GETTING DOWN TO FACTS II

Technical Report

Teacher Staffing Challenges in California: Exploring the Factors that Influence Teacher Staffing and Distribution

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September 2018

About: The *Getting Down to Facts* project seeks to create a common evidence base for understanding the current state of California school systems and lay the foundation for substantive conversations about what education policies should be sustained and what might be improved to ensure increased opportunity and success for all students in California in the decades ahead. *Getting Down to Facts II* follows approximately a decade after the first Getting Down to Facts effort in 2007. This technical report is one of 36 in the set of *Getting Down to Facts II* studies that cover four main areas related to state education policy: student success, governance, personnel, and funding.

Stanford University

PACE Policy Analysis for California Education

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Acknowledgements

We wish to thank Edjoin for providing the data we utilize, and Joshua Michaels in particular, for answering detailed questions about the Edjoin data. We also thank the National Center for Analysis of Longitudinal Data in Education Research (CALDER), which is funded by a consortium of foundations. For more information about CALDER funders, see www.caldercenter.org/about-calder. We are also grateful to the funders and leadership of the Getting Down to Facts II project. All opinions expressed in this paper are those of the authors and do not necessarily reflect the views of our funders or the institutions with which the author(s) are affiliated.

Introduction

California, like many states, is experiencing significant challenges with teacher staffing. Numerous headlines over the last few years highlight the difficulties that the state faces in developing, recruiting, and, ultimately, hiring enough teachers (Blume, 2016; Apodaca, 2017; Calefati, 2017; Carver-Thomas & Darling-Hammond, 2017; Times Editorial Board, 2017). In a 2016 survey of over 200 California school districts, roughly 75% of districts reported having a shortage of qualified teachers and a little over four in five districts indicated the problem has gotten worse in recent years (Podolsky & Sutcher, 2016). Similarly, in a 2018 survey of 206 California district human resources (HR) personnel conducted by the California School Boards Association for the *Getting Down to Facts II* studies, 76% of HR staff reported having teacher shortages. This reported trend comports with data collected by the California Commission on Teacher Credentialing (CCTC) which shows that the number of emergency permits, teaching credential waivers and limited assignment permits issued by the state has increased over the last several years, going from approximately 2,100 in 2012-13 to nearly 8,000 in 2016-17; an increase of nearly 300% (CCTC, 2018).[1] These staffing difficulties likely stem from a combination of reasons, including California's relatively high rates of teacher attrition (in some school systems and subject areas), declining enrollments in teacher preparation programs, severe cuts to education budgets alongside recessionary layoffs, and the fact that the recovery from the Great Recession means that California schools attempting to attract and retain teachers are competing in an increasingly tight labor market.

Yet digging beneath the headlines reveals a more complex situation. Conversations about "teacher shortages" often treat teacher staffing issues generically. In reality, however, teacher shortages tend to be concentrated in certain subjects and most acute for certain types of schools (Cowan, Goldhaber, Hayes, & Theobald, 2016; Dee & Goldhaber, 2017). In California, the California Department of Education lists shortage areas in special education and STEM, which is similar to other states, but they also list shortages in less commonly reported areas like English and Physical Education.[2] In 2018, the CSBA survey of human resources personnel shows the most severe shortages in special education, math and science, with 82, 56, and 50% of districts reporting shortages in those areas, respectively.

While schools compete for teachers in high demand fields, and teacher labor more generally, it is important to note that certain types of schools experience varying degrees of difficulty attracting and retaining teachers to fill their classrooms. In particular, there is a significant amount of research investigating the challenges traditionally disadvantaged schools face in securing quality teachers, and a body of evidence shows that measures of teacher

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[1] Districts in California can fill teaching assignments with candidates who are not "fully credentialed" (i.e. they do not meet all the state's licensure training and subject-matter competency requirements) by submitting a permit or waiver request to the state which often entails providing evidence that no qualified candidate could be found and/or that an "acute staffing need" exists. For more information regarding the different types of permits/waivers and the request process see https://www.ctc.ca.gov/docs/default-source/commission/agendas/2012-08/2012-08-5a-pdf.pdf.

[2] For a full listing of shortage areas see https://www2.ed.gov/about/offices/list/ope/pol/bteachershortageareasreport201718.pdf

quality tend to be inequitably distributed across students (e.g., Clotfeter, Ladd, & Vigdor, 2005; Goldhaber et al., 2015, 2017; Kalogrides & Loeb, 2013). These results suggest that certain kinds of schools – most often those with the greatest proportions of low-income, minority and low-achieving students – have the greatest difficulty attracting and retaining quality teachers, and especially in shortage areas (Clark, McConnell, Constantine, & Chiang, 2013; Sutcher, Darling-Hammond, & Carver-Thomas, 2016).

Understanding the nature of school staffing challenges is a significant policy issue. A growing body of research shows that teachers are the most important school-based factor influencing student achievement (e.g., Aaronson, Barrow, & Sander, 2007; Goldhaber & Hansen, 2013) and longer term life outcomes, such as college-going behavior and labor market earnings (e.g., Chamberlain, 2013; Chetty, Friedman, & Rockoff, 2014). Thus, the distribution of teacher quality is an important equity concern. There is also increasing evidence suggesting that the "churn" associated with teacher turnover may itself negatively impact student achievement (e.g., Ronfeldt, Loeb, & Wyckoff, 2013), as turnover disrupts instructional programs and/or impedes efforts to develop collaborative networks of teachers within schools. The findings on teacher quality and attrition provide a strong argument for the need to understand how school district policies affect teacher staffing.

In this paper we use district-level aggregate student and teacher administrative data publicly provided by the California Department of Education (CDE), information on teacher job postings, and local policies established in district collective bargaining agreements (CBAs) and associated compensation policies to assess the association between district staffing needs, district characteristics and school district pay and workforce policies. We address five inter-related questions:

1. What do districts' vacancy postings tell us about California districts' staffing needs and how they vary across districts?

2. What is the landscape of district compensation and workforce policies that affect the California teacher labor force, and how do these policies vary across districts within California?

3. What is the association between district compensation and workforce policies (e.g. those governed by CBAs) and the number of posted vacancies?

4. What is the association between district compensation and workforce policies and the number of vacancies that districts post late (i.e., in the fall for the current school year)?

5. What is the association between district compensation and workforce policies and the duration of job postings?

We believe that it is also important to highlight a final research question that we are unable to answer given data limitations in the state of California (for more on this, see Phillips, Reber, & Rothstein, 2018). In particular, any assessment of the supply and distribution of teachers across schools and districts should necessarily rely on individual student- and teacher-level data that enable researchers to understand what kinds of students, schools and districts have access to teachers of different experience levels, certification and education levels, and, ideally, measures of performance and effectiveness. In spite of efforts to acquire these data, we were not able to access them in time for this report.[3]

This paper proceeds as follows. In the next section, we review some of the many factors that affect districts' abilities to appropriately staff their classrooms, and potential state and district policy responses that can help facilitate teacher workforce management. Sections three and four outline the data, measures and analytic strategies we employ to answer our research questions. Section five discusses the results and section six concludes.

Factors Affecting Teacher Staffing and the California Context

Myriad factors affect the degree to which districts are able to meet their staffing needs; needs which often vary by context and/or change over time. For instance, it is well-documented that schools have quite different applicant pools when advertising for a teaching position (DeArmond, Gross, & Goldhaber, 2010; Goldhaber et al., 2017) and that attrition rates can vary significantly from school to school (Clotfelter, Ladd, & Vigdor, 2011; Hanushek, Kain, & Rivkin, 2004; Imazeki, 2005; Jacob, 2007; Ronfeldt, Loeb, & Wyckoff, 2013). There are also a host of issues that influence whether teachers (or prospective teachers) choose to apply to and remain in a particular school or district, ranging from considerations about pay to working conditions. And while some of these issues may be school specific (e.g. having to do with school leadership or the safety of the neighborhood in which a school is located), others are related to district-level factors (e.g. district pay scales or evaluation policies).

The differences in schools' and districts' challenges in recruiting and retaining teachers also translate into inequities in the distribution of teachers across students. In particular, it is well-established that a student's socioeconomic status, race, and/or locale can significantly impact the likelihood that he or she is taught by either a high- or low-quality teacher. Clotfelter, Ladd, and Vigdor (2005) find that black middle school students in North Carolina are much more likely to be taught by an inexperienced teacher in Math and English than are their white student peers. In three large urban districts in different parts of the country, Kalogrides and

[3] Due to legal restrictions, the California Department of Education (CDE) is unable to provide researchers with student-teacher linkages. At the time of this study, we were not able to acquire data on teacher credentials from the California Commission on Teaching Credentialing (CTC). As a consequence, it was not possible for us to understand how equitably teachers are distributed across students, schools and districts across the state, nor could we assess the distribution of teachers based on measures of performance or effectiveness. Thus, even though California boasts unique data unavailable in other states in the form of detailed CBA data (collected by the research team) and data on teacher vacancies (collected and provided by Edjoin), the lack of individual-level panel data of the sort available in many other states reduces the amount researchers and decision makers can learn in California about issues critical to education policy.

Loeb (2013) observe a similar trend whereby poor, lower-achieving, students of color are more likely to be taught by more novice teachers. Goldhaber, Lavery, and Theobald (2015) provide evidence that not only are disadvantaged students more likely to be taught by less experienced teachers, but they are also more likely to have teachers with lower licensure exam scores and value added (a statistical measure of teachers' contributions to student learning gains on tests). More recent research (Goldhaber, Quince, & Theobald, 2018b) explores the extent to which inequities in the distribution of teachers are associated with different processes – teacher hiring, within and between district mobility of teachers, and exits from the teaching profession. They find heterogeneity in the import of the processes across two states (North Carolina and Washington) and for different measures of teacher quality but note the importance of hiring in both.

In the remainder of this section, we briefly outline the literature on teacher staffing and the factors thought to influence the makeup of a district's teacher workforce, while also describing how these issues relate to the California context, focusing at the end on equity concerns.

Teacher Supply

Districts hire the majority of teachers new to the profession from the pool of teacher candidates obtaining licenses from traditional teacher education programs operated by institutions of higher education (IHEs).[4] A great deal of media attention has focused on recent decreases in the number of teacher candidates both enrolling in and emerging from traditional teacher education programs (e.g., Cowen & Strunk, 2016; Felton, 2017; Lindsay, 2018; Maio, 2016; Sawchuk, 2014; 2016; Strauss, 2015; Zinshteyn, 2018). Nationwide, between 2008-09 and 2015-16 (the most recent year of available aggregate Title II data) traditional teacher education programs saw enrollment decline from just under 640,000 to roughly 350,000 (a decrease of approximately 45%) (U.S. Department of Education, 2018).[5] Although this is a notable and steep decline, the slope and magnitude of this downward trend changes depending on the time horizon one considers (Cowan et al., 2016). If one examines the number of graduates from teacher education programs between 1999-2000 to 2015-16, for instance, there is an ebb and flow pattern to the year-to year-totals, where the number of graduates declined in the early 2000s, then steadily increased leading up to the Great Recession, and then declined again most recently (U.S. Department of Education, 2018). These national trends roughly mirror what has been taking place in California, with at least one important deviation: where the national trend has continued to decrease in recent years, in California the number of new credentials issued and enrollment in teacher education programs have both steadily increased since 2013-14 (California Commission on Teacher Credentialing, 2018). That said, it appears that this slight rebound might be slowing down (see Darling Hammond & Sutcher, 2018, *Getting Down to Facts II*).

[4] In the most recently available Title II report, over 85 percent of individuals completing a credential program were from a traditional teacher education program. For the annual number of completers by credential program type see https://title2.ed.gov/Public/TitleIIReport16.pdf

[5] Over this same period K-12 student enrollment grew by around 2 percent.

A second pool from which districts draw new teachers are those candidates completing alternative teaching programs. Nationwide, just under 15% of new teachers earned their credential through an alternative route (e.g. internship programs attended by Teach For America members, or in the California context, CalState Teach) (U.S. Department of Education, 2016).[6] Reliance on individuals entering teaching through alternative routes varies significantly from state-to-state, although in California this figure is roughly similar at 14.5%, or just over 2,100 teachers (California Commission on Teacher Credentialing, 2015). Similar to the trend in traditional teacher education program completion, alternative program numbers declined following the Great Recession, but in recent years have made modest but consistent gains (e.g. from 28,468 alternative program completers in AY 2012-13 to 31,757 in AY 2015-16).

While these national trends are important, focusing simply on enrollment or production in generic terms ignores the reality that for many years the nation has been producing far greater numbers of newly minted teacher candidates in certain endorsements areas, while producing relatively fewer candidates in other areas. Essentially, the supply of new teachers, when accounting for endorsement or subject area, does not seem to comport with demand (Sawchuk, 2013). For instance, using U.S. Department of Education data, Sawchuk (2013) shows that some states are producing far more elementary teachers than there are openings (e.g., ratios of 2:1 in Michigan, 4:1 in Pennsylvania and 9:1 in Illinois). In Washington State, for example, Goldhaber, Krieg, Theobald, and Brown (2015) provide evidence that over a fifteen-year period (1995-2010) the state produced 12,775 more elementary endorsed teachers than the number of teachers who exited the profession with this endorsement. Meanwhile, over this same period the state produced fewer Science, Technology, Engineering, and Mathematics (STEM) teachers than exited, resulting in a net shortage of approximately 3,719 STEM teachers. Although the picture may be more dire in California, it is impossible to accurately assess the true size of the teacher shortage, or determine in what areas of teaching and geographic locations districts are most in need of high quality teachers. However, research conducted in California by Sutcher, Darling-Hammond, and Carver-Thomas (2016) found that nationally between 20% to 30% of teachers leave the profession in the first five years, a figure that rises to 50% in some school systems, such as schools serving low-income and minority students. Similar to Washington state, it seems likely that the supply of new teachers has not kept pace with those leaving.

State and Local Policies to Address Teacher Shortages

The challenge, then, is not as simple as asking whether we are producing *enough* teachers, but rather, whether we are producing enough of the *right types* of teachers and if these teachers are finding their way into the classrooms that need them. If the answer to the latter, more pertinent set of questions is "no," then we must probe the *causes* of the disconnect between supply and demand, and what *solutions* districts can implement to address this issue.

[6] Includes both IHE and non-IHE programs.

One would think that if districts or states were not able to locate the teacher talent they require they might work to implement policies to address shortage concerns. However, the ability of districts and states to effectively address teacher shortages is often inhibited by both state-level barriers such as state licensure requirements, and teacher pension and compensation systems, as well as district-level policies, including seniority-based protections and specific forms of compensating teachers for "quality" only by their education credential, experience, or, less frequently, by some other credential enabling them to teach in shortage areas.

One seemingly obvious state-level response to teacher shortages might be implementing policies to recruit teachers from neighboring states or locales, especially those that have potential surpluses in teacher labor. Indeed, out-of-state teachers comprise a sizeable portion of state teacher workforces, though the proportion varies from state to state. In California, a 2017 report by the Commission on Teacher Credentialing shows that both the number and proportion of new credentials issued each year to individuals prepared out of state increased between 2012-13 to 2015-16, growing from 2,813 or roughly 18.4% to 3,965 or 25.7% of all new credentials (California Commission on Teacher Credentialing, 2017).

Districts' abilities to hire out-of-state teachers can be curtailed, however, by state licensure requirements. States can address this barrier by simplifying licensure reciprocity requirements. While most state licensure requirements for public school teachers tend to be quite similar,[7] it can often be a rather difficult and lengthy process for existing teachers to become certified in a new state. Ostensibly this should not be the case considering that many states maintain reciprocity agreements, whereby a state recognizes teacher certificates from other partner states. However, while reciprocity agreements may save an existing teacher from needing to complete certain steps or to start completely over in the licensure process, they often still must take and pass state-specific licensure tests, enroll and complete additional coursework, submit necessary paperwork, and await variable processing times to re-achieve their status as a licensed teacher. Anecdotal evidence suggests that this process is burdensome enough to discourage some teachers from pursuing re-certification when coming from out of state. Arbury et al. (2015) interviewed a sample of teachers struggling to relocate and from their interactions concluded, "the obscurity of individual state licensure requirements represents one of the largest obstacles to entry into the state's licensed workforce" (Arbury, Bonilla, Durfee, Johnson, & Lehninger, 2015, abstract).

California is one of several states to sign the National Association of State Directors of Teacher Education and Certification (NASDTEC) Interstate Agreement, which facilitates license reciprocity for member states. However, the NASDTEC-membership does not guarantee full teacher license reciprocity, it only provides information for which licenses will transfer and what additional requirements must be met. California does not offer full reciprocity for out-of-state teachers. Regardless of the number of years teaching, those desiring to teach in public schools in California may need to take a basic skills test, pass a subject-matter examination, or

[7] That is, teachers obtain an initial license following graduation from an approved teacher education program, and after passing basic skills and subject-matter tests.

complete additional coursework to earn an authorization to teach English learners (Goldhaber, Grout, & Holden, 2017).

Another way states can reduce barriers to entry into the teaching profession and address teacher shortages is by removing the requirement for teachers to pass one or more basic skills tests. Requiring teachers to pass certain skills tests may further dampen supply in certain shortage areas, as evidence clearly shows that pass rates are considerably lower for certain subject-based tests. For instance, Darling-Hammond, Sutcher, and Carver-Thomas (2018), in their report released as part of these *Getting Down to Facts II* studies, show that the passing rate on the California Basic Educational Skills Test (CBEST) in 2016-2017 was only 67% for first-time test-takers and the cumulative pass rate was only 76%. Additionally, teacher candidates must show subject matter competency by either completing a specified subject matter program of study or by passing one of the California Subject Examinations for Teachers (CSET). Cumulative pass rates (based on testing from 2003 to 2017) show that approximately 80% of all teacher candidates pass the CSET, but cumulative pass rates are only 65% for mathematics candidates and 64% for physics candidates. The pass rates are even more striking when considering the annual passing rate for 2016-2017: Only 63% for mathematics, 68% for biological sciences, 75% for chemistry, and 52% for physics.

