Unions and the allocation of teacher quality in public schools

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Introduction and executive summary

A renowned California court decision in 2014 declaring that teacher tenure laws violated the state constitution has highlighted the issue of tenure and its relationship to the allocation of teachers across schools (*Vergara v. State of California* 2014). This debate is rooted in a deeper discussion about whether disadvantaged children are taught by less-credentialed, less-effective teachers; whether this misallocation might vary across states and/or districts; and whether it could partly explain socioeconomic achievement gaps (Adamson and Darling-Hammond 2012; Clotfelter et al. 2006; Isenberg et al. 2013; Reardon 2011). Moreover, the question has been raised as to whether teachers' unions, through collective bargaining or legislation, could to some extent be responsible for this misallocation (Moe 2011; *Vergara v. State of California 2014*; Whitehurst, West, Chingos, and Dynarski 2015).

This paper explores these issues using nationally representative data on schools and teachers from the 2011 National Assessment of Educational Progress (NAEP). First, it examines the extent to which there is a misallocation of teachers in terms of a gap between the qualifications of teachers in schools in general versus the qualifications of teachers in high-poverty schools, defined as schools in which over half of students are eligible for free or reduced-price lunch. The observable credentials of interest are the teacher's years of experience, educational background in the subject taught, and certification. We selected these variables based on evidence of their association with more effective teaching (Darling-Hammond 1999; Ladd and Sorensen 2014). Also, they match with the federal definition of "highly qualified" teachers (see the U.S. Department of Education's Educator Equity Profiles).

Second, the paper examines whether a relationship exists between the strength of teachers' unions in a state and the allocation of teacher quality across schools. Our analyses rely on a simple bivariate relationship—are unions strong or weak, and qualified teachers evenly allocated or misallocated—and so we cannot assess any causal relationship between union strength and resource allocations. Nevertheless, the analyses provide information on the extent, if any, to which unions and collective bargaining are associated with the misallocation of teachers in schools with high proportions of students eligible for free/reduced-price lunch, relative to all schools, across states.[1]

Our analyses find that *there is no relationship between union strength and a misallocation of teachers that disadvantages students in high-poverty schools*. In other words, the misallocations are not more nor less severe or prevalent in states with stronger unions. Specifically, the results of regressions run

using two measures of union strength (each measured in two ways, continuous and categorical) and three teacher quality credentials for four grade and subject combinations (reading/math, 4th/8th grades) consistently show that misallocations of teacher quality are not more nor less severe in states with stronger teachers unions. Specific findings include the following:

- Almost half (47.7 percent) of U.S. public schools are high-poverty schools. The share is over two-thirds in Mississippi, Washington, D.C., New Mexico, Louisiana, Arkansas, Alabama, Oklahoma, Tennessee, and Florida, and less than 20 percent in Nebraska, Utah, Iowa, Minnesota, Wyoming, North Dakota, and New Hampshire (it is only 5 percent in the last state).
- The credentials of teachers in schools overall are better than the credentials of teachers in high-poverty schools. The misallocation in terms of teacher experience is greatest in Connecticut, Virginia, Nebraska, New Hampshire, Maryland, Minnesota, Pennsylvania, and New York. In terms of educational background, the gaps are largest in New Hampshire, Wisconsin, Pennsylvania, Massachusetts, Ohio, and North Dakota. In terms of certification, the gaps are largest in Virginia, South Dakota, and Maryland.
- In some states high-poverty schools have *more* experienced teachers (for example, New Jersey, Ohio, Rhode Island, Wyoming, and North Dakota), *more* certificated teachers (such as Hawaii and New Jersey), and *more* teachers with an educational background in the subject taught (such as Iowa, in math).
- The density of teachers unions has no apparent connection to either of these allocations. We see teacher misallocation problems in states with high teacher-union density (for example, Connecticut, Pennsylvania, and New York) and in states with low union density (such as Virginia, Arkansas, and Arizona). Credentials of teachers in high-poverty schools are better than average in some states with high teacher-union density (such as New Jersey and Rhode Island) but also in some states with low union density (for example, Wyoming and South Dakota). Some states with high union density (such as Hawaii and Wisconsin) and some with low union density (such as South Carolina and Tennessee) experience no significant misallocations in terms of credentials. (States above are listed according to values from highest to lowest.)

The contention that unions play a role in misallocating resources, sending them away from where they are most needed, is a distraction from efforts to address the persistent nature of achievement gaps between advantaged and disadvantaged students. Disentangling the relative importance of individual, school, community, institutional, and contextual factors in explaining these inequalities should be a primary step in guiding policy. With this goal, we should pursue research that provides further insights on why teachers sort the way they do, which other aspects of school finance and school quality (e.g., facilities, access to advanced classes, curriculum, climate, etc.) differ between high-poverty schools and others, and how these resources influence student performance gaps.

Background

The relationship between children's performance in school and their socioeconomic status (SES) is among the most widely documented in the empirical research into the economics of education. There is evidence of economic disadvantage affecting children's development at the individual and group level (first documented by Coleman et al. 1966), as well as evidence of the persistence of SES gaps across cohorts (Reardon 2011) and through time (Duncan and Brooks-Gunn 1997; Nores 2006; Papay,

Murnane, and Willett 2014). The research community has attempted to find the mechanisms that underlie these disadvantages, and in the last two decades numerous studies have highlighted the different circumstances that could in part explain the gaps. (For a comprehensive discussion of some of the factors, see Rothstein 2004 and Morsy and Rothstein 2015.)

Some studies have examined whether disadvantaged students attend schools that are not equal to those of their advantaged peers in terms of financing and access to education resources (teachers and school quality). In particular, the literature has suggested that children who are economically disadvantaged or who are racial minorities are taught by less-credentialed and/or less-effective teachers (Adamson and Darling-Hammond 2012; Clotfelter et al. 2006; Darling-Hammond 2004; Isenberg et al. 2013), and that this teacher misallocation could potentially drive some of the achievement gaps (Reardon 2011; Sass et al. 2012).

Several studies illustrate these points. In an examination of New York State schools, Lankford, Loeb, and Wyckoff (2002) found that low-income, low-achieving, and nonwhite students, especially those in urban areas, were more likely than higher-SES, higher-achieving, white students to be taught by teachers with no teaching experience (12 percent versus 10 percent), teachers not certified in any subject taught (21 percent versus 16 percent), and teachers who had failed the general knowledge or liberal arts exam (28 percent versus 20 percent). Loeb, Darling-Hammond, and Luczak (2005) found that in California higher proportions of low-income and minority students in a school increased the odds of high teacher turnover, and these students received slightly larger proportions of first-year teachers. Clotfelter, Ladd, and Vigdor (2005) found that in North Carolina black students were more likely than white students—54 percent more likely in math and 38 percent in English—to be instructed by a novice teacher. Goldhaber, Lavery, and Theobald (2014) found in Washington State that all measures of teacher quality (teacher experience, licensure exam score) were inequitably distributed by socioeconomic status, minority status, and prior academic performance at all educational levels (with the exception of licensure exam scores in high school math classrooms).[2]

In addition to differences in observable credentials, another way to estimate misallocation of teacher quality is to examine measures of teacher effectiveness, mostly associated with teacher value-added estimates. These studies tend to indicate that teachers' average effectiveness in high-poverty schools is lower than in low-poverty schools (Goldhaber, Lavery, and Theobald 2014; Isenberg et al. 2013; Sass et al. 2012). In a study of teacher quality in Florida and North Carolina, the authors estimated that the differences in average teacher quality across high-poverty schools (defined in the study as those in which 70 percent or more of students are eligible for free or reduced-price lunches) and low-poverty schools vary from 1 percent to 7 percent of a standard deviation in Florida and from 1 percent to 2 percent of a standard deviation in North Carolina (Sass et al. 2012). The evidence also suggests that there is greater variation in teacher quality among high-poverty schools themselves (Sass et al. 2012). However, when trying to reconcile the two available estimates of teacher quality, two important caveats arise. On the one hand differences in credentials—teachers' experience, certification status, and educational attainment —"explain at most one-fourth of the difference in teacher quality across high and lower-poverty schools" (Sass et al. 2012, 105). On the other hand, value-added estimates are sensitive to the model specification, especially to the inclusion of peer effects (Isenberg et al. 2013, 38–39) or to effects of unmeasured school characteristics (Sass et al. 2012, 110).

