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Teacher Attrition and Mobility During the Teach For America Clustering Strategy in Miami-Dade County Public Schools

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Abstract

We examine the extent to which clustering large numbers of Teach For America (TFA) corps members in a limited number of low-performing schools was accompanied by changes in teacher mobility decisions. Using longitudinal data from Miami-Dade spanning six school years, augmented with survey responses from TFA's own Alumni Survey for cohorts placed in the Miami region, we use Cox proportional hazards models and multinomial logit decision models in a modified difference-in-difference (DD) framework. Our results suggest that the increased concentration of TFA corps members in schools was associated with a reduction in TFA mobility across schools after the first year of service, but it did not affect the overall retention of corps members in the district after the two-year commitment. In addition, we find evidence suggesting non-TFA teachers in schools with a relatively high proportion of TFA corps members were significantly more likely to leave the district. We also find that TFA corps members retained beyond the two-year commitment performed substantially better in mathematics during their first two years of teaching: evidence of positive selection into postcommitment retention. Finally, we produce steady-state estimates of the minimum TFA effects necessary for the district to prefer hiring a TFA corps member relative to a non-TFA hire. TFA corps members in the district exceed this minimum value in both reading and mathematics.

Overview

Teach For America (TFA) is an alternative certification program that places intensively selected recent college graduates and midcareer professionals into classrooms serving high-need students. TFA requires a two-year commitment from the corps members it places in regions across the country. Part of the attraction of TFA to young college graduates presumably arises from the short-term, service-oriented ethos of the program as a life experience before moving on to graduate school or professional careers in other fields, comparable to the Peace Corps.[1] In light of this orientation, it is perhaps not surprising that most TFA corps members leave their initial low-income placement school after their commitment is fulfilled (Donaldson & Johnson, 2011),[2] and this low retention has been a major point of criticism directed at the program (e.g., Miner, 2010).[3]

TFA has worked with Miami-Dade County Public Schools (M-DCPS) since 2003 to place corps members into high-poverty schools in the district. Starting in the summer of 2009, in partnership with M-DCPS, TFA dramatically shifted its placement strategy for corps members in an attempt to accelerate the program's impact in the district's lowest performing schools. Where the prior TFA–district placement strategy had generally placed two or fewer corps members in many high-poverty schools across the district, the new strategy limited new TFA corps members to the lowest performing, highest

[1] TFA is currently a member of AmeriCorps, the national service network. This affiliation allows corps members to receive some modest financial help by deferring student loans while in the program, in addition to an education award worth over $5,000 at the end of each year of service, which can be applied to a student loan balance or future educational expenses. See https://www.teachforamerica.org/frequently-asked-questions.

[2] Donaldson and Johnson's (2011) nationwide survey of TFA alumni placed between 2000 and 2002 reports that 56.4% of corps members left their initial placement school at the conclusion of the two-year commitment. Using the Miami data in this study, we find that over 70% of TFA corps members in the region left their initial placement school by the end of their commitment (see Panel A of Figure 2).

[3] As a rebuttal, TFA emphasizes that the retention of corps members who stay in public schools overall is considerably higher, estimated in excess of 60% (Donaldson & Johnson, 2011). TFA claims that overall retention in public schools into a third year has increased even further for more recent cohorts (based on results of their internal Alumni Survey), though these results are not publicly available.

poverty schools. Because the limiting of placement schools coincided with a surge in the number of corps members coming to the Miami-Dade region,[4] the net result was a dense clustering of TFA corps members in a select number of low-performing target schools. TFA believed this change in its placement strategy would benefit students in targeted schools through several hypothesized means, one of which was the increased retention of its corps members in high-need schools beyond the two-year commitment.

The purpose of this paper is to examine the extent to which this clustering strategy affected teacher mobility—particularly retention of TFA corps members—in these low-performing schools. Whether and how TFA's clustering strategy impacted the attrition of its corps members in the region is an important element of evaluating the clustering strategy's overall impact on student learning. Three main research questions motivate our analysis:

1. Are TFA corps members' retention and mobility rates associated with the density of other TFA corps members in the schools where they are teaching?
2. Does TFA clustering influence the retention or mobility decisions of non-TFA teachers in targeted schools?
3. Do TFA corps members show any differences in classroom performance when classifying them by mobility status?

The analysis presented here uses longitudinal data from M-DCPS spanning six school years to produce evidence in response to these research questions, augmented with survey responses from TFA's own Alumni Survey for cohorts placed in the Miami region. The analysis uses Cox proportional hazards models and multinomial logit decision models in a modified difference-in-difference framework. In summary of our findings, our results suggest that the increased concentration of TFA corps members in schools reduces teacher mobility across schools after the first year of service, but it does not affect the overall retention of corps members in the district after the two-year commitment is fulfilled. In

[4] The surge in corps members in the region was part of a broader programwide surge in the TFA corps, induced by an Investing in Innovation (i3) funding award from the U.S. Department of Education to scale up the program.

addition, we find evidence suggesting that non-TFA teachers in schools with a relatively high proportion of TFA corps members are significantly more likely to leave the district. When evaluating classroom productivity using a value-added approach, we find TFA corps members retained beyond the two-year commitment perform significantly higher in mathematics during their first two years of teaching; in other words, we observe positive selection into postcommitment retention among TFA corps members. Finally, we produce steady-state estimates of the minimum TFA effects necessary for the district to prefer hiring a TFA corps member relative to a non-TFA hire, given the relatively low levels of retention observed among the TFA corps in M-DCPS. TFA corps members in the district exceed this minimum value in both reading and mathematics.

Theoretical rationale between clustering and retention

TFA implemented this new clustering placement strategy with the corps arriving in the Miami-Dade region in the summer of 2009. It immediately reduced the number of target placement schools for incoming corps members by about half, and in the span of five years, TFA's annual number of placements each summer more than tripled, going from approximately 50 in 2009 to nearly 170 by 2014.

TFA succeeded in increasing the density of TFA corps members in targeted schools in the years following 2009. Figure 1 is a box plot representing the range of TFA school-level densities that new TFA hires are exposed to in their first year.[5] This is reported over four successive cohorts of TFA corps members placed in M-DCPS, starting with those placed in the summer of 2008. (These are the cohorts for whom both entry and retention at the end of year 2 can be determined in the M-DCPS

[5] Box plots illustrate particular points of the distribution of the variable of interest. The middle 50% of the distribution (i.e., values between the 25th and 75th percentiles of the distribution) are contained in the box, and the value of the median is represented by the line through the area of the box. The extent of the whiskers represents the spread of the underlying variable, with the exception of any far outliers (which have been suppressed in this graphic).

administrative data.) As we will describe further, these TFA density measures are key explanatory metrics for this analysis; the values here represent the percentage of the school's teacher workforce that is affiliated with TFA (either as active corps members or alumni). As shown, each successive cohort of new TFA corps members was placed into schools with increasingly higher levels of TFA staff. TFA corps members placed in the summer of 2008 were generally spread across many schools, and the median school-level TFA density was less than 5% of the staff. When the 2011 corps arrived, the median school-level TFA density in their placement schools exceeded 20%.

Based on conversations with those originally involved in the design of the new placement strategy,[6] the change was hypothesized to increase TFA's impact in the district through several means, one of which was increased retention after the two-year commitment.[7] TFA believed the clustering strategy in the district would increase corps members' sense of support and satisfaction while in the program through stronger associations with other peer corps members in the same school. As a consequence of this increased sense of satisfaction and attachment, it was hoped that more may choose to stay in the district beyond the duration of their two-year commitment.