Teacher pension systems, and their portability (or lack thereof) may also affect whether a teacher decides to seek employment in a neighboring state. In contrast to the private sector, teachers are overwhelmingly enrolled in defined benefit pension systems in which their retirement compensation is based on a formula that takes into account a teacher's years of service (aka service credits), their average salary during the last few years of their employment (typically 3-5 years), and an age factor (multiplier based on their age at the time of retirement). Under such systems teachers face a penalty for moving from one state to another, even if their salary profile working across two states is exactly the same as if they maintained employment in only one state (Costrell and Podgursky, 2010; Goldhaber et al., 2015a; Koedel et al., 2011). Indeed, teachers who split their careers across states (and hence pension systems) will often see the value of their pensions cut by 25-50% relative to if they had stayed in the same state.

Consider, for instance, a hypothetical scenario where a 40-year-old teacher with 15 years of experience teaching in Nevada is considering taking a teaching job in California. For simplicity, we will assume the annual salary for each position to be equal at $60,000. If our teacher remains teaching in Nevada for 15 more years, they will receive an annual retirement benefit of $68,086. However, if our teacher moves to take a position in California and then teaches for 15 more years they will receive an annual retirement benefit of $49,894. This represents roughly a 30% reduction in their annual retirement benefit.[8,9] It is important to note

[8] California and Nevada have relatively similar pension structures. Nevada's benefit calculation formula is: 2.25% * Average Final Compensation (AFC) (3-year average) * Years of Service (YOS). California's formula is 2.0% *AFC * YOS. For the calculation we report above we assume an annual salary increase of 3%.

[9] A related issue inhibiting cross-state and cross-district teacher mobility, one that skirts state and local policies, is the granting of tenure. In California, tenure is earned after the accumulation of two years of experience. However,

that this benefit decrease is not being driven by differences between California and Nevada teacher pension formulas (the two states actually have quite similar formulas), but rather it is a result of the importance of accumulated years of service (YOS) credits and average final compensation (AFC) in calculating a final benefit (two features common to the majority of teacher pension systems). Despite teaching for 30 years in each scenario, the teacher who relocates is only able to apply their 15 YOS to each pension system, separately, while simultaneously achieving a much lower AFC in their origin state.

While state policymakers can enact reforms that reduce barriers to entry into teaching or make it easier for teachers to move across state or district lines, district policymakers (district administrators, school boards and teachers' unions) can also implement strategies to ease shortages. In particular, local California districts govern teacher compensation through their negotiated salary schedules. The way teachers are compensated greatly affects labor supply and teacher mobility. The use of uniform pay scales, commonly utilized by districts, which do not differentially compensate teachers based on specialty or subject area, may influence whether certain types of teachers decide to enter the teaching profession. Teachers with specialized training, such as those in STEM, likely have more favorable employment opportunities outside of teaching (Walsh, 2014) which in turn would affect both one's decision to enter teaching as well as how long to remain in the profession. Districts might offer economic incentives -- extra compensation on top of their schedule-allocated salaries, or separate salary schedules for certain kinds of high-need teachers. However, there is little evidence that such economic incentives are broadly used to target teachers in shortage areas. In a review of local policies in place in California school districts in the 2005-6 and 2008-9 school years, Strunk and Zeehandelaar (2011, 2015) show that only 1% of school districts offered salary incentives for math or science teachers in either year, and only 14% and 22% offered incentives to special education teachers in each year, respectively.

Although economic incentives may be a useful and underutilized policy, the research investigating the degree to which financial incentives can be used to attract and retain teachers in subject shortage areas and hard-to-staff schools is somewhat mixed. First, it is not clear that incentives are always aligned with districts' own staffing needs; Strunk and Zeehandelaar (2015) find that, in California, incentives that were in place for teachers with credentials to teach English as a Second Language or Special Education frequently are not aligned with the observable staffing needs of districts. That said, there is some evidence that incentives – even of relatively small values – might aid in retention and, to a lesser extent, in recruitment. Clotfelter, Ladd, Vigdor and Wheeler (2006) find that a short-lived incentive policy in North Carolina that provided $1,800 salary increases to math, science, and special education teachers who taught in low-performing public schools was successful at reducing turnover rates by an

school districts must inform teachers by March 15th of a teacher's second year whether or not they will be reelected and granted permanent status (i.e., tenure). Because of this March 15th deadline, districts have less than a year and a half to determine whether or not a teacher should be granted tenure. Because tenure is a district decision, teachers who move across district lines (or across state lines into a California district for the first time), lose their tenured status and must start a fresh tenure clock if they choose to move into the teaching workforce in a new district in California.

average of 12 percent. In addition, Steele, Murnane and Willett (2010) find that a California incentive policy providing $5,000 per year for four years to attract academically talented new teachers to the state's lowest performing schools increased the likelihood that those teachers would work in hard-to-staff schools by 28 percent. In addition, 75 percent of the teachers receiving the incentive stayed in the schools for at least four years. However, in the most recent large-scale study of sizable economic incentives, Glazerman, Protik, Teh, Bruch, and Max (2013) examined the effects of the Talent Transfer Initiative, a program which offered $20,000 bonuses (paid over two years) to teachers if they moved from advantaged to less-advantaged schools. They find that a relatively low percentage (approximately 5%) of eligible teachers accepted the offer. However, the program may have been a helpful retention tool, as the majority of teachers who accepted the incentive persisted in the less-advantaged schools while they received the bonuses.[10]

Probably the most important local policies that impact teacher supply and shortage are contained in districts' collective bargaining agreements (CBAs) – the contracts negotiated between school district administrators and local teachers' unions. These CBAs contain most of the local policies that govern teacher working conditions, and thus may affect district-specific recruitment and retention of teachers. These policies include those surrounding compensation and benefits, class size, preparation time, evaluations, school year and day schedule, seniority rules and transfer policies, all of which determine critical elements of teachers' working conditions (e.g., Strunk, 2012; Strunk et al., 2018). There is a significant amount of research on the relationship between CBA content and student achievement (e.g., Moe, 2009; Strunk, 2011; Marianno & Strunk 2018; Strunk & McEachin, 2011), but fewer studies have examined the relationship between CBA content or strength and teacher mobility, distribution or supply.[11]

The small group of studies that examine one set of CBA provisions -- seniority-based transfer and vacancy protections – and their association with teacher distribution suggests the transfer protections in teacher CBAs contribute to inequities in the distribution of teachers across schools by influencing patterns in teacher transfers that occur within-district (Cohen-Vogel, Feng, & Osborne-Lampkin, 2013; Feng, 2010; Moe, 2005; Anzia & Moe, 2014; Goldhaber et al., 2015). When CBAs contain provisions that shield senior teachers from involuntary transfers or allow senior teachers first pick of open positions in other schools within the district over less senior teachers, those provisions may be enabling certain teachers to move out of less desirable schools (as proxied by student poverty or minority composition) and stay in more attractive placements. The CBA provisions may therefore be contributing to the inequitable distribution of teacher experience within school districts. For instance, Goldhaber and colleagues (2015b) find evidence that seniority transfer protections play a role in the movement of teachers within school districts; the differences in mobility patterns by teacher experience vary depending on the CBA transfer provisions that govern such moves. In particular, they found that the interaction between teacher experience and school

[10] For more on the effects of financial incentives as a teacher retention tool see Clotfelter, Glennie, Ladd, and Vigdor, (2008), Cowan and Goldhaber (2015), Springer, Swain, and Rodriguez (2016).

[11] We will turn to an analysis of the contents of California CBAs below to better understand the landscape of local policies that affect teacher supply and distribution.

disadvantage in teacher transfer decisions is more extreme in districts with strong seniority transfer protections, with veteran teachers being more likely to leave disadvantaged schools and thus new teachers being more likely to stay in disadvantaged schools.

It has been difficult to pursue this line of questioning in California because of the afore-mentioned lack of access to teacher-level longitudinal data. This is a shame, given that in California the issue of equity and teacher quality has been a matter of considerable debate in the run-up to and wake of the *Vergara v. California* court case (Cal. Ct. App. 2016). In this case, student advocates argued that there was evidence that various state and district policies, including many that are ensconced in CBAs, were contributing to the increased likelihood that low-income and minority students were assigned to lower quality teachers. Eventually the court ruled against the plaintiffs in the case, but it was impossible to provide definitive evidence about the relationship between CBA policies and the equitable distribution of teachers, even though California is one of the few states in which researchers have collected a longitudinal dataset of CBAs to enable such study (e.g., Marianno & Strunk, 2018).

California is hardly the only state to struggle with issues of student equity and teacher quality. In fact, the widespread recognition that teacher quality gaps (TQGs) exist between advantaged and disadvantaged students and that this problem is systemic is likely the impetus behind the US Department of Education launching a recent initiative directing states to devise equity plans and describing the steps they would take to ensure every student has equitable access to excellent educators.[12] Crafting policies to address TQGs first requires a better understanding of what contributes to them and which policies seem to exacerbate them. In the remainder of this report we examine how policies contained in local CBAs might contribute to one aspect of TQGs: the distribution of teacher vacancies.

Data & Measures

This project draws upon three main sources of data, which we discuss below.

District-Level Administrative Data

The California Department of Education makes publicly available cross-sectional district-level data on the demographics and characteristics of students and teachers. From these data, we use aggregate student characteristics including the proportions of students in each district who are under-represented minorities (not White or Asian), eligible for free- or reduced-price lunches, English Language Learners, meet or exceed state standards in English Language Arts (ELA) and math, and average student performance on state standardized tests. We also use district enrollment size and geographic location (urban, suburban, town and rural). Aggregate teacher characteristics include the proportion of teachers in each district who are White, are considered new teachers (either to the profession or the district), have advanced degrees, and the average number of years teaching in the district. We mainly rely on data from the 2014-15 school year to complement the data collected from district CBAs (detailed in the section below).

[12] For more see https://www2.ed.gov/programs/titleiparta/equitable/titleiiequityanalysis1031.pdf

Table 1 provides summary statistics for these data.

Table 1. Summary statistics of district-level administrative data

	2014-2015	
	Mean	SD
Students (in each district)		
% of minority students (excluding Asians and Whites)	0.56	0.26
% of students eligible for free or reduced-price lunch	0.54	0.26
% of students who are ELLs (current and formally LEP)	0.21	0.15
% of students meeting or exceeding standards in ELA on CAASPP	0.46	0.17
% of students meeting or exceeding standards in Math on CAASPP	0.35	0.18
Average standardized scale score in ELA on CAASPP	0.15	0.86
Average standardized scale score in Math on CAASPP	0.13	0.89
District		
Rural	0.08	0.27
Town	0.17	0.37
Suburban	0.49	0.50
Urban	0.26	0.44
Total number of students in each district	11,695	31,189
Teachers (in each district)		
% of teachers who are White	0.72	0.19
% of teachers with 2 years or less of teaching experience	0.13	0.07
% of teachers with 2 years or less of district experience	0.19	0.09
Average # years teaching of teachers	13.71	2.16
% of teachers who have a doctorate	0.01	0.02
% of teachers who have a MA degree	0.22	0.16

	2015-2016	
	Mean	SD
Staffing difficulties (in each district)		
Average # of vacancies per 1,000 students[1]	7.41	5.90
Average duration of job postings (in days)	41.61	29.40

We also generate two measures that we believe may help to explain potential shortages faced by districts: 1) being located on the state borders with Arizona, Nevada or Oregon); and 2) the proximity (in miles) of the district to a Teacher Education Program (TEP). We include the former measure because of many of the reasons we highlight above. Teachers who live near the border have the option of teaching in two drastically different state contexts. We give the example above of the similarities between the Nevada and California pension systems, but California differs from Nevada and other border states in their licensure reciprocity, and other barriers to entry (e.g., standards for gaining a license).[13] We include the latter measure because TEPs often use nearby districts as placements for student teachers, and research shows that student teachers often gain and accept employment in the district in which they did their training (Krieg, Theobald, and Goldhaber, 2016).

[13] Of course there may be other instances of teachers who move across state lines, which we cannot capture using this analysis.

CBA and Salary Data

This paper also draws upon a dataset of contract provisions and salary schedules for California school districts from the 2014-2015 school year to examine individual provisions in the CBAs that may affect teacher supply and distribution and to generate measures of district desirability for all teachers, teachers who are new to the profession, those who continue to teach in the district, teachers who are not new to the profession, but are new to the district, and teachers in shortage areas. We combine measures of teachers' negotiated compensation at different points on their salary schedules and "district desirability" with California school district demographic and performance data.

We limit our sample to CBAs from school districts with four or more schools. The focus on districts with four or more schools is because many contract policies (e.g., teacher transfer and grievance provisions) do not operate in smaller districts or operate to a much lesser extent than similar provisions in larger districts. We collected 495 (86%) of California school district contracts with four or more schools from the 2014-15 school year.

Our measures of district desirability are developed from a close content analysis of the collected CBAs. We selected particular provisions and then marked them as potentially positive or negative for different types of teachers (i.e., all teachers, new teachers, shortage area teachers, those continuing in district, and those new to the district). For example, the provision, "Does the CBA provide a credit on the salary schedule for military experience?" could indicate a recruitment strategy that is potentially desirable to teachers new to the district. Similarly, whether or not the CBA outlines a required new teacher mentoring program might make that district more desirable to incoming new teachers. The provision of economic incentives (bonuses) for math or science teachers may help districts recruit teachers in those specific shortage areas. Other provisions send school culture signals, such as grievance procedures or layoff/transfer processes, which in turn can be thought as positively or negatively desirable for all types of teachers, new and those already teaching in the district.

The final items included in the model were selected according to standard test item selection methods. Following Strunk and Reardon (2010), we performed exploratory Cronbach's alpha analysis, removing items that were not associated with the underlying trait of desirability at above 0.10. Then we re-ran the alpha-item correlations and removed items that were not associated with contract desirability at above 0.25. The total number of items used in the model is reduced substantially by using this method but are more tightly aligned with the underlying trait.

The final measures are sums of the final set of CBA provisions identified via the process described above. Each district's score on an index measure is simply the number of provisions from the set for that measure that can be found in the district's CBA. We generate several measures of "desirability," assessing the prevalence of items that might make CBAs desirable to 1) all teachers in a district; 2) teachers who teach in a "shortage area"; 3) new teachers who are just entering the profession; 4) teachers who are new to a district but not necessarily new to

the profession; and 5) veteran or continuing teachers. Tables 3-7 provide the individual CBA provisions included in each desirability measure. The first column of Table 8 provides the summary statistics for the desirability indices. These means can be interpreted as the average proportion of CBA provision items in that index in California CBAs in our sample.

Edjoin Data

Job posting data are provided by Edjoin, a national organization that assists school districts with listing education job position openings. The Edjoin data span from July 2014 through December 2018 and include just under 400,000 unique district job postings throughout California, of which, a little over 130,000 are specific to teacher vacancies. There are approximately 98,155 teaching position openings stemming from 898 unique California public school districts, or roughly 85% of the total districts in the state.[14] The data include information on the position posting date, the title of the position, whether the position is full time or part time, as well as a number of other descriptive elements related to the various openings.

We use the Edjoin data to assess the degree of staffing difficulties faced by California districts. While these data likely represent the best California statewide information on teaching vacancies, they are limited in some respects. For instance, while the vast majority of districts using Edjoin follow guidelines when developing their job postings, flexibility within their system allows districts the opportunity for entry error. In some cases we are unable to link a posting to the corresponding district because the posting agency field (i.e. the agency for which the posting is submitted) contains either missing or incorrect information. California County Offices of Education, for example, often make postings on behalf of the school districts they serve, but in some cases a posting does not specify which particular district a position relates to. In exploring the data, and through correspondence with Edjoin official(s) we have established other instances of limitations with the data and have added notes regarding these issues while describing the measures below (J. Michaels, personal communication, July 25, 2018).

We use the Edjoin data to construct measures of teacher vacancies at the district and year level. We take the number of teaching position postings listed by a district in a year and divide that by the number of students in that district and year.[15] This measure is presented in Table 1 as the mean number of teaching position vacancies per 1,000 students.[16] We are also interested in the timing and duration of postings. Some of the teacher hiring literature defines

[14] Edjoin also serves private schools, county offices of education (COEs) (COEs in turn sometimes post on behalf of school districts), post-secondary institutions, and some alternative programs/schools which accounts for the difference in linkable postings.

[15] The Edjoin data also contain a measure for the number of openings associated with a position. However, this measure is not consistently utilized by districts. Therefore, each posting is treated as a single opening which may suggest measures of vacancy and/or total postings by districts are conservative.

[16] We also explore using a vacancy measure based on the number of teachers in each district. These two measures have a correlation of above 0.95. We elect to use the former per student measure as it has better coverage across districts and years. The latter measure is available upon request.

late postings as any hiring done over the summer months and during the first months after the start of the school year (Levin & Quinn 2003; Keo et al., 2017; Papay & Kraft, 2016). Using the date of a job posting we are able to track the number of postings listed from month-to-month and we are also able to create a late posting flag for any posting occurring after the start of the school year through the end of the calendar year (e.g. September-December). We then use these measures to ask, "What is the number and percentage of late job postings?" We report on how late posting figures break down by various district types and by posting subject areas (elementary, STEM, special education, ELL, and other).[17]

We also create a measure of the duration of the job posting – how long it was posted, which should provide information about how difficult it was to fill. However, we note at the outset that there are substantial limitations to the posting duration measure. While around 95% of postings have durations falling within 365 days, in some cases districts enter a posting end date that is chronologically before the original posting date. We assume in these cases that districts are back-dating the posting deadline field so that the position no longer appears to potential applicants, but we cannot confirm this or other assumptions about this measure. Because of the potential noisiness of the duration measure, we view our duration results only as loosely suggestive of relationships between district characteristics or CBA provisions and staffing difficulties.

