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School District Job Postings and Staffing Challenges Throughout the Second School Year During the COVID-19 Pandemic

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Abstract – We describe the extent and predictors of staffing challenges faced by school districts in Washington state throughout the 2021–22 school year using data collected from job posting websites for districts representing more than 98% of students in the state. These data suggest that school districts in the state faced considerable challenges filling paraeducator and, to a lesser extent, teaching positions at the beginning of the school year. When we focus specifically on teachers, we find that teacher staffing challenges were far more pronounced for special education positions and in schools serving more students of color, less pronounced for elementary positions, and highly correlated with teacher attrition from these types of positions after the prior school year. Accounting for these relationships, districts posted more teaching positions later in the school year when they had increasing student enrollments and received more Elementary and Secondary School Emergency Relief funds than nearby districts.

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> "With the proper information, leaders can know whether there are shortages, where they exist geographically or in specific subject areas, and which of the myriad solutions to apply." (Bell-Ellwanger, 2022)

> "Without understanding with detailed data the nature of the problem, we may try to solve it with solutions that are inappropriate for the way that shortages are playing out." —Matthew Kraft (as cited in Will, 2022)

1. Introduction

Numerous media stories over the past year detail problems that systems have faced trying to recruit and retain all manner of school personnel, from bus drivers to teachers. The number of news stories about the "teacher shortage"—shorthand for the staffing challenges school systems face—suggests that the issue has risen in the rank of public concerns. For example, a recent edChoice poll from August 2022 reported that more than two thirds of Americans have heard of teacher shortages in the past month (edChoice, 2022). While these stories are supported by district surveys about vacancies (e.g., AASA, 2022; Sparks et al., 2022), the stories themselves often do not provide much nuance about the nature of the problem (Goldhaber & Theobald, 2022), and researchers have documented severe deficiencies in the data infrastructure necessary to get a more comprehensive national picture (Bleiberg & Kraft, 2022).

Understanding the nature of hiring challenges is fundamental to addressing them. To what extent do staffing challenges vary by job classes or fields of specialization? Do they differ by geography or depending on the characteristics of school systems? These longstanding questions have taken on extra importance in the wake of the COVID-19 pandemic thanks to both heightened concerns about staffing and the unprecedented funding school districts have received for pandemic recovery. Administrative data can shed some light on these questions, but only retrospectively and often only long after policymakers have implemented solutions that may or may not reflect the specific nature of the problem. Unfortunately, there are no comprehensive

national data that clearly highlight school hiring needs as identified by job vacancies (Bleiberg & Kraft, 2022; Nguyen et al., 2022).

As the quotes at the top of the paper suggest, school systems are likely struggling to address staffing needs without up-to-date and accurate information. And when it comes to staffing, the stakes for students are high. For instance, there is evidence that the excessive churn of teachers can be detrimental to student achievement (Atteberry et al., 2016; Blazar, 2015; Ronfeldt et al., 2013),[1] that late teacher hiring is associated with lower quality teacher hires (Papay & Kraft, 2016), and that staffing challenges in general are impeding district efforts to implement COVID-19 academic recovery programs (Griesbach & Lurye, 2022; U.S. Department of Education, 2021).

In this paper, we provide a descriptive portrait of the dynamics of school district hiring challenges and needs as identified by posted vacancies for various school positions. We focus primarily on school districts as the level of analysis because districts are usually responsible for job postings and many parts of the hiring process. Specifically, we use novel data scraped from school system websites to document the number and type of postings per student (and full-time equivalent [FTE] teachers) and the extent to which job postings vary by local school system characteristics across the hiring cycle. For teachers, we explore the extent to which job postings can be explained by subject area (e.g., special education or STEM), prior teacher attrition, changes in enrollment, school system demographics and achievement, and the influx of new federal funding for COVID-19 recovery.

[1] Note, however, that teacher churn can also lead to improvements in student outcomes when, for instance, it results in a compositional improvement in teacher quality (Adnot et al., 2017) or a better match between teachers and schools' organizational culture (Dhaliwal et al., 2022).

This paper builds off an earlier analysis of job postings from fall 2021 (Goldhaber et al., 2022). That prior analysis found that school districts were struggling to hire paraeducators, teachers, health staff (e.g., nurses), and bus drivers at the start of the 2021–22 school year. In this paper, we look at additional job postings from winter, spring, and summer 2022. Consistent with typical teacher hiring schedules, we find that postings for teachers increased in the spring and summer while postings for other positions decreased.

Using statewide data on the teacher workforce, we also take a closer look at teacher staffing challenges and characterize them by quarter, district, and subject area. We are careful to use the term "staffing challenge" here, both because "teacher shortage" fails to capture the nuance of the situation (as discussed in Section 2) and because job postings may signify different things: early in the fall they likely reflect vacancies and late hires, but postings toward the end of the school year are likely indicative of future district needs.

Throughout the 2021–22 school year, we find that districts faced the most intense staffing challenges in special education and in schools serving more students of color. We also find, not surprisingly, that these staffing challenges were highly correlated with teacher attrition from these same positions after the prior school year and that districts faced the fewest staffing challenges in elementary positions. Finally, districts posted more teaching positions when they had increasing student enrollments and received more Elementary and Secondary School Emergency Relief funds than nearby districts.

2. Background

There has been a lot of discussion about teacher shortages related to the COVID-19 pandemic in the news recently, but most of these accounts are based on anecdotes from specific schools and school districts (e.g., Dill, 2022; Maxouris & Zdanowicz, 2022). This has led to

academic and policy disagreements about both the magnitude of the issue and how widespread it is across different specialties and job positions.[2]

In the case of the teacher labor market (and public labor markets more generally), defining a "shortage" is not as straightforward as it seems. The number of teachers needed depends on policy choices (e.g., class size decisions) as well as on the requirements to staff specific positions (e.g., credentialing requirements).[3] The U.S. Department of Education (2017) defines a teacher shortage in terms of whether teaching positions (1) go unfilled; (2) are filled with teachers who lack regular teaching credentials; or (3) are filled by teachers who have regular credentials but are teaching outside of the area of their specific credential (Nguyen et al., 2022). Based on this definition, all 50 states and the District of Columbia reported a teacher shortage in at least one subject area or grade level entering the 2022–23 school year (U.S. Department of Education, 2022). However, each of those situations represents a slightly different problem that may need a different solution. For example, issues with unfilled positions or positions without credentialed teachers might be more related to the overall supply of teachers in different areas, while issues with out-of-subject teaching may be more related to the distribution of different teacher skills and credentials across schools and districts.[4]

Operationalizing staffing challenges based on measures of job postings relative to workforce size or student enrollment arguably provides a clearer picture. A few studies provide such a picture by examining job postings and vacancies using state- or district-level data. James et al. (2022), for instance, use data from Boston Public Schools to document how teacher labor

[2] For more detail on different perspectives on the nature of these debates, see Nguyen et al. (2022).
[3] See discussion in Dee and Goldhaber (2017).
[4] Nguyen et al. (2022) examine reports from each state, the U.S. Department of Education, and news reports and estimate that in the spring of 2021, there were at least 36,000 vacant job positions (and at least 163,000 positions held by teachers lacking regular teaching credentials for the position they held). See further discussion in Dee and Goldhaber (2017).

supply varies substantially by position type, school, and the timing of job postings. They also find that the timing of postings is important: schools that have earlier postings end up hiring higher performing teachers (as evidenced by the receipt of better observational ratings). Job posting data can also provide insight into how staffing challenges differ across districts. Goldhaber et al. (2020), for example, examine teacher job postings in California and find that rural districts have more difficulty filling teacher job vacancies compared with more populated districts. This is partly explained by rural districts tending to be closer to state borders and further from teacher education programs; vacancies in rural districts may also be influenced by unmeasured factors, such as the amenities in rural communities. And, more recently, Goldhaber et al. (2022) provide evidence on job postings and vacancies in Washington in the fall of 2021. They find that, early in the school year, the number of athletic and paraeducator postings exceeds the number of postings for teachers; that rural and higher poverty districts have relatively high vacancy rates; and that vacancy rates are substantially higher for English language learner (ELL) and special education positions compared with elementary education positions.

These distinct staffing challenges are not new, but they have been exacerbated by a tight labor market during the pandemic. Bleiberg and Kraft (2022), for example, find that overall employment in the K–12 labor market decreased by 9% at the start of the pandemic and that schools faced more difficulty filling vacancies during the 2021–22 school year. These staffing shortages are not only in certified teaching positions but also in paraprofessional and administrator positions as well. However, national data from the Bureau of Labor Statistics suggests that public school employment had fully recovered (or exceeded) prepandemic staffing levels by the start of the 2021–22 school year (Aldeman, 2022). Part of this recovery may be related to the unprecedented federal funding schools received through the Elementary and

Secondary Emergency Relief (ESSER) fund.[5] Unfortunately, as several studies note (e.g., Bell-Ellwanger, 2022; Bleiberg & Kraft, 2022; Goldhaber & Holden, 2020; Nguyen et al., 2022), deficiencies in the nation's current data infrastructure make it hard to get a good handle on staffing challenges and how they may have been affected by ESSER.

Data deficiencies likely explain the lack of research on hiring nonteaching positions. There are a few quantitative studies on substitute teachers and paraprofessionals but none on other types of school personnel.[6] Liu et al. (2020) find that higher poverty schools tend to have lower rates of substitute coverage for teacher absences. They suggest that this is driven by substitute teachers having a preference for some schools over others. And Bisht et al. (2021) examine the labor market of paraprofessionals and find that it is large and growing and that paraprofessionals are more racially and ethnically diverse than certified teachers. But neither study provides hiring data about these important instructional positions.

We contribute to the above literature in several ways. First, we examine job postings throughout the hiring cycle during the second full school year of the pandemic (2021–22). This allows us to observe how hiring may change over the course of a school year and characterize the important distinctions between vacancies (typically posted in the fall and winter) and future staffing needs (typically posted in the spring and summer) for different types of school systems. We also categorize job vacancies in numerous ways (within both teaching and nonteaching jobs), allowing us to describe the hiring cycle for both teaching positions and nonteaching positions, which have received little attention in prior literature on school district hiring. Third, we

[5] The federal government has provided $190 billion in ESSER funding to education agencies as part of the American Rescue Plan. For more details on this funding, see https://www.nytimes.com/2022/09/08/magazine/covid-aid-schools.html

[6] For instance, a Google Scholar search using terms like "school bus driver hiring trends" and "school nurse labor market" failed to yield any quantitative studies that touch on the supply and demand of these classes of employees.

determine how job vacancies are correlated with district demographics as well as recent developments in the labor market, such as the extent of teacher attrition in different districts and the amount of ESSER funding these districts receive. These factors contribute to a more accurate prediction of late hires in teaching and nonteaching school district jobs.

3. Data

3.1 Job Posting Data Collection

The heart of our data collection comes from automated web scraping of 226 of the 295 school district hiring websites in Washington. It was not possible to scrape hiring data from the remaining 69 districts, which combined educate only 2% of students in the state. Nonscraped districts tend to be very small, serving on average fewer than 300 students, and do not to have clear job-posting websites.[7] Our fall web scraping resulted in one observation per unique job posting between mid-September and the end of November 2021. Starting in December, scraping for all districts occurred at least three or four times per month, allowing us to create monthly measures of the number of postings starting in December.

For most analyses, we collapse these weekly observations to similar-length quarters—fall (mid-September 2021 to November 2021), winter (December 2021 to February 2022), spring (March 2022 to May 2022), and summer (June 2022 to August 2022)—and scale results to be postings per week in each quarter to account for the fact that these quarters are somewhat different lengths (10 weeks in the fall, 11 in the winter, 12 in the spring, and 13 in the summer). We also present some results that collapse postings to individual months, starting in December, to take a more granular look at the hiring cycle over the course of the school year.

[7] For instance, the Summit Valley school district served 84 students in the 202122 school year and has not posted an opening that we've observed over the course of data scraping.

We collapse these data in two different ways, each reflecting a different way of describing staffing needs across the hiring cycle. First, we measure *first-time postings* by including any job posting within a given quarter or month, but only if it was first posted during this quarter or month. Every district job posting between September 2021 and August 2022 during the 2021–22 school year is placed within mutually exclusive quarters or months. This approach provides snapshots of the timing of *initial* staffing needs across the hiring cycle. Alternatively, we also measure *total postings* by including any job posting within a given quarter or month if it was *ever* open during this quarter or month (e.g., job postings that are open for two consecutive quarters are included in each quarter). This approach provides snapshots of *cumulative* staffing needs across the hiring cycle.

Before describing the details of the data we collected, we discuss two key issues with data and interpretation. First, because we observe job postings but do not observe hires, we do not always have a clear indication of whether a job posting is for multiple positions, or whether identical postings that appear in different weeks are for the same (unfilled) position or are being reused for multiple openings. When a posting indicates the number of positions (e.g., two teaching positions, one half-time position), we count the number of positions accordingly (e.g., 2, 0.5). And, if a posting contains specific FTE information, we count those individually as well (e.g., a posting for 4.0 FTE would be treated as 4 vacancies). In the absence of that information, we assume that each unique posting is for one full-time position. Further, we assume that identical postings from the same district at two different points in time are for the *same unfilled position*, rather than for two different positions. Almost 90% of job postings include a unique job number that allows us to disentangle specific postings, so we are not overly concerned with this potential undercounting. However, this does mean that we cannot necessarily characterize our

posting counts as an upper or lower bound because some issues—such as postings being for multiple positions—suggest we could be undercounting, while others—such as different postings actually being for the same position—suggest we could be overcounting.

A second issue relates to how the data are interpreted. We believe that job postings at different points in the school year provide different signals of staffing challenges. Specifically, most job postings in the first half of the school year (fall and winter) likely reflect job openings *during the current school year*, meaning there is an open position that has not already been filled. On the other hand, most job postings in the second half of the year (spring and summer) are likely for *anticipated* job openings *for the next school year*, consistent with most district hiring schedules (Papay & Kraft, 2016; James et al., 2022). Unfortunately, it is difficult to directly verify these assumptions from the data because very few job postings indicate the school year for which the position is open. However, postings for which these data are available are consistent with these assumptions. For example, of the approximately 13% of postings with school year or date data included in the posting, more than 99% of posts observed in the fall specify that the position is for the 2021–22 school year. Similarly, of the postings with date information included, 32% of posts observed in the spring and 6% of posts observed in the summer specify that the position is for the 2021–22 school year; in contrast, 68% of posts observed in the spring and 94% of posts observed in the summer indicate they are for the 2022–23 school year. Thus, while we describe all job openings using the umbrella term "staffing challenges," we also sometimes refer to postings in the first of half of the year as "open positions" or "vacancies" and postings in the second half of the year as "future staffing needs."

3.2 Job Categorization, Data Linking, and Summary Statistics

To investigate trends in job postings by different job categories, we first use job titles to place each job posting in one of 11 different job categories: teaching, paraeducator,

administration, principal, facilities, transportation, food service, health, athletics, superintendent, and a catch-all "other" category. Our main results omit the last two categories because there are very few superintendent postings and the "other" category is difficult to interpret.

We then identify the school district for each posting and merge several additional publicly available data sources for these districts. We begin by merging data maintained by the state Office of Superintendent of Public Instruction (OSPI) for the 2020–21 and 2021–22 school years. The first set of OSPI files come from the Washington Report Card data, which provide information on the demographics of students in each district (e.g., student race and ethnicity; total student enrollment; number of students receiving free or reduced-price lunch (FRL); number of students designated as English language learners (ELL); and number of students meeting standards in math and English language arts (ELA) on the Smarter Balanced assessment administered in fall 2021). We also use these data to calculate the change in student enrollment between the 2020–21 and 2021–22 school years.