Given the information provided by M-DCPS, we are unable to observe the retention rate for TFA cohorts prior to 2007; however, based on the administrative data we do observe, fewer than five distinct TFA alumni are identified in M-DCPS beyond their two-year commitment in the 2008–09 school year. This number is surprisingly low, given that nearly 200 corps members had been placed in the district between 2003 and 2006 (and could therefore be alumni in the district). However, this figure may be due to either low retention or the district's inaccurate identification of TFA corps members in these

[6] This section draws heavily on conversations with personnel in the TFA Miami regional office as well as in the M-DCPS central office. We thank them for generously providing details about the program.
[7] Hansen, Backes, Brady, and Xu (2015) describe some of the other benefits TFA hoped would result from the clustering strategy, including productivity spillovers across teachers, school cultural change, and successive exposure to effective teachers.

early years.[8] On the other hand, responses from the TFA Alumni Survey indicate that retention was somewhat higher than administrative data show. Nearly 49% (84 of 173 respondents) of alumni from the Miami-Dade region from cohorts placed between 2003 and 2006 report having taught for a third year in any school, though this was not necessarily in M-DCPS. Approximately 17% (29 respondents) report that their third year of teaching was in their initial placement school.[9]

The M-DCPS administrative data from more recent years, which will be described and analyzed in this report, show that slightly more than 25% of TFA corps members placed between 2008 and 2011 are retained for a third year in their initial placement school. Figure 2 presents survival curves of the new hires in the district between the summer of 2008 and 2011, by TFA status.[10] Panel A represents teachers' survival in their initial placement school; in other words, the proportion of placements remaining in their initial placement school (on the *y*-axis) at a given point in time after being hired (on the *x*-axis, measured in years). This graph shows that TFA corps members (the dashed lines) are more likely to return to their initial placement school after the first year but less likely to return for all years afterward, compared with non-TFA hires during the same period. Panel B represents survival within the district. Because relatively few TFA corps members are mobile across schools in the district, the TFA

[8] The TFA indicator variable used in our analysis contains those flagged by either the district or those identified in corps members lists in the Miami-Dade region made available by TFA. The TFA member lists only included placements since 2007, so any placements prior to 2007 could not be validated against TFA member lists and were those identified by M-DCPS in the administrative data only; it is possible that the district's tracking of TFA corps members in those early years was unreliable. Please see the appendix in Hansen et al. (2015) for more information on how the TFA indicator variable was created for this study.

[9] The remaining respondents who report teaching for a third year were either "not in my placement school and not in a low-income community" (fewer than 5 respondents), "not in my placement but in a low-income community" (approximately 20 respondents), or did not respond to this item (approximately 30 respondents). Whether the teaching occurred within M-DCPS is unclear based on these item responses. Because teaching for a third year refers to a point in time long preceding the administration of the survey to alumni from these cohorts, we cannot use the data from current employer or current alumni region, which are available in the data, to determine whether this third year of teaching occurred in M-DCPS, as we do with the most recent alumni cohort.

[10] We also looked at the survival of these two groups specifically in high-poverty schools (those with 85% or more students in the free or reduced-price lunch program, abbreviated FRL). Seventy-five percent of the districts' TFA corps members have been placed into these schools. We did not see any qualitative narrowing of the gap in survival rates between these two groups.

survival curves are slightly higher but nearly identical across the two panels of Figure 2 (in contrast to non-TFA hires, which indicate greater across-school mobility).

Combined, the available evidence from the administrative data and the TFA Alumni Survey suggests that TFA retention in placement schools for the region was and still is somewhat lower than typical TFA retention rates that have been documented elsewhere. (Placement school retention in M-DCPS is less than 30%.) In other studies, including Kane, Rockoff, and Staiger (2008) and Donaldson and Johnson (2010; 2011), placement school retention rates are generally above 40% but below 50%. Despite these relatively low retention rates in the region, however, neither TFA nor district administrators singled out low retention as a primary motivation for changing the placement strategy in the district. Nor was the clustering strategy designed specifically to improve retention, though it was one of several hypothesized results.

Clustering TFA corps members into the highest poverty schools with this strategy could also decrease retention, although it appears this was not considered a possible outcome from the clustering strategy. Prior empirical evidence, which we will discuss more extensively later on, suggests that teacher attrition from high-poverty schools is high in general, and it is particularly high among novice teachers. Placing this group of novice teachers exclusively into the highest poverty, lowest performing schools may, therefore, induce even higher overall levels of attrition among TFA corps members.[11] It is unclear, ex ante, the extent to which a TFA clustering strategy might enhance corps members' feelings of support and connection, leading to increased retention, or whether this might be a large enough effect to offset what could be possible negative retention effects of having a greater share of TFA teachers assigned to the district's most challenging schools.

[11] While corps members became more concentrated in the highest poverty schools under the clustering strategy, they had always been placed in relatively high-poverty schools. In practice, the differences across school settings may not be large enough to make a noticeable difference in corps members' behavior. For example, the classrooms of first-year corps members placed in 2008 (before clustering) were 87.5% free or reduced-price lunch eligible on average, compared with 92.2% among first-year corps members placed in 2009 (the first year of clustering).

TFA corps members' retention in the district is important for at least three reasons. First, there are large direct costs associated with the recruitment and placement of teachers in high-need schools.[12] TFA charges districts a fee for each corps member hired (though the full fee is often partially subsidized by area foundations, as is the case in Miami). Any changes in TFA retention rates, therefore, will have direct implications for the cost-effectiveness of those fees and on the district's total expenditures related to staffing in its highest need schools. Second, prior evidence suggests that TFA corps members have a statistically significant, positive impact on student learning gains in mathematics and science (e.g., Clark et al., 2013; Glazerman, Mayer, & Decker, 2006; Kane et al., 2008; Xu, Hannaway, & Taylor, 2011). A companion study to this one (Hansen et al., 2015) finds significant gains in both mathematics and reading associated with TFA corps members in M-DCPS during this time period. Any change in the retention of these relatively effective teachers will directly multiply the impact on outcomes for high-need students in the district by a proportional amount because of the direct exposure to relatively effective TFA instructors with at least two years of experience. Third, staff turnover itself has been found to be disruptive to student learning, independent of the demographics of the student body (Ronfeldt, Loeb, & Wyckoff, 2013); thus, any actions that may reduce turnover among corps members should reinforce student learning.

Background

Prior research shows teacher turnover in high-poverty school settings is notoriously high, regardless of the presence of TFA. For instance, a recent compilation of the evidence in this field indicates high-poverty schools typically lose 20% or more of their teaching faculty each year, and multiple studies find more than 50% of teaching staff must be replaced every five years; these rates are

[12] For example, the National Commission on Teaching and America's Future estimates that the cost of turnover in five school districts range from over $4,300 to nearly $18,000 per teacher leaver, and the highest costs are associated with the largest, most urban districts (Barnes, Crowe, & Schaefer, 2007).

roughly 50% higher than low-poverty schools (Simon & Johnson, 2013). Moreover, teachers new to the profession generally tend to exit the classroom at higher rates than veteran teachers (e.g., Hanushek et al., 2004), and those with stronger academic training appear to be especially prone to leaving disadvantaged school settings (Boyd, Lankford, Loeb, & Wyckoff, 2005).[13] Hence, relative to similar teachers in similar contexts, TFA's retention may not be as low as it appears on the surface. For example, comparing TFA corps members' attrition with those of non-TFA hires in all New York City schools, Kane et al. (2008) find a retention rate at year 3 (the first year after fulfilling their commitment) among TFA corps members near 40%, compared with nearly 60% among other uncertified teachers or nearly 70% among alternatively certified teachers. The retention gap widens between these groups over time, and by year 5, fewer than 20% of TFA corps members remained in the district, while more than 40% were retained from the other groups. The authors argue that even with lower retention, the district may still prefer to hire TFA corps members because their classroom performance is higher than non-TFA teachers.[14]

The most in-depth studies on the attrition and retention decisions of TFA corps members specifically are those from Donaldson and Johnson (2010; 2011) and Donaldson (2012). These studies use a common survey of over 2,000 TFA alumni, investigating their reasons for joining TFA and then their career decisions after fulfilling their two-year commitment. Donaldson and Johnson (2011) interpret the survey data as suggesting two very different subgroups of corps members. The first subgroup (constituting 57% of survey respondents) had short-term teaching expectations from the outset, with firm plans for graduate school or employment after their TFA commitment was complete. The second subgroup (the remaining 43%) more closely resembled typical career teachers with long-

[13] While relatively effective teachers tend not to leave the profession altogether as frequently as ineffective teachers (Goldhaber, Gross, & Player, 2011), those in low-performing schools do show a higher tendency to move toward more affluent schools, contributing to unequal access to effective teachers (Boyd, Grossman, Lankford, Loeb, & Wyckoff, 2008).

[14] Like Kane et al. (2008), we perform a similar steady-state calculation of the experience distribution across teachers across TFA and non-TFA groups in the results that follow.

term career expectations; many in this group also demonstrated other signals of commitment to teaching, including an Education major or minor or prior pedagogical coursework. The retention of the second group far exceeded those of the first.

Whether this particular group of novice teachers' retention in high-need schools can be influenced through some type of intervention is a different, though related, question. Clotfelter et al. (2008) investigate the impact of a bonus for teachers in high-poverty or low-performing schools on their retention and find that experienced teachers appear to be the most responsive to this monetary intervention. However, working conditions may weigh more heavily for novices: Feng (2010) shows new teachers' attrition is particularly high when given more challenging classroom assignments (e.g., low prior performance, students eligible for free or reduced-price lunch [FRL]), even after accounting for the school's poverty level. Another relevant finding from Donaldson and Johnson (2011) is that among TFA corps members who left K–12 teaching, nearly 18% cited school-based factors as the primary reason for leaving. Roughly half of this was attributed to poor administrative leadership, but the remaining respondents attributed their departure to reasons such as lack of collaboration or general dissatisfaction with the job description and duties. Other significant determinants of attrition they find from this survey are classroom assignments, including out-of-field, multisubject, or multigrade teaching assignments (Donaldson & Johnson, 2010).