Analytic Dataset

The final analytic dataset includes merged data from the three sources listed above (i.e., district-level administrative data, CBA and salary data, and Edjoin data). For consistency purposes we report outcomes based on the restricted sample of 495 unique school districts (described in the *CBA and salary data* section).[18] The final dataset includes administrative and Edjoin data for four academic years (e.g. 2014-15 to 2017-18 school years) and contain 87,862 district-year posting observations. CBA specific analyses are limited to 2014-15, while the Edjoin regression analyses are limited to 2015-16 (includes 28,908 district-year postings).[19] Summary statistics for these samples are reported in Table 1.

Analytic Approach

We rely on purely descriptive methods to assess the landscape of local workforce policies and the distribution of teacher vacancies in California, and how they vary across districts. To examine relationships between workforce and compensation policies and local teaching shortages, we run simple district-level regression models that merge the CBA data with the Edjoin measures. This allows us to identify how policies found in local CBAs are

[17] We extract posting subject areas using the listed position titles, grade (if listed), school (if listed), and endorsements required (if listed). If a teaching position title lacks a subject area descriptor but is at the elementary level the posting is assigned to "Elementary", and for secondary grades to "Other."

[18] Results for staffing difficulties for the full Edjoin data (898 unique school districts) are available upon request.

[19] Because the Edjoin data begin in July 2014, we select the 2015-16 school year for Edjoin regression analyses to have complete data for the calendar and academic year. In addition, this allows us to run lagged measures on select controls that would be influential in year t-1 but less so in year t (e.g. average student achievement).

associated with the number of vacant teaching slots posted, the proportion posted after the school year begins, and the average duration of vacancy postings, all controlling for other district characteristics that may affect vacancy rates. Together, these analyses help paint a picture of the kinds of policies that local districts negotiate to help address teacher shortages in California, and to take a first cut at the effectiveness of such policies. Of course, we cannot draw causal claims from these analyses.[20]

Using the available data, we estimate models of the following form:

$$(1)\ VACANCY_d = \beta_0 + \beta_1 CBA_d + \beta_2 \ln(enrollment)_d + \beta_3 \%\mathrm{FRL}_d + \beta_4 \mathrm{urban}_d + \beta_4 \mathrm{rural}_d + \varepsilon_d$$

Where $VACANCY_d$ is one of three outcome variables: 1) the number of vacancies per 1000 students (Vacancy Rates); 2) the proportion of vacancies posted late; or 3) the duration of the vacancy posting. CBA_d is one of several CBA compensation or workforce policies: Desirability indices for all teachers, shortage teachers, teachers new to the district, teachers new to the profession and continuing teachers; Negotiated class sizes for elementary (K-5) middle (6-8) and secondary (9-12) grades; negotiated salaries for teachers (with and without master's degrees) with 0, 5, 10, 20 and maximum scheduled years of experience; and salary structure as measured by the returns to experience in the first five years of teaching in a district and the measure of backloading discussed above. We include controls for district size (the natural log of enrollment) the proportion of students who qualify for Free or Reduced Priced Lunch (FRL), an indicator for Rural District, and the Urban or Rural location of the district (with suburban and town as the reference category). We also include an indicator for whether or not the district had any postings in Edjoin (not shown) to enable us to include districts without any postings in our analyses but not have these "0" outcome measures affect our results.

In addition, we run regressions similar to the model above, this time substituting the CBA provisions with our measures of border district location and proximity to the nearest TEP. These regressions are intended to answer our third research question, about the distribution of teacher vacancies and duration across different kinds of school districts.

Results

In this section, we address our five research questions in turn: 1) What do districts' vacancy postings tell us about California districts' staffing needs and how they vary across districts?; 2) What is the landscape of district compensation and workforce policies that affect the California teacher labor force, and how do these policies vary across districts within California?; 3) What is the association between district compensation and workforce policies (e.g. those governed by CBAs) and the number of posted vacancies?; 4) What is the association between district compensation and workforce policies and the number of vacancies that districts post late (i.e.,

[20] We cannot interpret the findings as being causal given that matches between teachers and schools/districts are only observed when preferences of teacher applicants and district hiring officials align (Boyd, Lankford, Loeb & Wyckoff, 2013).

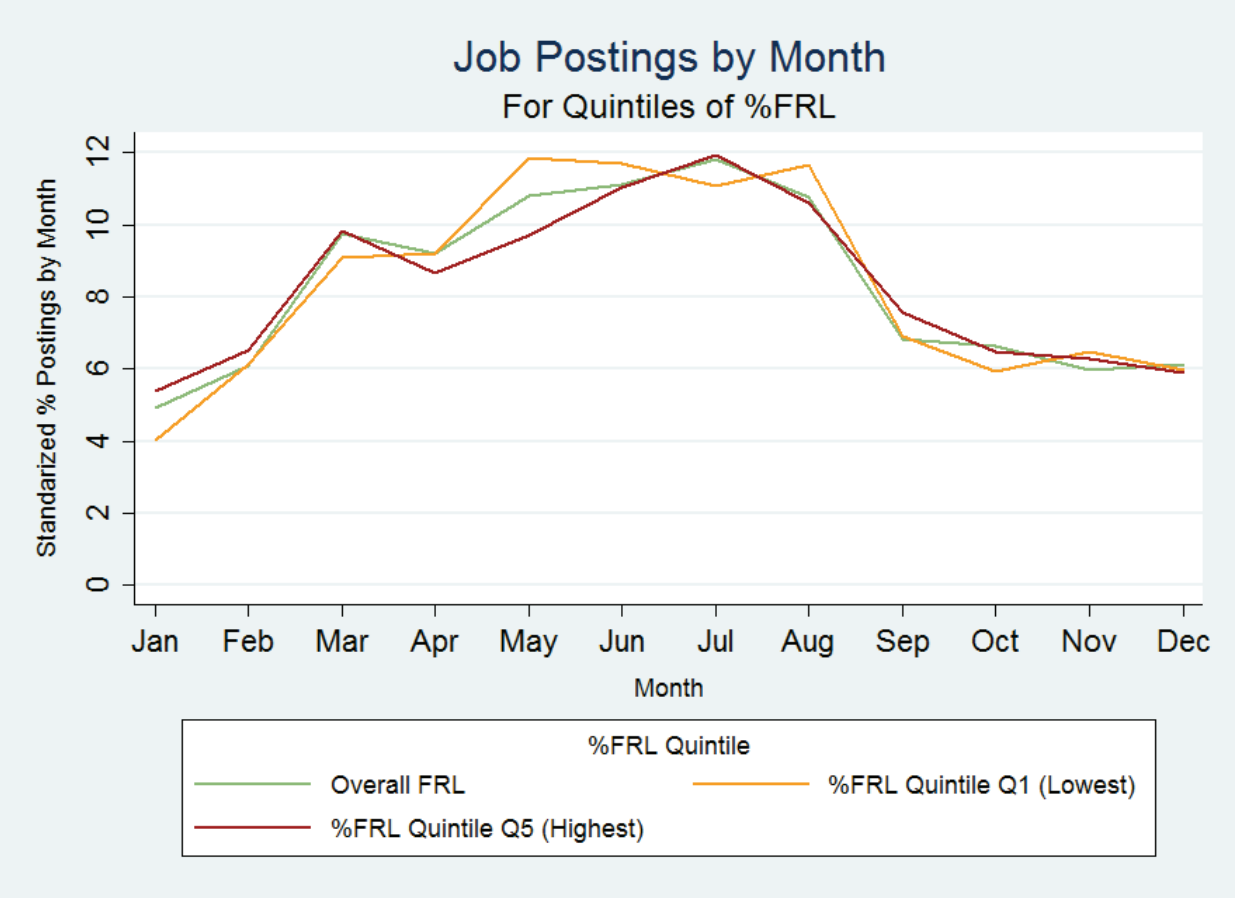
in the fall for the current school year)?; and 5) What is the association between district compensation and workforce policies and the duration of job postings?

What Do Districts' Vacancy Postings Tell Us about California Districts' Staffing Needs and How They Vary across Districts?

We begin to assess the staffing needs of various districts by looking at the *timing of the distribution of postings* by different types of districts for different types of teachers. As noted above, we assume that postings that happen in the spring of a year are for the following school year (i.e. these represent early postings), and that postings that happen in the fall of a year are for that same school year (i.e. represent late postings). Figures 1–3 describe the number of cumulative postings for teaching positions throughout the year for school districts that vary by poverty (as measured by the percentage of FRL students), achievement (as measured by the average of California Assessment of Student Performance and Progress (CAASPP) score in ELA and Math), and urbanicity.[21] We split districts into quintiles (Q1 are the lowest poverty and lowest performing and Q5 are the highest poverty and highest performing districts), and compare districts in the first and fifth quintile of districts to the overall distribution. Figure 1 shows that, in low poverty (bottom quintile) districts, 11.8% of the teacher postings throughout the year are posted by May of that year, whereas this is the case for only 9.8% of postings for low poverty districts).

[21] These figures are created by averaging the monthly percentage of postings for each district across years 2015-2017—as those are the years in which the Edjoin data covers the entire calendar year—and then averaging across all districts in each category of poverty, achievement, or urbanicity respectively. The analysis is restricted to the 495 districts that can be merged to the CBA and salary data described above. Comparable data for the full 898 districts in the data supplied by Edjoin are available upon request. The results for the full Edjoin dataset look qualitatively similar those described in the main text.

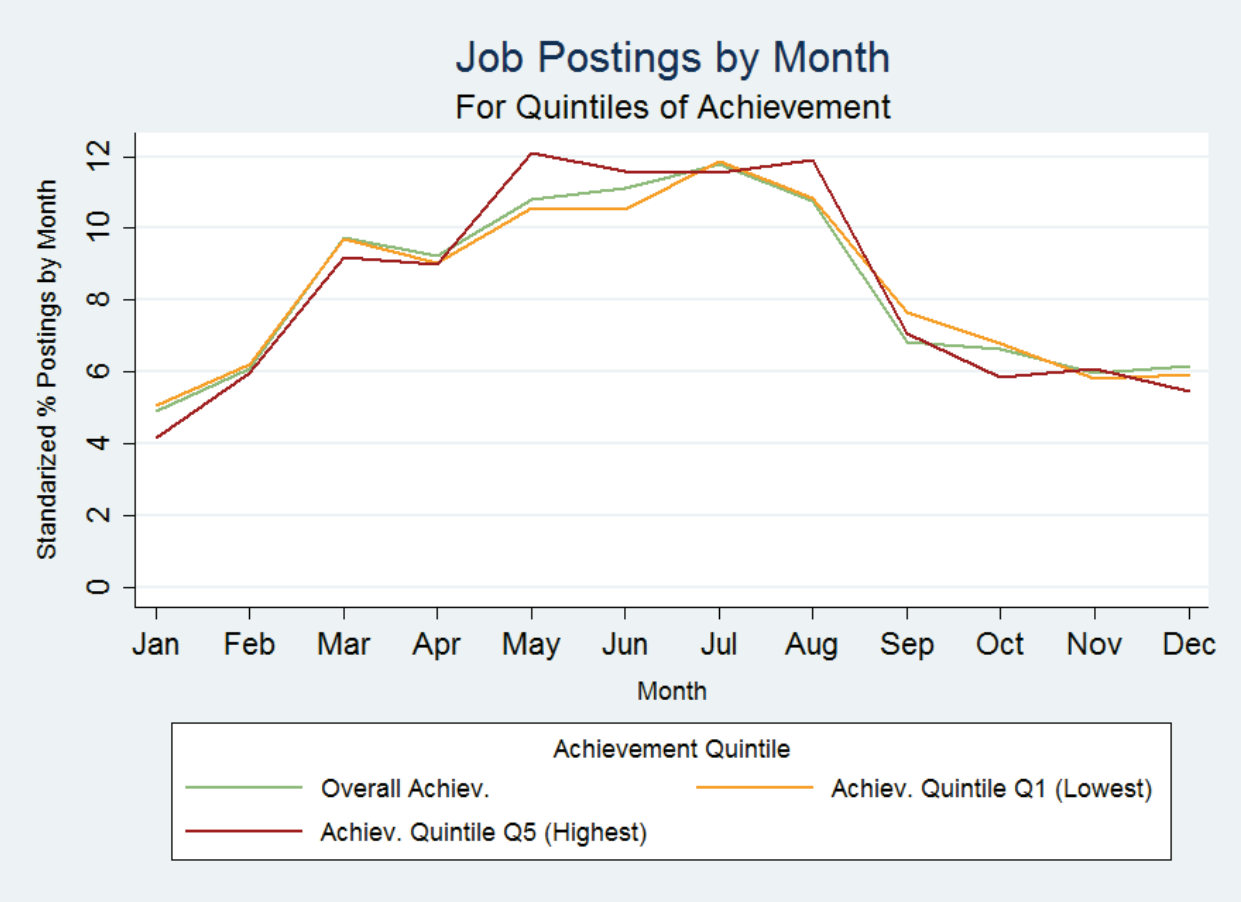
Figure 1. Percent postings throughout the year by FRL



Note. Total number of job postings: N=87,862. Job postings are standardized by school district and year. Result are based on all years of available data (e.g. 2014-2015, 2015-2016, 2016-2017). The overall %FRL plot is based on all quintiles of data. The %FRL quintiles are estimated using administrative data from California Department of Education (CDE). Assignment to quintile is done by taking the district year mean of %FRL across all years.

Figures 1 and 2 show that there are differences between districts in terms of poverty and achievement status in the timing of postings. Postings peak in July for high poverty districts but in May for low poverty districts. Moreover, roughly 25% of postings for low poverty (Q1) districts occur after August as compared to 28% of postings for high poverty (Q5) districts. We observe similar discrepancies by student performance, with high-performing districts posting earlier and having fewer late postings. The differential in the timing of postings may in turn have implications for districts' abilities to fill vacancies with high-quality teachers given the aforementioned (Levin & Quinn 2003; Keo et al., 2017; Papay & Kraft, 2016) evidence connecting hiring data and teacher quality.

Figure 2. Postings throughout the year by achievement

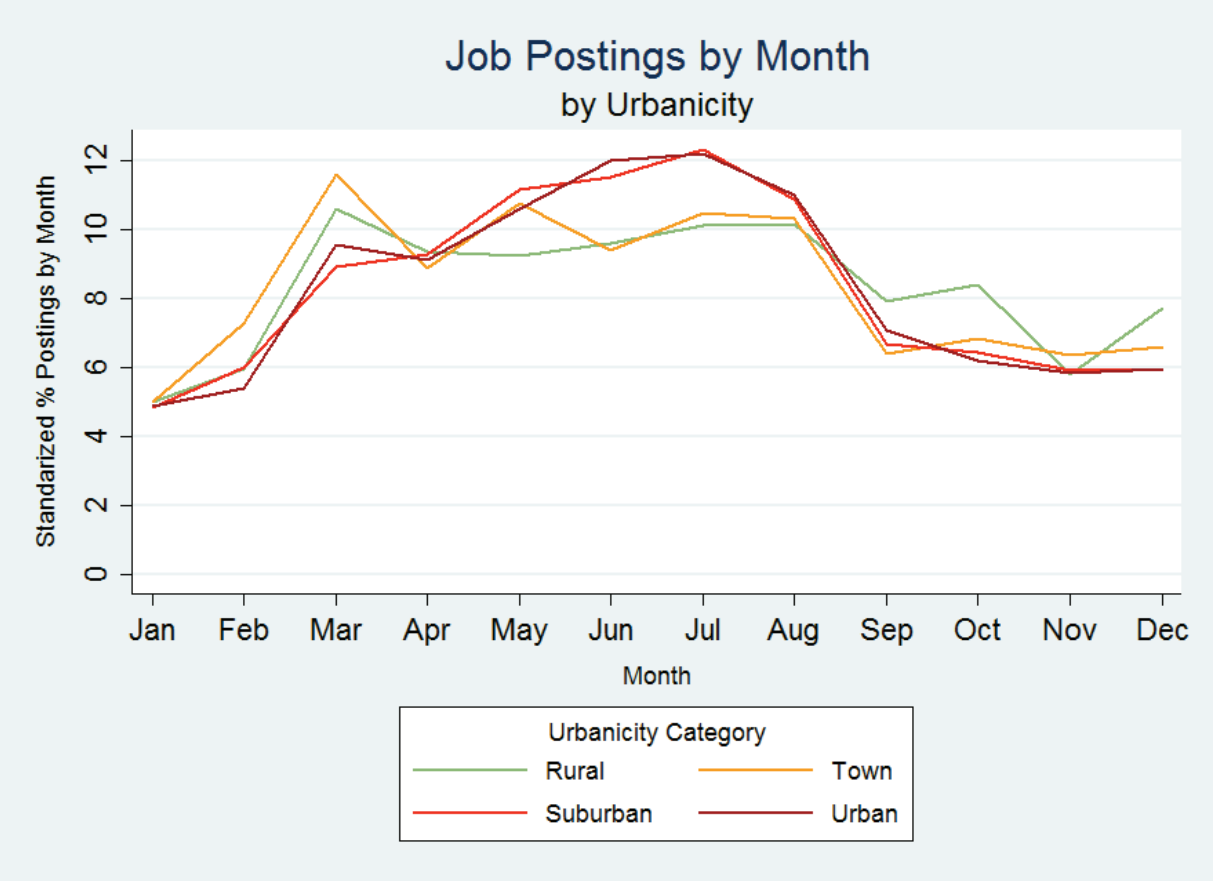


Note. Total number of job postings: N=87,862. Job postings are standardized by school district and year. Result are based on all years of available data (e.g. 2014-2015, 2015-2016, 2016-2017). Achievement is measured by the average of California Assessment of Student Performance and Progress (CAASPP) score in ELA and Math. The overall achievement plot is based on all quintiles of data. The achievement quintiles are estimated using administrative data from California Department of Education (CDE). Assignment to quintile is done by taking the district year mean of achievement across all years.