Overall, these studies support three main findings. One, even though most of the estimates refer to particular districts or states (and thus an average estimate of the misallocation of teacher quality across states is not shown), the evidence consistently points out statistically significant differences in the quality of teachers serving disadvantaged and other students. Second, while there is complete agreement and evidence about the importance of teachers for student learning (Rivkin, Hanushek, and Kain 2005), there is less agreement on how to measure teacher quality, how it contributes to student learning, whether such a contribution is the same for all types of students, and whether it could close achievement gaps.[3] Third, the empirical studies point to unequal allocation of resources besides teacher quality, such as access to advanced-placement classes, safety, etc., that can also affect achievement gaps (Office of Civil Rights 2014).

Less clear from existing studies is what factors determine the misallocation of teacher quality and the resulting impact on achievement gaps. These factors could include both teacher preferences and a variety of institutional factors.[4] It has been frequently claimed that tenure laws and the transfer rights and seniority provisions in teachers' collective bargaining contracts drive the teacher quality problems faced by disadvantaged students. This claim, however, has not been examined in depth empirically, either directly or indirectly. For instance, various analysts contend that teacher tenure laws—or, in general, a union's protection of the teaching profession—cause systemic problems, including "teacher quality issues and persistent achievement gaps" (as synthesized in D'Amico 2014), are "practically the sole causes of underperforming schools," or are "impeding quality schools" (as mentioned in Goldstein 2014, loc.123 and 2559). This view is represented in research by Moe (2011), by Whitehurst et al. (2015), and by various voices in policymaking and advocacy.[5] The reasoning behind this argument is that contracts grant teachers the option to transfer from schools with less-agreeable conditions to schools with more-agreeable conditions on the basis of seniority (not tenure). This option would facilitate or somehow induce a redistribution of teachers away from high-poverty schools, where presumably the working conditions are relatively tougher, and thus facilitate or somehow induce unequal sorting and misallocation of teacher quality. Ravitch (2006) dismisses this argument by noting that teacher tenure laws were not invented by unions and never really protected teachers, nor, as D'Amico (2014) points out, were they supposed to. Indeed, teacher tenure provisions, which predate teachers unions, exist in states without collective bargaining rights. As Ravitch (2006) notes, tenure policies do not ease or necessarily even cover transfers, and seniority does not always play a role in teacher transfer rights.[6] Moreover, as Moore-Johnson et al. (2007) argue, some unions, in collaboration with management, may play a significant role in promoting teaching quality via teacher dismissal policies, promotion of the use of rigorous evaluation of teachers, and encouragement of staffing in hard-to-attract schools. Examples include initiatives such as peer assistance and review to observe and increase teacher quality, and strategies that pursue adequate staffing in hard-to-staff schools (Moore-Johnson et al. 2007; NEA Foundation 2012).[7] Empirical work along these lines includes Baker (2012) and Koski and Horng (2007), among others.

The available empirical research on the impact of teachers unions on teacher quality allocation is neither robust nor conclusive. One challenge is that most of the research focuses on specific districts or states. Another challenge is that specific policies such as tenure or seniority that are part of collective bargaining agreements (or collective bargaining in general) vary from district to district or from state to state, based on the specific contract. Both things make it hard to make general statements about how unions affect teacher quality. A number of studies illustrating these challenges are mentioned below. For example, New York City recently modified teacher tenure regulations. An evaluation of that policy found that low-

performing and less-qualified teachers were more likely to be denied tenure—instead, most had their probationary periods extended (Loeb, Miller, and Wickoff 2014). Also, teachers in schools with a disproportionately large share of black students were more likely to have their probationary periods extended (although this reflected uneven distribution of less-effective teachers). Regarding seniority provisions in collective bargaining agreements, recent research looking at within-district teacher transfers in Washington State (Goldhaber, Lavery, and Theobald 2015) found that seniority was rarely the only factor in transfer decisions (just 5 percent of agreements used seniority as the single factor in voluntary transfer decisions; 12 percent used it as the single factor in involuntary transfers); 40 percent of agreements did not address the role of seniority for transfer decisions at all. In terms of whether transfer rates to schools with lower proportions of disadvantaged students varied by seniority and the seniority transfer protections accorded in the bargaining agreements across districts, the study found that within-district teacher mobility patterns varied depending on the transfer provisions in the bargaining agreement: "the interaction between teacher experience and school disadvantage in teacher transfer decisions is consistently more extreme [more senior teachers are even more likely to leave disadvantaged schools, and novice teachers are even more likely to stay in disadvantaged schools] in districts with strong seniority transfer protections" (p. 29). However, the study did not find evidence that the overall rates of teacher transfers varied across districts with different transfer provisions in the bargaining agreements,[8] but it concluded that the contribution of CBA [collective bargaining agreement] transfer provisions to teacher inequities between advantaged and disadvantaged schools "is likely to be small but meaningful."[9]

A detailed commentary by Baker (2012) dismissed any relationship between union strength on the one hand and funding levels and equity on the other. The correlations (it is worth emphasizing that, like ours, Baker's paper does not tackle the causality question) show that states with stronger teachers unions tend to have more adequate and equitable funding levels than states with weaker unions. His findings also suggest that income-adjusted performance for nonpoor students in states with weak unions is lower than in states with strong unions, and that there is no adverse relationship between the strength of unions and achievement gaps between poor and nonpoor students in the states. But Hoxby (1996) came to the opposite conclusion, finding that teachers unions raise school budgets and inputs but lower student achievement by decreasing the productivity of inputs. Lott and Kenny (2013), who used statewide teachers union dues and spending to identify states with strong unions, concluded likewise; they found that students in states with strong unions had lower test scores than students in states with low dues and spending.

In this paper we add to this literature by using basic analytic methods to examine whether disadvantaged children are taught by less-credentialed teachers and, if so, whether there is any variation in this trend across states. We also examine whether teachers unions, through either collective bargaining or legislation, are associated with an allocation of teachers that disadvantages students in high-poverty schools.

Data and methods

The empirical analyses rely on teacher credential data from the 2011 National Assessment of Educational Progress (NAEP) by the National Center for Education Statistics (NCES) and on two measures of teachers union strength, one computed from the Current Population Survey (2009–2013) and the other based on the Fordham Institute's ranking of union strength (Winkler, Scull, and Zeehandelaar 2012).

From NAEP, using a sample of public (noncharter) schools, we obtain the distribution of schools based on the proportion of students eligible for free or reduced-price lunch (FRL) in the school. High-poverty schools are considered to be those in which over 50 percent of students are FRL-eligible. We distinguish them from low-poverty schools (up to 25 percent eligible) and moderate-poverty schools (26–50 percent eligible).

Also using NAEP, we calculate the credentials of teachers of mathematics and reading in both the 4th and 8th grades in public schools. The credentials of interest include years of experience, educational background, and type of teaching certificate. Specifically, teachers are considered experienced if they have five or more years of experience. They are considered subject experts if they have educational background in the subject taught (for math, if the teacher has a major or minor in math as an undergraduate or graduate; for reading, if the teacher has a major or minor as undergraduate or graduate in reading, language arts/English, other language arts, or English-language learning). And they are considered certified if they have a regular/standard teaching certificate. We focus on three measures of teacher quality—the proportion of teachers with at least five years' experience, with certification, and with a major or minor in their subject matter—and examine teachers in each of the four grade/subject combinations (math 4th and 8th; reading 4th and 8th).