To obtain the physical location of districts and to determine district urbanicity, we use two datasets maintained by the National Center for Education Statistics (NCES) for the 2020–21 school year: the Common Core of Data (CCD) and the Education Demographic and Geographic Estimates (EDGE).[8] The EDGE data also allow us to calculate the distance to the nearest teacher education program (TEP) and whether a TEP is located within the boundaries of a given district. In many results, we standardize the number of postings per 1,000 students in the districts to facilitate "apples-to-apples" comparisons across different types of districts.

Finally, we leverage three additional data sources about the teacher workforce in Washington to further analyze teacher openings. First, we create counts of the number of

[8] While there is a newer year of CCD data, the EDGE data is only available through 2020–21.

teachers in each district using the S-275, a publicly available database of all certificated school personnel in the 2021–22 school year. The S-275 provides data on staffing FTE, so we sum this FTE within district and use this as the number of teachers in the district. This provides a more reliable "denominator" for the number of total teaching positions in posting districts and also allows us to determine teacher attrition rates. Since the S-275 also contains teacher salary information, we also use it to create a measure of beginning teacher salaries, defined as the average salary of full-time first-year teachers with a bachelor's (BA) degree in the district in 2021–22.[9]

Second, we use the information in the job postings to categorize each teacher posting as one of five mutually exclusive subject areas: special education, STEM, elementary, English language learners (ELL), and "other."[10] We do this by creating lists of key terms based on the list of state approved endorsement areas[11] and then comparing these key terms to information contained within job posting titles for positions that we identified as teacher openings. The STEM category includes vacancies that had key terms that match science- and math-related endorsement subject areas (e.g., "Middle-level math teacher"; "Biology teacher grade 7").[12] It is important to note, however, that we cannot determine whether a job opening specifically requires a particular endorsement.

[9] We impute these salaries for districts with missing first-year teacher data using predicted values from a model including district, experience, and degree level effects.
[10] Job postings are categorized as "other" if they are categorized as a teacher posting and not included in the four categories listed above. Examples include language arts teachers, music teachers, and physical education teachers.
[11] For additional information and a complete listing of endorsement areas see: https://www.pesb.wa.gov/current-educators/assignment/endorsements/.
[12] More specifically, biology; chemistry; computer science; mathematics; middle-level mathematics; middle-level science; physics; general science; and earth and space science (non-CTE). We flag positions that have STEM key terms in their titles but do not closely correspond to math and science endorsements as these are often CTE type positions (e.g., "Aerospace Science Careers") and designate these posting types as "other."

Finally, we use data from the state's Certificate and Endorsement files—provided by the state for all teaching certificates granted by June 10, 2022—to calculate the number of FTE teachers who hold particular endorsements in each of the subject areas within each district. Specifically, we use the state endorsement type codes to assign teachers to the five more consolidated subject areas listed above.[13] This is essential because there are, for instance, many more elementary teachers than special educators and STEM teachers in a given district, and staffing challenges are only meaningful in relation to the number of positions districts need to fill (e.g., it is a greater staffing challenge to have 5 out of 10 special education positions open than to have 6 out of 100 elementary positions open).

Table 1 provides summary statistics for the 213 districts that had at least one teacher job posting and presents measures for district variables considered in the regression models described below (in Section 4).[14] We begin in column 1 by showing the means for all districts for which we have information. Then, for fall 2021, we show the bottom quartile of posting districts (fewest postings per FTE) in column 2 and the top quartile (most postings per FTE) in column 3. The remaining columns follow this pattern for winter 2022, spring 2022, and summer 2022. The mean of first-time postings per 10,000 FTE in column 1 (1,156) indicates that, over the course of the 2021–22 school year, the average district posted about 11.5 unique teacher job postings for every 100 teachers in the district. This is higher than the overall attrition rate out of teacher positions after the 2020–21 school year (10%), which is consistent with the notion that districts—perhaps using Elementary and Secondary Emergency Relief (ESSER) funds—were "staffing up" in the wake of the COVID-19 pandemic.

[13] For a complete list of how particular endorsements were assigned to the five categories, see Appendix A.
[14] 226 districts had at least one job posting.

There are a number of important differences across districts with high and low levels of staffing challenges in each quarter. First, the magnitude of the staffing challenges across districts is notable. For instance, the number of postings per FTE is 36 times higher in top quartile districts than in bottom quartile districts in the fall and nearly 10 times higher in top quartile districts than in bottom quartile districts in the spring and summer. There are also stark differences between the types of districts that have differing degrees of staffing challenges. For instance, districts in the top quartile tend to have more students of color (between 6 and 20 percentage points, depending on the quarter) than districts in the bottom quartile, and also more students eligible for FRL in the spring (20 percentage points) and summer (7 percentage points). In the quarters with the most job postings (fall, spring, and summer), districts in the top quartile also tend to be lower performing by 0.4 to 1.2 standard deviations. And city districts are much more likely to be in the bottom quartile, while rural districts are much more likely to be in the top quartile, particularly early in the school year. Finally, the average per pupil ESSER funding also tends to be higher for districts in the top quartile, particularly later in the year.[15]

4. Methods

To understand the nature of hiring challenges, we begin by presenting simple descriptive information about the number of job postings by job category, quarter and/or month, and various district demographics. In the case of teachers, we are able to leverage the statewide data on size of the teacher workforce by district in order to describe the number of postings relative to the FTE for different teaching specialties.[16]

[15] There is some national evidence of differences in ESSER spending by urbanicity: see https://www.future-ed.org/covid-aid-spending-trends-by-city-suburban-rural-school-districts/.
[16] We could, in principle, investigate postings per student for nonteaching positions, so this will be part of future work.

We then estimate models predicting the *proportion* of open positions in a given district and teacher subject area. Specifically, let n_{ijt} be the number of *job postings* in subject area i, district j, and quarter t, and let N_{ij} be the number of *currently employed teachers* in that subject area and district according to the S-275 and state credential data. We calculate the proportion of open positions in a given subject, district, and time period as $pp_{iiiii} = \frac{nn_{iiiii\ \ i}}{nn_{iiiii}+NN_{iiii}}$. The rationale behind this measure is that, in the early part of the year, pp_{iiiiii} is an approximation of the proportion of open positions if the number of total positions equals the number of open positions plus the number of existing positions.

Following Goldhaber et al. (2021), we estimate two sets of binomial regressions predicting these proportions. In the first set of regressions, we stack the job posting data across districts, subjects, and quarters and estimate models predicting the proportion of open positions as a function of district characteristics, subject effects, and quarter effects:

$$\log\left(\frac{pp_{iiiii\ \ i}}{1-pp_{iiiiii}}\right) = \alpha_0 + \alpha\alpha_1 DD_{ii} + \alpha\alpha_2 AA_{iiii} + \alpha\alpha_{ii} + \alpha\alpha_{ii} \qquad (1)$$

In the model in equation 1, DD_{ii} includes various combinations of the variables for district j described in Section 3. When we transform the coefficients in $\alpha\alpha_1$ to average marginal effects, the estimates of these marginal effects can be interpreted as the expected change in the proportion of open positions associated with a one-unit increase in each of these district variables. All models include subject area effects $\alpha\alpha_{ii}$ and quarter effects $\alpha\alpha_{ii}$, and we cluster all standard errors by district to account for correlation across multiple observations from the same district in these models.

We sequentially add district variables to the model in equation 1, according to different ways that we hypothesize that staffing challenges might arise. First, districts with different student demographics, enrollments, and enrollment changes may face different staffing needs

arising from the fact that teacher attrition varies according to student demographics (e.g., Hanushek et al., 2005). We therefore first include the percentage of underrepresented minority (URM) students (i.e., American Indian, Black, Hispanic) in the district, the average fall test performance of students in the district, and the log student enrollment and enrollment change in DD_{ii}.[17] We also know that district staffing needs can vary by geography (e.g., Goldhaber et al., 2020, 2021), so we then add district urbanicity indicators, the distance to the nearest teacher education program, and county unemployment rate to DD_{ii}. Resources also clearly matter for staffing challenges, so our next specification adds per student spending (from the prior 2020–21 school year), total Elementary and Secondary Emergency Relief (ESSER) funding (from the three waves through March 2021), and beginning teacher salaries to DD_{ii}. The first measure is meant to capture overall time-invariant levels of district spending, the second is meant to capture the one-time influx of ESSER funds, and the last is meant to capture any influence of teacher salaries on openings.

In some specifications, we also include AA_{iiii}, the attrition rate from teaching positions in subject area *i* and district *j*, as an additional predictor variable. This allows us to investigate the extent to which these other relationships are driven by differential teacher attrition in different subject areas in these districts, as we would expect higher attrition to predict greater staffing needs in those subject areas.

There is also prior evidence from Washington that institutional relationships matter for staffing outcomes (Goldhaber et al., 2014). Specifically, districts in Washington are organized into nine educational service districts (ESDs), and districts in the same ESD may receive similar

[17] The percentage of URM students is highly correlated with the percentage of low-income students ($r = 0.65$), so we only include the percentage of URM students to avoid interpretability issues with collinearity. Results using percentage FRL are available in Table A2 in Appendix A and discussed in Section 5.

support for staffing. Likewise, districts in the same Uniserv council—which supports teacher unions in collective bargaining—may have similar rules around teacher staffing. Thus, to test the extent to which these relationships are driven by these institutional relationships, we estimate some specifications (not shown in equation 1) that include fixed effects for the 9 ESDs and the 20 Uniserv councils. Finally, for the small subset of variables that vary within districts (subject effects, quarter effects, and subject-specific prior attrition rates), we can estimate a final specification with district fixed effects $\alpha\alpha_{ii}$ to investigate staffing challenges by subject areas and differential attrition rates within districts.

The second set of models is designed to allow us to investigate how these relationships vary over the course of the school year. Specifically, instead of estimating one stacked model across all quarters, we estimate binomial regressions separately by quarter.

5. Results

5.1 How do the numbers of new and total job postings vary by position type, quarter, and month?

We present evidence for first-time postings by month, first cumulatively in **Figure 1** and then separately by month in **Figure 2**. We provide analogous figures for total open postings by month in **Figure 3**. Within each figure we break up the categories of postings roughly according to whether they are likely to be hired by principals to work in individual schools (i.e., teachers and paraeducators) (top panel of each figure) or by the district (bottom panel of each figure).

Figures 1 and 2 suggest that the hiring cycles and staffing needs for different job types vary throughout the year. Focusing first on teachers (top panel), there were 1,810 new open teaching positions across the state throughout the 10 weeks of the fall of the 2021–22 school year (or nearly 800 new open teaching positions per month). Figure 1 shows that new paraeducator

positions were posted disproportionately earlier in the year while new teacher positions were posted disproportionately later in the year. Specifically, Figure 2 shows that new teacher job postings peaked in May 2022, while new paraeducator postings were highest in the fall (presumably for the 2021–22 school year) and in August 2022 (presumably for the 2022–23 school year). We are cautious not to overgeneralize because it is quite possible that these trends are specific to this school year—particularly if districts were disproportionately using Elementary and Secondary Emergency Relief (ESSER) funding to hire for paraeducator positions in the fall—but the data do suggest that the hiring cycle for teaching positions is significantly different from the cycle for nonteaching positions. This conclusion is reinforced in Panel B of Figures 1 and 2, which shows similar trends for paraeducators and for most other employment categories (i.e., a drop in new postings from fall to winter followed by a steady increase through the summer). The outlier is athletics, where most postings occur in the fall and winter months.

We now turn to Figure 3, which includes postings in multiple months if they remain open, to create a better measure of statewide need by position category. If every job posting were filled and removed the month it was posted, Figures 2 and 3 would be identical. Thus, differences between Figures 2 and 3 provide some information about how quickly certain positions are filled relative to others.[18] We see in Figure 2 that the number of open postings is relatively stable over time, with the exception of teachers, for whom the number of open positions spikes considerably in the spring and summer. When comparing Figures 2 and 3, we see that many paraeducator positions remained open for multiple months early in the school year (consistent with challenges with staffing these positions during the 2021–22 school year), while

[18] Note, however, that districts may not immediately take down a posting once it is filled.

many teacher positions remained open for multiple months later in the school year (consistent with teacher hiring processes that last several months).

We are aware of little prior evidence about how school job postings vary throughout the hiring cycle for these positions,[19] and it is likely that the 2021–22 school year is unique given school staffing connected to ESSER funding (DiMarco & Jordan, 2022). For both of these reasons we are cautious about interpreting what the statewide job postings suggest about needs. But one way to think about differences across job categories is simply to consider how much the number of postings varies across months within job categories. We explore this in **Table 2** by computing the coefficient of variation across first-time postings (column 1) and total postings (column 2) within each position type. Principal, paraeducator, and transportation postings have the most variation in first-time postings across months, though transportation has the least variation in total postings across months (suggesting that many of these positions stay open for a long time). Athletics and facilities positions also have relatively little variation over time, suggesting that postings for these positions are more consistent throughout the year.[20]

Additional useful context for thinking about the numbers that are presented is the size of the existing workforce in each category. Among certificated employees represented in the S-275, slightly more than half (50.6%) are teachers, about 12% are paraeducators, 9% are administrators, 4% are health professionals, and 3% each are principals, transportation employees, and food services employees.

[19] A Google Scholar search with terms like "district staff hiring trends" and "noninstructional hiring cycles in schools" failed to yield any quantitative studies on the hiring cycles for nonteachers.

[20] Another way to think about postings is how they are correlated across time and across different districts within employment categories. We provide correlation matrices in Appendix Table A1 that show that postings tend to be positively correlated across districts, suggesting that districts with staffing difficulties in one category also tend to have staffing difficulties in others. For example, the correlation between teacher and paraeducator postings is about 0.5 across districts.

A final piece of context comes from comparing the total number of teacher job postings from fall 2021—which we assume represents teaching vacancies at the start of the 2021–22 school year—to recent data collected from many states (not including Washington) by Nguyen et al. (2022). In total, according to our data, there were 1,810 teacher vacancies in fall 2021, or roughly 17.2 vacancies per 10,000 students in the state. While we acknowledge that these data are collected very differently than the state-reported data used in Nguyen et al. (2022), we note that this rate is comparable to other western states like Arizona (15.2), Idaho (15.6), Montana (22.4), and Nevada (17.0), though quite a bit smaller than some southern states, such as Alabama (40.8) and Mississippi (68.6), and considerably higher than many states in the Midwest, such as Indiana (9.5) and Illinois (8.7).[21] While it is impossible to test the comparability of these measures directly, given that Nguyen et al. (2022) do not report data from Washington, we take this as evidence that scraped data from hiring postings provides estimates of teacher vacancies of a similar magnitude to state-reported figures from other states.

5.2 How does the proportion of job postings vary by school district characteristic?

In this and subsequent sections, in addition to normalizing the data by student enrollment, we aggregate new and total postings to the quarter level to facilitate comparisons across different categories. In subsequent figures, the blue bars represent the average number of *new* weekly postings per 1,000 students and the stacked (blue + red) bars represent the average *total* number of weekly open postings per 1,000 students.

[21] These rates come from a companion map, which can be accessed at https://teachershortages.com/details/relativevacancy.html.

In **Figure 4,** we describe the postings for various job categories by the proportion (quartile) of underrepresented minority (URM) students that districts serve.[22] The horizontal line shows the average (across the 2021–22 school year) postings per pupil for each of the job categories. Two findings jump out. First, districts serving more students of color tend to have more new postings and overall higher staffing challenges. For instance, in the case of teachers, the average number of weekly new postings per 1,000 students for the highest quartile of URM districts in the spring is .35, compared with .29 in the lowest quartile. The difference is even starker when looking at the total postings: .43 for the highest quartile and .35 for the lowest. This is consistent with well-documented literature on teacher labor markets, which indicates that there tends to be more churn of teachers in higher poverty settings and schools and districts serving more students of color (e.g., Goldhaber et al., 2022; Hanushek et al. 2004; Scafidi et al., 2007). We also see this pattern when examining other employment categories. For instance, job postings from administration, nonteaching, and paraeducator positions are all consistently higher in districts that serve more students of color.