There are even larger differences in hiring timing by urbanicity (shown in Figure 3). Less urban areas are far more likely to post positions early. For instance, 31% of yearly job postings in rural districts and 33% of yearly postings in town districts occur prior to May, whereas urban districts post only 29% of their openings in the same time frame. One possible explanation for this finding is that urban districts are more likely to have CBA provisions requiring that candidates for a position who are internal to a district get a first shot at a new job opening, i.e. districts cannot post a job for external applicants before a set date by which internal (transfers) candidates get a first shot at the job (Marianno et al., 2018; Strunk, 2012).[22]

[22] However, we test for this by including such provisions in the CBA measure in equation (1) and find no consistent relationship between these provisions and our measures of vacancy rates or late posting. Results available upon request.

Figure 3. Postings throughout the year by urbanicity

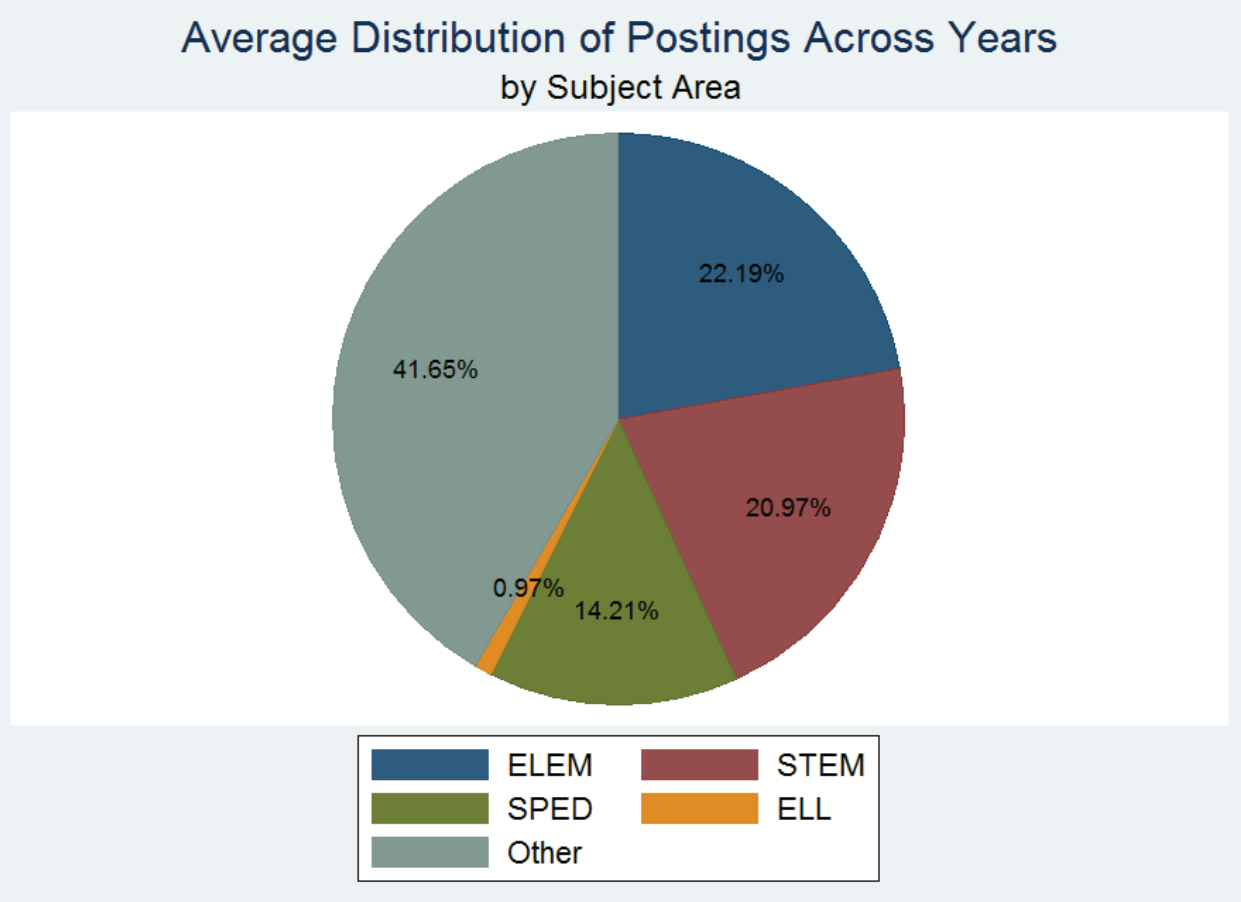


Note. Total number of job postings: N=87,862. Job postings are standardized by school district and year. Result are based on all years of available data (e.g. 2014-2015, 2015-2016, 2016-2017). All Districts: N=495, Rural Districts: N=38, Town Districts: N=89, Suburban Districts: N=246, Urban District: N=122. Urbanicity categories are assigned based on the mode category observed across all years of the data.

Next, we turn to the type of teachers that districts are seeking. Figure 4 shows the percentage of postings by subject area (Elementary, STEM, Special Education, ELL, and Other[23]), averaged across all years. Approximately 22% of postings are for elementary teachers, with another 21% seeking STEM teachers. Fourteen percent of postings are for special education teachers. A small number (less than 2% in any year) are for ELL teachers. The largest category of postings for all types of districts in all years is for the *Other* category (42%).

[23] The Other category is inclusive of all other subject areas (i.e. everything from English to Physical Education to Art and Drama).

Figure 4. Percent breakdown of postings by subject areas



Note. Total number of postings: N=87,862. Percentages displayed are based on raw counts of job postings and are influenced by number of postings by district and year.

These teaching vacancy rates differ substantially from actual district staffing by subject area. For instance, in most K-12 districts throughout the country, about 32% of teachers are considered elementary teachers whereas only 15% are STEM teachers (U.S. Department of Education, 2016). Thus, to gain a better sense of the *relative needs* for specific teacher skills in California, we divide each share by the proportion of teachers in a subject area, creating a *relative needs ratio*. More explicitly, we first take the percent of postings by subject area at the district-year level, and then using figures derived for California from the National Teacher and Principal Survey (NPTS) 2015-16 estimate over the percent of positions associated with those subject areas.[24] Under this weighting scheme, postings across all areas would have an equal percentage if the relative staffing needs were the same across subject areas. However, there are cases where the proportion of postings exceeds the estimated existing staffing, meaning that the relative needs ratio is higher than 1, which in turn suggests that the need is relatively

[24] NPTS 2015-2016 is designed to be a nationally representative survey which collects data on a range of education related issues, one of which is, teaching positions by subject area.

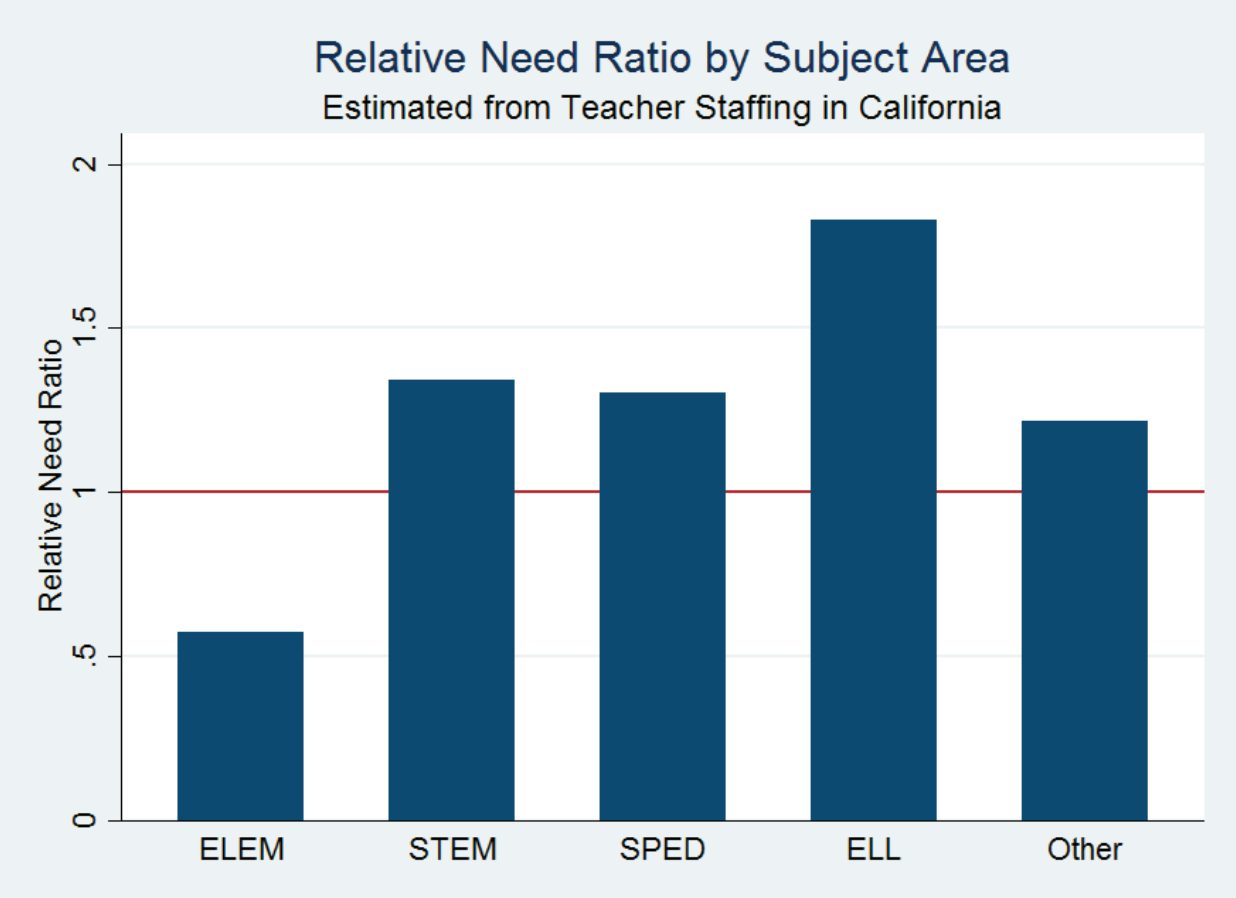
high in that subject area (the converse is also true in that a ratio of less than 1 suggests that the relative need is low).

Figure 5 shows the estimated relative need in each subject area using the weighting scheme described above. The relative needs ratio in Figure 5 strongly reflects the difficulties that districts face in staffing STEM classrooms. Specifically, while 21.0% of the postings are for a STEM teacher, only 15.6% of teachers are in STEM areas, meaning that, on average, STEM postings are about 1.3 times as likely as one would expect relative to the proportion of STEM teachers in districts. We also observe high relative needs for special education teachers, teachers who fall into "other" categories, and ELL.[25] By contrast, districts have relatively little difficulty staffing Elementary positions; 22.2% of all postings are for an Elementary position, but 38.7% of California teachers are Elementary teachers, so that Elementary positions are on average .58 times as likely as one would expect.[26] The finding that schools in California face more difficulty staffing special education, ELL, and STEM classrooms is very much in line with evidence about school staffing difficulties nationally (Cowan et al., 2016; Dee and Goldhaber, 2017).

[25] The percentage of teachers in each subject area are based on the 2015-2016 NPTS estimates of California teachers. Results are qualitatively similar when percentages are based on nationally representative (rather than California specific) estimates of staffing from the 2015-2016 NPTS.

[26] It is worth mentioning that estimates based on ELL staffing are limited. The 2015-2016 NPTS estimates California having ELL teachers account for 0.53% of teachers in the state, whereas the national estimate is 2.05%. While the 1998 California Proposition 227 imposed "English Only Classrooms", that was only recently overturned in 2016 by Proposition 58, the estimate still seems low.

Figure 5. Weighted proportion of postings by subject area

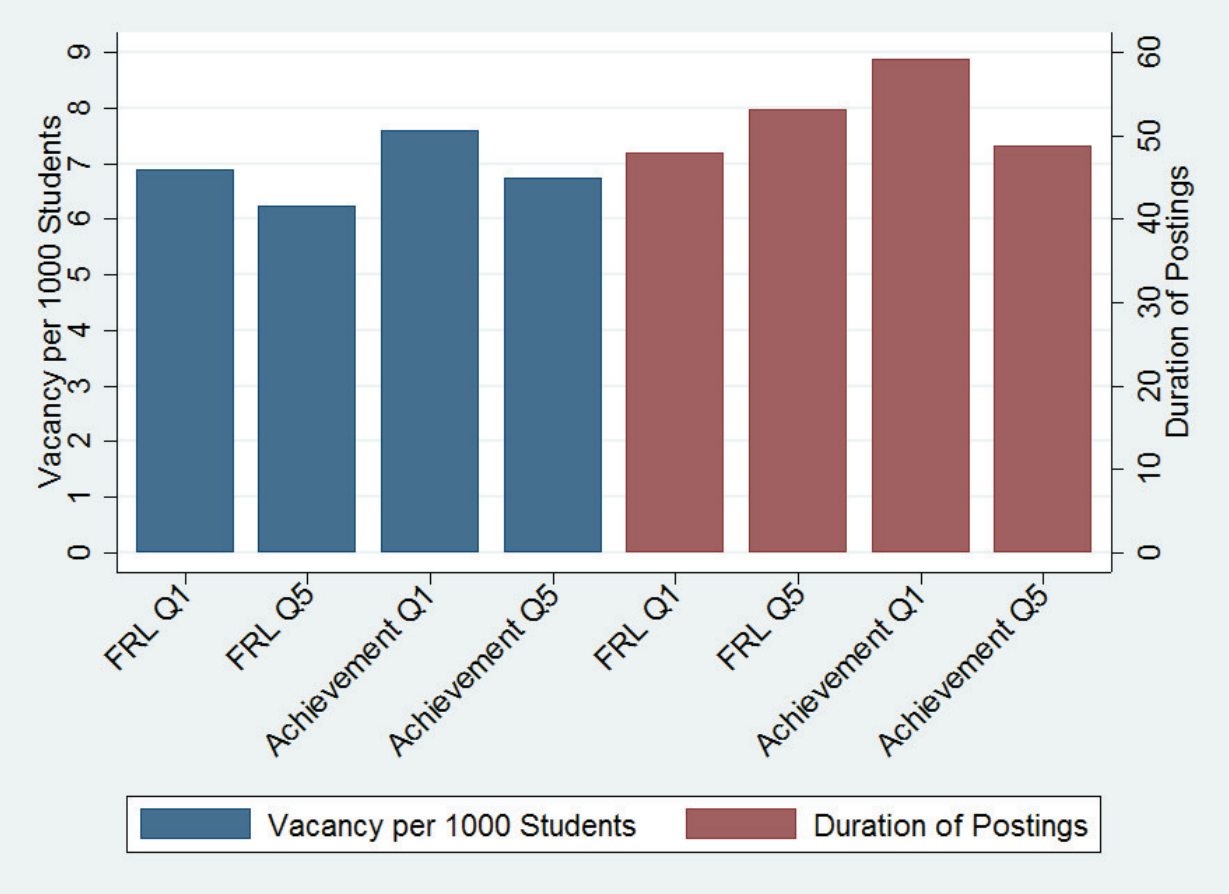


Note. Total number of postings: N=87,862. Proportion of teachers in each subject category estimated from 2015-2016 NTPS survey, restring the sample to California respondents.

Figures 6 and 7 report measures of district need by poverty and achievement quintiles (Figure 6) and by urbanicity (for both figures, the left vertical axis and blue bars shows vacancies as a measure of the number of postings per 1000 students. The right vertical axis and red bars provides the average duration of postings.[27] The evidence clearly shows that lower achieving (bottom quintile) districts (shown on the right sides of each figure) have relatively more vacancies – roughly twice the number per 1000 students than higher achieving (top quintile) districts. We also see that lower-achieving districts tend to have their postings available for longer periods – approximately 11 days – before they are filled.

[27] The vacancy measure reported is average vacancies per 1000 students. Only postings that had a positive reported duration spanning less than a year were used, which accounts for 98.54% of the overall postings from the CBA district restricted sample.