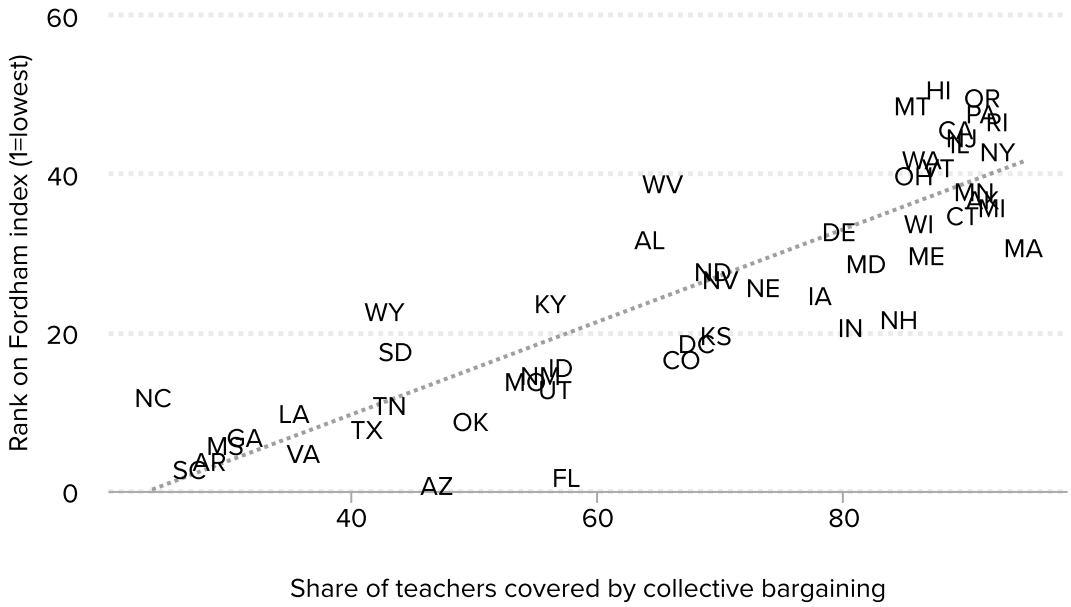
In order to assess whether teachers are misallocated in high-poverty schools, we compare the proportion of teachers having each of the three quality measures (experience, credentials, major or minor in field) in high-poverty schools relative to the average proportion across all schools in the state. We refer to these differences as "gaps" and focus our analysis on the relationship between teachers union strength and these gaps across the states.

We use two different measures of the strength of unions in each state, and the measures are highly correlated (see **Figure A**).[10] In particular, the collective bargaining coverage (CBC) rate from the Current Population Survey measures the proportion of teachers covered by collective bargaining, as opposed to having actual union membership. (Specifically, the sample is from the CPS ORG data on full-time public K-12 teachers with at least a bachelor's degree and with imputed or nonimputed positive weekly earnings, for a pooled sample from 2009–2013.) Fordham's index reflects an assessment of a wide variety of dimensions of union strength; higher values show states with stronger unions.[11] In our analyses we deploy these variables as either a continuous or a categorical variable. Our categorical analyses rely on states being assigned to quintiles based on a ranking of union strength, allowing us to compare the states at the bottom quintile of union strength with those in successively stronger quintiles. The use of the categorical specification provides a mechanical but probably more realistic test of the role of unions: instead of testing whether there is a different outcome in states per percentage-point difference of union coverage, say 38 percent rather than 37 percent, which is predetermined to be the same as between 60 and 61 percent, the test is whether states with strong unions (high CBC) have different outcomes than those with very little collective bargaining coverage (low CBC).

FIGURE A

EPI and Fordam measures of union strength are highly correlated

Relationship between collective bargaining coverage rate and Fordham Institute's (inverse) ranking of union strength



Source: Union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from EPI's analysis of Current Population Survey data

As mentioned above, we use basic descriptive and regression analyses to analyze the relationship between teacher credential allocations across schools and union strength. We have repeated these analyses comparing the credentials of teachers in high-poverty schools with the credentials of teachers in low-poverty schools. We have also repeated our analyses, not shown but available from the authors, using the recently released metrics on teacher quality by state (from the U.S. Department of Education's Educator Equity Profiles for the 2011–2012 school year) and confirmed our results.[12]

In sum, our analyses are essentially descriptive, presenting plots of relationships across states and offering some regressions using one explanatory variable (various measures of union strength) and three teacher-quality measures in four subject/grade combinations. We view these analyses as a first cut at examining the empirical relationship between unions and teacher quality allocation. It might be the case that developing alternative specifications with more controls could result in different outcomes. We view the fact that our multiple ways of examining the relationship between unions and teacher quality allocation yield the same conclusion—that there is no relationship between union strength and teacher quality misallocation—as a strong indication that other more robust analyses would yield a similar conclusion. Results are discussed in the next section.

Findings

We start with some basic descriptive results (**Table 1**). First, almost half of U.S. public schools (47.7 percent) are high-poverty schools, i.e., schools in which over 50 percent of the student body is eligible for free or reduced-price lunch. The concentration of high-poverty schools varies widely across states. While less than 20 percent of schools are high poverty in New Hampshire, North Dakota, Wyoming, Minnesota, Iowa, Utah, or Nebraska, over two-thirds of schools in Mississippi, D.C., New Mexico, Louisiana, Arkansas, Alabama, Oklahoma, Tennessee, and Florida have more than half of their student bodies in FRL status. These differences obviously constitute very different scenarios for the provision of education and associated resource and funding needs.

TABLE 1

Share of public schools with low, moderate, and high proportions of students who are eligible for free or reduced-price lunch, by state

State	Up to 25%	26 to 50%	Over 50%
Alabama	10.0%	17.2%	72.9%
Alaska	28.5	42.8	28.8
Arizona	16.6	17.7	65.7
Arkansas	3.8	23.1	73.1
California	15.8	27.5	56.7
Colorado	25.3	34.5	40.2
Connecticut	55.0	11.8	33.2
Delaware	11.8	34.4	53.8
District of Columbia	2.3	15.4	82.2
Florida	11.3	19.4	69.3
Georgia	9.3	25.4	65.3
Hawaii	9.2	54.1	36.7
Idaho	11.3	28.1	60.6
Illinois	23.1	22.9	54.0
Indiana	23.3	49.8	26.9
Iowa	31.6	51.1	17.3
Kansas	21.7	42.1	36.2
Kentucky	3.7	31.8	64.4
Louisiana	1.4	25.4	73.2
Maine	15.4	41.9	42.8
Maryland	47.1	23.1	29.8
Massachusetts	47.7	24.1	28.1
Michigan	16.2	36.4	47.4
Minnesota	31.6	51.8	16.5
Mississippi	2.9	12.2	84.9
Missouri	18.3	31.2	50.6
Montana	14.9	58.7	26.4
Nebraska	24.4	56.7	18.9
Nevada	25.3	30.2	44.5
New Hampshire	59.3	36.0	4.7
New Jersey	54.6	22.8	22.6
New Mexico	1.2	24.5	74.3
New York	35.0	27.4	37.6
North Carolina	8.8	28.1	63.1

North Dakota	26.6	63.2	10.2
Ohio	19.8	38.7	41.5
Oklahoma	4.4	25.3	70.3
Oregon	11.6	38.8	49.6
Pennsylvania	29.1	40.2	30.8
Rhode Island	43.7	25.4	30.9
South Carolina	5.0	37.1	58.0
South Dakota	36.4	43.0	20.6
Tennessee	5.3	25.0	69.7
Texas	10.7	29.1	60.2
Utah	30.6	51.2	18.2
Vermont	33.5	45.3	21.3
Virginia	27.5	46.0	26.5
Washington	20.8	39.0	40.2
West Virginia	2.3	42.8	54.9
Wisconsin	21.9	51.5	26.5
Wyoming	24.9	63.9	11.2
Total	20.4	31.8	47.7

Note: Charter schools are not included.