Our third research question exploring the relationship between classroom performance and the retention of TFA corps members has no direct relevance with the clustering placement strategy in M-DCPS, though it is related indirectly. If clustering does affect the retention of TFA corps members, then this is a boon to their placement schools' performance so long as the retained corps members are equally or more productive than the average non-TFA teachers in the school. On the other hand, if the most effective TFA corps members leave anyway and those who stay are systematically less effective,

then any changes to TFA corps members' retention behavior because of clustering should be of little consequence to school performance. We are unaware of any prior studies that explore productivity differences across the TFA corps interacted with their postcommitment retention; all prior studies implicitly assume a uniform impact among all TFA corps members and alumni.[15] Donaldson and Johnson's (2011) observation of two discrete subgroups among TFA corps members with very different attachments to the teaching profession suggests that productivity differences by retention may be plausible, though we have no prediction as to which subgroup (if any) will outperform the other.

In summary of this literature, there appears to be an opportunity for clustering to make an impact on the retention of TFA corps members, though whether the effect will be positive or negative is not obvious. Among new teachers in general, retention is lower among teachers of disadvantaged students in high-poverty schools; thus, clustering TFA corps members in the highest poverty schools may inadvertently accelerate their departure. On the other hand, nearly a fifth of TFA corps members cite school-level factors as contributing to exiting the classroom, providing an opening for TFA corps members to respond to working conditions, which may potentially include colleagues. Whether this change in TFA placement strategy actually has an impact on mobility is the primary empirical question we investigate here.

Data

We use administrative longitudinal data from M-DCPS' teacher personnel files to create year-specific observations for each teacher in Miami-Dade. The time span of the data extends from the 2008–09 through the 2013–14 school year. Variables contained in these data files include hire date and assigned school. The outcome variables for this analysis are indicator variables on whether a teacher left

[15] Multiple studies have investigated whether returns to experience among TFA teachers differ from those among non-TFA teachers (e.g., Hansen et al., 2015; Kane et al., 2008) and generally find no evidence of differences. Nonrandom retention will affect the estimates on the returns to experience, though the estimates of returns to experience alone will not necessarily reveal the presence of nonrandom attrition.

his or her placement school or exited from M-DCPS generally at the end of each school year observation, which are generated from these personnel files.[16] Personnel files are linked with course files that identify all courses teachers taught for each year and the students assigned to those courses. These course files are then used to create measures of the classroom composition, including student demographic variables and prior test scores.

The TFA density variables are a key piece of our analysis here, and these are derived from the course files. We do not have any strong prior hypotheses about the best way to model the density of TFA, and it could be measured in various ways (as discussed in Hansen et al., 2015). For example, we could simply count the number of TFA staff in a school or measure density as a proportion of TFA staff over all instructional staff. Alternatively, we could measure TFA corps members among the group of relevant peers (other same-subject teachers in the same school in middle and high school grades, or same-grade teachers in the same school in elementary grades) rather than at the school level. In the absence of strong priors, we use the proportion of TFA corps members among instructional staff in a school as our primary TFA density metric for this analysis; however, we also report results using the proportion of TFA staff among the relevant peer group.[17]

Table 1 presents descriptive statistics of the teacher-level data that will be used for this analysis. In the analyses that follow, we will use two distinct teacher samples, which are presented across the columns. The first sample (presented in Column 1), used for the Cox proportional hazard models, includes all TFA corps members who began in the district sometime from the 2008–09 school year up

[16] Teachers' retention status is coded based on two subsequent year observations. Teachers observed in the same school for both years are flagged as being retained (i.e., they exit neither the district nor the school during this period). When a teacher is observed to change schools between these year observations, the teacher is coded as exiting the school (though retained in the district). Those who do not return to the administrative data in a subsequent year are coded as exiting both the school and the district.

[17] We have run these regression models using various parameterizations of TFA density, including counts and threshold values on both counts and percentages. Our results are qualitatively robust to the choice of how TFA density is measured for teachers.

through and including the 2011–12 school year. The second sample (in Column 2), used for the multinomial logit model, includes all teacher-year observations available in the data through the 2012–13 school year, regardless of when those teachers were actually hired into the district and regardless of TFA status.[18] TFA corps member observations account for less than 1% of the all-teachers sample in Column 2.

As shown in Table 1, TFA hires (in Column 1) are very distinct from the general population of M-DCPS teachers (in Column 2) in terms of reported demographic variables. While it is unsurprising that TFA corps members would be younger and have significantly less experience, Table 1 shows that they are also significantly more male and White than the larger population of M-DCPS teachers.[19] TFA corps members also teach in school contexts where these key socioeconomic indicators signify greater levels of disadvantage than the population of teachers generally. The average school-level TFA density experienced by TFA hires is over 15%, compared with the all-teachers sample where the average density is less than 1%. This large disparity is expected given the clustering strategy, which focuses placements in select schools, resulting in an intentionally uneven distribution of TFA corps members across schools. Finally, inspection of the outcome variables shows that although TFA corps members demonstrate within-district mobility roughly comparable to the general teacher population, their attrition from the district is over four times greater than the population.

To get a more informative overview of how TFA corps members' retention patterns have shifted over time, we analyze the mobility decisions of separate TFA cohorts. Figure 3 shows the proportion of

[18] Note that observations in the data from the 2013–14 school year are used to code retention for the prior year and are not directly included as observations in the analysis.

[19] TFA has been actively working to improve the diversity of its corps. The most recent corps beginning in 2014 is its most racially diverse in the organization's 25-year history, with 50% identifying as people of color (see https://www.teachforamerica.org/about-us/media-resources/news-releases/teach-america-welcomes-25th-anniversary-corps-bringing-its). Other TFA studies have documented TFA corps members being relatively more White and male than comparison teachers in the schools they are assigned (e.g., Clark et al., 2013). Note that in the context of the public teaching profession, where most teachers are female, TFA's higher share of male corps members can be viewed as diversifying the workforce.

corps members moving from their initial placement school at the end of year 1 and the proportion retained in the district beyond the two-year TFA commitment, across each of the four cohorts placed between 2008 and 2011. There is an evident decrease over time in the frequency of moving between schools at the end of year 1. TFA retention in the district after the commitment expires is less clear. Figure 3 shows that retention rates fluctuate over these four cohorts, but it may hint at an upward trend for the 2009 through 2011 cohorts that could potentially extend beyond the span of the administrative data. We investigate this possibility further in the results section of this report.

Finally, our third question uses a separate data structure comprised of the teachers who can be linked to students in tested grades and subjects to explore whether TFA corps members' productivity varies by postcommitment retention status. Descriptive statistics for these two analysis samples, corresponding to the two tested subjects, are presented in Table 2. These samples are simply the analysis samples used in Hansen et al. (2015), with the addition of indicators flagging TFA corps members' retention.[20] The variables presented in Table 2 are selected control variables in the value-added approach that will be used. Note that the English Language Arts (ELA) sample has many more student-year-teacher linked observations; this increase is due to the higher frequency of students taking multiple courses that meet the inclusion criteria for ELA. There are just under 200 unique TFA teacher-year observations in both samples, constituting less than 2% of all observations.[21]

[20] See Hansen et al. (2015) for additional information on the construction of the sample for value-added analyses.
[21] Some active TFA corps members have unknown retention status because of our inability to observe entry or exit in the longitudinal data. We observe corps members from the 2007 cohort in their second year, but we cannot tell if this is their initial placement school; thus, corps members from this cohort have unknown retention status from their placement school, but we can still observe their retention in the district. We observe initial placements for the 2012 cohort, but we cannot observe whether any of them stay in either the district or the school; these are coded with unknown retention status from both the school and the district. These unknown retention flags are included in the value-added models we will describe, but they are not reported in the results.

Methods

The study's research questions seek to understand the relationship between the placement of TFA corps members in M-DCPS and mobility decisions of both TFA and non-TFA teachers. The main explanatory variable we use to identify this relationship is the density of TFA corps members and alumni at the school level (or peer level, for robustness). We cannot, however, interpret the results presented in any of our empirical models that follow as causal because of possible covariation between TFA density and omitted variables.