A second notable finding is that the general pattern observed for quartile of URM students tends to vary throughout the year. These differences—particularly for instructional positions like teachers and paraeducators—tend to be starker later in the year than earlier in the year. In the case of teachers, this means that districts serving more students of color didn't necessarily have greater staffing challenges or vacancies earlier in the school year but have greater future staffing needs as measured by their job postings later in the year. One hypothesis to explain this is that these districts also received disproportionately more ESSER funding to

[22] In Appendix A we present analogous figures (A2 and A3) for quartile of students receiving free or reduced-price lunch (FRL). The findings are largely consistent with what we present in this section, but district ESSER spending is a more significant predictor of staffing challenges when we control for FRL rather than URM.

accelerate their hiring for future school years. We are able to test this hypothesis in future regressions that include both students of color and ESSER funding within the same regression models (see Section 5.4).

Figure 5 presents the results for districts by urbanicity. There is consistent evidence that rural school systems especially struggle with staffing across most job categories: with the exception of food services, rural systems have more new and total postings per student across all job categories than any of the other urbanicities.[23] The differences are particularly stark for teachers and transportation: compared with city districts, rural districts had nearly twice as many total postings per student for teachers and more than four times as many postings per student for transportation from fall through spring. The transportation differences are likely related to the importance of student transportation in rural districts, and teacher-to-student ratios also tend to be lower in rural districts, meaning that differences in teacher postings could be driven in part by greater staffing per student in rural districts. It is also interesting to note that the rural district findings on teachers run counter to the findings on URM students, as rural districts have a lower percentage of students of color (35%) than do other districts (42% for city, 37% for suburb, and 41% for town). We are able to tease apart these different relationships in the next section by normalizing by the number of teachers (rather than the number of students) in each district and controlling for all of these different district variables simultaneously in a regression framework.

5.3 How does the proportion of teacher postings vary by subject area?

Figure 6 shows the results for job postings per 10,000 FTE, to be consistent with Nguyen et al. (2020), for different categories of teachers defined by the subject area of the job posting. Note that job postings in each subject area are divided by the number of teachers in each subject

[23] This is especially true for superintendents, as is shown in Figure A1 Appendix A.

area to create consistent comparisons of staffing needs across subjects. The results largely confirm what was seen in a snapshot of teacher vacancy rates in fall 2021 (Goldhaber et al., 2021): there are widely varied needs according to the area of teaching specialization and district demographics. For instance, the number of vacancies in the fall of 2021 for STEM, special education (SPED), English language learner, and "other" teaching positions was anywhere from 2 (for STEM and "other") to 4 (for SPED) times higher than the vacancy rate for positions at the elementary level. This discrepancy across teacher types persists throughout the year and is even more stark when measured by total postings rather than first-time postings. In particular, there are very few elementary postings that persist quarter to quarter, suggesting that they get filled relatively quickly, while there are far more SPED postings that remain open for multiple quarters.

As was the case in Section 5.2, where we measured postings per pupil, we also see in **Figure 7** that it is schools serving more students of color that struggle to staff classrooms when teacher vacancies is our metric. Note, however, that the findings are far less stark by district demographics for teacher specialties that are not generally seen as hard to staff than for subjects that *are* hard to staff. For instance, the difference in vacancy rates in fall 2021 between Q1 and Q4 URM schools is twice as large for special education (40 jobs per 10,000 FTE) than for elementary positions (20 jobs per 10,000 FTE). This becomes even more apparent later in the hiring cycle. For instance, the Q1 to Q4 difference in weekly future needs (because these postings are likely for the next school year) for spring 2022 in special education is 50 jobs per FTE (all jobs) or 40 jobs per FTE (first time).

In **Figure 8,** we report the postings per FTE for different categories of teachers by district urbanicity. In this case, the trends across urbanicities vary considerably by subject area and are

not always consistent with the overall per pupil numbers reported in Figure 5. In particular, while rural districts tend to have considerably more future staffing needs (i.e., more postings in the spring and summer) for STEM and elementary teaching positions as well as positions in the "other" category, it is actually towns and (in some cases) cities that have more staffing needs for SPED and ELL teachers. Given that districts in different urbanicities also tend to have very different student demographics and other observable characteristics, we try to tease apart these relationships in the regressions described in the next section.

5.4 To what extent do district characteristics, ESSER funding, and attrition predict the proportion of open teaching positions?

The previous comparisons of teacher job postings across different subject areas and districts have focused on a select set of variables. However, as described in Section 4, there is a large range of (sometimes collinear) district factors that could influence staffing needs. To help disentangle these different factors, we present regression results in **Tables 3 and 4** that predict the proportion of first-time teaching postings (Table 3) and total teacher postings (Table 4) across different districts, subject areas, and quarters as a function of a number of different variables, added sequentially to the model as outlined in Section 4.

Other than the quarter effects, the results in Tables 3 and 4 are qualitatively similar, so we focus primarily on the first-time postings in Table 3. The specification in column 1 of Table 3 simply predicts the proportion first-time open teaching positions as a function of quarter and teaching subject area. Consistent with prior figures, the proportion of open positions drops by about half a percentage point in the winter relative to the fall but then increases by 2 or 3 percentage points in the spring and summer. Also consistent with Figure 6, the proportion of open positions in special education is nearly 4 percentage points higher than the proportion of open positions in elementary positions (on a base of about 1 percent, so almost 5 times higher, all

else equal), while the proportion of open STEM and "other" positions are about 2 percentage points higher.

The specification in column 2 of Table 3 adds district characteristics to the model. The most striking finding is that higher URM districts have greater staffing challenges: an increase from 0 to 100 percent on this measure predicts an increase in the teacher postings per FTE of 1.6 percentage points, representing more than a 50% increase over the mean (2.8%), all else equal. When we add geographic and unemployment variables (see column 3), we see that none of these variables (including urbanicity) are significant predictors of postings per FTE, while the percentage of students of color is still a significant and positive predictor.[24] This suggests that some of the differences across urbanicity categories in Figure 8 are actually driven by the racial composition of these districts and that nearby unemployment rates are (perhaps surprisingly) not particularly important predictors of district staffing challenges.

We then consider district resource variables in column 4 by including ESSER funding, prior per pupil spending, and beginning teacher salaries. ESSER funding is, as expected, positively related to staffing challenges, but an inconsistently significant predictor of postings per FTE. The results are statistically significant and positive when comparisons are made within the same educational service district (ESD) and Uniserv council (columns 6 and 7). This suggests that districts tend to have more open positions when they receive relatively more ESSER funding than nearby districts that share institutional bargaining structures.[25] Perhaps surprisingly, we find no evidence that (conditional on district funding levels) teacher salaries predict the proportion of postings.

[24] We estimate some specifications that control for district size rather than change in enrollment; we do not include both as they both use current enrollment and results are similar.
[25] It is not possible to disentangle whether or not this is because of the shared structure of geographic proximity.

In column 5, we add the attrition rate of teachers in the same subject area and district after the prior school year. Not surprisingly, this is a very significant predictor of open postings per FTE, suggesting that a given increase in attrition predicts a corresponding increase in open positions of 4% to 6% on the same scale.[26] This and most of the other significant relationships are robust to comparisons within the same ESD (column 6), the same Uniserv council (column 7), and the same school district (column 8). The ESD and Uniserv council effects help account for the fact that districts and unions within the same ESD or Uniserv council may have similar rules around staffing, given that they received common bargaining support (Goldhaber et al., 2014). The notable change after controlling for these bargaining structures is the URM finding, which is significantly diminished when we add ESD and Uniserv council fixed effects.[27] This suggests that the relationship between students of color and staffing challenges are driven by students of color disproportionately attending districts in regions of the state that have more staffing difficulties, all else equal.

To be more precise about this, we follow the methodology of Gelbach (2016) to decompose the overall difference in first-time teacher postings per FTE between high-URM districts (Q4 as shown in Figure 7) and other districts in the proportion of teaching postings, one percentage point, into proportions explained by other variables in the models in Table 3. This decomposition is shown in **Figure 9**, where the total height of each bar is the proportion of teacher job postings in high-URM districts, the first bar within each stacked bar is the proportion of teacher job postings in other districts, and the gap between those is split into portions explained by other district variables. For first-time postings, differences in ESSER funding

[26] This makes intuitive sense if, for example, districts are able to replace about 95% of departing teachers (i.e., if 100 teachers leave, there are likely to be 5 more open positions the next year).
[27] We cannot include both district fixed effects and district level URM as these variables are collinear.

account for about 40% of this gap, while differences across ESDs account for another 20%, and 40% is unexplained by other variables (differences in other district demographic variables, location variables, and attrition explain little of the gap). Interestingly, when we perform the same exercise to explain the gap in postings between rural districts and other districts (shown in **Figure 10**), these gaps can be explained almost equally by differences in student demographics, distance to the nearest teacher education program, prior teacher attrition, and ESSER funding.[28]

Note also that the magnitude of the coefficient on attrition is much smaller than 1, which is what we might expect in a situation where there was no change in school district resources, educational programming, or enrollment and districts simply replaced teachers who left. Put another way, in a closed system, the proportion of job postings in a subject area would equal the proportion of teachers who left that same subject area. That the coefficient on prior attrition is much smaller than 1 shows that there are a number of additional factors that influence job postings.[29] Moreover, the coefficients on the various subject indicators attenuate somewhat towards zero once we control for teacher attrition from these subjects, which reflects the fact that attrition rates from STEM positions (11.6%) and special education positions (10.6%) are higher than attrition rates from elementary positions (9.3%). This likely understates the influence of attrition in special education given that prior work in Washington (Theobald et al., 2021) shows considerable movement from special education positions to general education positions, which is an important factor in special education teacher shortages and is not reflected in these attrition rates from the workforce.

[28] We also estimate these decompositions separately by quarter and find—consistent with the regressions in Table 4—that ESSER funding explains more of these differences in later quarters.
[29] The pseudo R-squared of these models is between .05 and .06 depending on specification, suggesting that these variables (including attrition) predict a relatively small share of the variation in teacher postings.

The specifications in Tables 3 and 4 pool across different quarters, but the trends in Figures 6 through 8 suggest that staffing difficulties may vary considerably across quarters. We therefore estimate variants of the model in Section 4 in which we estimate these relationships separately by quarter, for first-time postings (**Table 5**) and for all open positions (**Table 6**). Five trends are apparent that were not already clear from the pooled results in Tables 3 and 4. First, it is clear that staffing difficulties in special education only increase over the course of the school year relative to staffing difficulties in elementary positions; by the spring and summer, for example, the proportion of open positions in special education is 4 to 6 percentage points higher than the proportion of open elementary positions, all else equal. Second, the change in district enrollment from the prior school year becomes a significant and positive predictor of open positions in the spring and summer, meaning that districts that experienced a growth in student enrollment tend to post more open positions for the next school year. Third, rural districts faced greater staffing challenges than other districts in the fall, meaning they had more open positions at the start of the school year (but not later in the school year). Fourth, districts in counties with higher unemployment rates had fewer job postings in the summer, all else equal. And finally, while not significant at conventional levels, ESSER funding appears to be more important in the spring and summer than in the fall and winter, based on the significantly larger magnitude of the ESSER coefficient in those quarters. While not reported here, these differences are statistically significant when the models include ESD fixed effects, meaning when districts are compared to other districts nearby. This is consistent with reports that ESSER spending was low in the beginning of the 2021–22 school year but accelerated in the spring.[30]

[30] Our estimates suggest that each $1,000 increase in ESSER spending is associated with about a .3 percentage point increase in job postings per FTE.

6. Discussion and Conclusions

This analysis makes two main contributions to the literature on school district hiring and staffing challenges. First, by examining job postings throughout the hiring cycle over the course of an entire school year for many different types of school positions, we document how staffing challenges can change over the course of a school year and characterize the important distinctions between vacancies (typically posted in the fall and winter) and future staffing needs (typically posted in the spring and summer). Specifically, we find that teacher hiring (at least during the 2021–22 school year) followed a very different hiring cycle than nonteacher hiring, with postings for teachers peaking in late spring and posting for other positions being more consistent throughout the year. While the timing of teacher hiring is consistent with prior work (e.g., James et al., 2022; Papay & Kraft, 2016), we believe this is the first statewide evidence of teacher hiring throughout a year and the first evidence on the hiring cycle for nonteaching positions (e.g., paraeducators).

Second, we demonstrate a strong relationship between prior attrition and staffing difficulties that has not been documented in the prior literature and also explore how staffing is influenced by district factors, such as the recent infusion of Elementary and Secondary Emergency Relief (ESSER) funding. Rural districts have relatively greater staffing challenges than do districts in other urbanicities, which appears to be due to a number of difference between rural districts and other districts such as attrition rates, distance to teacher education programs, demographics, and ESSER funding.

Our findings about the types of positions that face staffing shortages (by district characteristic and subject area, for example) are consistent with literature showing that it is more difficult to fill positions in rural districts (e.g., Goldhaber et al., 2020), districts serving more students of color (e.g., Hanushek et al., 2005), and special education classrooms (e.g., Cowan et

al., 2016). And while the amount of ESSER funding received by districts was inconsistently predictive of staffing difficulties during the 2021–22 school year, ESSER funding explains much of the gap in teacher job postings we observe between districts with a high percent of students of color and other districts. We view this as an important direction of future research because districts in Washington were reported to have spent less than 45% of their allocated ESSER funding as of August 2022.[31]

The work described in this paper also demonstrates the value of scraping school hiring data directly from hiring websites to obtain close to real-time data about the state of the educator labor market. That said, the approach has limitations. In particular, our exclusive focus on job *postings* in the absence of any *hiring* data means that we rely on the assumption that job postings are a useful proxy for staffing needs. But it is possible that these postings obfuscate or even overstate hiring intentions. Future work can address these concerns by connecting job postings to district hiring in subsequent years (as observed in future years of employment data) and exploring the extent to which different postings are more or less likely to be filled.

Future work can also connect the staffing challenges experienced by different districts to the district rules and practices that influence hiring, an important issue given that the hiring cycle for certificated positions is typically governed by collective bargaining agreements that vary across districts (Goldhaber et al., 2016; Strunk et al., 2018). For instance, some districts encourage or incentivize teachers to announce early whether they plan to leave or retire (Strunk et al., 2018); teacher responses to these incentives may provide districts with a good and early sense of hiring needs for the next school year, influencing when postings occur. In other cases, collective bargaining agreements may specify that incumbent teachers have a first shot at open

[31] The amount of spending by each district varies considerably. For more see: https://www.k12.wa.us/about-ospi/press-releases/novel-coronavirus-covid-19-guidance-resources/state-federal-funding

positions; such rules create an internal teacher labor market that may delay when districts seek out external applicants (Goldhaber et al., 2016; Levin & Quinn, 2003). Given that many postings also include data about the specific school for which the position is posted, future work could also consider variation within districts in terms of staffing challenges across different schools.

Our analysis also has implications for practice. In particular, our work underscores the point that staffing challenges are not generic across school districts or job types. Consistent with well-developed literature, we find large differences in postings per student depending on school district demographics (e.g., student racial composition), urbanicity (e.g., rural vs. suburban), and subject area (e.g., special education vs. elementary). Thus, our findings reinforce calls to differentiate how we describe and address "teacher shortages" in U.S. public schools.