Source: 2011 National Assessment of Educational Progress (NAEP) microdata from the National Center for Education Statistics (NCES). Data from schools operated by the Department of Defense for the children of service members are excluded.

Table 2, which looks at 8th-grade math teachers in 2011, provides two ways of computing the gaps in teacher allocation. The top panel compares teacher quality in high-poverty schools and the "average" school. For instance, we see that, on average, 83.7 percent of teachers in public schools had five years or more of experience, 82.4 percent had an educational background in math, and 92.2 percent were certified. In contrast, high-poverty schools had three percentage points fewer teachers (83.7 percent versus 80.7 percent) with five or more years of experience. Also, fewer teachers in high-poverty schools had a degree in the subject they taught (78.9 percent, 3.5 percentage points less than the average) and 90.2 percent of teachers were certified (a gap of 2 percentage points).

TABLE 2

Are teachers evenly allocated among low, average, and high-poverty schools?

Share of U.S. 8th-grade math teachers with quality measure in high-poverty schools compared with average and low-poverty schools, 2011

With five or more years of experience			With major or minor in math			With regular/standard certification		
Average	High poverty	Gap (average–high poverty)	Average	High poverty	Gap (average–high poverty)	Average	High poverty	Gap (average–high poverty)
83.7%	80.7%	3.0%	82.4%	78.9%	3.5%	92.2%	90.2%	2.0%
Low poverty	High poverty	Gap (low–high poverty)	Low poverty	High poverty	Gap (low–high poverty)	Low poverty	High poverty	Gap (low–high poverty)
86.1%	80.7%	5.4%	88.8%	78.9%	9.9%	95.2%	90.2%	5.0%

Note: Data are for public, noncharter schools. High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. In low-poverty schools the share of such students is up to 25 percent.

Source: 2011 National Assessment of Educational Progress (NAEP) microdata from the National Center for Education Statistics (NCES). Data from schools operated by the Department of Defense for the children of service members are excluded.

The bottom panel in Table 2 repeats this exercise with a comparison of teacher quality in high-poverty versus low-poverty schools.[13] We do not use these gaps in our empirical analysis because the share of schools with low poverty differs so greatly across states, and some states have few such schools (meaning that the comparisons are not all that meaningful).[14]

Table 3 shows the substantial variation across states in the gaps between teacher-quality shares in high-poverty and average schools. For example, the results show substantial misallocation of experienced teachers (large gaps between their shares on average compared with in high-poverty schools) in Connecticut, Virginia, Nebraska, New Hampshire, Maryland, Minnesota, Pennsylvania and New York (from 19 to about 9 percentage points of difference). In terms of teachers' educational background, New Hampshire (with a 40 percentage-point gap), Wisconsin, Pennsylvania, Massachusetts, Ohio, and North Dakota have the largest misallocations. With respect to teacher certification, the gaps tend to be smaller, with only Virginia, South Dakota, and Maryland reaching a roughly 10 percentage-point difference in the proportion of teachers with a certificate in high-poverty schools compared with the average. In some states high-poverty schools have *more* experienced teachers (New Jersey, Ohio, Rhode Island, Wyoming, and North Dakota, on the order of 5 to 10 percentage-point differences), *more* certificated teachers (Hawaii and New Jersey, 5 to 13 percentage points), and *more* teachers with an educational background in math (Iowa, 4.5 percentage points).

TABLE 3

States ranked by misallocation of teacher quality

Share of U.S. 8th-grade math teachers with quality measure in average school compared with high-poverty schools, by state, 2011

With five or more years of experience				With major or minor in math				With regular/standard certification			
	Average	High poverty	Gap (average–high poverty)		Average	High poverty	Gap (average–high poverty)		Average	High poverty	Gap (average–high poverty)
Connecticut	81.7%	62.3%	19.3	*New Hampshire*	88.8%	48.7%	40.0	*Virginia*	88.9%	77.4%	11.5
Virginia	82.5%	67.6%	14.9	*Wisconsin*	77.4%	55.4%	22.0	*South Dakota*	96.9%	85.6%	11.4
Nebraska	83.2%	71.2%	12.0	*Pennsylvania*	82.0%	70.3%	11.7	*Maryland*	94.2%	84.4%	9.8
New Hampshire	84.0%	72.3%	11.8	*Massachusetts*	83.8%	72.5%	11.3	*Connecticut*	89.4%	80.8%	8.7
Maryland	80.7%	69.4%	11.3	*Ohio*	88.6%	77.5%	11.1	*Massachusetts*	89.3%	81.2%	8.1
Minnesota	81.9%	71.1%	10.7	*North Dakota*	93.1%	82.7%	10.4	*Utah*	91.8%	84.4%	7.4
Pennsylvania	82.3%	72.7%	9.6	*Kansas*	86.5%	77.9%	8.6	*District of Columbia*	62.7%	56.7%	6.1
New York	83.2%	74.2%	9.1	*New Jersey*	79.7%	71.7%	7.9	*Vermont*	96.0%	90.2%	5.8
District of Columbia	58.2%	51.3%	6.9	*South Dakota*	86.1%	79.1%	7.0	*Iowa*	91.6%	87.5%	4.1
Arizona	75.8%	69.7%	6.1	*Montana*	73.6%	66.9%	6.7	*Washington*	93.3%	89.2%	4.1
Washington	87.8%	81.7%	6.0	*Colorado*	86.6%	80.4%	6.2	*California*	88.5%	84.4%	4.0
Oregon	88.8%	83.2%	5.6	*Nebraska*	92.5%	87.1%	5.4	*South Carolina*	90.9%	87.0%	4.0
Iowa	83.4%	78.2%	5.2	*Idaho*	75.6%	70.3%	5.3	*North Carolina*	83.4%	79.4%	3.9
Idaho	84.5%	79.7%	4.8	*District of Columbia*	77.5%	72.2%	5.3	*Nebraska*	98.0%	94.6%	3.5
California	89.5%	84.9%	4.6	*Maryland*	85.4%	80.5%	5.0	*Arizona*	82.9%	79.5%	3.4
Missouri	79.5%	75.5%	4.1	*Alaska*	63.6%	59.0%	4.6	*New York*	89.3%	86.1%	3.2
Indiana	82.6%	78.7%	3.9	*Arizona*	64.2%	59.9%	4.3	*Nevada*	87.9%	85.2%	2.6
Florida	85.7%	82.0%	3.7	*Minnesota*	96.5%	92.5%	4.0	*Missouri*	95.3%	92.7%	2.5
Colorado	77.6%	74.0%	3.6	*Nevada*	78.6%	74.7%	3.9	*Kansas*	97.0%	94.6%	2.5
Arkansas	80.4%	76.9%	3.6	*Indiana*	97.0%	93.3%	3.8	*Michigan*	94.1%	91.9%	2.2
Delaware	79.5%	76.7%	2.9	*Utah*	90.4%	86.7%	3.7	*New Mexico*	93.0%	90.9%	2.1
Nevada	84.0%	81.1%	2.9	*New Mexico*	80.4%	76.7%	3.7	*Montana*	95.1%	93.0%	2.1
Georgia	80.8%	78.1%	2.7	*Vermont*	89.5%	86.2%	3.4%	*Arkansas*	92.7%	90.7%	2.0
Hawaii	74.4%	71.7%	2.7	*Georgia*	83.8%	81.1%	2.7%	*Rhode Island*	99.2%	97.2%	2.0
Kentucky	81.7%	79.2%	2.6	*Missouri*	83.0%	80.7%	2.3%	*Oregon*	93.3%	91.3%	1.9
North Carolina	80.5%	78.1%	2.4	*Wyoming*	93.5%	91.3%	2.2%	*Wisconsin*	93.2%	91.5%	1.8
Vermont	80.1%	77.7%	2.3	*West Virginia*	94.1%	92.0%	2.1%	*Georgia*	93.5%	91.8%	1.7
West Virginia	82.0%	79.7%	2.2	*Michigan*	95.3%	93.2%	2.1%	*Kentucky*	93.2%	92.1%	1.1
Texas	78.3%	76.2%	2.1	*North Carolina*	81.0%	79.0%	2.0%	*Wyoming*	97.2%	96.1%	1.1
Alabama	87.6%	85.5%	2.0	*Hawaii*	79.9%	78.0%	1.8%	*Florida*	91.8%	90.7%	1.0
Montana	88.3%	86.3%	1.9	*New York*	93.9%	92.5%	1.4%	*Indiana*	97.3%	96.3%	1.0
South Carolina	76.8%	75.3%	1.5	*Illinois*	86.3%	85.0%	1.4%	*Maine*	93.9%	93.1%	0.8
Louisiana	86.6%	85.2%	1.5	*Virginia*	86.7%	85.9%	0.8%	*Tennessee*	93.3%	92.8%	0.6
Mississippi	70.0%	68.9%	1.0	*Kentucky*	92.9%	92.3%	0.6%	*Louisiana*	88.5%	88.0%	0.5
Kansas	85.1%	84.5%	0.6	*Oklahoma*	73.1%	72.6%	0.5%	*West Virginia*	94.3%	93.8%	0.5
Tennessee	85.0%	84.8%	0.2	*Tennessee*	68.2%	68.0%	0.1%	*Pennsylvania*	93.8%	93.5%	0.3
Oklahoma	84.8%	84.8%	-0.1	*Arkansas*	73.0%	73.0%	0.0%	*Illinois*	98.2%	97.9%	0.3
Wisconsin	87.6%	88.0%	-0.3	*Washington*	74.4%	74.5%	-0.2%	*Colorado*	84.7%	84.4%	0.3
New Mexico	76.4%	77.0%	-0.5	*Delaware*	79.7%	80.0%	-0.3%	*Alabama*	95.8%	95.6%	0.2
Utah	78.0%	78.9%	-0.9	*Oregon*	81.9%	82.3%	-0.4%	*Texas*	93.1%	93.1%	0.0
Maine	90.5%	91.5%	-0.9	*Rhode Island*	95.3%	95.9%	-0.6%	*Minnesota*	95.6%	96.0%	-0.4