Specifically, the variation in this density measure comes from three sources: (1) variation over time/cohorts because of the surge in corps members for the region; (2) variation across schools based on their selection as a targeted cluster school; and (3) variation across schools but within clustering status and cohorts, which may occur because of the number of job openings, principal preferences for TFA, or other reasons. The first two sources of variation, stemming from the surge in corps members and the targeting of cluster placements, are the most plausibly exogenous sources of variation. Note, though, that these two sources of variation do not make causal identification entirely clean in our analysis, as targeted cluster schools were selected because they were the lowest performing schools serving historically low-performing communities; hence, a school's selection may have been influenced by factors not observed in the administrative data. Lastly, the third source of variation is more readily endogenous, as the density of TFA clusters can be directly controlled by individual school principals' hiring of TFA corps members in recent years, and school leaders also are key factors in determining teachers' mobility decisions (e.g., Boyd et al., 2011). For example, it could be the case that principals who choose to hire large numbers of TFA corps members are more likely to strive to create a welcoming environment for those corps members, leading to the reduction in transfer rates between schools. Hence, cleanly separating the density effect from the school leadership effect is not feasible in this study. Despite these possible covariations clouding our causal identification, this analysis is still helpful

in describing mobility patterns across TFA and non-TFA teachers in targeted schools during this time period.

We proceed by conducting analyses using three separate analytical models. The first model we employ is a Cox proportional hazards model, which is used to model and predict time-to-exit among all entering TFA hires in M-DCPS for cohorts hired from the summer of 2008 through the summer of 2011 (the sample in Column 1 of Table 1). The second model is a multinomial logit model that uses a modified difference-in-difference approach; this is estimated for all teacher-year observations in the district (the sample in Column 2 of Table 1). Finally, for the subset of TFA teachers who can be linked to students and their corresponding test scores (the sample in Table 2), we estimate differences in productivity across groups of teachers using a value-added approach. We will now describe these methods here.

First, we employ a Cox proportional hazards model to predict the likelihood that a teacher exits either the school or the district, conditional on the presence of other TFA corps members as peers. We apply this model to all new TFA entrants into M-DCPS schools between the summer of 2008 and 2011.[22] An underlying assumption of the Cox proportional hazards model is that the underlying hazard function (i.e., the risk of exiting), notated as $\lambda_0(t)$, is shared across all observations in the estimation sample. The estimation equation takes the following form:

$$\lambda(t|TFA\ density, \boldsymbol{X}) = \lambda_0(t)e^{(TFA\ density\beta_1 + \boldsymbol{X}\beta_2 + v_i)}$$

The primary conditioning variable is the density of TFA corps members as peers. Other covariates employed in the model, notated as the **X** vector, include teacher characteristics (gender, race/ethnicity, age); school characteristics (elementary school, high school, receipt of interventions from the district's Educational Transformation Office [ETO], and school proportions of FRL eligible students,

[22] We estimated an analogous model on non-TFA hires into the district during the same time period of the study as these TFA hires, but we omit reporting them here for brevity. Because the shape of the baseline hazard function is distinct across the TFA versus non-TFA groups, these could not be estimated in the same regression.

Black students, or English language learners [ELLs]); and classroom characteristics (mean prior test scores in mathematics where available [and a missing flag for those observations where this value is undefined], mean unexcused and suspended absences for students, and multigrade or multisubject teaching assignments).

Second, we employ a multinomial logit model where teachers are predicted to stay, move between schools within the district, or leave the district entirely. Our estimating equation is motivated by the desire to model retention among TFA versus non-TFA teachers, and the effect of TFA density is interacted across both groups. Thus, we take a variation of a typical difference-in-difference (DD) design. A typical DD design in this context would include a binary variable representing pre- versus post-clustering TFA cohorts interacted with another binary variable on cluster and noncluster schools, with the coefficient on the interacted postclustering cohorts in cluster schools representing the DD estimate of changes in mobility because of clustering in the postperiod. A basic model could be written as the following:

$$Y_{it} = \beta_0 Post_t + \beta_1 Cluster_{it} + \beta_2 Post_t * Cluster_{it}. \quad (1)$$

Rather than using a pre-post distinction as in (1) above, we instead control for TFA density directly to distinguish between relatively high- and low-density contexts.[23] In our context, controlling for density directly represents an improvement over a *Post* dummy because the pre- versus post-clustering distinction only accounts for a fraction of the variation in the TFA density variable, and we do not want to ignore variation occurring among the postclustering cohorts. For example, when clustering began with the 2009 cohort, many corps members in that cohort experienced TFA densities similar to those in the prior 2008 cohort (see Figure 1), but they were exposed to densities roughly half of those in the later

[23] This is a modified DD where treatment intensity is controlled for directly (e.g., Draca, Machin, & Van Reenen, 2011).

2011 cohort. In addition, in contrast to (1), we do not interact the *Cluster* variable with TFA density because TFA density only varies meaningfully in cluster schools.[24]

Finally, because we also are interested in the response of both TFA and non-TFA teachers to clustering, we include a TFA*Density interaction term. Thus, putting all our modifications together, our updated version of (1) becomes:

$$Y_{it} = \beta_0 Density_t + \beta_1 Cluster_{it} + \beta_2 Density_t * TFA_{it}. \qquad (2)$$

We obtain our final estimating equation by taking (2), adding a TFA*Experience interaction term to capture experience-specific TFA attrition effects, and adding controls for demographic characteristics $\boldsymbol{X}_j$. We put this into a multinomial logit model, following Boyd et al. (2008):

$$P_j^h = \frac{\exp\left(\alpha^h + \beta_1^h \boldsymbol{X}_j + \beta_2^h \left(TFA_j * Exp_j\right) + \beta_3^h Density_j + \beta_4^h (TFA_j * Density_j)\right)}{\sum_g \exp\left(\alpha^g + \beta_1^g \boldsymbol{X}_j + \beta_2^g \left(TFA_j * Exp_j\right) + \beta_3^g Density_j + \beta_4^g (TFA_j * Density_j)\right)}$$

$$for\ h = Stay, Leave, Move$$

The parameterization presented here thus estimates the relationship between the density of TFA (β_3^h) among all teachers (i.e., the clustering effect on non-TFA teachers in cluster schools), and the interaction of TFA density with TFA status (β_4^h) represents the differential mobility of TFA corps members in TFA-dense schools (i.e., the clustering effect on TFA teachers).

This estimating equation is applied to each of the three mobility outcomes (stay, leave, move), and it uses stayers as the reference group (in other words, all coefficients associated with staying are equal to zero). Thus, coefficient estimates are interpreted as mobility differences relative to staying in the same school. Because we estimate this model on the entire sample of available teacher-year observations in the district for the study period through the 2012–13 school year, and do not explicitly

[24] Because only very small values of TFA density are observed outside of cluster schools, interacting the cluster school indicator with TFA density and the TFA indicator makes no qualitative difference on the results.

condition on time-within-school as the proportional hazards model does, teacher experience is controlled separately and included in the covariate vector (***X***).[25] To account for the unique shape of TFA corps members' retention over time relative to non-TFA teachers, we interact a teacher's TFA status with experience (which is entered as a series of three indicator variables for year 1, year 2, and all years afterward). This allows TFA corps members to have an entirely separate mobility profile than non-TFA teachers in the sample. To model the effect of clustering on retention, we include a TFA density measure ($Density_j$) and also interact this measure with TFA status ($TFA_j * Density_j$) to allow TFA and non-TFA teachers to show associations with it.

The value of using a multinomial logit model here, relative to the proportional hazards model, is two-fold. First, it allows us to include all teacher-year observations in the data, rather than just new hires, to observe how the placement of TFA corps members in the district might be associated with all teachers' mobility. Second, the multinomial logit approach explicitly models moves within the district jointly with exits from the district entirely, whereas the proportional hazards model included earlier in this report ignores this distinction. The drawback of this approach is that we cannot explicitly model different mobility decisions within teachers over time as the proportional hazards model does; however, standard errors in this model are clustered to account for within-teacher correlations.