Figure 6. Poverty and achievement bar charts vacancies postings/duration



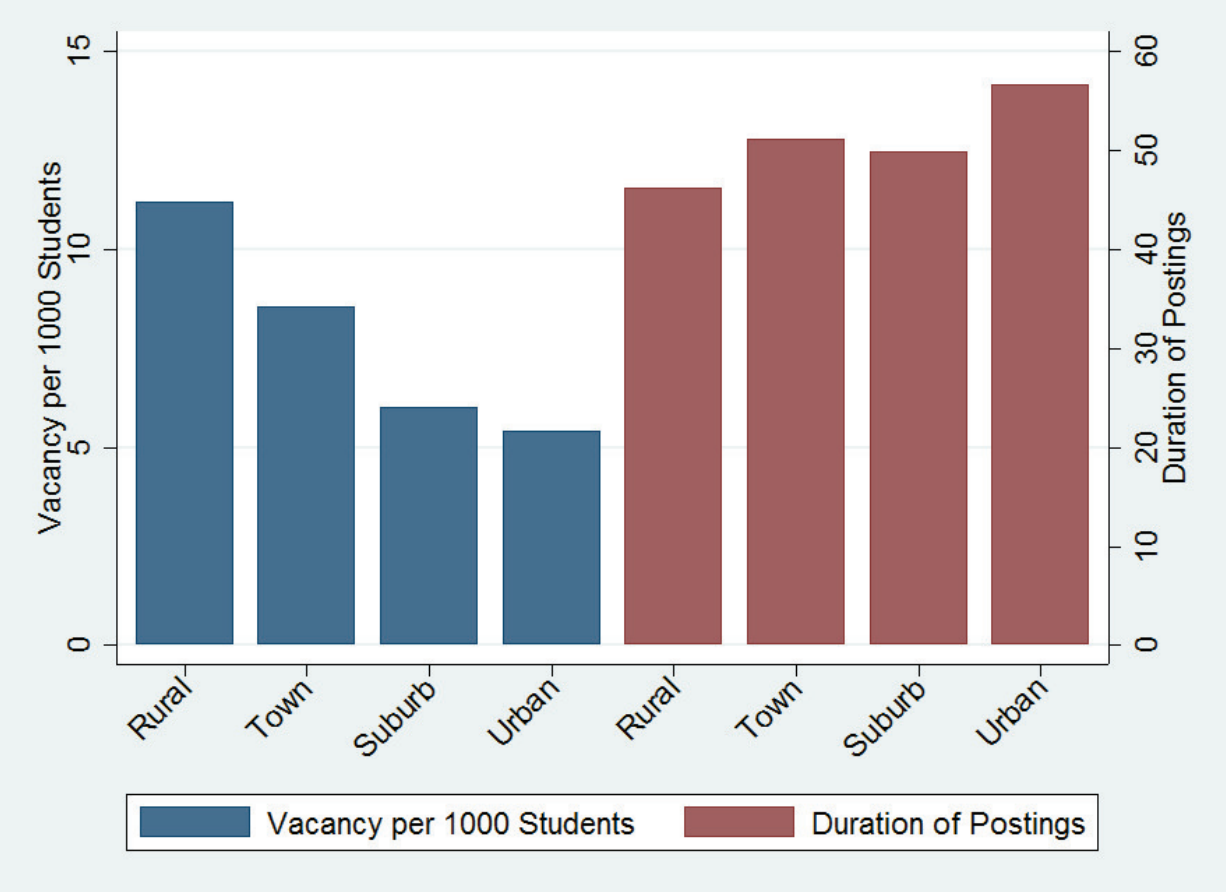
Note. Total number of postings: N=87,862. The FRL quintiles are estimated using administrative data from California Department of Education (CDE). Assignment to quintile is done by taking the district year mean of FRL across all years. Achievement is measured by the average of California Assessment of Student Performance and Progress (CAASPP) score in ELA and Math. Assignment to quintile is done by taking the district year mean of achievement across all years. Only postings that had a positive reported duration spanning less than a year were used, which accounts for 98.5% of the overall postings from the 495 districts restricted sample.

Interestingly, the picture is less clear when we examine the economic disadvantage of districts, shown on the left side of Figure 6; high-poverty districts have fewer vacancies per 1000 students than do the low-poverty districts, but the average posting duration is about 6 days longer in the highest quintile FRL districts than the lowest quintile districts. This finding for the postings per student by FRL is counterintuitive. It appears, however, that this is at least partially an artifact of the subset of districts in the CBA sample (those with four or more schools). The full sample follows the intuition that higher FRL tends to be associated with (slightly) higher vacancies (these results are available upon request).[28]

[28] The CBA sample predominantly excludes small rural districts: 13% of all rural districts are in the CBA sample. Furthermore, only 8% of top quintile FRL rural districts are in the CBA sample, while for all other urbanicity categories 70% of the top quintile FRL districts are in the CBA sample.

In Figure 7 we observe that rural districts have far more vacancies per 1000 students than do other districts, about twice as many as urban districts, but their posting duration is shorter. Again, the dichotomy between the vacancies per student and posting duration is counterintuitive. It may be that urban districts have more cumbersome hiring processes than other, generally smaller and potentially less bureaucratic districts. In addition, as noted above, we cannot ascertain if a single posting is for more than one vacancy. It may be that urban districts are using a single posting to fill several vacancies, in which case postings may be left on Edjoin for longer as districts work to hire additional teachers. We return to this question in Section 5.3, when we examine the relationship between district location (near a border and distance from nearest TEP) and vacancy rates, late posting and duration.

Figure 7. Urbanicity bar charts vacancies postings/durations



Note. Total number of postings: N=87,862. All Districts: N=495, Rural Districts: N=38, Town Districts: N=89, Suburban Districts: N=246, Urban District: N=122. Urbanicity categories are assigned based on the mode category observed across all years of the data. Only postings that had a positive reported duration spanning less than a year were used, which accounts for 98.54% of the overall postings from the 495 districts restricted sample.

Next, we turn to Table 2, which reports coefficients from the regressions shown in equation (1), where we regress the vacancy outcomes discussed above on districts' location on a border and proximity to the nearest TEP. The first column in each vertical panel shows relationships between CBA policies and vacancy outcomes (vacancy rates, percent of vacancies

posted late, and posting duration) without any controls included in the model, and the second column shows regressions including controls for district characteristics: district size (total student enrollment), the proportion of students in poverty (percent of students qualifying for FRL), and district geographic location (rural and urban, with town/suburban as the reference). Each row provides just the coefficient of interest (the relationship between the border / TEP proximity variable and the outcome) from separate regressions.

Table 2. OLS regressions of vacancy measures on district border location and TEP proximity

		(1)		(2)		(3)	
		Vacancy Rates		**Vacancy Posted Late**		**Posting Duration**	
Panel A	Border district	7.935***	6.116***	-0.34	-0.014	-0.64	2.027
		1.852	1.83	0.004	0.045	9.402	9.506
	Miles to nearest TEP	0.073***	0.057***	-0.001***	-0.001**	0.110+	0.126+
		0.013	0.014	0.00	0.00	0.065	0.073
	CONTROLS		X		X		X

Note. Results are restricted to 2015-16 school year. Total number of postings: N=28,908. All Districts: N=495. Vacancy Rates are the number of job postings per 1,000 students. Vacancy Posted Late are the vacancy rates limited from August to December. Only postings that had a positive reported duration and a span of less than a year were used, which accounts for 98.54% of the overall postings from the restricted sample of 495 districts. Means and standard deviations reported for each covariate in the panel. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

We find that California districts located on the border with Oregon, Nevada or Arizona have substantially and significantly higher vacancy rates, on the order of six additional vacancies per 1,000 students in a district. This finding accords with our hypothesis; when California districts face increased competition from districts in *another state,* they have a harder time staffing their schools with qualified candidates. The second row shows that districts that are farther away from TEPs have higher vacancy rates and are less likely to post their vacancies late. The first relationship is intuitive. If, as we hypothesize above, districts have an easier time drawing new teachers from the set of graduates who have student-taught in their schools, then districts that are farther away from TEPs will have greater difficulty gaining access to such new teachers. This may, in turn, cause them to post their vacancies earlier, in an effort to attract teachers, since they have less of a ready pool.

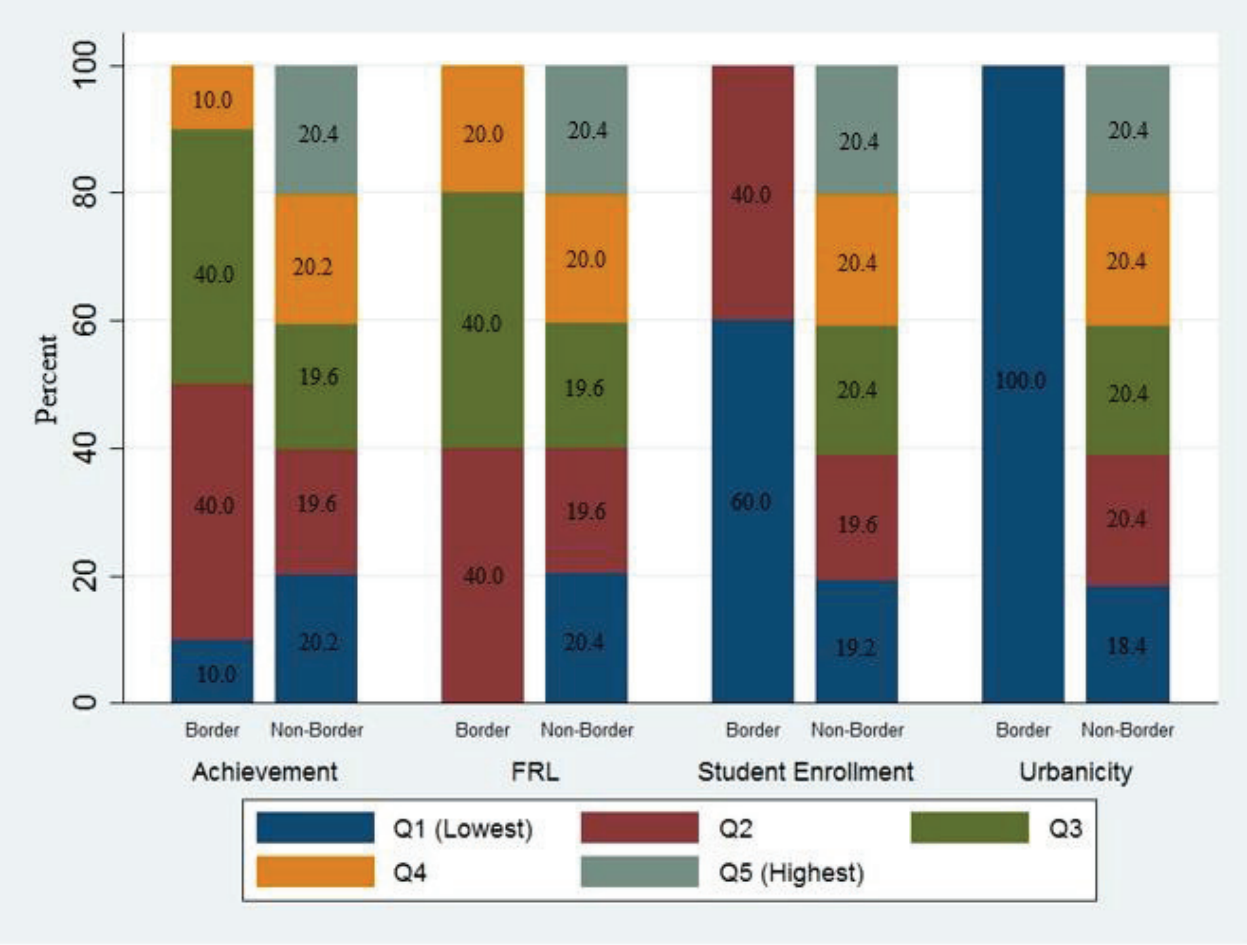
The above findings are based on regressions that attempt to make apples to apples comparisons across school districts. Nevertheless, one might worry that the border districts and districts the furthest away from TEPs differ in systematic ways from other districts across California that are not accounted for in the regression models (see equation 1 above). Indeed, there is evidence that these districts tend to be different. For instance, in Figure 8 we compare border districts to non-border districts in terms of the percentages of districts that fall into different quintiles of student achievement, FRL, size (student enrollment), and urbanicity.[29] In the figure we include quintile values for non-border districts, just for visual comparison, but these

[29] The quintiles are based on the entire sample of districts for which we have CBAs, and each district is equally weighted.

are each roughly 20% as would be expected given the construction of the measures. The border districts tend to be far smaller, tend to exhibit lower levels of achievement, and have roughly average levels of FRL (no border district falls within either highest or lowest quintiles of FRL for the entire sample). The measure of urbanicity we used was created by dividing the number of students enrolled in the district by the geographic area (in square miles) of the district (i.e. is somewhat more refined than the census measure of urbanicity).[30] Based on this measure, we find border districts are comprised entirely of the most rural of district types. Clearly border districts tend to be quite different from the average California district.

[30] We created this measure of urbanicity because the census urbanicity measure is somewhat crude and may mask important differences between districts that fall into the same census category. California has elementary, secondary, and unified school districts. In instances where district borders overlap, the total number of students recorded for a district is their individual total plus a portion of the total students in the overlapping district proportional to that of overlap. For instance, if district A had a 30% overlap with district B then the total for number of students for district B would be equal to: Total students in district B + (.3 * Total students in district A).

Figure 8. Comparing border and non-border districts on observables

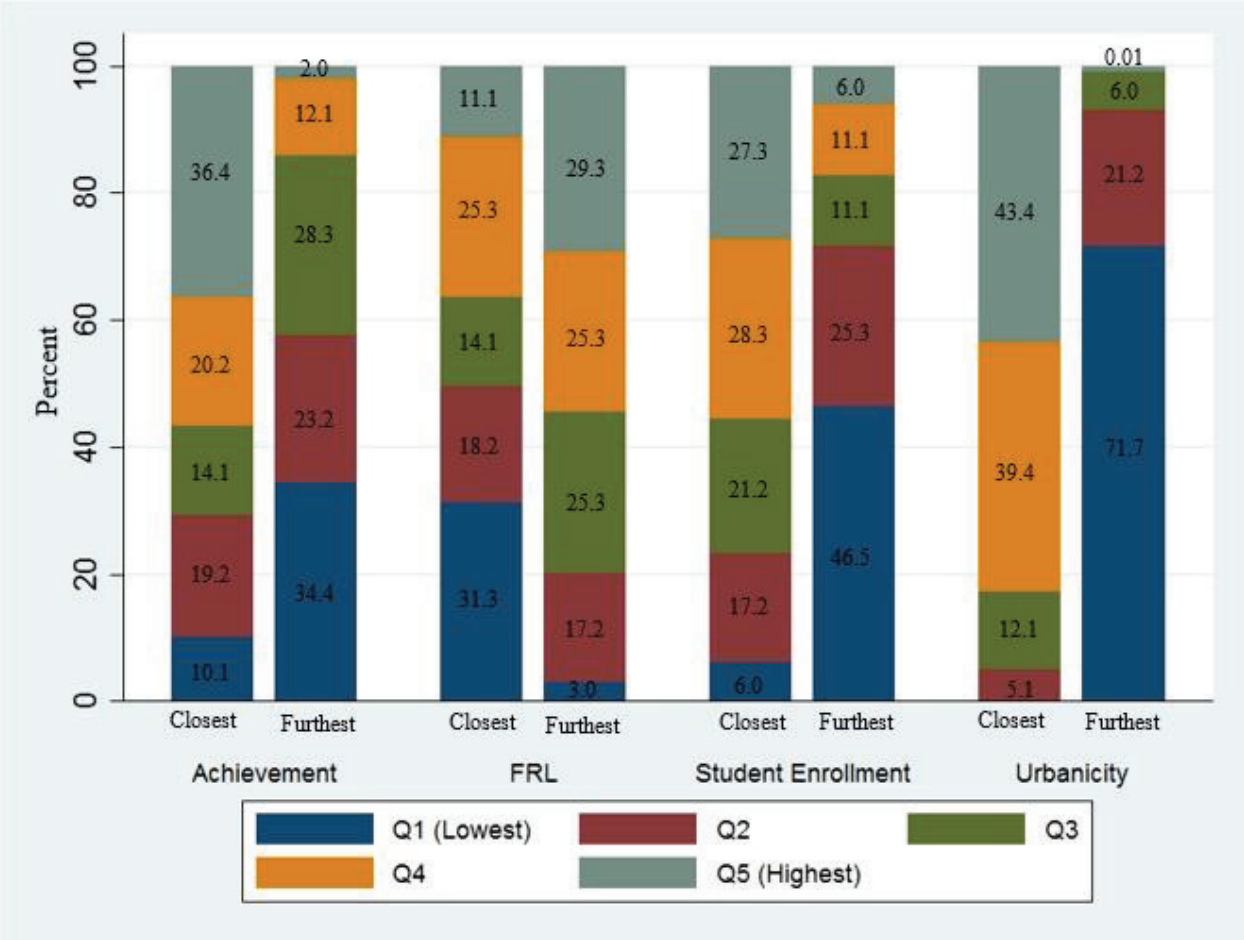


Note. All Districts N= 495; of which 10 are border districts. Achievement is measured by the average of California Assessment of Student Performance and Progress (CAASPP) score in ELA and Math. FRL is the percent of FRL eligible students in the district. Student enrollment is total number of students enrolled in district. Urbanicity is a measure of total student enrollment (and any overlap as described in FN30) divided by district area in square miles.

Next we assess whether districts of varying distance from TEPs are different from each other. In Figure 9 we categorize districts into quintiles based on the minimum distance to the nearest TEP. Those categorized as the closest are districts located between 0 to 4 miles from the nearest TEP, whereas those designated as furthest are 28 to 141 miles from the nearest TEP. There are rather striking differences across each observable (achievement, FRL, student enrollment, and urbanicity) between closest and furthest districts, particularly in the lowest (Q1) and highest (Q5) quintiles for each area. Thus, districts far from TEPs also differ substantially from those that are close to TEPs. The differences shown in Figures 8 and 9 between district types seem notable but may be confounded with urbanicity; border districts and districts furthest away from TEPs are both overwhelmingly rural. Because of this, we compare border districts and

districts furthest way from TEPs with districts of similar urbanicity levels.[31] Consistent with regressions in Table 2, border districts have higher rates of vacancies per 1000 students and per teachers, and a higher percentage of late vacancies than non-border districts with similar urbanicity. Note, however, that none of the differences are statistically significant, likely due to the smaller sample sizes in the comparison groups (relative to the regressions described earlier).