Illinois	85.3%	86.4%	-1.0	*Florida*	68.1%	69.4%	-1.3%	*Idaho*	95.6%	96.1%	-0.5
Michigan	93.6%	94.9%	-1.3	*Mississippi*	78.6%	80.1%	-1.5%	*Mississippi*	91.9%	92.9%	-1.0
Massachusetts	84.5%	87.1%	-2.6	*Alabama*	89.6%	91.1%	-1.5%	*North Dakota*	93.5%	94.7%	-1.2
South Dakota	84.0%	86.8%	-2.8	*Louisiana*	44.7%	46.4%	-1.7%	*Delaware*	94.9%	96.3%	-1.4
Alaska	83.3%	87.6%	-4.3	*Connecticut*	90.0%	91.8%	-1.8%	*Oklahoma*	92.9%	94.4%	-1.5
New Jersey	86.4%	91.3%	-4.9	*Texas*	80.0%	81.8%	-1.8%	*Alaska*	93.3%	95.4%	-2.0
Ohio	88.3%	93.3%	-5.1	*Maine*	71.2%	73.1%	-1.8%	*Ohio*	91.7%	95.6%	-3.9
Rhode Island	86.0%	91.8%	-5.8	*California*	79.6%	81.9%	-2.3%	*New Hampshire*	95.7%	100.0%	-4.3
Wyoming	83.7%	89.8%	-6.1	*South Carolina*	82.3%	84.8%	-2.6%	*New Jersey*	94.8%	100.0%	-5.2
North Dakota	78.9%	88.0%	-9.1	*Iowa*	86.6%	91.1%	-4.5%	*Hawaii*	86.1%	98.6%	-12.5
Total	82.5%	79.7%	2.8	*Total*	82.4%	78.6%	3.8%	*Total*	92.2%	90.3%	1.9

Note: Data are for teachers in public, noncharter schools. High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. Gaps may not sum due to rounding.

Source: 2011 National Assessment of Educational Progress (NAEP) microdata from the National Center for Education Statistics (NCES). Data from schools operated by the Department of Defense for the children of service members are excluded.

Although some of the scales of teacher misallocation found in the NAEP data look modest, all these differences are statistically significant (using the t-tests of equal means). We say "modest" because the gaps do not seem large enough to drive large differences in educational outcomes across schools. The newly released data in the NCES's Educator Equity Profiles from the 2011–2012 school year also seem to show the degree of misallocation to be fairly modest. (That these gaps are modest on average does not mean that this is an important focus for policy discussion.)

As in Table 2, we limit our graphical presentation (**Figures B–D)** to the results for 8th-grade math teachers, but the results are comparable for the other grade/subject groups. For each measure of teacher quality we plot each of the two measures of union strength against (1) the proportion of teachers in high-poverty schools who have that quality; (2) the proportion of teachers with that quality across all schools on average; and (3) the gap between the proportion of teachers with that quality in all schools and the proportion with that quality in high-poverty schools.

In the top two panels of each figure, the vertical axis shows higher teacher quality the further up the axis and the horizontal axis shows greater union strength moving to the right (one column for each union measure). Therefore, if teacher quality declined with union strength, we would expect to see a downward-sloping line in each graph. The bottom pair of graphs in each set shows the allocation gap, with the vertical axis this time showing a greater gap between all schools and high-poverty schools the further up the axis: therefore, an upward sloping line indicates that states with stronger unions have larger gaps in teacher quality allocation.

We follow each set of figures on the particular quality measure with a table presenting regression statistics (tables 4–6). Regressions are presented for each of the three variables, as listed above, but for every subject/grade combination (three dependent variables, four subject/grades). The regression is specified with the union variable as a set of dummies indicating levels of union strength—broken down into quintiles (fifths)—with union strength rising as the fifth gets larger (the fifth "fifth" has the strongest unions), and the omitted category represents the weakest unions. This exercise is repeated for the collective bargaining coverage measure in the top panel and the Fordham measure of union strength in the bottom panel. We also conduct these exercises using the two union variables as continuous variables

(proportion of teachers with collective bargaining coverage and the ordinal ranking of the Fordham measure), which coincide with the slope of linear adjustment shown in the figures (for all the combinations of teacher qualities, grades, subjects, and union variables). For each teacher quality, this method provides a total of 24 tests of correlations between teacher quality and union strength for the quintile regressions, and another 24 tests of correlations for the continuous variables. We focus our discussion, however, on the last four columns, which present the results for the allocation of teacher quality in all the schools versus high-poverty schools (columns called "Average minus high-poverty").