Finally, we investigate the relationship between teacher quality, as measured by value-added, and the observed retention among TFA corps members following the conclusion of their two-year commitment. To do this, we employ a straightforward value-added regression predicting student achievement for student *i* in school *s* at time *t* on test scores (A_{ist}) as a function of prior student

[25] Experience is controlled as a series of indicator values representing year 2 of teaching, years 3–8, and year 9 or higher. The omitted category represents 1 year of experience. TFA status is interacted with these indicator variables and the omitted category, though no TFA corps members are observed beyond year 8 of teaching.

achievement (A_{it-1}), student characteristics (X_{it}), classroom characteristics (X_{ct}), an indicator representing active TFA corps members ($Active\ TFA_{it}$), and a school fixed effect (γ_s):[26]

$$A_{ist} = \alpha A_{it-1} + \beta_1 X_{it} + \beta_2 X_{ct} + \beta_3 Active\ TFA_{it} + \gamma_s + \varepsilon_{ist}$$

This value-added approach is consistent with prior studies of TFA impacts (e.g., Hansen et al., 2015; Kane et al., 2008). We vary slightly from this typical construction to decompose the TFA impact based on observed mobility following the two-year commitment into two groups: those retained for a third year and those not retained for a third year. Thus, we estimate the following regression equation:

$$A_{ist} = \alpha A_{it-1} + \beta_1 X_{it} + \beta_2 X_{ct} + \beta_3 Active\ TFA_{it} I^{Retained} + \beta_4 Active\ TFA_{it} I^{Not\ Retained} + \gamma_s + \varepsilon_{ist}$$

As in prior models, we alternately estimate models referring to retention in either the initial placement school or the district overall. Our primary purpose here is to separately estimate TFA impacts between those who stay beyond their two-year commitment (estimated by $\widehat{\beta_3}$) and those who choose not to ($\widehat{\beta_4}$). Note that the TFA indicator flag in this specification refers to corps members during the years of their two-year TFA commitment and does not include TFA alumni; this is intentional, as we wish to avoid confounding our $\widehat{\beta_3}$ estimate in this model with returns to experience that accrue only to retained teachers.

Results

Proportional Hazards Model Results

Table 3 presents the results of estimating the proportional hazards model on the sample of TFA hires to the district. Columns 1–4 report the hazard of exiting the initial placement school (which could be due to moving to another school or exiting the district altogether). Columns 5–8 report the hazard of

[26] Included teacher control variables are gender, Black and Hispanic teacher indicators, and race congruence with students. Student control variables are a cubic expansion of prior test scores in both mathematics and ELA, gender and race/ethnicity indicators, FRL eligibility, ELL status, and indicators on mental, physical, and emotional disabilities. Classroom control variables are average pretest scores and the percentage of FRL eligible students. All control variables are interacted with grade, and grade-year fixed effects also are included. Observations are weighted by teacher dosage.

exiting the district.[27] Note that this model assumes a baseline hazard function underlying all TFA placements, and the explanatory variables are assumed to exert a proportional effect on the hazard of the outcome at all points in time after placement. The coefficients are reported as hazard ratios, where the baseline value is one (which represents no change in the outcome's hazard). Values greater than one on the hazard ratio indicate an increasing hazard as the explanatory variable increases; values less than one indicate a decreasing hazard as the explanatory variable increases.

The primary coefficients of interest reported here are those on the density of TFA corps members and the school-level percentage of students who are FRL eligible. The units of TFA density in this and the following table are scaled so that the coefficient estimates represent a 1 percentile point change in TFA density (e.g., the association of moving from a school with a TFA density of 5% to 15% is 10 times the coefficient estimate). The models add teacher, school, and classroom variables to the estimating equation in a stepwise manner. The hazard ratio estimates reported here show no statistically significant association with either the school's FRL percentage or the density of TFA corps members among the peer group. As described previously, the density of TFA corps members is calculated in two different ways; Panel A of Table 3 reports the results when the density is calculated off of all teachers in the school, and Panel B presents the results with density calculated using a teacher's relevant peer group. In neither case does TFA corps members' exit decisions appear to be associated with these included covariates. One important feature of the proportional hazards method is that only one outcome is estimated in the model at a time. In the case of estimating the hazard of exiting the school, transferring to another school within the district is treated the same as leaving the district entirely; and, as shown in Table 1, district exits are the most common movements observed among the

[27] The discrepancy in the number of observations across the outcome types is due to mobile teachers who stay in the district, continuing to contribute observations to the survival model on district exits even though they have left their initial placement school. Fewer than five TFA corps members left the district after fulfilling their two-year commitment and then later returned after a gap of a year or more; the observations from the postexit period are dropped from the sample for the Cox proportional hazard models, as subjects are only allowed to exit once.

sample of TFA hires. Thus, in Table 3, Columns 1–4 will have the majority of observations in common with those in Columns 5–8.[28]

Multinomial Logit Model Results

Next, we turn to the results of the multinomial logit model, which differentiates the two exit types by jointly estimating both within the same model. The results of these models are presented in Table 4. The estimated coefficients are reported as relative risk ratios, which have a baseline value of one with the same interpretation as the hazard ratios presented previously. Columns 1 and 2 use TFA density calculated across the entire sample of school teachers, while Columns 3 and 4 use TFA density based on relevant peer groups. Note that the estimates reported in Columns 1 and 2 come from the same regression (likewise for Columns 3 and 4) because the multinomial logit model estimates relative risk among both exit types simultaneously.[29] The bottom row of the table reports a chi-squared hypothesis test on whether the sum of the TFA Density and TFA*TFA Density estimates is equal to zero.

Focusing first on the estimates presented in Columns 1 and 2, we see evidence of three noteworthy mobility patterns associated with TFA school density. First, TFA teachers are significantly less likely to move across schools within the district as the density of TFA corps members in a school increases, though non-TFA teachers do not appear to show any changes in their mobility across schools from these measures.[30] The TFA*TFA Density relative risk ratio in Column 1 indicates that a 1 percentage point increase in TFA density is associated with an 8% reduction in the likelihood of transferring among

[28] Of the 590 observations in the model with school exits as the outcome, only 34 of the total 244 exits from the school are for within-district transfers; the remainders are school exits from leaving the district entirely.
[29] We would like to estimate the model comparing outcomes among other teachers in the school only, but the application of school fixed effects to a multinomial logit is not straightforward and may add bias to the estimates. Instead, we include the set of school covariates described above, and we additionally include a cluster school indicator to absorb any excess mobility that may be associated with schools where TFA clusters overall.
[30] Though the estimated model's parameterization represents across-school mobility at any point in a teacher's career, at the end of year 1 of the two-year commitment is the primary time when such moves are observed to occur among TFA corps members in the data—34 of the 45 total observed moves among TFA corps members occurred at this point. We estimated an alternate specification in which we interacted experience and TFA status with TFA density, but the experience cells for year 2 and years 3–8 failed to be identified because of collinearity in the small TFA-experience cell sizes.

TFA teachers. The test of a null TFA density effect on TFA corps members (in the bottom row of the table) is strongly rejected, indicating a statistically significant association even when combined with the slightly positive TFA Density estimate.

Second, the TFA Density relative risk ratio from Column 2 shows a significant increased tendency for all teachers to exit the district in schools with a higher concentration of TFA teachers. The estimated risk ratio suggests that a 1 percentage point increase in TFA density in the school is associated with a 1.5% greater likelihood of exiting the district—a somewhat modest effect in magnitude but still noteworthy. With the longitudinal data, we cannot determine whether this is a causal relationship or the direction of causality. For example, it is plausible that schools with exceptionally high out-of-district exits in general rely more on TFA staffing; on the other hand, high concentrations of TFA teachers may contribute to a culture of high turnover in the school and induce non-TFA teachers to exit.[31]

Finally, changes in TFA density show no significant association with TFA corps members' decisions to exit the district. From Column 2 of Table 4, note that TFA corps members are extremely unlikely to exit the district after the first year, but they are significantly more likely to exit in the second year or afterward. The risk ratio of the interaction variable TFA*TFA Density is marginally significant and suggests a lower probability of exit; however, note that this estimate needs to be combined with the main effect of TFA Density, which is significant in the positive direction. The combination of the main effect and the interacted effect for TFA corps members is again tested in the bottom row of Table 4, and the null hypothesis of no density effect on TFA corps members fails to reject in this case. These findings square with the proportional hazards results in Table 3, which showed that the hazard of leaving the

[31] Many of the schools where TFA clustered its corps members also received school turnaround interventions from the district's ETO. These interventions may have included large amounts of staff turnover in select schools. It is unlikely that school turnaround is driving this significant estimate for two reasons. First, the high levels of staff turnover in these schools occurred in the year prior to being replaced by TFA (whereas the model estimates exit patterns as a function of current density). Second, teachers displaced by turnaround were transferred within the district, whereas these estimates suggest a relationship with leaving the district altogether.

initial placement school was slightly lower than the hazard of exiting the district (though not significantly so) in schools with more TFA teacher placements.

These same three mobility patterns also are observed when using TFA density calculated among the relevant peer group (in Columns 3 and 4 of Table 4). In addition, Table 4 reveals a strong association between the school FRL percentage and the likelihood of within-district transfers. Contrast this with exiting the district, where we do not see a significant association. We also estimated additional specifications (omitted for brevity) that fully interacted TFA status with teacher experience and school FRL percentage, and we did not see any evidence suggesting that TFA corps members showed any differential mobility patterns (relative to similarly experienced non-TFA teachers) associated with changes in school FRL percentage.