Getting clear about the meaning of the "teacher shortage" is not just a semantic exercise. Consider the example of federal TEACH grants in Washington. Washington identifies teacher shortage areas using the overall *counts* of limited certificates and out-of-subject placements in different subject areas.[32] This definition has led the state to list elementary education as the top shortage area in the state, making elementary education positions eligible for federal TEACH grants.[33] While school districts may struggle to find elementary level teachers given the tight labor market and ESSER resources, if we scale teacher job postings by the number of teacher positions across the state, it is clear that staffing difficulties in other areas—special education in particular—far exceed staffing difficulties in elementary classrooms. We view this as a good example of the need to identify the precise nature of staffing problems in order to design effective solutions.

[32] See https://wsac.wa.gov/sites/default/files/2021-06-Educator-Shortage-Report.pdf.
[33] See https://www.pesb.wa.gov/current-educators/educator-shortage/.

Of particular emphasis, we believe our results regarding staffing difficulties in special education classrooms and in districts serving more disadvantaged students suggest that the system needs targeted incentives to attract and retain educators in these positions. Outside of Washington, these kinds of incentives are becoming less novel. For example, as of May 2022, nearly half of all large districts in the country and a notable but smaller number of states were offering some kind of financial incentive specifically for special educators (Putnam & Gerber, 2022). But the magnitudes of these incentives outside of a few high-profile examples (e.g., McCoy, 2022) tend to be dwarfed by other incentives in teacher compensation, such as for acquiring master's degrees (Saenz-Armstrong, 2022). Although one-size-fits-all district salary schedules may seem equitable for the *adults* in the system, ensuring equity for *students* regardless of their race or disability status suggests we need more differentiated solutions to staffing challenges.

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Figures and Tables

Figure 1. Cumulative First-Time Job Postings by Month and Job Category

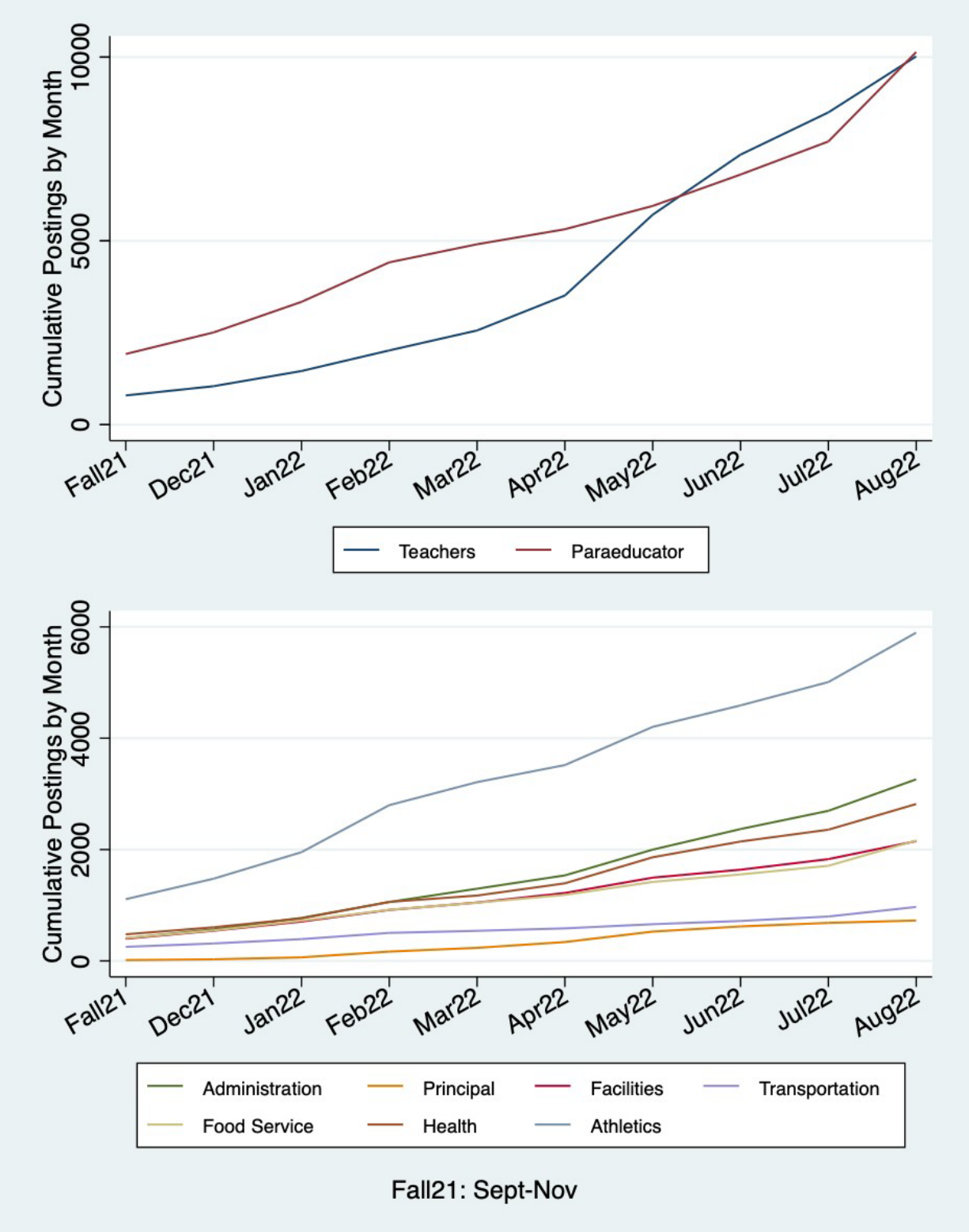


Figure 2. First-Time Job Postings per Month by Job Category

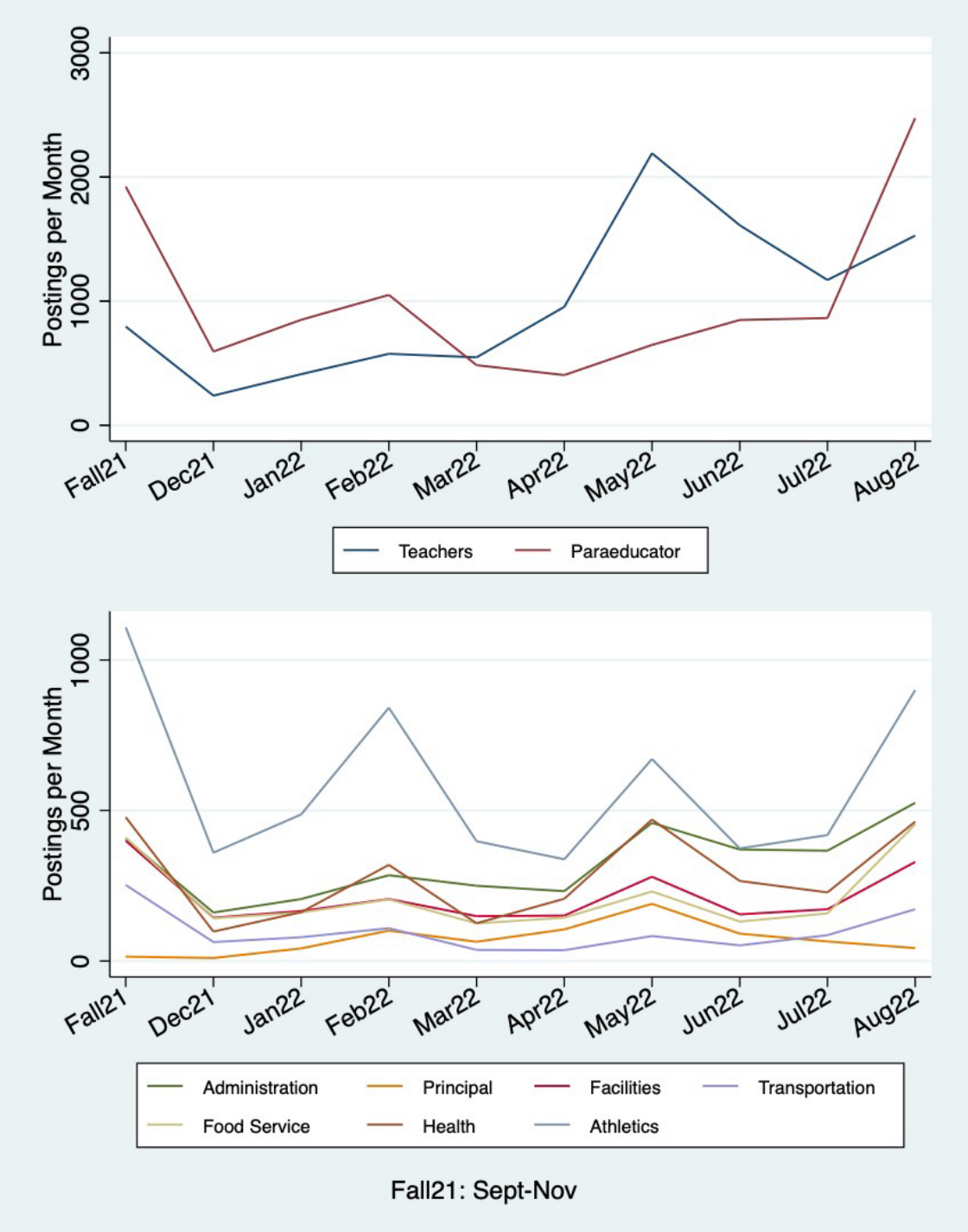


Figure 3. Total Job Postings per Month by Job Category

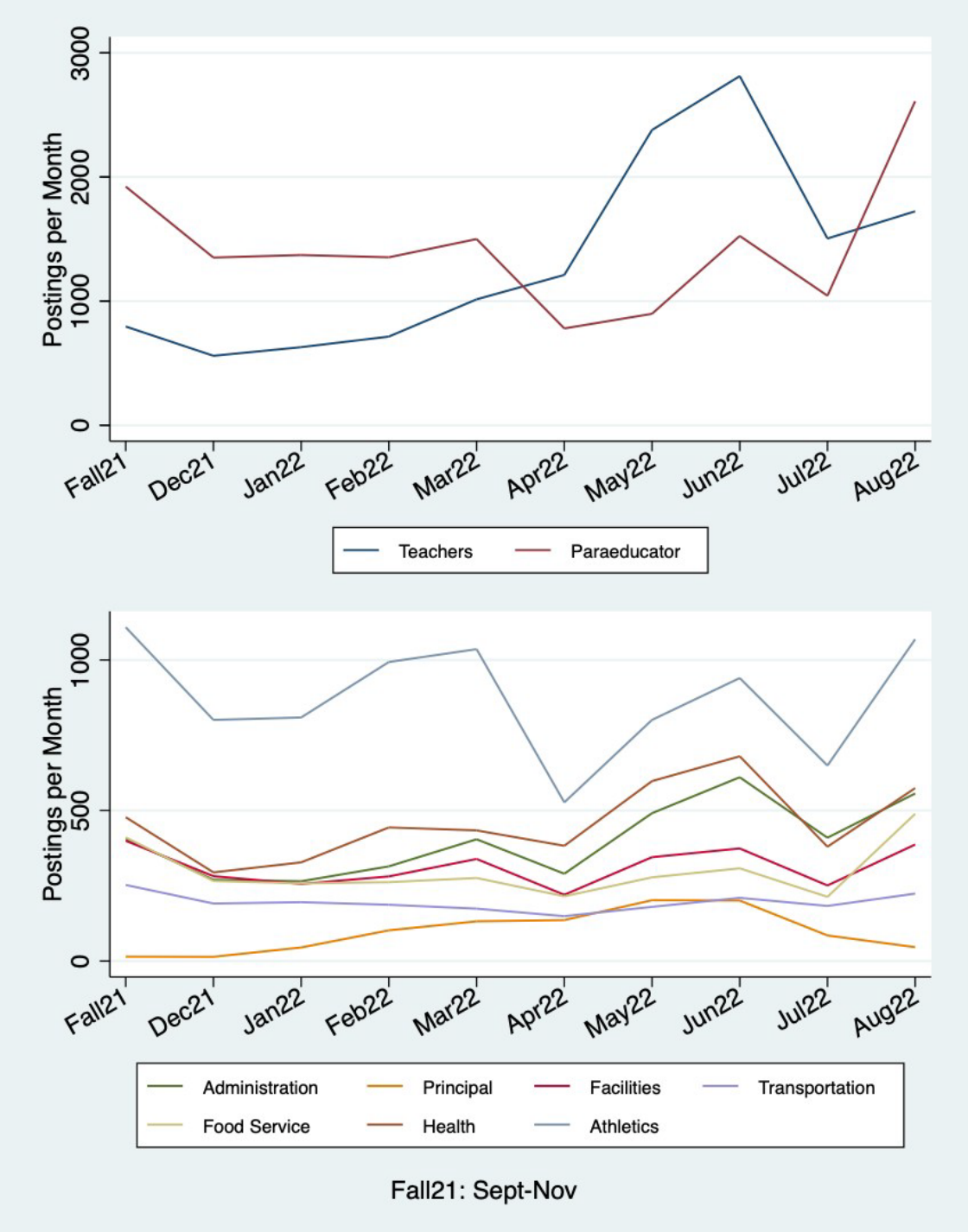
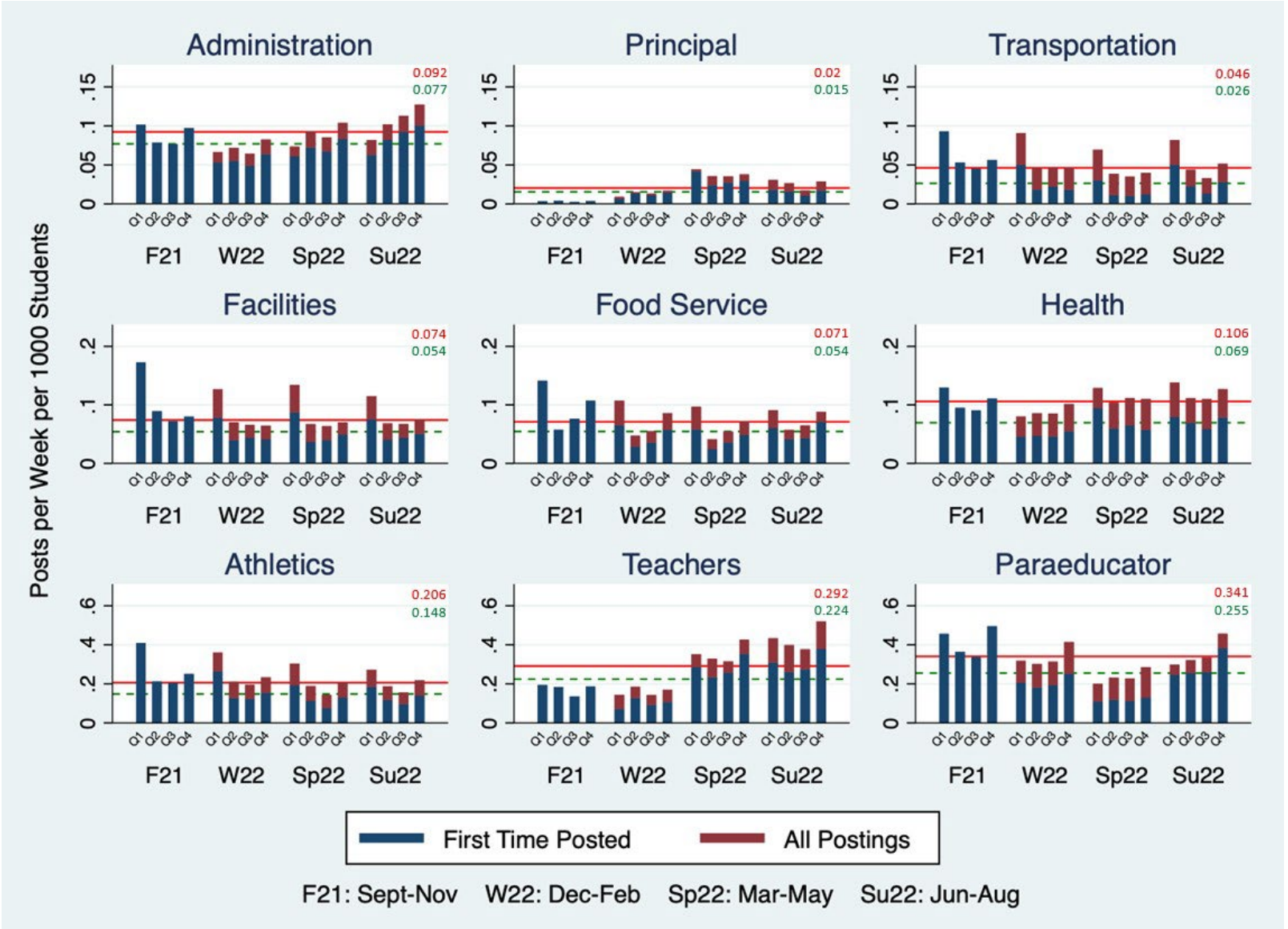


Figure 4. Job Postings per Week per 1,000 Students by Job Category and Quartile of District Percentage of URM Students



Note. Q1–Q4 represent quartiles of percentages of underrepresented minority (URM) students in the district.