It is easy to summarize our results because we consistently fail to show an association between the strength of unions and the allocation or misallocation of teacher credentials across schools in a state. States with stronger teachers' unions do not seem to place teachers with weak credentials in schools with disadvantaged students any more than states with weak unions do. We find no negative or no association at all between union strength on the one hand and the allocations of credentials in average schools or in high-poverty schools on the other (although we find some positive slopes, suggesting that the credentials of teachers—on average and in high-poverty schools—are better in states with stronger unions). Most importantly, we find no association between union strength and the misallocation of credentials among high-poverty schools relative to the average school.[15]

This result is confirmed using different specifications of union strength, measured categorically in quintiles and as continuous, and adding an additional control for the proportion of high-poverty schools in the state. The results also hold when we look at the gap between low- and high-poverty schools (results not shown) and when we use the credentials available from the Educator Equity Profiles database (results available upon request). Our examination of the relationship between union strength and teacher misallocation (the bottom panels of Figures B-D and right panels in Tables 4–6) shows no relationship regardless of teacher quality measure, grade level, or subject matter: all figures show a flat/zero slope.[16]

A more detailed examination of the results allows us to point out other correlations of interest, as well as a few exceptions to the main stated findings. Looking at the misallocations (right panels on the regression tables using quintiles), the previous conclusions would hold for all credentials, grades, and subjects with just a few exceptions. For instance, we find some positive and some negative statistically significant coefficients that indicate union strength has an impact. These exceptions are few and they run in both directions, indicating that stronger unions are sometimes associated with a more favorable and sometimes with a less favorable allocation of teacher quality for disadvantaged students. In experience (reading, 8th grade), in states with unions on the third quintile as per the collective bargaining coverage measure, the gap between teachers' experience in average schools and high-poverty schools is larger than the gap in states with the weakest unions. In education, also as per the bargaining agreement variable, in states in the fourth quintile the gap between teachers' background (math, 8th grade) in average schools and high-poverty schools is larger than the gap in states with the weakest unions (the comparison of states in the third quintile of union strength using the Fordham index and states at the bottom produces a similar finding). However, in states in the third quintile the gap between teachers' background (reading, 4th grade) in average schools and high-poverty schools is smaller than the gap in states with the weakest unions, indicating union strength is associated with less misallocation. There are some positive coefficients, as reflected by the Fordham index, in the misallocation of teachers according to their certificate and reading teachers in 4th grade, and some according to the bargaining agreement variable and reading teachers in 8th grade, but a negative coefficient (indicating union strength

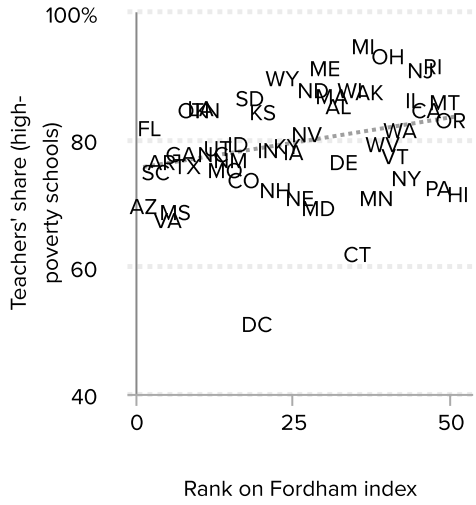
associated with teacher quality allocations more favorable to disadvantaged students) in the fourth quintile associated with states with strong unions and math teachers in 8th grade, relative to states with the weakest unions.

FIGURE B

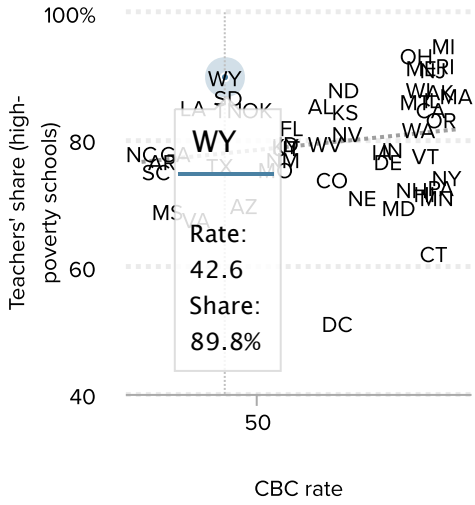
There is no evidence of a correlation between union strength in states and shares of experienced teachers that disadvantage high-poverty schools

Relationship between union strength and share of teachers with five or more years of experience, 2011

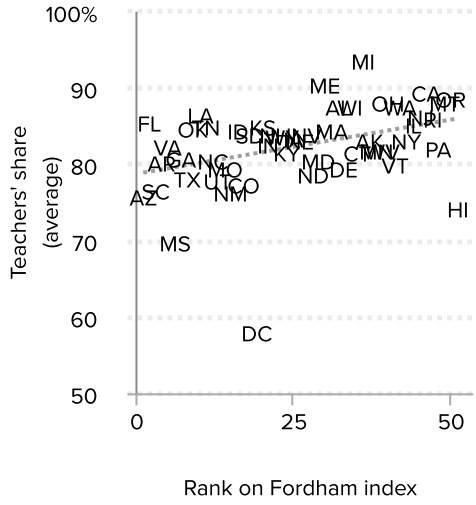
By union strength



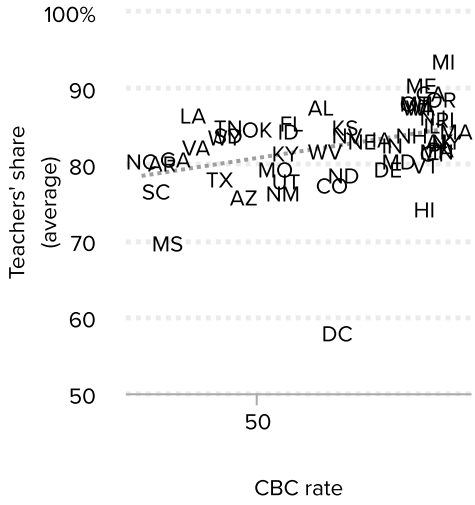
By collective bargaining coverage



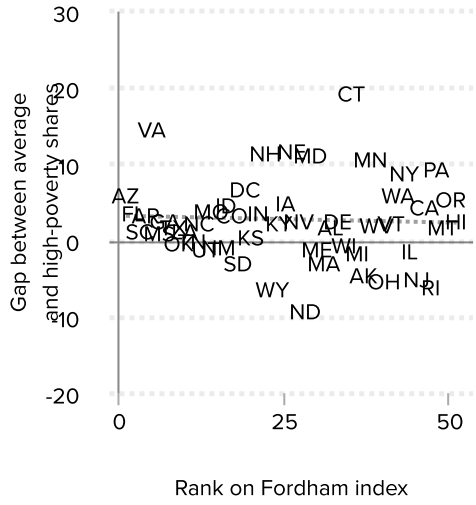
By union strength



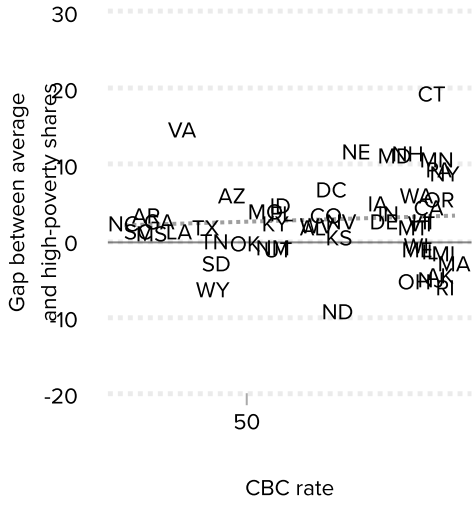
By collective bargaining coverage



By union strength



By collective bargaining coverage



Note: High-poverty schools are those in which more than 50 percent of students are eligible for free and reduced-price lunch. On the inverse Fordham index of union strength, 1 is the lowest value. The CBC rate is the share of teachers covered by collective bargaining.