District Retention of the 2012 TFA Cohort

In our earlier discussion of Figure 3 in the Data section, we noted what might be an emerging upward trajectory in district retention based on the last three TFA cohorts in the sample. Though the multinomial results presented previously do not find any association between TFA density and district retention, perhaps future cohorts may show a relationship if we had data on their retention.

We wish to investigate district retention further with the TFA Alumni Survey to determine whether this pattern is a developing upward trend or simply variation across cohorts. Of the 142 corps members in the 2012 cohort observed in our administrative dataset, 141 of them could be identified as survey respondents. However, given item-level nonresponse of some corps members, coupled with the closed-response options that do not allow us to pin down a teacher's retention in the district, precisely estimating the cohort's district retention is not possible. Instead, we use the survey responses to estimate the 2012 cohort's district retention numbers in two different ways. First, there are 35 respondents who report that their most recent employer (in 2014) was M-DCPS, are classified in the

Miami alumni region (based on current residence), and indicate that their most recent professional role (in 2014) was teacher; this method suggests district retention of nearly 25%. Under the second method, 43 respondents indicate that they taught for a third year and are classified in the Miami alumni region (an additional 5 respondents in the Miami region did not respond to the third year question); here, district retention is 30%.

Both methods to estimate district retention based on survey responses result in estimates below the 37% retention rate of the 2011 cohort of TFA corps members observed in the administrative data. Based on these estimates, we conclude that the 2012 cohort was likely retained at a lower rate than the 2011 cohort, and an upward trend extending beyond the span of the administrative data seems very unlikely. Thus, it is similarly unlikely that the relationship between district retention and TFA density would qualitatively differ if the time span of our data sample were extended by one year to include the 2012 cohort.

Value-Added Results on TFA Impacts by Retention Subgroups

The third research question explores the issue of nonrandom retention among TFA corps members, using a value-added approach to estimate effects by teacher subgroups.[32] The results of this analysis are presented in Table 5, reported separately by mathematics (in Columns 1–3) and English Language Arts (Columns 4–6). The column headings indicate how the retention subgroups are defined: Columns 1 and 4 report the coefficient estimate for active TFA corps members in each sample as a reference point and do not break out into retention subgroups; Columns 2 and 5 decompose the active TFA effect among retained and nonretained corps members in their initial placement school; and Columns 3 and 6 represent the effects among retained and nonretained corps members in the district overall.

[32] We also estimated models where we flagged active TFA corps members based on their across-school mobility after year 1 of their TFA commitment to determine whether the TFA impact varied significantly by mover status. The results of these regressions were rather noisy and inconclusive; for brevity, we omit them here.

The results in Table 5 indicate that retained TFA corps members' performance in mathematics is markedly higher than those who are not retained after their two-year commitment expires. Tests of statistical significance reported in the bottom row of Table 5 indicate rejections of the hypothesis of equality between the two groups' performance for Columns 2 and 3. In other words, based on performance during their years as active corps members, we observe positive selection into postcommitment retention: on average, TFA mathematics teachers who choose to continue teaching after their two-year commitment are more effective in their first two years than those who do not. This pattern holds in mathematics regardless of whether we view this as retention in corps members' initial placement school (Column 2) or in the district generally (Column 3), though the difference in performance between retained and nonretained corps members is slightly larger when looking at school-level retention. In ELA, the coefficient estimate on active TFA corps members is not significant, and decomposing by retention subgroup shows no significant differences.[33]

TFA Minimum Impacts Adjusted for Attrition

A common criticism of TFA is that the high level of turnover among corps members undermines any effectiveness advantage that corps members might bring to the classroom because of the returns in experience that accrue to career teachers over time that do not accrue to most TFA hires. Kane et al. (2008) address this criticism directly by modeling steady-state differences in experience between the TFA workforce and those of non-TFA hires, and they identify the minimum difference in productivity between the groups to make the hiring of TFA corps members advantageous to the district. They describe this minimum to be relatively "modest" based on their estimates of TFA retention: 0.019 student standard deviations in mathematics and 0.012 standard deviations in ELA.

[33] Recall from footnote 21 that a third retention subgroup, representing those with unknown retention status based on data availability, also is included in the models but is not reported here. Because of this, the range of the two retention subgroup estimates may not include the coefficient estimate on active TFA, as is the case in ELA.

We expect this minimum difference in productivity to be different in magnitude in M-DCPS, primarily because of TFA retention being considerably lower in this region than what has been demonstrated in prior studies of TFA, including the New York City data that Kane et al. (2008) used to calculate their minimum values. We replicate their strategy using the retention estimates produced here and the returns to experience estimated in Hansen et al. (2015). Like Kane et al. (2008), we assume that teacher retention beyond year 5 is constant for both teacher groups and that the returns to teaching experience are equal for TFA and non-TFA teachers (consistent with the results in Hansen et al., 2015).[34] Our calculations show the minimum productivity differences required in M-DCPS are 0.015 standard deviations in mathematics and 0.006 standard deviations in ELA.[35] Comparing these values against the estimates produced in Hansen et al. (2015), TFA corps members exceed this difference in both subjects, indicating that TFA corps members are beneficial hires for M-DCPS students in terms of student achievement, even when accounting for their relatively low levels of retention in the district.

Conclusion

This analysis investigates whether the change in how TFA corps members were placed in M-DCPS during the study period was associated with changes in the mobility decisions of TFA teachers or non-TFA teachers. The evidence we find in the personnel data suggests that the clustering strategy had a significant association with a reduction in the likelihood of transferring between schools within the district for TFA corps members, though there was no significant association with TFA retention in the district. The clustering strategy also shows a significant association with increased attrition of non-TFA

[34] Kane et al. (2008) use logistic regressions of hazard rates to model district exits, whereas we use the Cox proportional hazards model presented earlier. The differences attributed to model choice here should be trivial.
[35] The lower minimum values in our data, despite the lower TFA retention rate, is due to the relatively small returns to experience estimated in our data (see Hansen et al., 2015) and the relatively low retention rate after year 5 among non-TFA teachers in the district (which is assumed to carry forward). When using higher returns to experience values and higher retention rates that carry forward among non-TFA teachers, the minimum values were slightly higher, 0.030 standard deviations in mathematics and 0.017 standard deviations in ELA, though still low enough that estimated TFA impacts in the district exceed these values.

teachers out of the district, suggesting a possible adverse response among the larger workforce in these schools. Finally, our value-added model decomposing the TFA effect into retention subgroups showed significantly positive selection into postcommitment retention based on mathematics performance. No corresponding selection effects were observed in ELA performance.

We cannot interpret these results as causal, but they support the hypothesis that the influx of TFA corps members in clusters provides support that TFA corps members value and thus helps retain them in their initial placement school for the duration of the two-year commitment.[36] While this support hypothesis may be true, it does not appear to help retain corps members in the district long term. Thus, if TFA seeks to promote retention of its corps members in the teacher workforce, we recommend exploring other strategies, as the support provided in M-DCPS during this clustering period did not appear to affect corps members' retention decisions following their initial two-year commitment.

In our discussion of the background on the clustering strategy, we suggested that a potentially unintended consequence of clustering TFA corps members in the lowest performing, highest need schools would be an increase in TFA turnover and attrition from these schools. Based on our estimates, the share of disadvantaged students in the school had very small associations with within-district mobility and no associations with exiting the district (based on Table 4), and TFA corps members did not show any particular relationship to changes in this variable (based on Table 3). Hence, this adverse consequence failed to materialize, though another did: clustering is associated with higher levels of attrition from the district for non-TFA teachers. One could speculate that it may be possible that

[36] We would like to explore whether this outcome is more strongly associated with having TFA alumni in the school or whether this is correlated with large numbers of active corps members (i.e., testing whether mentoring or cohort support may be more critical). The small number of TFA alumni causes such a test to have very little power, though we speculate the outcome is more likely driven by the size of the cohort.

clustering TFA corps members contributes to a culture of high teacher turnover, which might discourage non-TFA teachers in the school and inadvertently drive them out from the district.[37]

Finally, these results influence our assessment of the clustering strategy's overall impact on student learning in M-DCPS. Although we do see promising evidence that the best TFA corps members in mathematics are more likely to stay longer than two years, the clustering strategy does not appear to influence the corps members' likelihood of staying in general. Meanwhile, clustering does appear to sharply decrease transfers among TFA corps members, which should presumably translate to learning gains for students (Ronfeldt et al., 2013); yet, it simultaneously suggests a modest increase in the attrition of non-TFA teachers from the workforce, contributing to more turnover that may harm students. On balance, we cannot determine whether teachers' mobility responses induced by the clustering strategy result in a net harm or a net balance, though they are likely very small in either case.

[37] During interviews with school leaders where TFA corps members have been placed during the study period, no such opinions were stated, though our interview questions did not probe this issue specifically.