Figure 5. Job Postings per Week per 1,000 Students by Job Category and District Urbanicity

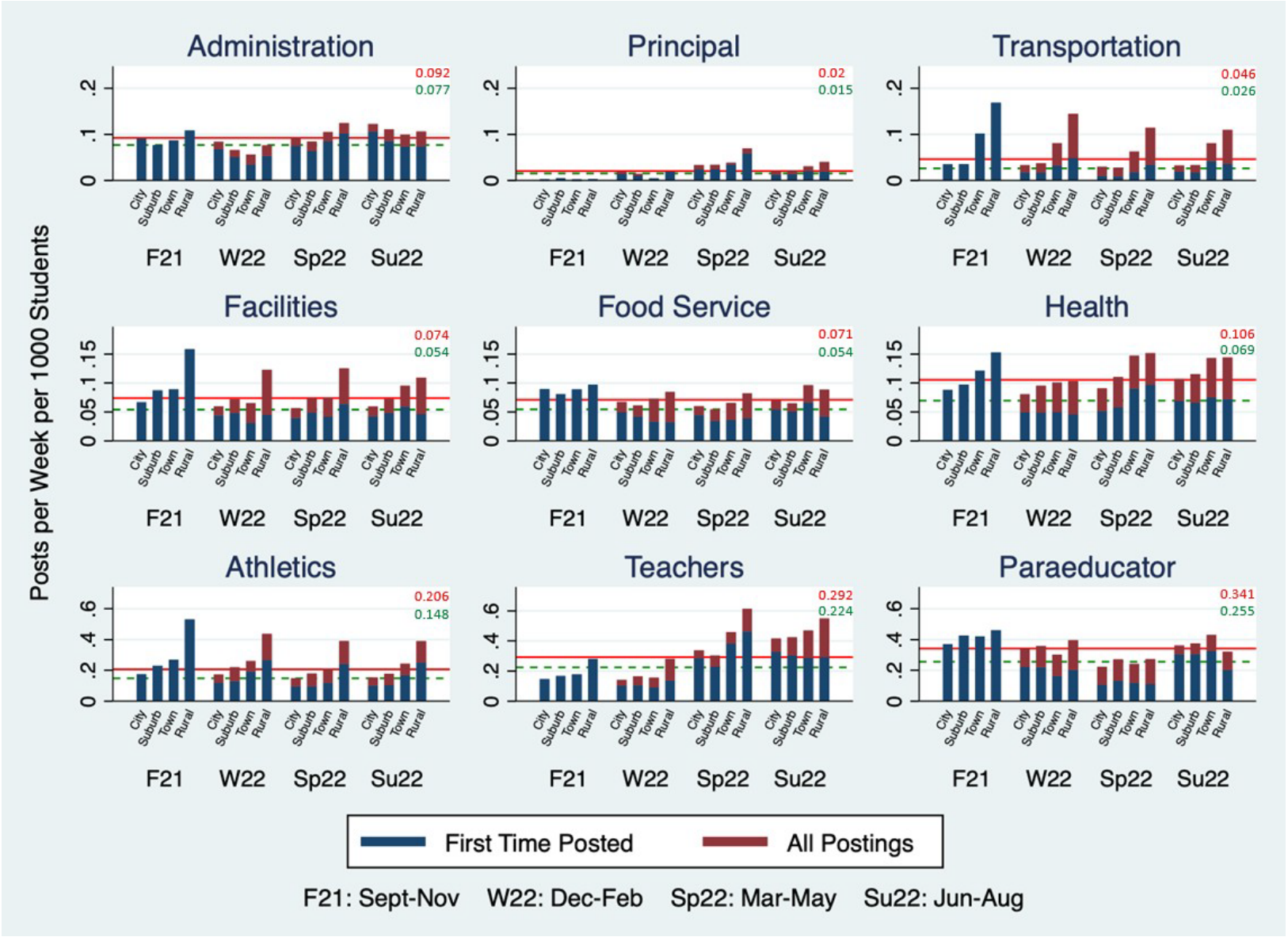


Figure 6. Teacher Job Postings per Week per 10,000 FTE by Subject Area

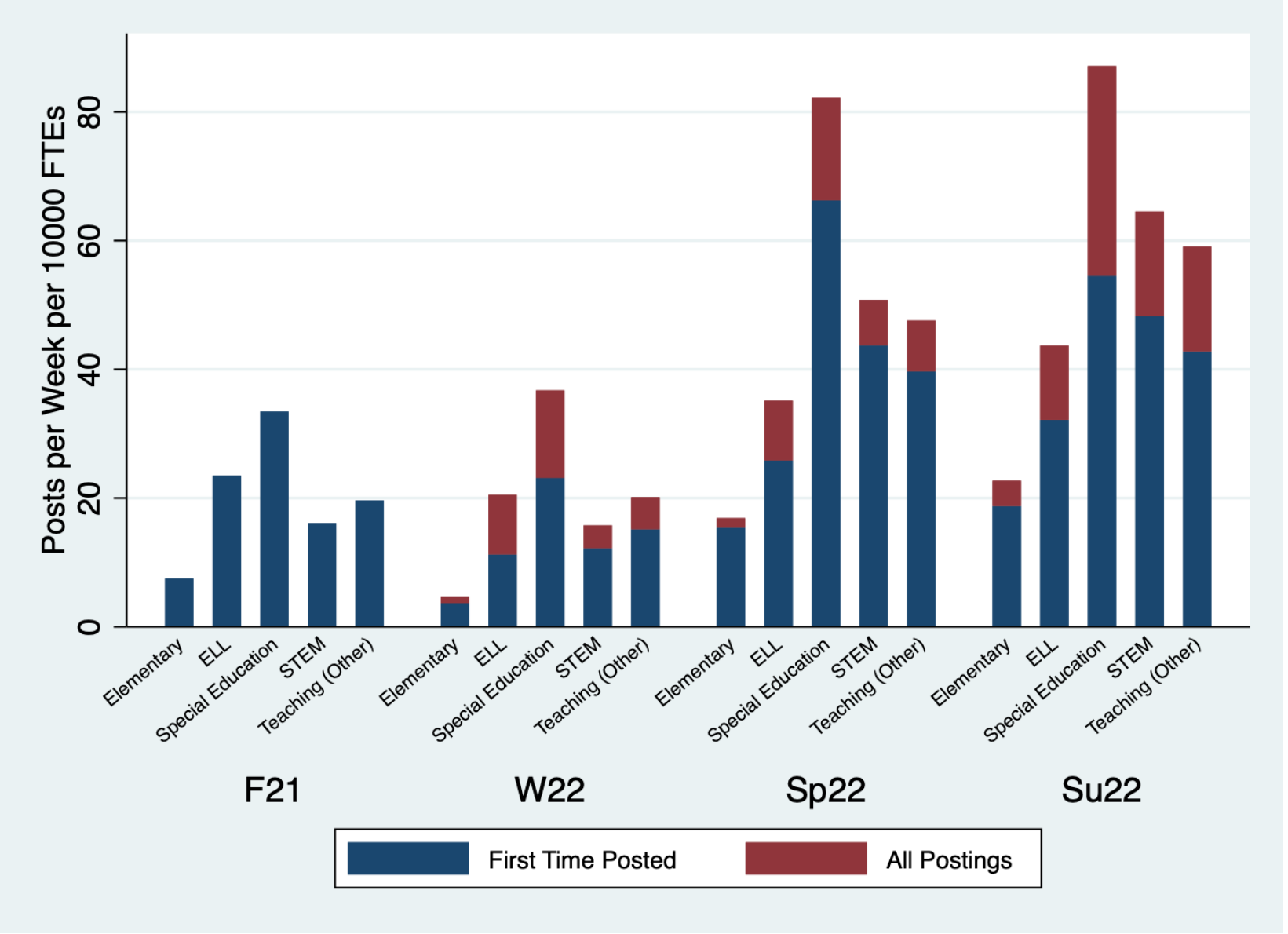
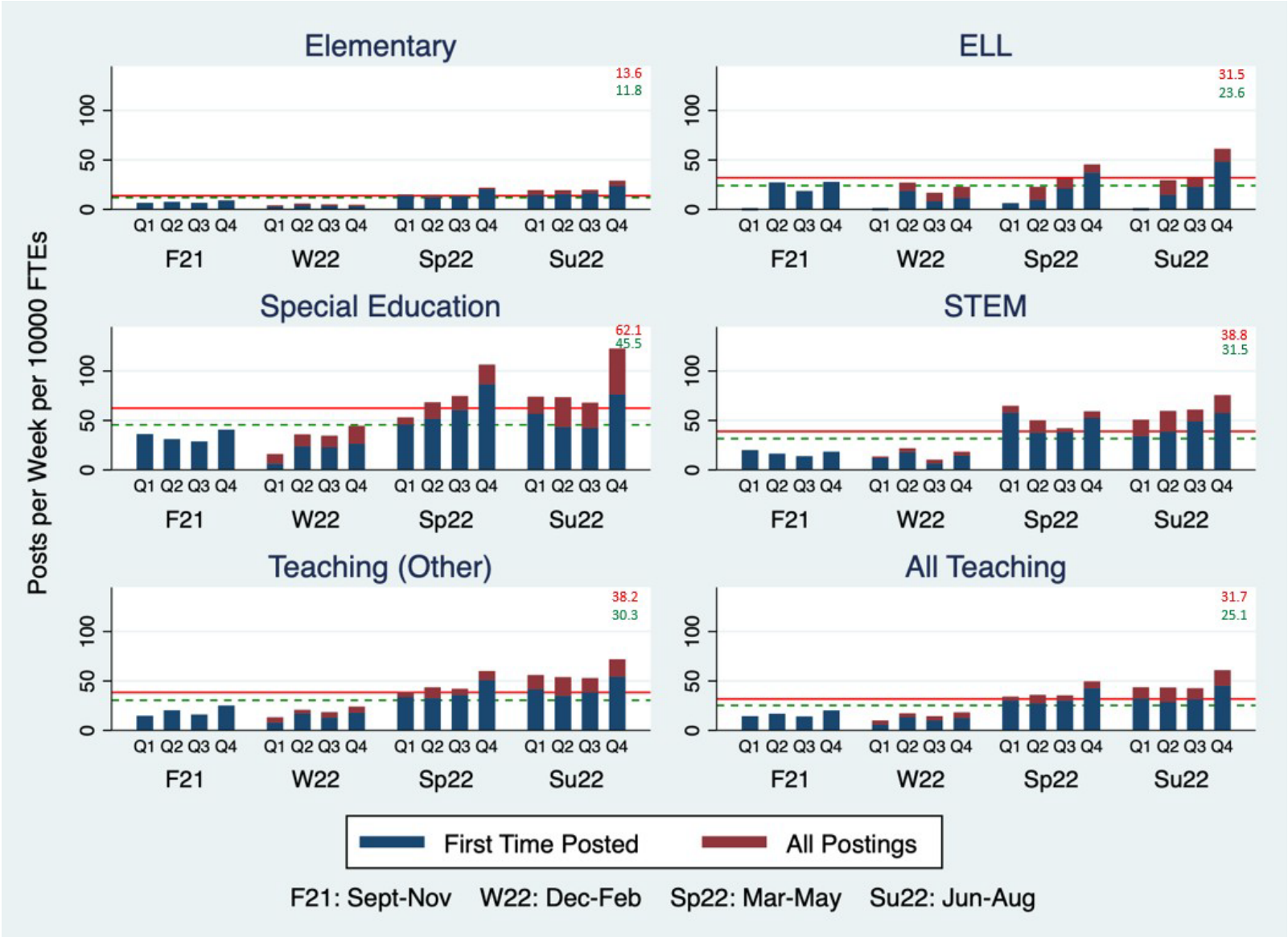


Figure 7. Teacher Job Postings per Week per 10,000 FTE by Subject Area and Quartile of District Percentage URM Students



Note. Q1–Q4 represent quartiles of percentages of underrepresented minority (URM) students in the district.

Figure 8. Teacher Job Postings per Week per FTE by Subject Area and District Urbanicity

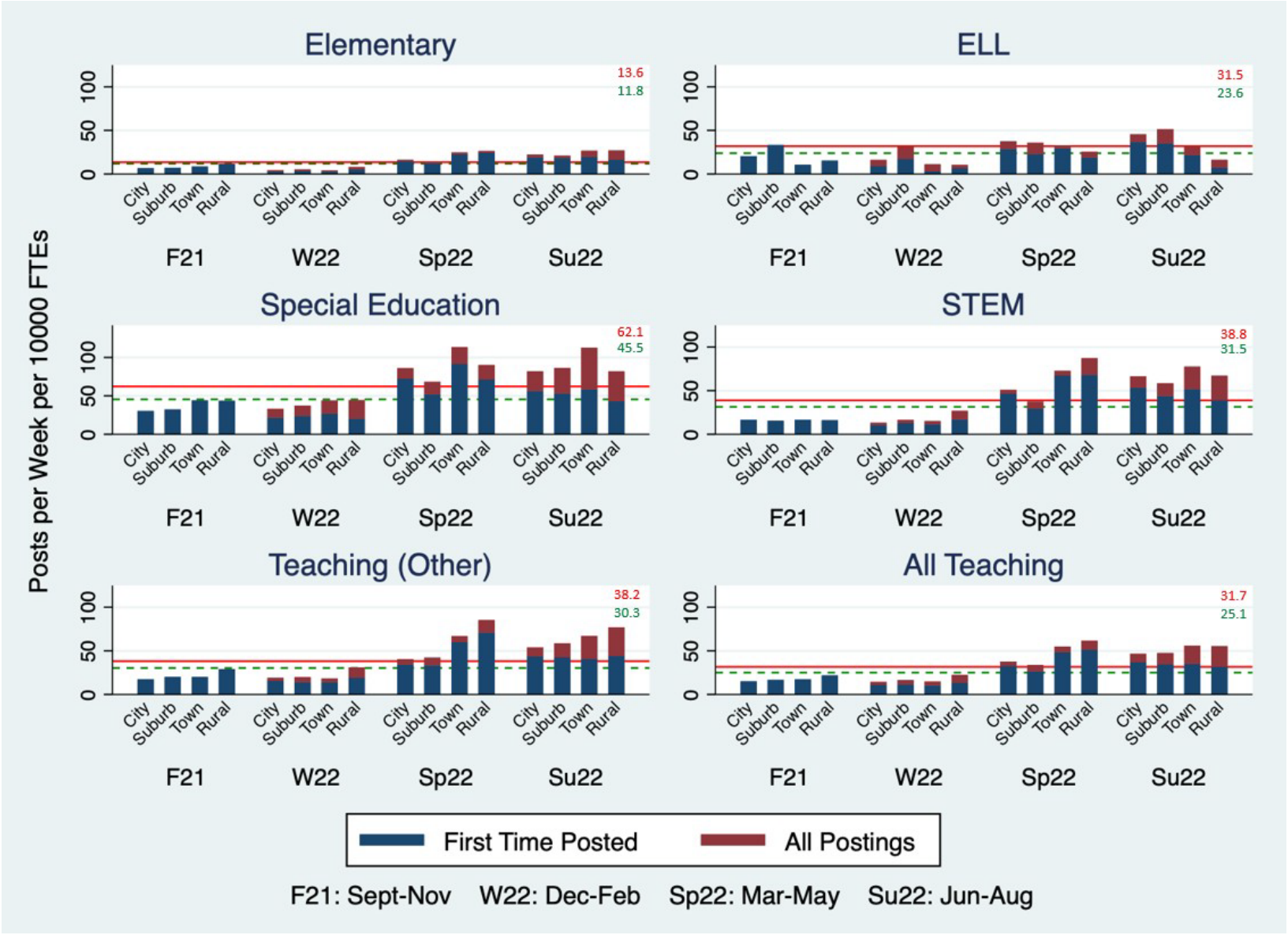


Figure 9. Decomposition of Gaps in Proportion of Teacher Postings Between High-URM Districts and Other Districts