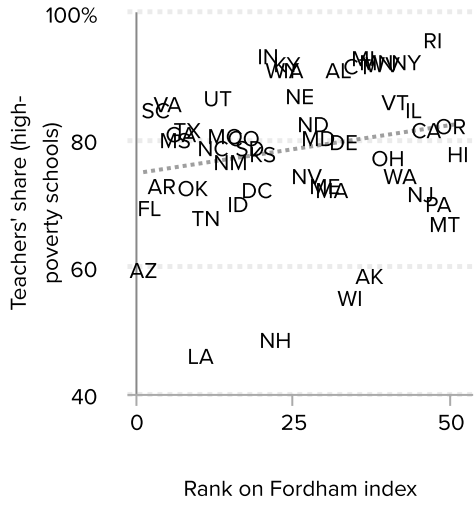
Source: Data on teacher experience are from the National Center for Education Statistics (8th-grade math); union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from the Current Population Survey

FIGURE C

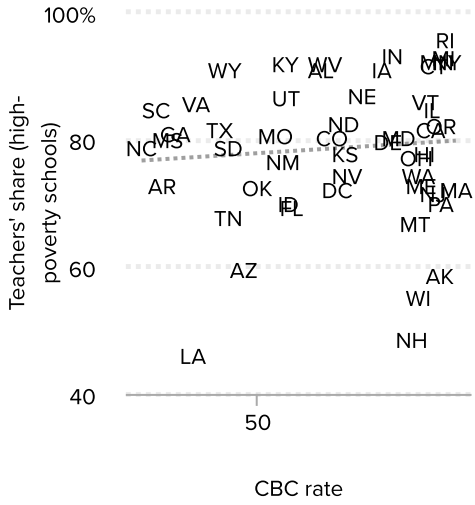
There is no evidence of a correlation between union strength in states and shares of subject-expert teachers that disadvantage high-poverty schools

Relationship between union strength and share of teachers with educational background in the subject taught, 2011

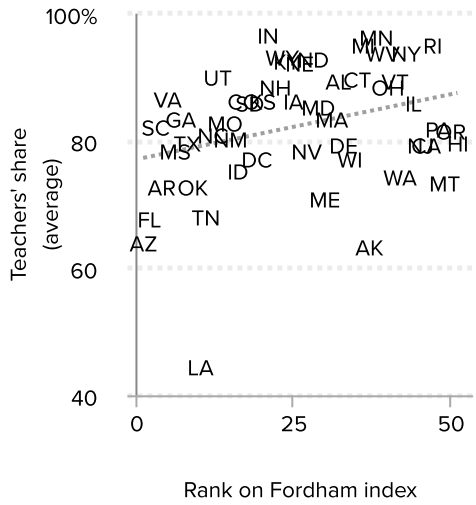
By union strength



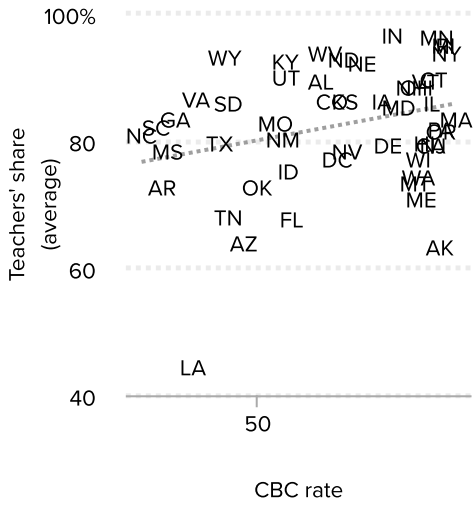
By collective bargaining coverage



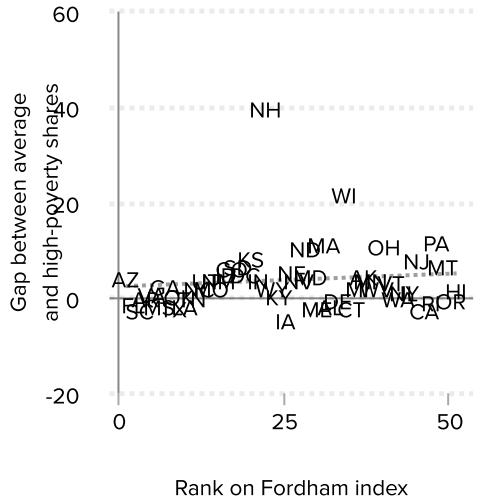
By union strength



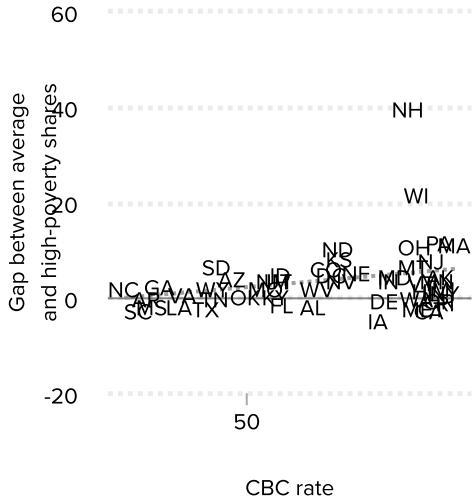
By collective bargaining coverage



By union strength



By collective bargaining coverage



Note: High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. On the inverse Fordham index of union strength, 1 is the lowest value. The CBC rate is the share of teachers covered by collective bargaining.

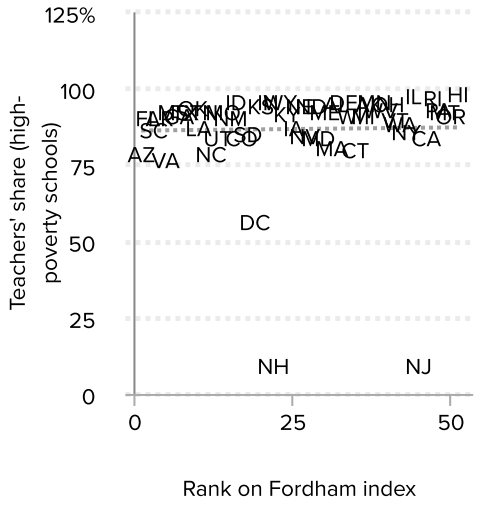
Source: Data on teacher educational background are from the National Center for Education Statistics (8th-grade math); union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from the Current Population Survey

FIGURE D

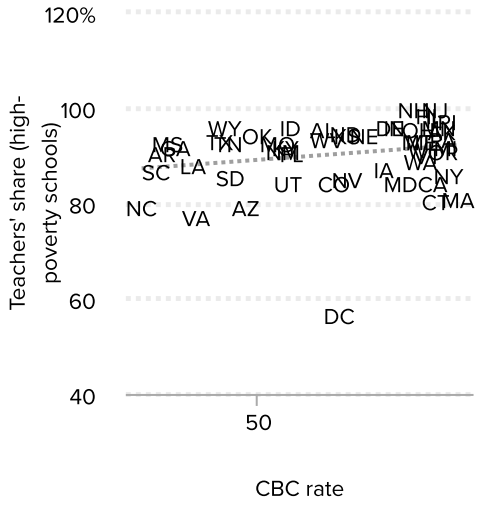
There is no evidence of a correlation between union strength in states and shares of certified teachers that disadvantage high-poverty schools