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Figure 1.

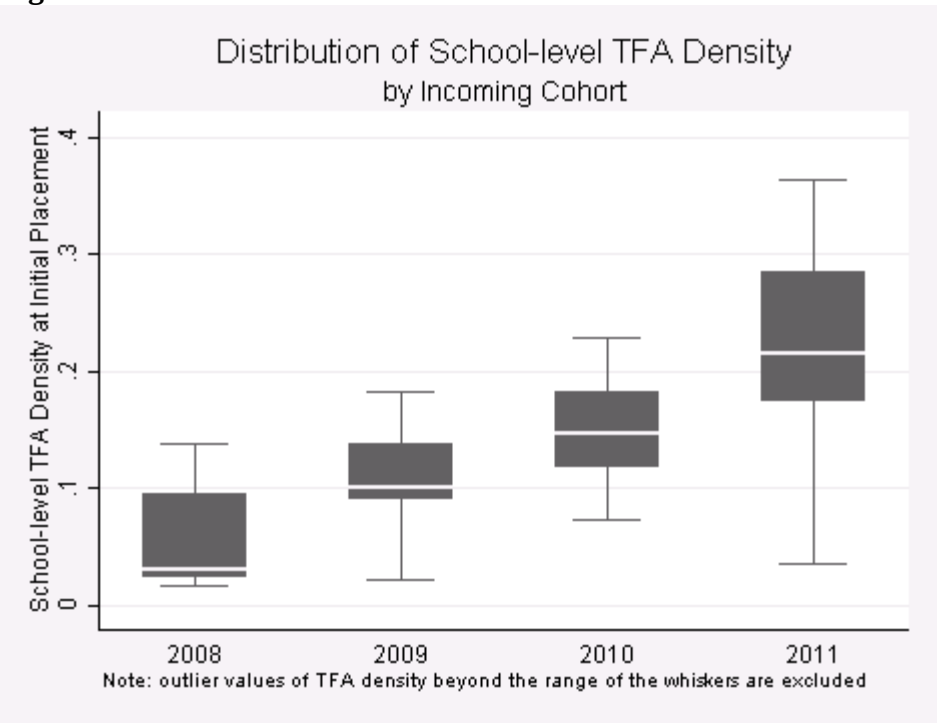
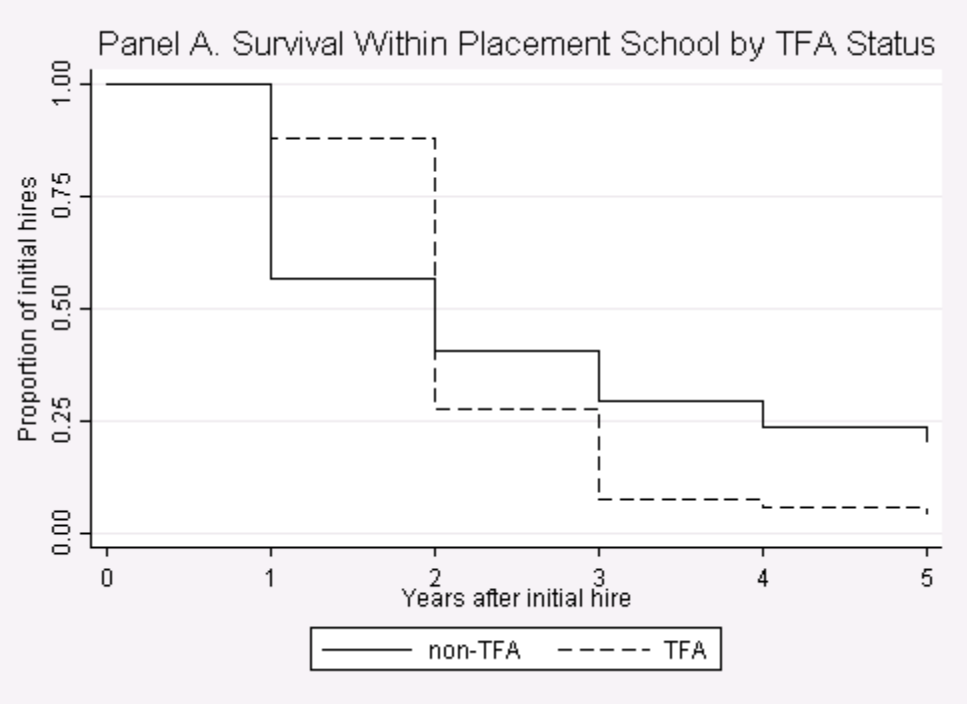

Distribution of School-level TFA Density
by Incoming Cohort
School-level TFA Density at Initial Placement
0
.1
.2
.3
.4
2008
2009
2010
2011
Note: outlier values of TFA density beyond the range of the whiskers are excluded

Figure 2.


Panel A. Survival Within Placement School by TFA Status
Proportion of initial hires
0.00
0.25
0.50
0.75
1.00
0
1
2
3
4
5
Years after initial hire
non-TFA
TFA

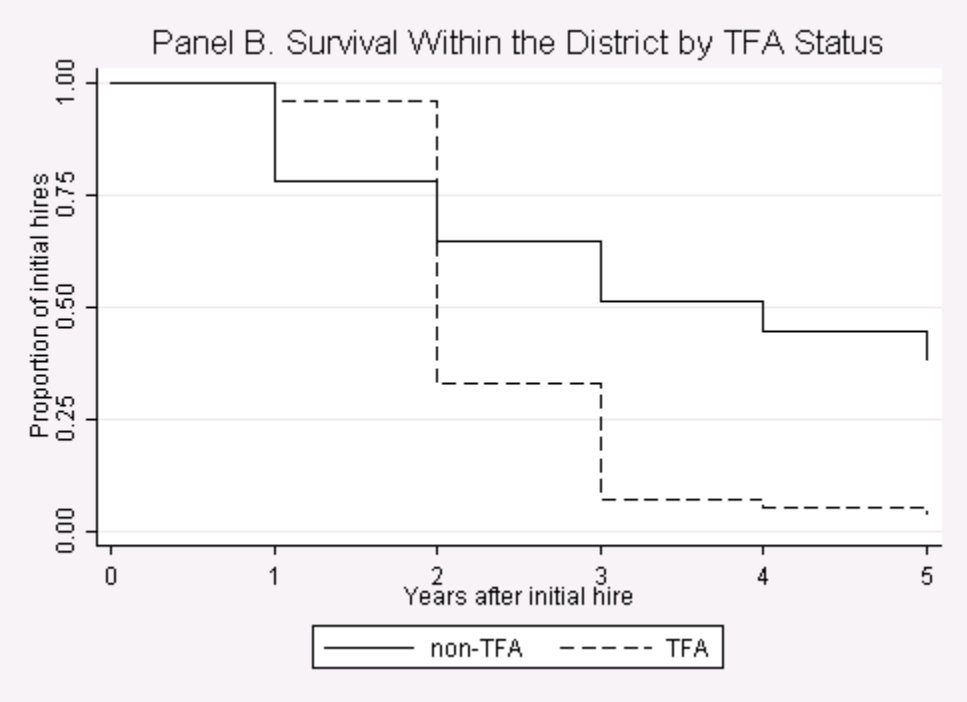

Panel B. Survival Within the District by TFA Status
Proportion of initial hires
0.00
0.25
0.50
0.75
1.00
0
1
2
3
4
5
Years after initial hire
non-TFA
TFA

Figure 3.