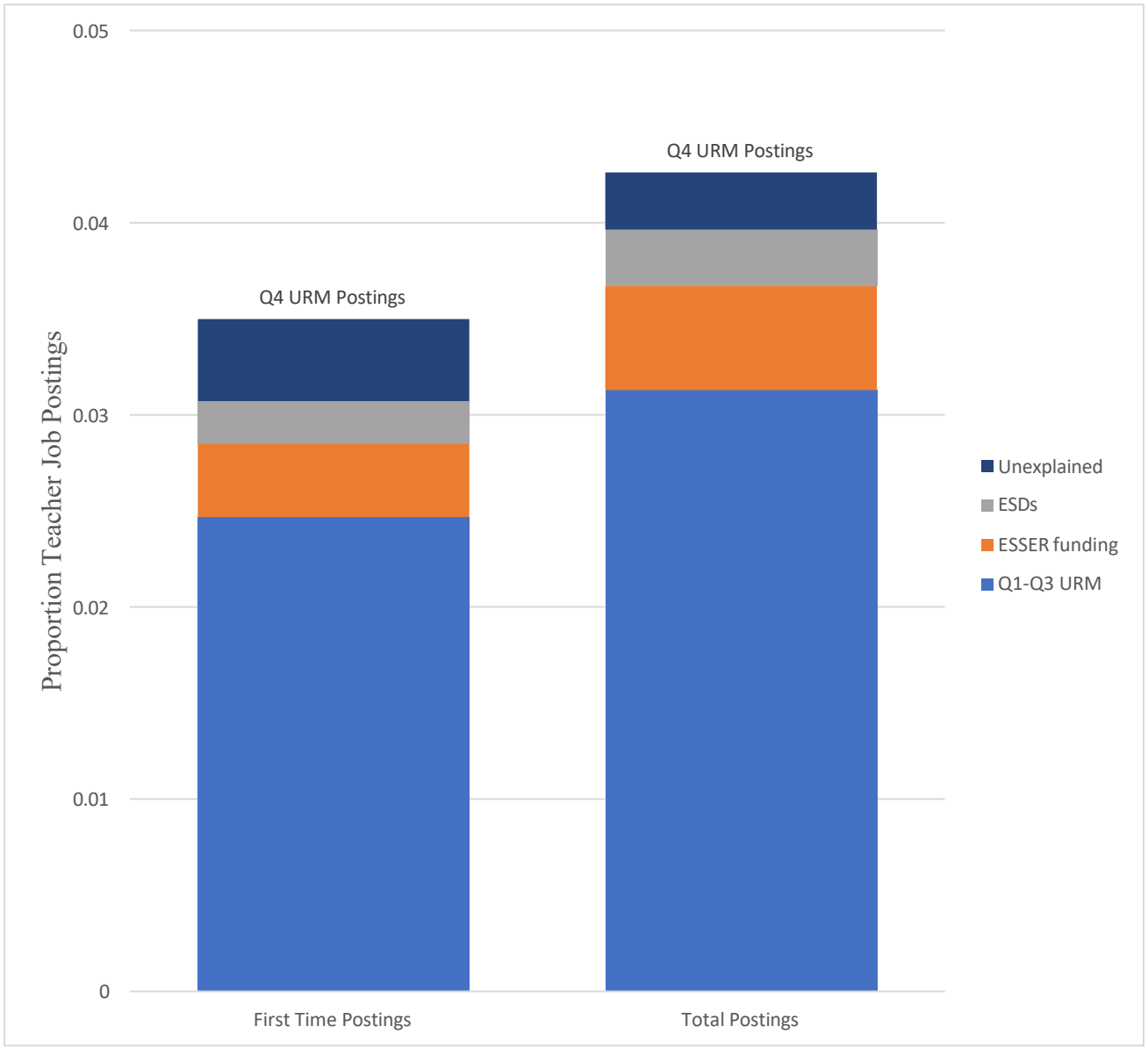


Figure 10. Decomposition of Gaps in Proportion of Teacher Postings Between Rural and Nonrural Districts

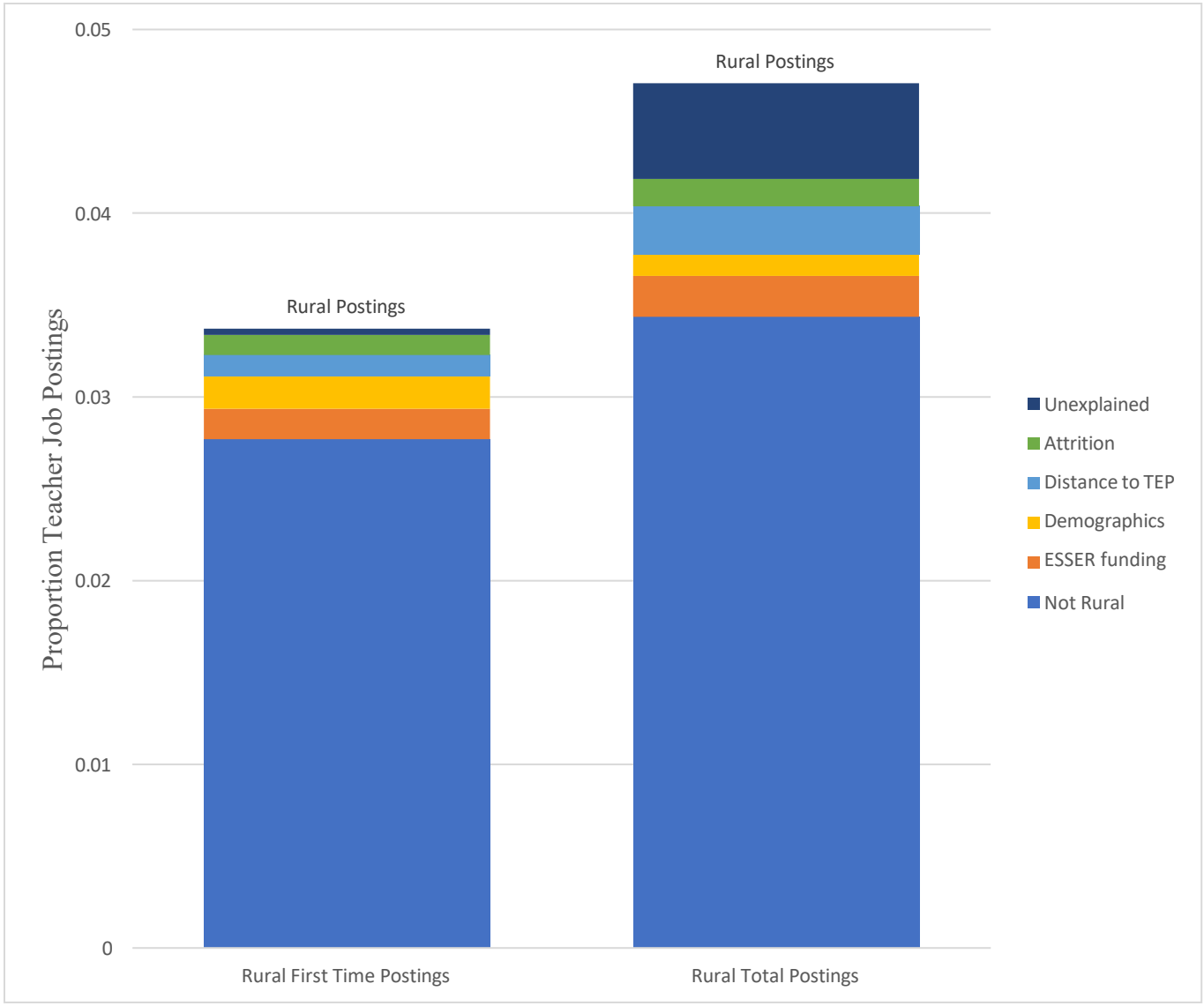


Table 1. Summary Statistics by Quarter and Quartile of Teaching Openings per FTE

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Quarter	All	Fall 2021		Winter 2022		Spring 2022		Summer 2022	
Quartile of Teaching Openings per FTE	All	Bottom Quartile	Top Quartile	Bottom Quartile	Top Quartile	Bottom Quartile	Top Quartile	Bottom Quartile	Top Quartile
First Time Teaching Openings per 10K FTE	1156.295 (542.768)	10.382 (14.449)	379.365 (179.767)	0.000 (0.000)	287.111 (156.667)	119.840 (68.281)	1000.323 (270.575)	112.830 (65.186)	847.091 (212.403)
Total Teaching Openings per 10K FTE	1457.351 (748.401)	10.382 (14.449)	379.365 (179.767)	49.921 (139.132)	356.585 (267.999)	203.023 (83.321)	1122.799 (367.382)	266.779 (119.097)	1060.898 (313.122)
District % of URM Students	0.409 (0.181)	0.325 (0.228)	0.498 (0.205)	0.379 (0.256)	0.369 (0.178)	0.336 (0.145)	0.531 (0.254)	0.368 (0.137)	0.471 (0.178)
District % of FRL Students	0.458 (0.202)	0.482 (0.209)	0.541 (0.190)	0.555 (0.204)	0.369 (0.230)	0.390 (0.193)	0.599 (0.213)	0.435 (0.178)	0.506 (0.205)
District Avg. Fall Test Scores (std)	0.380 (1.097)	0.350 (0.988)	-0.124 (1.152)	-0.008 (0.849)	1.042 (1.524)	0.837 (1.193)	-0.327 (1.034)	0.527 (1.008)	0.171 (1.245)
District Log Student Enrollment	9.244 (1.060)	7.904 (1.183)	9.043 (1.160)	7.499 (0.944)	9.155 (1.099)	9.519 (0.870)	8.563 (1.166)	9.029 (1.111)	9.192 (1.080)
District Enrollment Change SDs 2021–22	-0.091 (1.037)	0.691 (1.208)	-0.124 (0.996)	0.244 (1.381)	-0.329 (0.811)	-0.221 (0.737)	0.376 (1.359)	-0.261 (0.779)	-0.217 (1.036)
City District	0.408 (0.493)	0.257 (0.441)	0.524 (0.504)	0.047 (0.214)	0.248 (0.436)	0.420 (0.498)	0.205 (0.407)	0.365 (0.486)	0.339 (0.478)
Suburban District	0.398 (0.491)	0.208 (0.410)	0.195 (0.400)	0.249 (0.435)	0.541 (0.503)	0.493 (0.505)	0.339 (0.478)	0.418 (0.498)	0.501 (0.505)
Town District	0.124 (0.331)	0.280 (0.453)	0.161 (0.371)	0.388 (0.491)	0.126 (0.335)	0.063 (0.246)	0.288 (0.457)	0.100 (0.303)	0.081 (0.276)
Rural District	0.070 (0.256)	0.255 (0.440)	0.120 (0.328)	0.315 (0.468)	0.084 (0.281)	0.023 (0.152)	0.168 (0.378)	0.117 (0.324)	0.079 (0.272)
District Log Distance to Nearest TEP	1.463 (1.348)	2.655 (0.723)	1.356 (1.369)	2.870 (0.767)	1.116 (1.306)	1.130 (1.235)	2.007 (1.289)	1.613 (1.342)	1.326 (1.299)
County Unemployment Rate	0.054 (0.009)	0.058 (0.008)	0.055 (0.011)	0.059 (0.010)	0.050 (0.009)	0.052 (0.007)	0.062 (0.008)	0.053 (0.008)	0.051 (0.010)
Per Pupil ESSER Funding ($1K)	2.371 (1.365)	2.389 (1.197)	2.918 (1.400)	2.669 (1.446)	1.768 (1.564)	1.909 (1.277)	3.092 (1.799)	2.061 (1.120)	2.663 (1.584)
Per Pupil Spending 2020–21 ($1K)	15.932 (1.507)	15.689 (2.821)	16.408 (1.549)	15.938 (3.109)	16.105 (1.210)	15.821 (1.455)	15.577 (1.696)	16.088 (1.398)	16.211 (1.942)
Starting Salary for BA Teachers ($1K)	51.840 (4.512)	48.254 (3.766)	53.012 (4.321)	48.897 (4.270)	52.665 (3.832)	52.571 (5.272)	50.616 (4.047)	52.209 (4.361)	52.319 (4.710)
Number of Districts	213	54	53	74	53	54	53	54	53

Table 2. Coefficients of Variation Across Monthly Postings by Position Type

	First Time	All
Administration	0.362	0.301
Athletics	0.464	0.217
Facilities	0.418	0.202
Food Service	0.550	0.292
Health	0.515	0.271
Other (nonteaching)	0.487	0.284
Paraeducator	0.658	0.369
Principal	0.729	0.713
Superintendent	0.584	0.536
Teachers	0.618	0.578
Transportation	0.697	0.147