Figure 9. Comparing districts closest and furthest to teacher education programs (TEPs) (closest = 0-4 miles to nearest TEP; furthest = 28.3-141.2 miles to nearest TEP)



Note. All Districts N= 495. Achievement is measured by the average of California Assessment of Student Performance and Progress (CAASPP) score in ELA and Math. FRL is the percent of FRL eligible students in the district. Student enrollment is total number of students enrolled in district. Urbanicity is a measure of total student enrollment (and any overlap as described in FN30) divided by district area in square miles.

[31] We identify 99 districts as either border districts or districts in the top quintile of miles to the nearest TEP. We then randomly sample 99 districts from the rest of the CBA sample by matching each border or furthest from TEP district with the district which minimizes their difference in continuous urbanicity, sampling without replacement to ensure unique matching. We run two-sided t-tests of vacancy per 1000 students, vacancy per teacher, and percent of late vacancy postings between the two groups.

What is the Landscape of District Workforce and Compensation Policies that Affect the California Teacher Labor Force?

CBA provisions that make districts more desirable to teachers. Tables 3 – 7 show the individual provisions included in CBAs that may make the district more desirable to teachers. We first examine Table 3, which provides summary statistics for items included in our overall teacher desirability index. The first panel of Table 3 shows that California districts use economic incentives to reward teachers with high levels of education credits; 23% of all CBAs in California include incentives for teachers with National Board Certifications and 57% provide extra compensation for teachers who possess a doctorate degree. Nearly all districts in California offer medical and dental benefits, and nearly a third of districts include protections for teachers who are being involuntarily transferred between positions. In addition, the vast majority (approximately two-thirds) of districts provide protections for teachers whose class size exceeds negotiated class size maximums. Although not shown here, districts must recompense teachers in oversized classes in various ways, including through the provision of extra-duty pay (32%), rebalancing of classes within a specified set of time (13%), moving students out of over-enrolled classes (11%) and increasing aid and clerical time (17%).

Although there are many provisions governing teacher evaluations and professional growth in California CBAs, the two that remained as part of our desirability index after item reduction were: 1) provisions that disallow publishers' norms on standardized tests from being included in teachers' evaluations (16% of CBAs);[32] and 2) that require that the district provides teachers with advance notice of any reprimand or complaint that will become part of an employee's record (44%). These provisions provide protections for teachers whose students are not achieving expected levels on standardized tests and who have had previous complaints against them.

The majority of California CBAs also dictate the specific processes by which teachers can be transferred. We highlight three provisions in CBAs that are specifically related to involuntary transfers and may affect the desirability of a district for all teachers. Involuntary transfers are particularly important because these are the subset of provisions that govern how teachers can be moved across classrooms or schools even if they do not want to. First, we show that nearly a third (31%) of district CBAs limit the frequency with which teachers may be involuntarily transferred. This is important because seniority rules in CBAs often cause substantial reshuffling of teachers across schools when teachers must be displaced from their positions (e.g., Goldhaber et al., 2016). This provision protects teachers from frequent involuntary moves across classrooms or schools. Only eight percent of CBAs require that districts honor placement

[32] We also code for two additional items about standardized test score usage in teachers' evaluations: 1) "Does the CBA explicitly hold that teachers will be evaluated at least in part on student achievement or progress on standardized achievement tests?" (which we reverse code to indicate desirability); and 2) "Standardized test scores are not allowed to be included in the evaluation." Neither are included in our desirability index. The former is not included because our item-test analysis suggests that it is not highly enough aligned with the underlying desirability construct (although 81% of districts do not explicitly require the use of student achievement/progress on standardized achievement tests) and the latter because only 9% of districts include it in their CBAs.

requests of involuntary teachers. Thirty-nine percent of CBAs protect teachers from being involuntarily transferred if there is another qualified teacher who wishes to be voluntarily transferred into that vacant position.

Table 3. Items desirable for all teachers (proportion of districts with each item)

CBA specifies/requires:	(1) All Districts	(2) Urban	(3) Rural	(4) Town/ Suburban	(5) Low Minority	(6) High Minority	(7) Low Poverty	(8) High Poverty
Economic Incentives								
National Board Certification bonus	0.23	0.29	0.13	0.21	0.32***	0.12	0.32***	0.14
PhD/EdD bonus	0.57	0.64*	0.55	0.54	0.66***	0.43	0.71***	0.41
Medical benefits	0.89	0.91	0.82	0.90	0.94**	0.83	0.94**	0.83
Dental benefits	0.90	0.95	0.82	0.90	0.93*	0.84	0.96***	0.83
Retirement plan details	0.73	0.80	0.68	0.71	0.69	0.75	0.70	0.73
District & association split the costs of the arbitrator	0.74	0.80	0.68	0.73	0.73	0.75	0.73	0.79
Class Size								
Action taken if class size ceiling is exceeded	0.69	0.70	0.63	0.69	0.63*	0.75	0.65	0.73
Particular action(s) if class size is exceeded	0.65	0.67	0.63	0.64	0.60	0.67	0.62	0.67
Caseloads/total # of students seen/day	0.32	0.38	0.15*	0.32	0.32	0.24	0.35	0.24
Evaluation & Professional Growth/Discipline								
Publishers' norms on standardized tests are not allowed to be included in evaluation	0.16	0.13	0.13	0.18	0.15	0.16	0.17	0.18
Advance notice of reprimand/complaint provided before becoming part of employee record	0.44	0.50	0.50	0.41	0.47	0.41	0.43	0.42
Transfer Assignments & Layoffs								
Limit on the frequency with which members may be invol. transferred	0.31	0.42*	0.13*	0.29	0.27	0.35	0.32	0.30
Honors request among list of vacancies if member meets req. in invol. transfer	0.08	0.13*	0.10	0.06	0.05	0.08	0.06	0.10
No member can be invol. transferred if there is another member as qualified requesting a voluntary transfer to that position	0.39	0.43	0.28	0.38	0.35	0.43	0.31	0.39
Layoff notifications procedure	0.08	0.11	0.23*	0.06	0.10	0.08	0.05	0.11
Association Rights								
Additional specific association rights	0.62	0.64	0.63	0.61	0.60	0.67	0.61	0.63

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123. Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123; * p<0.05, ** p<0.01, *** p<0.001

Table 4. Items desirable for shortage area teachers (proportion of districts with each item)

CBA specifies/requires:	(1) All Districts	(2) Urban	(3) Rural	(4) Town/ Suburban	(5) Low Minority	(6) High Minority	(7) Low Poverty	(8) High Poverty
Economic Incentives								
Bonus for "hard to recruit" teachers	0.30	0.26	0.15**	0.33	0.17	0.49***	0.19	0.43***
Bonus for math teachers	0.01	0.01	0.00*	0.02	0.01	0.03	0.01	0.04
Bonus for science teachers	0.01	0.01	0.00*	0.02	0.01	0.03	0.01	0.04
Bonus for special ed teachers	0.25	0.22	0.13*	0.28	0.13	0.44***	0.15	0.38***

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123
* p<0.05, ** p<0.01, *** p<0.001

Table 3 also shows that only eight percent of district CBAs describe district procedures for layoffs. This is because state education code dictates how layoffs occur in all districts in the state, specifying that layoffs must occur in reverse order of seniority and notices must be given by a specified date. The eight percent of districts that provide additional information may be more desirable for teachers because these districts clarify expectations, timelines and/or recall rights for teachers, perhaps providing teachers with an increased sense of job security.

The last item we include in our desirability index for all teachers falls into the subsection of CBAs called "Association Rights." This set of provisions specifies the rights union leadership and members are guaranteed. The last panel of Table 3 shows that 62% of districts provide additional association rights in their CBAs. For example, additional rights might include time off to represent members in grievances, the ability to serve on school/district committees and the like.

The first column of Table 8 provides the summary statistics for the desirability indices. These means can be interpreted as the average proportion of CBA items in that index contained in California CBAs in our sample. We see that, overall, California district CBAs contain nearly ½ (49%) of the 16 items that are included in our "All teacher" desirability index.

CBA provisions that make districts more desirable to shortage area teachers. As noted above, the "Shortage teacher desirability" index consists of only four items, all of which are economic incentives intended to target high-need teachers. Table 8 (column 1) shows that districts on average have only 14% of the four items in this index, suggesting that districts do little in their CBAs to target shortage area teachers. Table 4 shows that the majority of districts that provide any extra incentive are for a general "hard to recruit" teacher (30%) or for special education teachers (25% of districts). Only one percent of districts, on average, provide incentives targeted specifically at math or science teachers.

CBA provisions that make districts more desirable to new teachers & teachers new to the district. California district CBAs include only 41% of the seven potential items that target teachers who are brand new to the profession, whereas CBAs include nearly 2/3 of the potential nine provisions intended to target experienced teachers who are new to the district, but not new to the profession (see Table 8). The relative lack of focus on making working conditions desirable for new teachers is apparent in Table 5, which provides information about the proportion of districts that negotiate specific provisions into their CBAs that may make the district desirable to *new* teachers. We find that only 20% of districts provide salary credit for teachers' previous military experience, even though doing so would help recruit teachers who have such experience by immediately placing them at a higher point on the salary schedule (thus paying them more upon entry). Only a little over a third of districts (35%) contractually provide teacher mentoring programs, and only 12% guarantee that new teachers will be assigned to mentor peers, even though doing so might show districts' attention to new teacher development and support.

Table 5. Items desirable for new teachers (proportion of districts with each item)

CBA specifies/requires:	(1) All Districts	(2) Urban	(3) Rural	(4) Town/ Suburban	(5) Low Minority	(6) High Minority	(7) Low Poverty	(8) High Poverty
Economic Incentives								
Salary credit for military experience	0.20	0.20	0.03***	0.22	0.17	0.23	0.14	0.22
Professional Growth								
Teacher mentoring	0.35	0.35	0.47	0.34	0.27	0.36	0.27	0.33
New teachers are assigned to mentor peers	0.12	0.12	0.23	0.10	0.07	0.13	0.10	0.11
CBA does not specify/require:								
School Year								
Mandatory additional work days for new teachers	0.74	0.71	0.75	0.74	0.78	0.76	0.70	0.79
Transfer Assignments & Vacancies								
Seniority in district is considered when transferring members overall	0.29	0.31	0.28	0.28	0.34	0.31	0.31	0.28
Seniority is deciding factor in who is involuntarily transferred when all else is equal	0.61	0.58	0.70	0.62	0.61	0.57	0.55	0.65
Teacher with the most seniority fills vacant position when all else is equal	0.56	0.53	0.65	0.55	0.52	0.54	0.50	0.58

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123
* p<0.05, ** p<0.01, *** p<0.001

Table 6. Items desirable for teachers new to the district (proportion of districts with each item)

CBA specifies/requires:	(1) All Districts	(2) Urban	(3) Rural	(4) Town/ Suburban	(5) Low Minority	(6) High Minority	(7) Low Poverty	(8) High Poverty
Economic Incentives								
New employees get credit on salary schedule for previous teaching experience	0.87	0.83	0.80	0.89	0.85	0.85	0.84	0.82
New employees get credit for previous teaching in public school or private if credentialed	0.84	0.81	0.80	0.86	0.82	0.80	0.82	0.78
CBA does not specify/require:								
School Year								
Mandatory additional work days for new teachers	0.74	0.71	0.75	0.74	0.78	0.76	0.70	0.79
Transfer Assignments & Vacancies								
Seniority in district is considered when transferring members overall	0.29	0.31	0.28	0.28	0.34	0.31	0.31	0.28
Seniority is deciding factor in who is invol. transferred when all else is equal	0.61	0.58	0.70	0.62	0.61	0.57	0.55	0.65
Current teachers will be considered for a vacant position before new personnel	0.74	0.74	0.82	0.73	0.73	0.73	0.73	0.72
Retirement Benefits								
Minimum employment in order to receive retirement benefits	0.43	0.36	0.57	0.44	0.51**	0.34	0.47	0.40
Minimum time members must have worked full time in district prior to retirement	0.44	0.35*	0.55	0.46	0.52**	0.36	0.52	0.41
Regulations restrict who can take retirement benefits (e.g., Min step/ row on salary schedule max # members receiving benefits)	0.75	0.74	0.82	0.75	0.84*	0.72	0.80	0.74

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123
* p<0.05, ** p<0.01, *** p<0.001

Districts do appear to refrain from creating additional work for new teachers; three-quarters of districts do not require additional work days for new teachers, which would often be used for professional development or school set-up.

Perhaps most important to new teachers – at least to new teachers who value job stability and the ability to choose their own classroom and school placements – is whether or not CBAs enshrine protections for teachers based on seniority. Although, as mentioned above, layoffs in California are required to proceed along traditional "last-in-first-out" lines, Table 5 shows that many districts are *not* using – or at least not relying on – seniority in decision-making for transfer assignments, if all else is equal between teachers. This can be a positive for teachers new to the teaching profession or new to the district, who may feel job insecurity because of being "last in."

Table 6 reviews the additional items included in our desirability index for teachers who are *new to the district*, even if not new to the profession. We find that over 80% of districts offer new teachers credit on the salary schedule for previous teaching experience regardless if in a public or private school setting. Further, 43% of all districts do not specify minimum employment in order to receive retirement benefits and 75% do not have a required minimum step on the salary schedule in order to receive retirement benefits, allowing for teachers later in their careers to transfer without feeling penalized.

CBA provisions that make districts more desirable to continuing teachers. Last, we consider how policies established in CBAs may make districts more or less desirable to continuing, or veteran, teachers. Table 8 shows that district CBAs include, on average, 42% of the provisions within CBAs that may make the district more attractive to continuing teachers. Items desirable for veteran teachers include how districts handle open positions and early, partial, and full retirement. Table 7 shows that many districts use seniority in making transfer decisions in ways that provide veteran teachers with enhanced choice and job security; 44% of CBAs give the most senior teacher right of preference for voluntary transfers; 86% of all districts make vacancies open to all teachers in the district before opening the position to new teachers/external hires; and 71% require that vacancies are held open for a specified amount of time, giving teachers time to apply. However, only 39% of CBAs require that districts use seniority as a deciding factor in who is involuntarily transferred. Of course, as we mentioned earlier, these same provisions that may make districts more attractive to continuing teachers may be exactly those that dissuade new teachers from coming to the district.

Table 7. Items Desirable for Continuing Teachers (proportion of districts with each item)

CBA specifies/requires:	(1) All Districts	(2) Urban	(3) Rural	(4) Town/ Suburban	(5) Low Minority	(6) High Minority	(7) Low Poverty	(8) High Poverty
Transfer Assignments & Vacancies								
Teacher with the most seniority fills vacant position if 2 or more apply, if all else is equal	0.44	0.47	0.35	0.45	0.48	0.46	0.50	0.42
Seniority will be the deciding factor in who is invol. transferred, if all else is equal	0.39	0.42	0.30	0.38	0.39	0.43	0.45	0.35
All certificated vacancies must be posted/made available to teachers in the district	0.86	0.89	0.88	0.85	0.85	0.89	0.83	0.91
Cannot fill vacancy within a set amount of time after posting	0.71	0.64	0.75	0.73	0.72	0.75	0.68	0.76
Early or Part-Time Retirement								
Early retirement incentive	0.39	0.33	0.40	0.42	0.47	0.37	0.35	0.41
Additional early retirement incentive	0.23	0.19	0.20	0.24	0.28	0.20	0.21	0.17
Additional money towards health & welfare benefits for early retirees	0.12	0.12	0.13	0.12	0.15*	0.07	0.13	0.07
50% or more part-time employment with full retirement credit	0.51	0.54	0.38	0.51	0.55**	0.37	0.52*	0.38
Early-retirement/consulting option	0.32	0.36	0.15**	0.32	0.38	0.30	0.40	0.32
Compensation for consulting work	0.22	0.24	0.10*	0.23	0.28	0.23	0.30	0.20
Full benefits for consulting work	0.10	0.12	0.05	0.10	0.07	0.14	0.07	0.13
CBA does not specify/require:								
Retirement Benefits								
Minimum employment to receive retirement benefits	0.43	0.36	0.57	0.44	0.51**	0.34	0.47	0.40
Minimum time member must have worked full-time in district prior to retirement	0.44	0.35*	0.55	0.46	0.52**	0.36	0.52	0.41
Other regulations restricting who can take retirement benefits	0.75	0.74	0.82	0.75	0.84*	0.72	0.80	0.74

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326. Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123 * p<0.05, ** p<0.01, *** p<0.001

Table 8. CBA desirability indices by district

	(1) All		(2) Urban		(3) Rural		(4) Town/Suburban		(5) Low Minority		(6) High Minority		(7) Low Poverty		(8) High Poverty	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
All Teachers	0.49	0.15	0.53***	0.14	0.44*	0.16	0.48	0.15	0.49	0.13	0.47	0.15	0.50***	0.14	0.46	0.15
Shortage Teachers	0.14	0.23	0.13*	0.22	0.07***	0.16	0.16	0.24	0.08	0.19	0.25***	0.28	0.09	0.19	0.22***	0.28
New Teachers	0.41	0.19	0.40	0.19	0.45*	0.17	0.41	0.19	0.39	0.20	0.41	0.18	0.37	0.20	0.42**	0.18
New to District Teachers	0.63	0.18	0.61**	0.18	0.67	0.21	0.64	0.18	0.66***	0.19	0.60	0.17	0.64	0.18	0.62	0.18
Continuing Teachers	0.42	0.19	0.41	0.17	0.40	0.17	0.43	0.19	0.46***	0.18	0.40	0.17	0.45***	0.19	0.40	0.17

Note. SD is standard deviation. The means reflect the proportion of districts with the CBA provisions in that index (e.g., 49% of all districts included in this study have all of the CBA provisions deemed desirable for All Teachers).