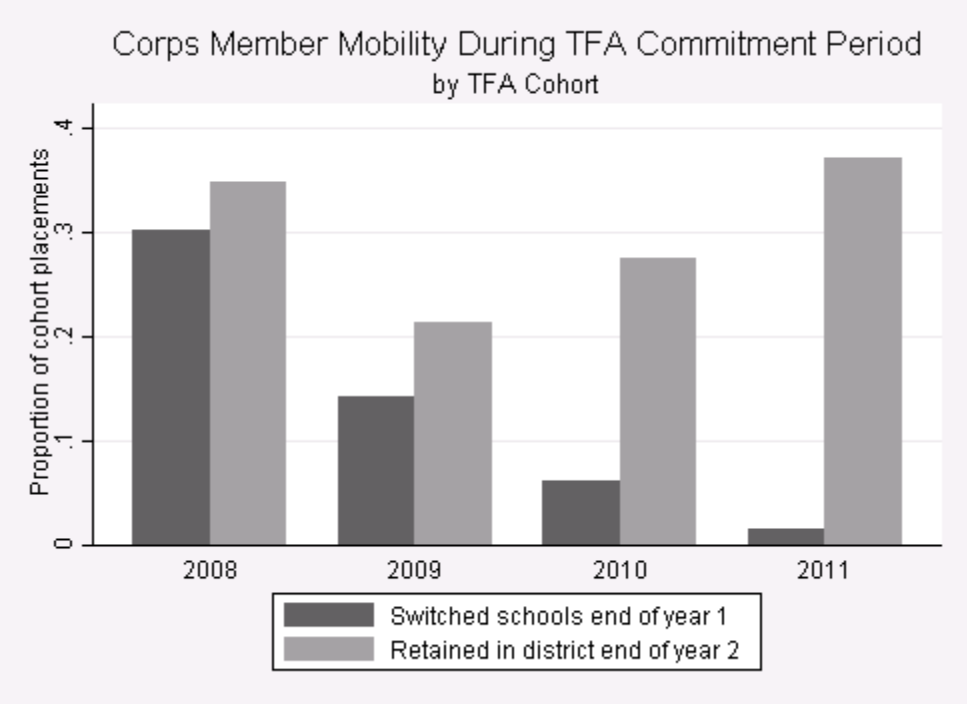

Corps Member Mobility During TFA Commitment Period
by TFA Cohort
Proportion of cohort placements
0
.1
.2
.3
.4
2008
2009
2010
2011
Switched schools end of year 1
Retained in district end of year 2

Table 1. Descriptive Statistics of Analysis Samples

Variable	TFA Hires	All Teachers
Male teachers	0.334	0.221
Black teachers	0.087	0.243
Hispanic teachers	0.058	0.443
Years experience	1.6	15.3
Age	24.8	44.8
School % FRL eligible	0.91	0.748
School % Black	0.769	0.273
TFA density in the school	0.182	0.008
Class average unexcused absences	9.6	5.2
Class average days suspended	1.2	0.5
Moving to another school	0.054	0.060
Leaving the district	0.321	0.091
Teacher-year observations	635	96,610
Unique teachers	300	24,366

Table 2. Descriptive Statistics of the Linked Student Analysis Samples

Variable	1 Linked Teachers Mathematics	2 Linked Teachers English Language Arts
Student-level variables		
Pretest achievement (normalized)	-0.097	-0.122
Black	0.253	0.248
Hispanic	0.657	0.664
FRL eligible	0.762	0.766
Limited English proficiency	0.109	0.140
Total student-year-teacher linked observations	741,852	1,187,592
Teacher-level variables		
Years experience	12.0	12.3
Age	38.4	37.3
Active TFA corps member	0.0168	0.0111
Active TFA * retained in initial placement school	0.0032	0.0010
Active TFA * retained in M-DCPS	0.0042	0.0021
Unique teacher-year observations	16,063	20,167
Unique TFA teacher-year observations	173	193

Table 3. Estimating the Hazard of Exit Among TFA Hires

Panel A. TFA density at the school level								
	1	2	3	4	5	6	7	8
	Hazard of exiting the school				Hazard of exiting the district			
TFA density	0.991	0.994	0.996	0.994	1.000	1.000	1.002	1.000
	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.007)	(0.008)	(0.008)
School % FRL eligible	1.005	1.006	0.976	0.974	1.000	1.000	0.982	0.977
	(0.011)	(0.011)	(0.019)	(0.020)	(0.011)	(0.011)	(0.019)	(0.020)
Teacher characteristics		✓	✓	✓		✓	✓	✓
School characteristics			✓	✓			✓	✓
Classroom characteristics				✓				✓
Observations	590	590	590	590	628	628	628	628
Panel B. TFA density among relevant peers								
	Hazard of exiting the school				Hazard of exiting the district			
TFA density	0.996	0.997	0.997	0.996	0.999	0.999	1.000	0.999
	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)
School % FRL eligible	1.004	1.005	0.975	0.973	1.000	1.000	0.983	0.977
	(0.010)	(0.011)	(0.019)	(0.019)	(0.011)	(0.011)	(0.019)	(0.019)
Teacher characteristics		✓	✓	✓		✓	✓	✓
School characteristics			✓	✓			✓	✓
Classroom characteristics				✓				✓
Observations	590	590	590	590	628	628	628	628

Note: *, **, *** corresponds to $p < 0.1$, 0.05, and 0.01. Estimation sample is the TFA hires sample in Column 1 of Table 1. The Cox proportional hazard models each type of exit in isolation, thus school exits are coded to represent both school moves and districts exits. Included teacher control variables are gender, Black and Hispanic teacher indicators, and age. School control variables are elementary and high school indicators, percentage of ELLs, percentage of Black students, and an ETO school indicator. Classroom control variables are average pretest scores in mathematics (and an indicator for classrooms without pretests), mean unexcused absences, mean absences from suspension, and teaching either multiple grades (in elementary school grades) or multiple subjects (in middle and high school grades).

Table 4. Multinomial Logit Results Among the Full Sample of Teachers

	1	2	3	4
	TFA Density at the School Level		TFA Density Among Relevant Peers	
	Move Between Schools	District Exit	Move Between Schools	District Exit
TFA*Year 1	0.367**	0.092***	0.290***	0.0884***
	(0.142)	(0.030)	(0.100)	(0.028)
TFA*Year 2	0.663	5.312***	0.544	5.119***
	(0.280)	(1.210)	(0.243)	(1.109)
TFA*Year 3+	0.244	8.273***	0.223	8.011***
	(0.241)	(2.515)	(0.227)	(2.335)
TFA density	1.002	1.015***	1.005	1.012***
	(0.004)	(0.003)	(0.004)	(0.003)
TFA * TFA density	0.920***	0.980*	0.943***	0.983*
	(0.021)	(0.009)	(0.016)	(0.007)
School % FRL eligible	1.007***	1.001	1.007***	1.001
	(0.001)	(0.001)	(0.001)	(0.001)
Teacher characteristics	✓		✓	
School characteristics	✓		✓	
Classroom characteristics	✓		✓	
Observations	96,610		96,610	
Test of null density effect on TFA corps members	$\chi^2(1) = 12.93$ $p < 0.001$	$\chi^2(1) = 0.41$ $p = 0.52$	$\chi^2(1) = 10.39$ $p = 0.001$	$\chi^2(1) = 0.46$ $p = 0.49$

Note: *, **, *** corresponds to $p < 0.1$, 0.05, and 0.01. Estimation sample is the all-teachers sample in Column 2 of Table 1. Omitted outcome in the multinomial logit model is returning to the same school in the following year; thus, all transition estimates presented here are relative to staying in the same school. Included teacher control variables are gender, Black and Hispanic teacher indicators, and age. School control variables are elementary and high school indicators, percentage of ELLs, percentage of Black students, an ETO school indicator, and a cluster school indicator. Classroom control variables are average pretest scores in mathematics (and an indicator for classrooms without pretests), mean unexcused absences, mean absences from suspension, and teaching either multiple grades (in elementary school grades) or multiple subjects (in middle and high school grades).

Table 5. Value-Added Results of TFA Effects by Retention Subgroups

	1	2	3	4	5	6
	Mathematics			English Language Arts		
	No Retention Subgroups	Retained in Placement School	Retained in District	No Retention Subgroups	Retained in Placement School	Retained in District
Active TFA	0.089***			0.007		
	(0.019)			(0.012)		
Active TFA * retained		0.121***	0.109***		-0.006	-0.001
		(0.035)	(0.032)		(0.034)	(0.019)
Active TFA * not retained		0.043**	0.046***		-0.004	-0.007
		(0.017)	(0.017)		(0.013)	(0.014)
Teacher characteristics	✓	✓	✓	✓	✓	✓
Student characteristics	✓	✓	✓	✓	✓	✓
Classroom characteristics	✓	✓	✓	✓	✓	✓
Observations	741,852	741,852	741,852	1,187,592	1,187,592	1,187,592
R-squared	0.65	0.65	0.65	0.70	0.70	0.70
Test of equality between retained and nonretained subgroups		$F(1, 459) = 5.10$ $p = 0.024$	$F(1, 459) = 4.76$ $p = 0.030$		$F(1, 458) = 0.00$ $p = 0.971$	$F(1, 458) = 0.10$ $p = 0.747$

Note: *, **, *** corresponds to $p < 0.1$, 0.05, and 0.01. Estimation samples are the linked teacher samples reported in Table 2. All models are estimated with school and year-grade fixed effects. Included teacher control variables are gender, Black and Hispanic teacher indicators, and race congruence with students. Student control variables are a cubic expansion of prior test scores in both mathematics and ELA, gender and race/ethnicity indicators, FRL eligibility, ELL status, and indicators on mental, physical, and emotional disabilities. Classroom control variables are average pretest scores and the percentage of FRL eligible students. All control variables are interacted with grade. Observations are weighted by teacher dosage.