Table 3. Marginal Effects on Proportion First-Time Job Postings by District, Subject Area, and Quarter (Binomial Regressions)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Winter (ref. fall)	-.0040***	-.0040***	-.0040***	-.0077***	-.0077***	-.0076***	-.0076***	-.0076***
	(.0010)	(.0010)	(.0010)	(.0020)	(.0020)	(.0020)	(.0020)	(.0020)
Spring (ref. fall)	.0223***	.0222***	.0222***	.0238***	.0238***	.0238***	.0237***	.0236***
	(.0030)	(.0028)	(.0029)	(.0030)	(.0030)	(.0030)	(.0029)	(.0027)
Summer (ref. fall)	.0277***	.0277***	.0277***	.0276***	.0276***	.0275***	.0275***	.0274***
	(.0026)	(.0025)	(.0025)	(.0026)	(.0026)	(.0026)	(.0024)	(.0022)
SPED (ref. elem)	.0362***	.0365***	.0366***	.0367***	.0358***	.0358***	.0358***	.0362***
	(.0025)	(.0025)	(.0024)	(.0018)	(.0018)	(.0019)	(.0019)	(.0019)
STEM (ref. elem)	.0214***	.0218***	.0217***	.0266***	.0249***	.0252***	.0253***	.0256***
	(.0015)	(.0016)	(.0016)	(.0018)	(.0018)	(.0020)	(.0018)	(.0019)
Other (ref. elem)	.0194***	.0196***	.0196***	.0248***	.0239***	.0241***	.0240***	.0243***
	(.0012)	(.0011)	(.0011)	(.0015)	(.0015)	(.0016)	(.0016)	(.0016)
District % of URM Students		.0163*	.0187**	.0155*	.0143*	.0000	.0007	
		(.0064)	(.0064)	(.0068)	(.0064)	(.0085)	(.0079)	
District Avg. Fall Test Scores (std)		-.0168	-.0140	-.0017	-.0020	-.0148	.0016	
		(.0110)	(.0115)	(.0135)	(.0131)	(.0148)	(.0183)	
District Enrollment Change SDs 2021–22		.0013	.0014	.0016*	.0021**	.0018*	.0016*	
		(.0007)	(.0007)	(.0008)	(.0007)	(.0007)	(.0008)	
Suburban District (ref. city)			-.0003	.0006	-.0002	-.0013	-.0038	
			(.0026)	(.0028)	(.0027)	(.0025)	(.0029)	
Town District (ref. city)			.0044	.0048	.0038	.0027	.0020	
			(.0035)	(.0032)	(.0031)	(.0030)	(.0030)	
Rural District (ref. city)			.0079	.0069	.0046	.0032	.0027	
			(.0043)	(.0036)	(.0036)	(.0030)	(.0031)	
District Log Distance to Nearest TEP			-.0004	.0001	.0004	.0006	.0008	
			(.0010)	(.0010)	(.0010)	(.0009)	(.0010)	
County Unemployment Rate			-.0987	-.0908	-.1163	-.0284	.0970	
			(.1265)	(.1256)	(.1202)	(.1214)	(.1434)	
Per Pupil ESSER Funding ($1K)				.0021	.0021*	.0024*	.0029*	
				(.0011)	(.0010)	(.0010)	(.0011)	
Per Pupil Spending 2020–21 ($1K)				-.0001	-.0004	-.0007	-.0004	
				(.0005)	(.0005)	(.0006)	(.0006)	
Starting Salary for BA Teachers ($1K)				.0002	.0002	.0001	.0003	
				(.0003)	(.0002)	(.0002)	(.0003)	
Prior Teacher Attrition Rate (Same Subject)					.0650***	.0550***	.0547***	.0398***
					(.0118)	(.0111)	(.0108)	(.0108)
ESD Fixed Effects						X		
Uniserv Fixed Effects							X	
District Fixed Effects								X
N	3408	3408	3408	3408	3408	3408	3408	3408

Note. Average marginal effects calculated from binomial regression of proportion first-time openings by district, subject area, and quarter. Standard errors are clustered by district. *p*-values from two-sided *t*-tests: *$p<.05$, **$p<.01$, ***$p<.001$.

Table 4. Marginal Effects on Proportion of Total Job Postings by District, Subject Area, and Quarter (Binomial Regressions)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Winter (ref. fall)	.0008 (.0009)	.0008 (.0009)	.0008 (.0009)	.0017 (.0018)	.0017 (.0018)	.0017 (.0018)	.0017 (.0018)	.0016 (.0018)
Spring (ref. fall)	.0293*** (.0028)	.0292*** (.0027)	.0292*** (.0027)	.0351*** (.0033)	.0351*** (.0032)	.0350*** (.0031)	.0349*** (.0030)	.0348*** (.0028)
Summer (ref. fall)	.0431*** (.0026)	.0430*** (.0024)	.0430*** (.0024)	.0445*** (.0028)	.0445*** (.0028)	.0444*** (.0028)	.0443*** (.0025)	.0442*** (.0023)
SPED (ref. elem)	.0509*** (.0034)	.0512*** (.0032)	.0516*** (.0031)	.0511*** (.0022)	.0498*** (.0021)	.0499*** (.0022)	.0498*** (.0022)	.0504*** (.0022)
STEM (ref. elem)	.0271*** (.0017)	.0275*** (.0019)	.0273*** (.0018)	.0350*** (.0021)	.0328*** (.0021)	.0332*** (.0023)	.0332*** (.0021)	.0335*** (.0023)
Other (ref. elem)	.0258*** (.0014)	.0260*** (.0014)	.0259*** (.0013)	.0338*** (.0018)	.0325*** (.0018)	.0328*** (.0020)	.0326*** (.0018)	.0330*** (.0019)
District % of URM Students		.0219* (.0089)	.0266** (.0083)	.0215* (.0090)	.0199* (.0083)	.0019 (.0104)	.0016 (.0097)	
District Avg. Fall Test Scores (std)		-.0147 (.0147)	-.0081 (.0140)	.0074 (.0171)	.0065 (.0165)	-.0090 (.0181)	.0130 (.0223)	
District Enrollment Change SDs 2021–22		.0013 (.0010)	.0012 (.0009)	.0016 (.0010)	.0021* (.0009)	.0019* (.0009)	.0014 (.0009)	
Suburban District (ref. city)			.0017 (.0031)	.0030 (.0034)	.0019 (.0033)	.0003 (.0031)	-.0048 (.0033)	
Town District (ref. city)			.0090* (.0043)	.0096* (.0040)	.0084* (.0038)	.0064 (.0036)	.0041 (.0035)	
Rural District (ref. city)			.0167** (.0059)	.0144** (.0048)	.0114* (.0047)	.0094* (.0039)	.0070 (.0039)	
District Log Distance to Nearest TEP			-.0004 (.0011)	.0003 (.0012)	.0006 (.0012)	.0009 (.0011)	.0009 (.0012)	
County Unemployment Rate			-.1361 (.1616)	-.1014 (.1610)	-.1341 (.1558)	-.0164 (.1566)	.2162 (.1733)	
Per Pupil ESSER Funding ($1K)				.0027 (.0016)	.0026 (.0015)	.0032* (.0015)	.0043** (.0015)	
Per Pupil Spending 2020–21 ($1K)				.0002 (.0006)	-.0001 (.0007)	-.0006 (.0008)	.0000 (.0007)	
Starting Salary for BA Teachers ($1K)				.0003 (.0003)	.0003 (.0003)	.0002 (.0003)	.0002 (.0003)	
Prior Teacher Attrition Rate (Same Subject)					.0831*** (.0158)	.0685*** (.0145)	.0688*** (.0138)	.0499*** (.0137)
ESD Fixed Effects						X		
Uniserv Fixed Effects							X	
District Fixed Effects								X
N	3408	3408	3408	3408	3408	3408	3408	3408

Note. Average marginal effects calculated from binomial regression of proportion total openings by district, subject area, and quarter. Standard errors are clustered by district. *p*-values from two-sided *t*-tests: *$p<.05$, **$p<.01$, ***$p<.001$.

Table 5. Marginal Effects on Proportion of First-Time Job Postings by District and Subject Area (Binomial Regressions)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quarter	Fall		Winter		Spring		Summer	
SPED (ref. elem)	.0250***	.0234***	.0208***	.0220***	.0557***	.0538***	.0424***	.0435***
	(.0027)	(.0021)	(.0019)	(.0020)	(.0060)	(.0049)	(.0049)	(.0043)
STEM (ref. elem)	.0084***	.0111***	.0093***	.0139***	.0318***	.0366***	.0353***	.0377***
	(.0013)	(.0017)	(.0016)	(.0023)	(.0033)	(.0035)	(.0042)	(.0046)
Other (ref. elem)	.0124***	.0151***	.0119***	.0163***	.0255***	.0325***	.0275***	.0321***
	(.0013)	(.0016)	(.0014)	(.0021)	(.0022)	(.0028)	(.0028)	(.0036)
District % of URM Students		.0057		.0089		.0279*		.0097
		(.0089)		(.0070)		(.0129)		(.0136)
District Avg. Fall Test Scores (100 pts.)		-.0022		.0161		-.0008		-.0293
		(.0141)		(.0136)		(.0323)		(.0338)
District Enrollment Change SDs 2021–22		.0000		-.0004		.0052**		.0034*
		(.0009)		(.0006)		(.0016)		(.0015)
Suburban District (ref. city)		.0038		.0025		-.0076		-.0001
		(.0029)		(.0024)		(.0063)		(.0055)
Town District (ref. city)		.0066*		.0040		.0040		-.0012
		(.0031)		(.0028)		(.0062)		(.0056)
Rural District (ref. city)		.0109**		.0094**		.0038		-.0083
		(.0036)		(.0031)		(.0070)		(.0076)
District Log Distance to Nearest TEP		-.0012		-.0017		.0033		.0008
		(.0011)		(.0009)		(.0022)		(.0022)
County Unemployment Rate		-.1430		.0053		.2593		-.5989**
		(.1622)		(.1464)		(.2636)		(.2174)
Per Pupil ESSER Funding ($1K)		.0011		.0003		.0031		.0037
		(.0013)		(.0016)		(.0021)		(.0025)
Per Pupil Spending 2020–21 ($1K)		.0004		.0001		.0001		.0004
		(.0002)		(.0002)		(.0005)		(.0006)
Starting Salary for BA Teachers ($1K)		.0003		.0005		-.0013		-.0016
		(.0005)		(.0005)		(.0014)		(.0017)
Prior Teacher Attrition Rate (Same Subject)		.0439***		.0262*		.0877***		.0959***
		(.0128)		(.0114)		(.0249)		(.0254)
N	852	852	852	852	852	852	852	852

Note. Average marginal effects calculated from binomial regression of proportion openings by district and subject area. Standard errors are clustered by district. *p*-values from two-sided *t*-tests: *$p<.05$, **$p<.01$, ***$p<.001$.

Table 6. Marginal Effects on Proportion of All Job Postings by District and Subject Area (Binomial Regressions)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Quarter	Fall		Winter		Spring		Summer	
SPED (ref. elem)	.0250***	.0234***	.0338***	.0340***	.0702***	.0680***	.0732***	.0731***
	(.0027)	(.0021)	(.0026)	(.0024)	(.0061)	(.0046)	(.0062)	(.0045)
STEM (ref. elem)	.0084***	.0111***	.0120***	.0193***	.0376***	.0450***	.0488***	.0547***
	(.0013)	(.0017)	(.0017)	(.0026)	(.0032)	(.0036)	(.0042)	(.0049)
Other (ref. elem)	.0124***	.0151***	.0166***	.0236***	.0326***	.0420***	.0407***	.0494***
	(.0013)	(.0016)	(.0016)	(.0023)	(.0023)	(.0030)	(.0029)	(.0039)
District % of URM Students		.0057		.0094		.0352*		.0253
		(.0089)		(.0089)		(.0142)		(.0140)
District Avg. Fall Test Scores (100 pts.)		-.0022		.0184		.0239		-.0174
		(.0141)		(.0186)		(.0268)		(.0309)
District Enrollment Change SDs 2021–22		.0000		-.0005		.0041*		.0046**
		(.0009)		(.0008)		(.0017)		(.0016)
Suburban District (ref. city)		.0038		.0046		-.0042		.0030
		(.0029)		(.0031)		(.0064)		(.0058)
Town District (ref. city)		.0066*		.0066*		.0085		.0109
		(.0031)		(.0033)		(.0071)		(.0061)
Rural District (ref. city)		.0109**		.0148***		.0121		.0068
		(.0036)		(.0041)		(.0078)		(.0085)
District Log Distance to Nearest TEP		-.0012		-.0012		.0030		.0015
		(.0011)		(.0011)		(.0023)		(.0021)
County Unemployment Rate		-.1430		-.0951		.2646		-.5694*
		(.1622)		(.1777)		(.2703)		(.2585)
Per Pupil ESSER Funding ($1K)		.0011		.0016		.0039		.0037
		(.0013)		(.0022)		(.0024)		(.0022)
Per Pupil Spending 2020–21 ($1K)		.0003		.0006		-.0007		-.0007
		(.0005)		(.0006)		(.0012)		(.0016)
Starting Salary for BA Teachers ($1K)		.0004		.0004		.0002		.0005
		(.0002)		(.0003)		(.0005)		(.0006)
Prior Teacher Attrition Rate (Same Subject)		.0439***		.0402**		.1070***		.1390***
		(.0128)		(.0147)		(.0277)		(.0277)
N	852	852	852	852	852	852	852	852

Note: Average marginal effects calculated from binomial regression of proportion openings by district and subject area. Standard errors are clustered by district. *p*-values from two-sided *t*-tests: *$p<.05$, **$p<.01$, ***$p<.001$.

Appendix A

Teaching endorsements were categorized as follows.

STEM includes: Mathematics; Mathematics - Primary; Mathematics - Supporting; Middle Level Math/Science; Middle Level Mathematics; Middle School Mathematics; ELEMENTARY MATHEMATICS SPECIALIST; MATHEMATICS APPLIED (V610000); Natural Sciences; Biological Science; Physics; Earth Sciences; General Science; Science; Biology; Chemistry; Earth Science; Physics; Science - Primary; Biology - Primary; Chemistry - Primary; Earth Science - Primary; Physics - Primary; Biology - Supporting; Chemistry - Supporting; Earth Sciences - Supporting; Physics - Supporting; Middle Level Math/Science; Middle Level Science; Science; Designated Science: Biology; Designated Science: Chemistry; Designated Science: Earth Sciences; Designated Science: Physics; Designated Science: Earth; Physical Science; Middle School Science; Secondary Education: Biology; Natural Science; Geology; Environmental Science; SCIENCE APPLIED (V620000); STEM TECHNOLOGY (V141000)

ELL includes: Bilingual Education; English as a Second Language; Bilingual Education - Supporting; English Language Learner

Elementary includes: Early Childhood; Elementary Education; Early Childhood Education; Elementary Education - Primary; Early Childhood Education - Primary; Early Childhood Education - Supporting; Early Childhood/Elementary Education; Multiple Subjects; Elementary/Middle School; Prekindergarten; MIDDLE LEVEL-PRIMARY

Special Education includes: Special Education; Early Childhood Special Education; Communication Disorders; Special Education - Primary; Early Childhood Special Education; Special Education; Deaf Education; Early Childhood Special Education; Varying Exceptionalities; Special Education: LD/BH; Special Education II; Mild/Moderate Impairments; Orientation and Mobility; Vision Impairments; Early Childhood Intervention: Special Education; Special Education: Learning Disabilities; Emotionally Handicapped; Emotionally Handicapped; Learning Disabilities; Behavioral Disorders; Educable Mentally Handicapped; Behavioral/Mental Disability; Specialty Area: Visual Impairment; Specialty Area: Orientation and Mobility; SPECIAL EDUCATION-LEARNING HANDICAPPED