All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326

Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.

Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123

* p<0.05, ** p<0.01, *** p<0.001

Another set of policies that may make districts more attractive to continuing or experienced teachers are early- or part-time retirement incentives, which enable veteran teachers to stay in the district until they reach the experience level for early retirement benefits. Only 39% of all districts offer an early retirement incentive, with 23% of districts specifying additional details such as money towards health and welfare benefits (12%) and additional money paid out over time (e.g., money paid into a supplemental early retirement plan). However, 51% of districts allow for teachers who teach part-time to receive full retirement credit, and nearly a third provide an option for teachers to retire early and yet retain a salary as a consultant, and nearly a quarter provide extra compensation for consulting work. A full 10% of districts provide consulting retired teachers full benefits while they serve in this capacity.

Retirement incentives, shown in the bottom panel of Table 7, provide similar incentives to continuing teachers to have them stay in the district until they are qualified to draw down these benefits. Forty-three percent of district CBAs do not establish minimum employment to receive retirement benefits (these districts instead likely require teachers to be a certain age upon retirement), and approximately 44% do not require specified levels of full time work. Nearly ¾ of district CBAs do not include additional restrictions on who can take retirement benefits, above and beyond the minimum age and/or time-in-service requirements.

Other working conditions. District administrators might also work to improve working conditions and make their districts more attractive for prospective teachers by negotiating reduced loads into teachers' CBAs. They might do this via negotiating smaller class sizes, shorter school days, or fewer teacher work days in a year. Table 9 shows average negotiated class sizes for California districts. We see that the mean and median class sizes are around 30 students/teacher, on average, across all grade ranges, with negotiated elementary class sizes slightly lower (28 students/teacher) and negotiated high school class sizes slightly higher (31 students/teacher). Table 10 shows the length of the school day (in minutes) in California school districts. We see that, on average, kindergarten days last 259 minutes, and days get increasingly longer as grades go up. There is substantial variation around these means. Table 11 shows average teacher work hours required in CBAs and the number of days in the school year. We see that, on average, teachers are required to work 7 hours/ day and there is very little deviation around the mean, and the average school year lasts 184 days.

Table 9. Negotiated class size

	All Districts					Urban Districts					Rural Districts					Town/Suburban Districts				
	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max	Mean	Median	SD	Min	Max
Grade K - 5	28	29	2.9	14	34	28	29	3.0	20	34	27	28	2.4	24	30	28	29	3.0	14	34
Grade 6 - 8	30	30	2.5	23	36	30	30	2.5	23	36	29*	30	2.5	25	33	30	30	2.5	24	36
Grade 9 - 12	31	30	2.8	20	37	30	30	3.1	20	36	30	30	3.1	25	37	31	31	2.7	24	37
	Low Minority					High Minority					Low Poverty					High Poverty				
Grades K - 5	28	29	3.0	20	33	28	29	2.7	23	33	27	28	3.5	14	33	28	29	2.6	23	33
Grades 6 - 8	30	30	2.7	24	35	31*	31	2.3	25	36	30	30	2.9	24	36	30	31	2.3	24	35
Grades 9 - 12	30	30	2.9	24	37	31	32	2.3	27	36	30	29	3.6	20	37	31	31	2.4	27	36

Note. Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: 25.05%; Districts with High % of Minority Students: 24.85%.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: 25.05%; Districts with High % of Students in Poverty: 24.85%
* p<0.05, ** p<0.01, *** p<0.001

Table 10. Length of school day (in minutes) specified by CBA

	All				Urban				Rural				Town/Suburban			
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
Kindergarten	259	52.8	197	450	246*	43.0	200	347	284	69.0	200	400	264	55.3	197	450
Grades 1 - 5	305	26.6	200	450	300	17.9	200	330	323	35.8	293	400	306	29.2	240	450
Grades 6 - 8	316	32.5	240	450	313	24.8	250	366	325	31.6	292	397	316	36.2	240	450
Grades 9 - 12	333	45.9	250	450	323	44.0	250	372	331	45.7	275	400	339	46.7	250	450
	Low Minority				High Minority				Low Poverty				High Poverty			
Kindergarten	250	47.5	200	360	274	59.6	197	400	254	46.7	200	360	273	60.1	197	400
Grades 1 - 5	301	28.8	200	385	313	24.7	283	400	302	24.2	240	385	311	25.6	280	400
Grades 6 - 8	314	34.9	250	410	320	23.2	267	370	310	33.0	250	410	321	22.8	267	390
Grades 9 - 12	328	53.6	250	440	323	47.8	250	394	328	52.8	250	440	320	44.6	250	394

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123
* p<0.05, ** p<0.01, *** p<0.001

Table 11. Teacher work day and year

	All				Urban				Rural				Town/Suburban			
CBA specifies/requires:	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max
# of hours/day teachers must work	7	0.3	6	9	7	0.4	7	9	7	0.2	7	8	7	0.3	6	8
# of work days/school year	184	2.9	171	234	185	4.9	171	234	184	1.9	178	188	184	1.7	175	190
	Low Minority				High Minority				Low Poverty				High Poverty			
# of hours/day teachers must work	7	0.3	7	9	7	0.3	6	9	7	0.3	7	9	7	0.3	6	9
# of work days/school year	185	1.6	178	190	184	5.0	176	234	185***	2.1	171	190	184	1.7	176	188

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326
Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: *N*=124; Districts with High % of Minority Students: *N*=123.
Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: *N*=124; Districts with High % of Students in Poverty: *N*=123
* p<0.05, ** p<0.01, *** p<0.001

Compensation. One obvious way that districts might attempt to attract and retain teachers is through compensation. In particular, we are interested in the degree to which districts reward teachers early in their teaching career by frontloading compensation via a high starting salary and large increases in salary early in a teaching career relative to backloading compensation by having large increases in compensation associate with late-career gains in teaching experience. This is an important question given evidence that teacher turnover is relatively high for early career teachers and that new teachers are likely to pay more attention to the front-end of the salary schedule (Goldhaber, Grout & Holden, 2017; Grissom & Strunk, 2012; Lankford & Wyckoff, 1997).

Table 12 examines the amounts and structures of compensation provided to teachers via uniform salary schedules negotiated into CBAs. The first column provides the actual salary dollars negotiated into CBAs, column 2 shows average compensation adjusted for cost-of-living using Taylor's extension of the NCES Comparable Wage Index based on the 2012-14 American Community Survey (Taylor & Glander, 2006; Taylor, 2016), and column 3 adjusts these figures to 2017-18 dollars. The top panel of Table 12 simply reports average salaries built into negotiated salary schedules. The average base salary for new teachers with no master's degree is approximately $45,000, with an approximately $2,500 bump for having a master's degree upon district entry. Salaries increase over time, with the master's degree bonus staying about constant. On average, teachers in the 2014-15 school year can make a maximum of approximately $90,000. Notably, the variation around the mean is large, and grows over the course of the salary schedule, with a teacher who makes 1 SD above the mean in real dollar salaries making nearly $106,000 per year.

It is useful to assess how salaries look when adjusted for location via the Comparable Wage Index (CWI), and then when converted to real dollars, signifying purchasing power in the current year (2017-18). Adjusting just for CWI (column 2), we see that the salary schedule is at least somewhat constricted, with base salaries approximately $4,000 lower and maximum salary over $8,000 lower than in the average unadjusted figures. Converting CWI-adjusted into average salaries into real dollars (Column 3) brings the minimum base salary to approximately $42,000 and the maximum salary to a little over $83,000 in 2017-18 dollars.

The bottom panel of Table 12 provides some detail about the structure of the salary schedule, showing that yearly returns to experience teaching in-district are, on average, largest in the first ten years of teachers' careers and relatively small in the last ten years. This can be seen in the measure of backloading, which is only 7% (far lower than the national average; see Grissom & Strunk, 2012). Moreover, our two frontloading measures (comparing yearly returns to experience in the first five relative to the last five years, and in the first ten relative to the last ten years, respectively), show that gains early in teachers careers in California are far larger than gains in later years.

Table 12. Salary

	(1) *Contract Salary Amounts from CBAs*		(2) *Adjusted by NCES Comparable Wage Index (CWI)*		(3) *2017-2018 Salary Amounts (Using CWI Adjusted Salaries)*	
	Mean	SD	Mean	SD	Mean	SD
Salary Schedule Averages						
Base salary with credential (Year 1), no MA	$44,834	4,871	$40,539	4,300	$4,2035	4,459
Base salary with credential (Year 1), with MA	47,131	5,233	42,648	4,950	44,223	5,133
5 years experience, no MA	50,034	5,493	45,262	5,045	46,934	5,231
5 years experience, with MA	53,274	6,404	48,229	6,184	50,009	6,413
10 years experience, no MA	62,172	7,537	56,243	6,906	58,320	7,161
10 years experience, with MA	64,640	8,034	58,498	7,529	60,658	7,807
20 years experience, no MA	78,096	8,987	70,698	8,680	73,308	9,001
20 years experience, with MA	80,489	9,286	72,895	9,198	75,586	9,538
Highest row experience, no MA	82,996	9,756	75,131	9,351	77,905	9,696
Highest row experience, with MA	85,841	10,077	77,742	9,918	80,612	10,284
Highest row, highest column (max salary)	88,824	9,254	80,411	9,053	83,379	9,387
Yearly Salary Returns						
Yearly salary returns in first 5 years	$1,040	552	$945	505	$980	524
Yearly salary returns in first 10 years	1,734	533	1,570	489	1,628	507
Yearly salary returns in last 5 years	980	840	887	756	919	783
Yearly salary returns in last 10 years	490	420	443	378	460	392
Yearly salary returns - Year 10 to Year 20	1,592	604	1,445	562	1,499	583
Backloading	7%	75%	7%	75%	7%	75%
Frontloading first vs. last 5	134%	148%	134%	148%	134%	148%
Frontloading first vs. last 10	453%	491%	453%	491%	453%	491%

Note.

Contract salary amounts from CBAs were adjusted by NCES Comparable Wage Index (CWI) based on the 2012-2014 American Community Survey

Yearly salary returns in first 5 years = (salary in year 5 – salary in base year) / 5

Yearly salary returns in first 10 years = (salary in year 10 – salary in base year) / 10

Yearly salary returns in last 5 years = (highest row experience – salary in year 20) / 5

Yearly salary returns in last 10 years = (highest row experience – salary in year 20) / 10

Yearly salary returns in Year 10 to Year 20 = (salary in year 20 – salary in year 10) / 10

Backloading = [((salary in year 20 – salary in year 10)/10 – (salary in year 10 – salary in base year)/10)) all divided by ((salary in year 10 – salary in year 0)/10)]*100

Frontloading first vs. last 5= (salary returns in first 5 years / salary returns in last 5 years)*100

Frontloading first vs. last 10= (salary returns in first 10 years / salary returns in last 10 years)*100

How do Workforce and Compensation Policies Included in CBAs Vary across Districts within California?

Tables 3-7 and 9-14 provide details on the variation in specific CBA workforce provisions across district urbanicity, proportion minority students and proportion of students in poverty. We generate indicators for district location in urban, rural and town/suburban areas, and for districts in the top and bottom quartiles of proportion minority students and students in poverty. Table 8 shows how the desirability indices vary across districts of these types.

Although the overall means in Table 8 suggest that, on average, district administrators are not implementing all of the potential CBA provisions they could to attract and retain teachers to their districts, the standard deviations (SD) show that there is wide variation across districts in California. For instance, although the mean proportion of shortage teacher policies provided in CBAs is 14%, the standard deviation is 23%. Some districts in California are putting into place multiple CBA provisions intended to attract and retain teachers and others are putting in very few or none. Some of this variation seems to be explained by districts' location in an urban or rural area. We see that urban district negotiate CBAs that are more desirable to all teachers than do town/suburban districts, and rural districts negotiate CBAs with fewer provisions that might make the district attractive to teachers overall. Rural districts also negotiate fewer of the shortage teacher provisions than do town/suburban and urban districts, though suburban/town districts negotiate more of these provisions than either, on average. Urban districts negotiate fewer provisions that might make districts more attractive to teachers who are new to the profession or to the district, whereas rural districts lead in this regard.

It also appears that high poverty and high minority districts negotiate CBAs that are more or less desirable than their low poverty/minority counterparts. In particular, high minority/poverty districts negotiate more provisions into their CBAs that might prove desirable to shortage area teachers and to teachers who are new to the profession. On the other hand, low poverty/minority district CBAs contain more provisions, on average, that might attract teachers overall, and especially teachers who might be switching districts (new to the district) and continuing teachers. This may help them recruit and retain more experienced teachers relative to their lower minority/poverty peers.

Tables 3-7 provide more detail about what kinds of provisions vary across district types. There are some notable differences across district types, and in particular variation by district proportion minority and low-income. For instance, low-minority and low-poverty districts are more likely to include economic incentives for NBC teachers and teachers with PhDs or EdDs. They are also more likely to specify medical and dental benefits in their CBAs. On the other hand, high-minority and high-poverty districts are more likely to provide incentives for teachers in "hard-to-recruit" subjects and special education teachers. This is in line with studies that examine similar variation in earlier California CBAs (e.g., Strunk & Zeehandelaar, 2011; 2015). Moreover, across the board, low-minority districts are more likely to provide retirement and early-retirement incentives and benefits than are higher-minority districts.

There are fewer differences in CBA provisions across geographic type; urban districts are more likely to provide teachers with protections from frequent involuntary transfers and to honor teachers' requests for placement when involuntarily transferred. Rural districts, on the other hand, are less likely to provide economic incentives for teachers who teach in "hard to recruit" fields and special education, as well as to provide new teachers with salary credit for previous military experience.

Notably, there is very little variation across district types in class size, length of school day and teacher workday/year policies, as shown in Tables 9-11.

Tables 13 and 14 show how average salary levels and structure differ by district characteristics. Table 13 uses dollar values as negotiated directly into the CBAs and Table 14 uses dollar values adjusted by the NCES Comparable Wage Index. Using these two measures provides slightly different results. First, Table 13 (using negotiated dollar values), shows that rural districts pay teachers significantly less than do town/suburban districts at every single point along the salary schedule. By contrast, urban districts pay slightly more, and significantly so at many levels in the salary schedule. Unsurprisingly, low-poverty districts also pay more, and again this is the case at every single step in the salary schedule. When we examine negotiated salaries adjusted by the CWI and into real dollars (Table 14), the geography differences hold, but we now see that high minority and high poverty districts pay teachers significantly more than do other districts.

Table 13 also highlights important differences in the structure of salary schedules by district type, when considering negotiated actual wages. Rural districts provide lower yearly returns to experience for teachers in their first 10 years than do urban or town/suburban districts. Low-minority and low-poverty districts provide greater yearly returns to experience for teachers in their last five and 10 years of experience than do other districts, again revealing preferential policies for more senior teachers. Interestingly, we see that high-minority districts frontload salary schedules to a greater extent than do their low-minority peers (and there are similar patterns for high-poverty vs. low-poverty districts, although not significant), suggesting that they work to reward novice/early career teachers more for teaching in these working conditions. These patterns are again consistent for the adjusted values in Table 14.

Table 13. Salary schedule in 2014-2015 CBA dollars

	All	Urban	Rural	Town/ Suburban	Low Minority	High Minority	Low Poverty	High Poverty
Salary Schedule Averages								
Base salary with credential (Year 1), no MA	$44,834	$46,152**	$41,369***	$44,738	$45,332	$44,698	$46,504***	$43,877
Base salary with credential (Year 1), with MA	47,131	48,342*	42,951***	47,165	47,367	47,639	48,583**	46,500
5 years' experience, no MA	50,034	51,215*	46,186***	50,039	50,481	49,891	51,893***	49,342
5 years' experience, with MA	53,274	54,445	47,904***	53,469	53,336	54,355	54,973**	52,901
10 years' experience, no MA	62,172	64,043*	55,959***	62,194	62,658	61,446	64,875***	60,835
10 years' experience, with MA	64,640	66,662*	57,431***	64,725	64,898	64,982	67,279***	63,670
20 years' experience, no MA	78,096	80,443**	70,589***	78,088	79,168	77,398	82,167***	76,965
20 years' experience, with MA	80,489	82,392	72,194***	80,754	81,305	80,438	84,410***	79,854
Highest row experience, no MA	82,996	85,278*	74,806***	83,098	84,923*	81,659	87,448***	81,112
Highest row experience, with MA	85,841	87,580	76,601***	86,287	87,422	85,177	90,133***	84,336
Highest row, highest column (max salary)	88,824	90,857	79,104***	89,212	89,445	88,504	92,548***	87,031
Yearly Salary Return Averages								
Yearly salary returns in first 5 years	$1,040	$1,013	$963	$1,060	$1,030	$1,038	$1,078	$1,093
Yearly salary returns in first 10 years	1,734	1,789	1,459***	1,746	1,733	1,675	1,837*	1,696
Yearly salary returns in last 5 years	980	967	843	1,002	1,151**	852	1,056*	829
Yearly salary returns in last 10 years	490	483	422	501	575**	426	528*	415
Yearly salary returns - Year 10 to Year 20	1,592	1,640	1,463	1,589	1,651	1,595	1,729	1,613
Backloading	7%	11%	24%	4%	17%	9%	11%	9%
Frontloading first vs. last 5	134%	135%	141%	133%	104%	158%**	132%	177%
Frontloading first vs. last 10	453%	494%	452%	436%	352%	506%**	491%	531%

Note. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326

Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: 25.05%; Districts with High % of Minority Students: 24.85%.

Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: 25.05%; Districts with High % of Students in Poverty: 24.85%

* p<0.05, ** p<0.01, *** p<0.001

Yearly salary returns in first 5 years = (salary in year 5 – salary in base year) / 5

Yearly salary returns in first 10 years = (salary in year 10 – salary in base year) / 10

Yearly salary returns in last 5 years = (highest row experience – salary in year 20) / 5

Yearly salary returns in last 10 years = (highest row experience – salary in year 20) / 10

Yearly salary returns in Year 10 to Year 20 = (salary in year 20 – salary in year 10) / 10

Backloading = [((salary in year 20 – salary in year 10)/10 – (salary in year 10 – salary in base year)/10)) all divided by ((salary in year 10 – salary in year 0)/10)]*100

Frontloading first vs. last 5= (salary returns in first 5 years / salary returns in last 5 years)*100

Frontloading first vs. last 10= (salary returns in first 10 years / salary returns in last 10 years)*100

Table 14. Salary schedule in 2017-2018 CWI dollars

	All	Urban	Rural	Town/ Suburban	Low Minority	High Minority	Low Poverty	High Poverty
Salary Schedule Averages								
Base salary with credential (Year 1), no MA	$42,035	$42,676	$39,883**	$42,046	$41,555	$43,049**	$41,633	$42,772*
Base salary with credential (Year 1), with MA	44,223	44,727	41,406***	44,369	43,457	45,902***	43,525	45,348**
5 years' experience, no MA	46,934	47,393	44,558	47,043	46,301	48,058**	46,500	48,082*
5 years' experience, with MA	50,009	50,424	46,217***	50,310	48,948	52,362***	49,307	51,545**
10 years' experience, no MA	58,320	59,232	54,019***	58,487	57,490	59,160	58,178	59,268
10 years' experience, with MA	60,658	61,695	55,428***	60,889	59,570	62,568**	60,361	62,021
20 years' experience, no MA	73,308	74,524	68,145***	73,461	72,643	74,539	73,729	75,019
20 years' experience, with MA	75,586	76,350	69,709***	76,005	74,620	77,506**	75,770	77,858
Highest row experience, no MA	77,905	78,979	72,229***	78,176	77,968	78,619	78,467	79,057
Highest row experience, with MA	80,612	81,141	73,976***	81,217	80,282	82,038	80,922	82,221
Highest row, highest column (max salary)	83,379	84,167	76,327***	83,933	82,138	85,216**	83,067	84,803
Yearly Salary Return Averages								
Yearly salary returns in first 5 years	$980	$943	$935	$999	$949	$1,002	$973	$1,062
Yearly salary returns in first 10 years	1,628	1,656	1,414**	1,644	1,594	1,611	1,655	1,650
Yearly salary returns in last 5 years	919	891	817	943	1,065*	816	948	808
Yearly salary returns in last 10 years	460	445	408	472	533*	408	474	404
Yearly salary returns - Year 10 to Year 20	1,499	1,529	1,413	1,497	1,515	1,538	1,555	1,575
Backloading	7%	11%	24%	4%	17%	9%	11%	9%
Frontloading first vs. last 5	134%	135%	141%	133%	104%	158%**	132%	177%
Frontloading first vs. last 10	453%	494%	452%	436%	352%	506%**	491%	531%

Note. Contract salary amounts from CBAs were adjusted by NCES Comparable Wage Index (CWI) based on the 2012-2014 American Community Survey, then by the Comparable Wage Index. All Districts: *N*=495; Urban Districts: *N*=129; Rural Districts: *N*=40; Town/Suburban: *N*=326. Districts are classified as "Low Minority" if the percent of the minority student population is less than 35.2% and "High Minority" if the percent is greater than 79.9%. Districts with Low % of Minority Students: 25.05%; Districts with High % of Minority Students: 24.85%. Districts are classified as "Low Poverty" if the percent of students eligible for free or reduced-price lunch is less than 35.6% and "High Poverty" if the percent is greater than 76.2%. Districts with Low % of Students in Poverty: 25.05%; Districts with High % of Students in Poverty: 24.85%. * p<0.05, ** p<0.01, *** p<0.001

Yearly salary returns in first 5 years = (salary in year 5 – salary in base year) / 5

Yearly salary returns in first 10 years = (salary in year 10 – salary in base year) / 10

Yearly salary returns in last 5 years = (highest row experience – salary in year 20) / 5

Yearly salary returns in last 10 years = (highest row experience – salary in year 20) / 10

Yearly salary returns in Year 10 to Year 20 = (salary in year 20 – salary in year 10) / 10

Backloading = [((salary in year 20 – salary in year 10)/10 – (salary in year 10 – salary in base year)/10)) all divided by ((salary in year 10 – salary in year 0)/10)]*100

Frontloading first vs. last 5= (salary returns in first 5 years / salary returns in last 5 years)*100

Frontloading first vs. last 10= (salary returns in first 10 years / salary returns in last 10 years)*1000

What is the Association between District Compensation and Workforce Policies (e.g., Those Governed by CBAs) and the Number of Posted Vacancies?

We next turn to our final set of research questions, which combine the CBA policy and compensation data with the Edjoin data about teacher vacancies. Tables 15 and 16 provide results from the regressions described in equation (1). As in Table 2, the first column in each vertical panel shows relationships between CBA policies and vacancy outcomes (vacancy rates, percent of vacancies posted late, and posting duration) without any controls included in the model, and the second column shows regressions including controls for district characteristics (district size (ln), the proportion of students in poverty, and district geographic location (rural and urban, with town/suburban as the reference). Each row provides just the coefficient of interest (the relationship between the CBA policy and the outcome) from a separate regression.

Column 1 in Tables 15 and 16 examine how workforce and compensation policies outlined in the CBAs are associated with the number of vacancies posted by districts (per 1000 students).[33] Somewhat counterintuitively, we find suggestive evidence that districts with CBAs that seem to make the district more "desirable" – to teachers overall, to teachers new to the district and to teachers who continue to teach in the district—have higher rates of vacancies (see Panel A of Table 15). This may be simply a result of reverse causation, which of course plagues all of these cross-sectional analyses. In brief, it may be that being more "desirable" (as per the CBA policies) does not *cause* a district to have more vacancies, but rather that districts that are harder to staff (as proxied by vacancy rates) try to make themselves more attractive by negotiating friendlier policies into their CBAs. This finding actually echoes earlier work on individual CBA provisions and overall contract "restrictiveness" that shows that districts traditionally considered "hard to staff" (i.e., those with greater proportions of minority, low income and low-achieving students) may negotiate more restrictive CBAs, perhaps in order to attract teachers to these districts (e.g., Strunk, 2012). Conversely, we see negative correlations between *desirability to shortage area teachers* and vacancy rates. Notably, as discussed earlier in, this particular CBA desirability measure solely captures economic incentives to teachers in shortage area subjects. This may suggest that districts that provide economic incentives to shortage area teachers have *fewer* vacancies, as theory might predict.[34]

[33] We also run these analyses using the ratio of number vacancies per 1000 teachers. Results remain consistent and are available from the authors upon request.

[34] We also examine the relationship between individual items in the CBAs that specify how districts must staff their vacant positions and vacancy rates. We find no significant relationship between these provisions and actual posted vacancy rates. We do not show these results, but they are available upon request.

Table 15. OLS Regression of Vacancy Measures on District Desirability as Expressed in CBA Provisions and Negotiated Class Sizes

		(1)		(2)		(3)	
		Vacancy Rates		**Vacancy Posted Late**		**Posting Duration**	
Panel A	All teacher desirability index	1.053	2.573	0.127**	0.127**	-11.278	-12.1
		1.775	1.748	0.041	0.042	8.854	9.013
	Shortage area teacher desirability index	-2.036+	-1.717	0.045+	0.042	13.007*	10.032+
		1.143	1.135	0.027	0.028	5.699	5.847
	New Teacher desirability index	-0.707	-1.142	0.041	0.045	11.217	10.283
		1.415	1.367	0.033	0.033	7.091	7.07
	New to district teacher desirability index	2.553+	1.672	-0.027	-0.021	2.221	4.08
		1.486	1.441	0.035	0.035	7.448	7.437
	Continuing teacher desirability index	3.949**	3.767**	0.001	0.002	0.899	3.389
		1.432	1.391	0.034	0.034	7.218	7.227
Panel B	Negotiated class size K-5	-0.188	-0.122	0.007**	0.007*	-0.666	-0.874
		0.123	0.117	0.003	0.003	0.629	0.625
	Negotiated class size 6-8	-0.589***	-0.483***	0.008*	0.007*	-0.4	-0.7
		0.146	0.144	0.003	0.003	0.774	0.781
	Negotiated class size 9-12	-0.499***	-0.416**	0.006+	0.005	0.366	0.168
		0.138	0.134	0.003	0.003	0.6	0.611
	CONTROLS		X		X		X

Note. Vacancy Rates are the number of job postings per 1000 students. Vacancy Posted Late are the vacancy rates limited from August to December. Only postings that had a positive reported duration spanning less than a year were used, which accounts for 98.54% of the overall postings from the restricted sample of 495 districts. Details of district level "desirability" for desirability indices are given in Table 3. Means and standard deviations reported for each covariate in the panel. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Panel B of Table 15 Column 1 provides the coefficients of interest from regressions on the class sizes negotiated in the CBAs. Here we see a negative relationship between the negotiated class size for elementary (K-5), middle (6-8) and high school (9-12) grades and vacancy rates, and these relationships are significant for middle and high school class sizes. In other words, districts with higher negotiated class sizes have lower vacancy rates. While this may again seem surprising given that larger class sizes are usually viewed as undesirable characteristics of districts, it is mathematically intuitive; districts with larger class sizes require fewer teachers to staff the same number of classes/serve the same number of students, thus need to post for fewer positions.

Table 16. OLS regressions of vacancy measures on negotiated salaries (adjusted)

		(1)		(2)		(3)	
		Vacancy Rates		**Vacancy Posted Late**		**Posting Duration**	
Panel A	Base salary, no MA ACS	-0.340***	-0.277***	-0.001	-0.002	-0.274	-0.446
		0.058	0.058	0.001	0.001	0.299	0.304
	Base salary, with MA ACS	-0.315***	-0.265***	0	0	-0.192	-0.365
		0.05	0.05	0.001	0.001	0.26	0.266
	5 years' experience, no MA ACS	-0.349***	-0.307***	0	-0.001	-0.123	-0.255
		0.049	0.048	0.001	0.001	0.256	0.259
	5 years' experience, with MA ACS	-0.296***	-0.261***	0.001	0.001	-0.119	-0.25
		0.039	0.04	0.001	0.001	0.209	0.213
	10 years' experience, no MA ACS	-0.271***	-0.237***	0.001	0	-0.194	-0.277
		0.035	0.035	0.001	0.001	0.187	0.191
	10 years' experience, with ACS ACS	-0.268***	-0.238***	0.001	0	-0.225	-0.315+
		0.033	0.033	0.001	0.001	0.173	0.177
	20 years' experience, no MA ACS	-0.163***	-0.135***	-0.001	-0.001	-0.122	-0.179
		0.029	0.028	0.001	0.001	0.148	0.15
	20 years' experience, with MA ACS	-0.183***	-0.157***	0	0	-0.183	-0.249
		0.027	0.027	0.001	0.001	0.14	0.142
	Max Salary ACS	-0.215***	-0.188***	0.001	0	-0.172	-0.250+
		0.027	0.027	0.001	0.001	0.142	0.146
	Yearly salary returns first 5 years ACS	-0.408***	-0.410***	0.001	0.001	0.308	0.263
		0.101	0.097	0.002	0.002	0.511	0.51
	Backloading ACS	0.010**	0.009*	0	0	-0.006	-0.004
		0.004	0.004	0	0	0.018	0.018
	CONTROLS		X		X		X

Note. Vacancy Rates are the number of job postings per 1000 students. Vacancy Posted Late are the vacancy rates limited from August to December. Only postings that had a positive reported duration spanning less than a year were used, which accounts for 98.54% of the overall postings from the restricted sample of 495 districts. ACS = XXX. Means and standard deviations reported for each covariate in the panel. + p<0.10, * p<0.05, ** p<0.01, *** p<0.001

Panel A of Table 16 shows the relationships between salaries negotiated into CBA salary schedules (at the entering level, with five, 10 and 20 years of experience, and the maximum possible salaries, all with and without master's degrees) and a measure of frontloading (salary returns in the first five years) and our measure of backloading (as described in the data section above). We ran these regressions using salaries taken directly from salary schedules and after adjusting for both inflation (CPI) and cost of living (CWI). We provide results from the latter adjusted salary figures, but results from the actual salary regressions are consistent in magnitude and direction, and available upon request from the authors. As expected, we find that on every point on the salary schedule, whether with or without a master's degree, higher salaries are associated with lower vacancy rates. Moreover, the greater the yearly returns to experience in the first five years of teaching, the lower the vacancy rate. The only salary measure that is *positively* (and significantly) associated with vacancy rates is our measure of

backloading; districts that provide greater returns to experience for very senior teachers relative to very junior teachers – i.e., those that reward veteran teachers for each year they teach more than they do for early career teachers – have significantly *higher* vacancy rates.

What is the Association between District Compensation and Workforce Policies (e.g., Those Governed by CBAs) and the Number of Vacancies that District Post Late (e.g., in the Fall for the Current Year)?

Column (2) of Tables 15 and 16 provides the relationships of interest from regressions of the proportion of total vacancies posted "late" (September through December) and CBA policies. We again find a positive (and this time significant) relationship between the overall desirability index and the proportion of vacancies posted late (Panel A), which again could suggest a reverse causality argument. Panel B shows that we find positive (and almost always significant) relationships between negotiated class sizes and the proportion of vacancies posted late. It is hard to say why this might be the case. There is no relationship between salary amounts or schedule structure and late posting of vacancies.

What is the Association between District Compensation and Workforce Policies and the Duration of Job Postings?

Panel (3) of Tables 15 and 16 present the relationships between the duration of postings and the CBA policies of interest. We find almost no significant relationships between any CBA measures and this outcome, suggesting that duration of posting (which, in theory, signifies difficulty filling a vacancy) is related to the overall policy desirability of the district, negotiated class size, or salary measures. This may be because our measure of posting duration is inherently noisy, as we discuss above.

Conclusions

Our findings on job vacancies in California tend to confirm what we know from research in other contexts: school systems have greater difficulty staffing STEM, special education, and ELL positions than elementary teaching positions, and more disadvantaged and lower performing systems also tend to have great staffing difficulties. There is some suggestive evidence, as well, that districts that face steeper competition from school systems in other states have greater difficulties staffing their schools. In addition, proximity to a teacher education program is associated with fewer staffing difficulties.

Although we show that there is substantial variation in the kinds of provisions included in CBAs that may make districts more desirable to certain kinds of teachers, our analyses reveal only week evidence of links between the CBA working conditions measures and district vacancies. As we noted above, it is difficult to disentangle whether this is related to potential teachers being aware or unconcerned with the provisions in CBAs, or the fact that the provisions in CBAs may be adjusted over time in light of staffing needs.

There is much better evidence that district compensation structure is related (in expected directions) to vacancies. For instance, districts with higher salaries have fewer

vacancies. Interestingly, districts that backload their salary schedules, providing greater returns to experience for senior relative to junior teachers, have *higher* vacancy rates. These districts may be working to retain their senior teachers, but they have greater difficulty staffing their openings.

These results give rise to several potential solutions that California and districts within the state may consider as they work to alleviate the specific teacher shortages plaguing their own districts. First, given the strong evidence cited here and elsewhere that relatively few districts utilize compensation as a tool to address staffing difficulties, more districts may wish to consider using economic incentives to target high-need teachers. If salaries matter, as our results and others cited earlier suggest they do, and districts appear to be underutilizing economic incentives to target specific teachers, as our results and those from earlier work in California suggest they do, there seems to be an opportunity for districts to provide enhanced salaries to targeted teachers to address specific shortage areas. The California state government might also consider how to put into place incentives for certain kinds of teachers to enter the profession.

Second, our results that highlight the staffing difficulties faced by districts on the state borders suggest that California may wish to make it easier for districts to compete for out-of-state teachers, and make teaching in the Golden State more desirable relative to states in close proximity to California. There is an opportunity for California to make what is required for experienced teachers to become teachers in California transparent, and perhaps easier as well. Many of the barriers to cross-state mobility associated with licensure rules are artificial and do not serve a policy purpose; it is unclear why teachers who have already demonstrated that they are highly successful in one state wouldn't be readily welcomed into the California teacher workforce, especially if they could staff hard-to-fill positions. Indeed, it is likely that there exists a significant reserve pool of potential teachers who actually have moved from other states but have opted not to re-enter the teacher labor market in California due to real or perceived burden of doing so.

Last, we find that districts that are closer to TEPs have fewer staffing challenges, at least as expressed through vacancy rates. While it is impossible for districts to locate closer to a TEP, it is not difficult for districts to provide TEPs with student teaching slots and for the state to encourage student teaching in districts that need to fill vacancies. Given that student teaching appears to be a key factor in influencing the location of a first job, it makes good sense for the state to encourage teacher candidate-student teaching internship matches be in districts with greater classroom staffing struggles.

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