380	32,780	31,770	139,700
Panel B: Switchers (Multinomial logistic regression)					
Administrative support	-0.009**	-0.001	-0.006*	-0.009**	-0.007**
Teacher cooperation	-0.007**	-0.008**	-0.008**	-0.004+	-0.007**
Principal effectiveness	-0.000	-0.003	-0.002	-0.001	-0.001
Princ-Tch gender congr	0.005	-0.006	0.005	0.000	0.001
Princ-Tch race congr	0.011+	-0.017**	-0.001	-0.001	-0.000
N	36,770	38,380	32,780	31,770	139,700
Panel C: Leavers (Multinomial logistic regression)					
Administrative support	-0.008**	-0.007*	-0.003	-0.005+	-0.006**
Teacher cooperation	-0.005*	0.002	-0.001	-0.001	-0.001
Principal effectiveness	-0.003	-0.003	-0.004	-0.010**	-0.005**
Princ-Tch gender congr	0.012**	0.001	-0.010	0.000	0.002
Princ-Tch race congr	-0.012*	-0.001	-0.023*	-0.010	-0.009*
N	36,770	38,380	32,780	31,770	139,700

Note. Nationally-representative weights are employed. All models include state fixed effects and control for teacher and school characteristics. The pooled models also include wave fixed effects. Heteroskedastic-robust standard errors are in parentheses. Observations have been rounded to the nearest 10 per IES compliance. Source: U.S. Department of Education, National Center for Education Statistics, Schools and Staffing Survey (SASS).

+ p < 0.10, *p < 0.05, **p < 0.01.

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