Other includes: all other endorsements not previously assigned to the above

Figure A1. Superintendent Postings by District Characteristics

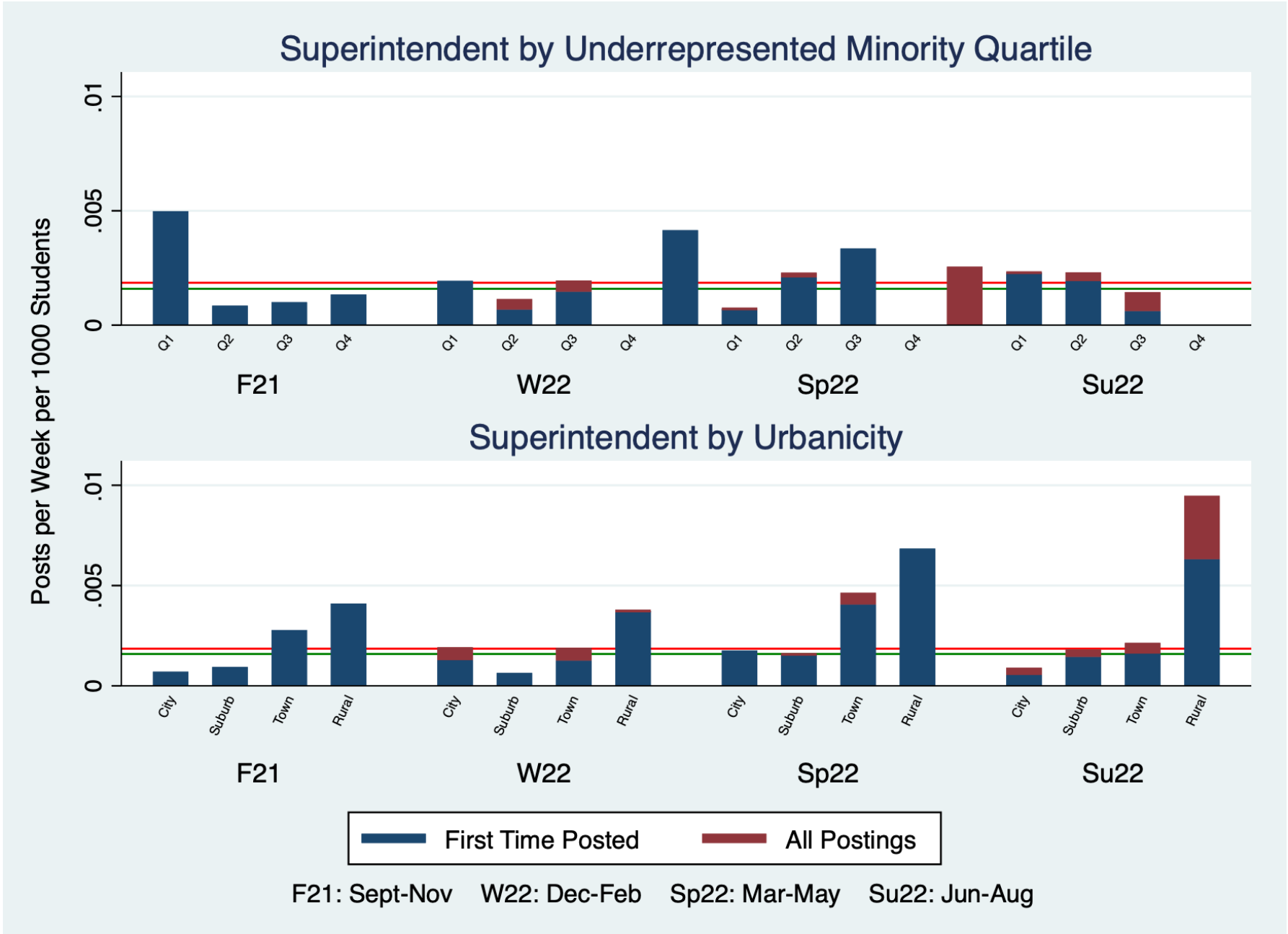


Figure A2. Job Postings per Week per 1,000 Students by Job Category and Quartile of District Percentage of FRL Students

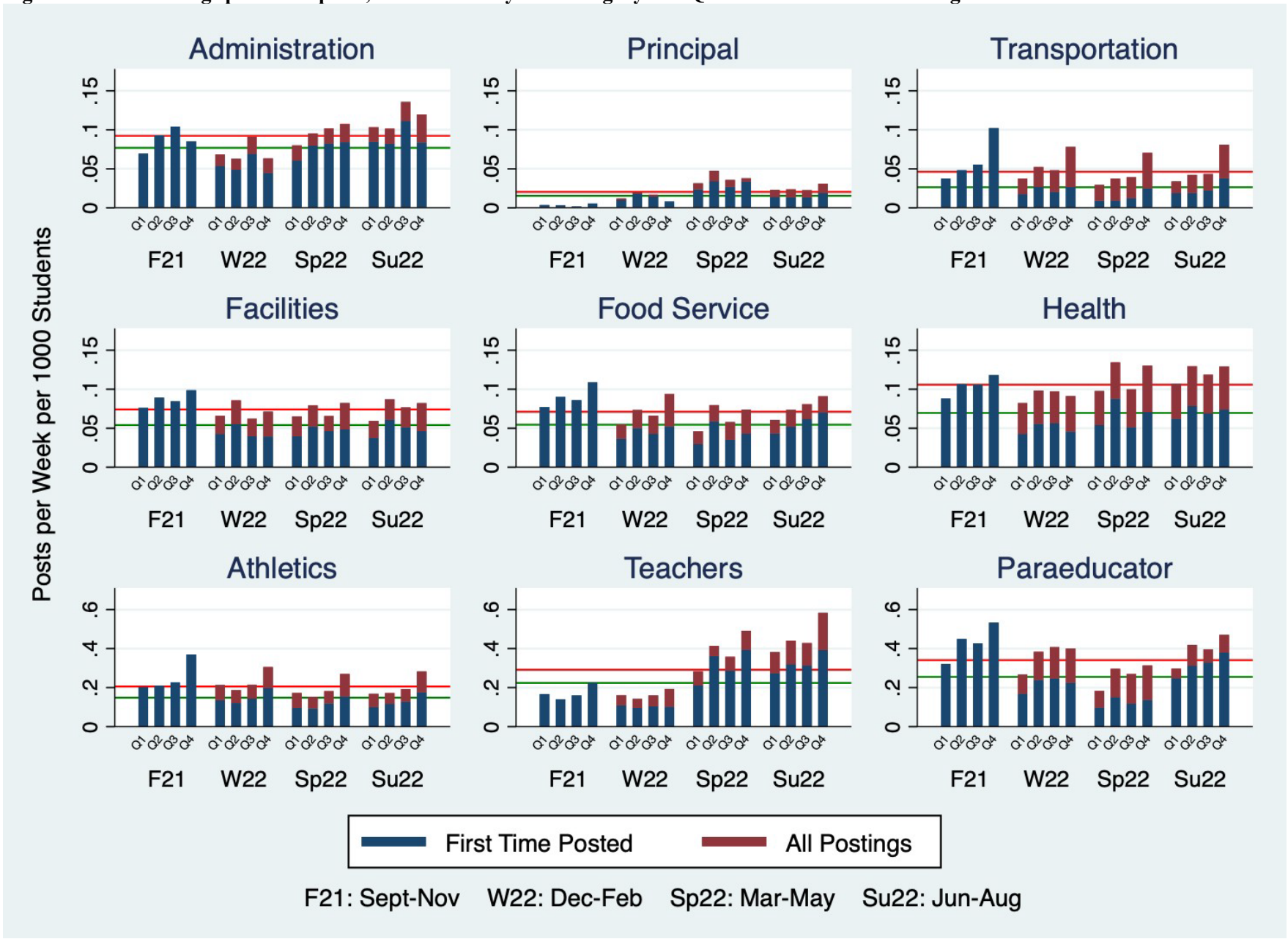


Figure A3. Teacher Job Postings per Week per FTE by Subject Area and Quartile of District Percentage of FRL Students

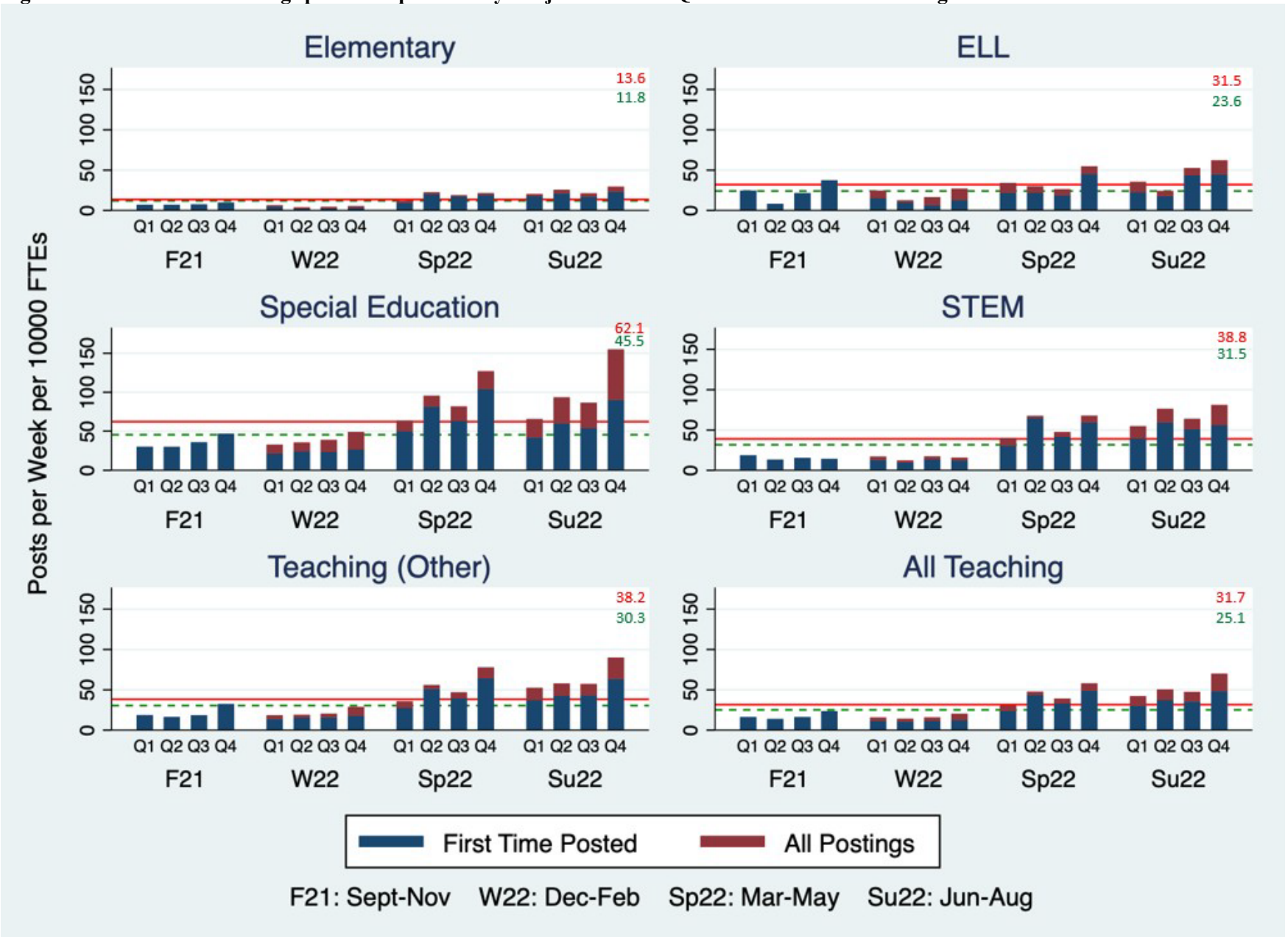


Table A1. Correlations in Monthly Job Postings Across Employment Categories

Panel A: First-Time Monthly Postings									
	Administration	Athletics	Facilities	Food Service	Health	Paraeducators	Principal	Teachers	Transportation
Administration	1								
Athletics	0.5468	1							
Facilities	0.6215	0.3509	1						
Food Service	0.6669	0.5572	0.4697	1					
Health	0.5790	0.4599	0.2757	0.5328	1				
Paraeducators	0.6179	0.4737	0.4531	0.5516	0.6594	1			
Principal	0.5849	0.5051	0.4202	0.4619	0.5034	0.5406	1		
Teachers	0.7389	0.3688	0.3908	0.6461	0.7250	0.5153	0.4907	1	
Transportation	0.0776	0.2557	0.1479	0.3801	0.1861	0.2533	0.0640	-0.0168	1
Panel B: Total Monthly Postings									
	Administration	Athletics	Facilities	Food Service	Health	Paraeducators	Principal	Teachers	Transportation
Administration	1								
Athletics	0.4950	1							
Facilities	0.6214	0.3581	1						
Food Service	0.6837	0.4818	0.4084	1					
Health	0.5922	0.4344	0.2999	0.5900	1				
Paraeducators	0.6156	0.4770	0.4404	0.4844	0.6436	1			
Principal	0.6133	0.5607	0.3960	0.5466	0.5806	0.4474	1		
Teachers	0.7341	0.3767	0.3801	0.6692	0.7536	0.4637	0.5609	1	
Transportation	0.0776	0.2604	0.1258	0.2969	0.1854	0.2492	0.0718	-0.0038	1

Table A2. Marginal Effects on Proportion of First-Time Job Postings by District, Subject Area, and Quarter (Binomial Regressions, Including FRL)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Winter (ref. fall)	-.0040***	-.0040***	-.0040***	-.0077***	-.0077***	-.0077***	-.0076***	-.0076***
	(.0010)	(.0010)	(.0010)	(.0020)	(.0020)	(.0020)	(.0020)	(.0020)
Spring (ref. fall)	.0223***	.0222***	.0222***	.0238***	.0238***	.0238***	.0237***	.0236***
	(.0030)	(.0029)	(.0029)	(.0030)	(.0030)	(.0030)	(.0028)	(.0027)
Summer (ref. fall)	.0277***	.0277***	.0277***	.0276***	.0276***	.0275***	.0275***	.0274***
	(.0026)	(.0025)	(.0025)	(.0026)	(.0026)	(.0026)	(.0024)	(.0022)
SPED (ref. elem)	.0362***	.0363***	.0364***	.0366***	.0356***	.0358***	.0357***	.0362***
	(.0025)	(.0026)	(.0025)	(.0019)	(.0018)	(.0019)	(.0019)	(.0019)
STEM (ref. elem)	.0214***	.0217***	.0216***	.0266***	.0248***	.0252***	.0253***	.0256***
	(.0015)	(.0016)	(.0016)	(.0018)	(.0018)	(.0020)	(.0018)	(.0019)
Other (ref. elem)	.0194***	.0196***	.0195***	.0248***	.0238***	.0241***	.0240***	.0243***
	(.0012)	(.0011)	(.0011)	(.0015)	(.0015)	(.0016)	(.0016)	(.0016)
District % of FRL Students		.0037	.0009	-.0095	-.0104	-.0088	-.0131	
		(.0106)	(.0115)	(.0091)	(.0087)	(.0089)	(.0078)	
District Avg. Fall Test Scores (std)		-.0288	-.0338	-.0245	-.0247	-.0240	-.0131	
		(.0175)	(.0183)	(.0164)	(.0157)	(.0168)	(.0201)	
District Enrollment Change SDs 2021–22		.0008	.0010	.0013	.0018*	.0018*	.0015*	
		(.0008)	(.0008)	(.0007)	(.0007)	(.0007)	(.0008)	
Suburban District (ref. city)			.0004	.0023	.0014	-.0007	-.0028	
			(.0028)	(.0030)	(.0030)	(.0027)	(.0031)	
Town District (ref. city)			.0043	.0057	.0047	.0033	.0031	
			(.0036)	(.0034)	(.0033)	(.0031)	(.0030)	
Rural District (ref. city)			.0062	.0066	.0044	.0038	.0040	
			(.0044)	(.0040)	(.0039)	(.0032)	(.0033)	
District Log Distance to Nearest TEP			-.0007	-.0002	-.0000	.0004	.0003	
			(.0010)	(.0011)	(.0011)	(.0010)	(.0011)	
County Unemployment Rate			-.1018	-.0633	-.0897	-.0241	.1081	
			(.1277)	(.1249)	(.1214)	(.1220)	(.1440)	
Per Pupil ESSER Funding ($1K)				.0030**	.0029**	.0027**	.0032**	
				(.0010)	(.0010)	(.0010)	(.0010)	
Per Pupil Spending 2020–21 ($1K)				.0002	-.0000	-.0006	-.0001	
				(.0005)	(.0005)	(.0006)	(.0006)	
Starting Salary for BA Teachers ($1K)				.0002	.0002	.0001	.0003	
				(.0003)	(.0003)	(.0002)	(.0003)	
Prior Teacher Attrition Rate (Same Subject)					.0668***	.0556***	.0553***	.0398***
					(.0122)	(.0110)	(.0108)	(.0108)
ESD Fixed Effects						X		
Uniserv Fixed Effects							X	
District Fixed Effects								X
N	3408	3408	3408	3408	3408	3408	3408	3408