Relationship between union strength and share of certified teachers, 2011

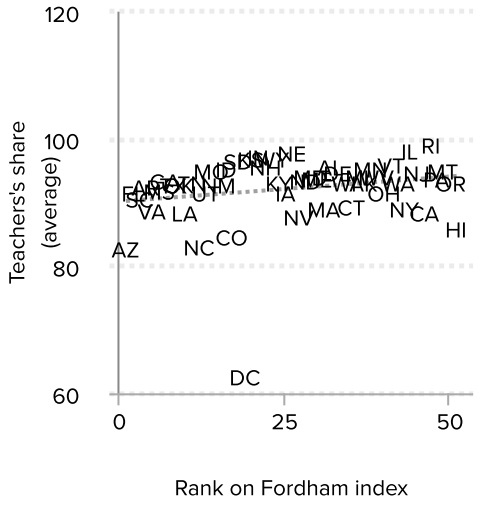
By union strength



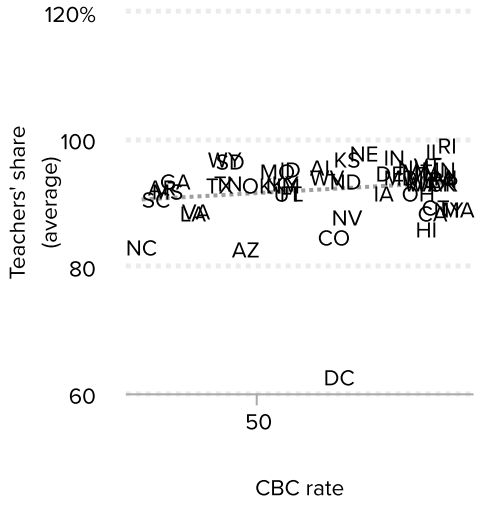
By collective bargaining coverage



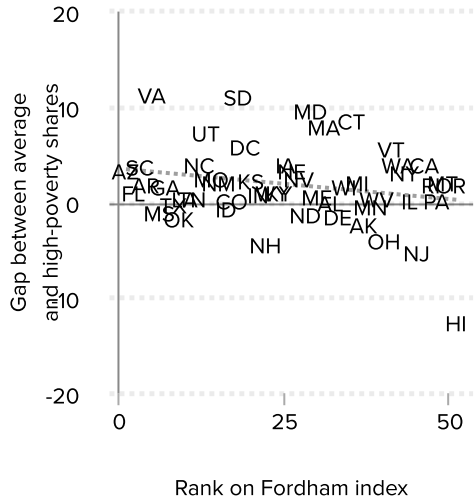
By union strength



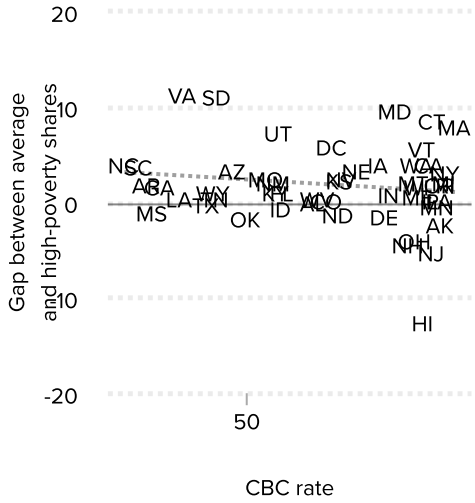
By collective bargaining coverage



By union strength



By collective bargaining coverage



Note: High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. On the inverse Fordham index of union strength, 1 is the lowest value. The CBC rate is the share of teachers covered by collective bargaining.

Source: Data on teacher certification are from the National Center for Education Statistics (8th-grade math); union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from the Current Population Survey

TABLE 4

Association between the measures of union strength and the levels of/gaps in allocation of teachers with five or more years of experience

Independent variable: quintiles, reference: first (lowest) quintile (states where unions are the least strong)

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Experience: collective bargaining coverage rate												
Second quintile	0.012	0.009	0.003	-0.041	0.009	0.003	0.008	-0.028	-0.003	-0.006	0.005	0.013
	(0.022)	(0.019)	(0.036)	(0.043)	(0.017)	(0.016)	(0.023)	(0.036)	(0.013)	(0.013)	(0.025)	(0.021)
Third quintile	0.027	0.017	-0.036	-0.070	0.016	0.003	-0.015	-0.034	-0.011	-0.015	0.021	0.036*
	(0.022)	(0.019)	(0.036)	(0.043)	(0.017)	(0.016)	(0.023)	(0.036)	(0.013)	(0.013)	(0.025)	(0.021)
Fourth quintile	0.069***	0.067***	0.045	0.045	0.062***	0.055***	0.048**	0.047	-0.007	-0.012	0.003	0.002
	(0.022)	(0.019)	(0.036)	(0.043)	(0.017)	(0.016)	(0.023)	(0.036)	(0.013)	(0.013)	(0.025)	(0.021)
Fifth quintile	0.093***	0.095***	0.027	0.015	0.083***	0.080***	0.044*	0.012	-0.010	-0.015	0.017	-0.003
	(0.022)	(0.019)	(0.036)	(0.043)	(0.017)	(0.016)	(0.023)	(0.036)	(0.013)	(0.013)	(0.025)	(0.021)
Constant	0.782***	0.783***	0.789***	0.808***	0.809***	0.814***	0.808***	0.821***	0.027***	0.031***	0.019	0.013
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.358	0.438	0.105	0.158	0.430	0.466	0.197	0.118	0.021	0.041	0.023	0.090
Experience: union strength												
Second quintile	0.010	0.009	-0.008	-0.070	0.003	-0.005	-0.020	-0.044	-0.007	-0.013	-0.012	0.027
	(0.023)	(0.021)	(0.037)	(0.043)	(0.019)	(0.018)	(0.023)	(0.037)	(0.012)	(0.013)	(0.025)	(0.020)
Third quintile	0.016	0.016	0.036	0.017	0.029	0.026	0.029	0.016	0.012	0.009	-0.007	-0.001
	(0.023)	(0.021)	(0.037)	(0.043)	(0.019)	(0.018)	(0.023)	(0.037)	(0.012)	(0.013)	(0.025)	(0.020)
Fourth quintile	0.071***	0.062***	0.045	0.055	0.059***	0.050***	0.040*	0.024	-0.011	-0.012	-0.005	-0.031
	(0.023)	(0.021)	(0.037)	(0.043)	(0.019)	(0.018)	(0.023)	(0.037)	(0.012)	(0.013)	(0.025)	(0.020)
Fifth quintile	0.078***	0.083***	0.052	0.012	0.067***	0.065***	0.046**	0.028	-0.011	-0.018	-0.006	0.016
	(0.023)	(0.021)	(0.037)	(0.043)	(0.019)	(0.018)	(0.023)	(0.037)	(0.012)	(0.013)	(0.025)	(0.020)
Constant	0.787***	0.787***	0.772***	0.795***	0.811***	0.815***	0.806***	0.816***	0.025***	0.028***	0.034*	0.020
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.307	0.342	0.084	0.160	0.314	0.322	0.200	0.096	0.098	0.113	0.005	0.167

Independent variable: Continuous

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Experience: collective bargaining coverage rate												
CBC	0.142***	0.144***	0.072	0.071	0.131***	0.123***	0.090**	0.071	-0.01	-0.02	0.018	0
	(0.033)	(0.030)	(0.054)	(0.066)	(0.027)	(0.026)	(0.034)	(0.054)	(0.018)	(0.019)	(0.036)	(0.031)
Constant	0.725***	0.722***	0.748***	0.750***	0.753***	0.758***	0.763***	0.772***	0.028**	0.035**	0.016	0.023
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.273	0.313	0.035	0.023	0.332	0.308	0.125	0.034	0.006	0.022	0.005	0
Experience: union strength												
Fordham ranking (+)	0.002***	0.002***	0.002**	0.001	0.002***	0.002***	0.001***	0.001	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Constant	0.765***	0.763***	0.755***	0.761***	0.794***	0.795***	0.788***	0.791***	0.029***	0.032***	0.033**	0.030**
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.293	0.335	0.079	0.044	0.306	0.303	0.142	0.041	0.026	0.038	0.002	0.008

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
**NAEP 2011 estimates

Note: High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. M=math, R=reading, 4=4th grade, 8=8th grade.

Source: Data on teacher experience are from the 2011 National Assessment of Educational Progress; union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from EPI's analysis of Current Population Survey data

TABLE 5

Association between measures of union strength and the levels of/gaps in allocation of teachers with educational background in the subject taught

Independent variable: quintiles, reference: first (lowest) quintile (states where unions are the least strong)

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Education: collective bargaining coverage rate												
Second quintile	0.013	0.07	0.019	0.046	0.008	0.057	0.031	0.036	-0.005	-0.012	0.013	-0.009
	(0.025)	(0.054)	(0.049)	(0.045)	(0.023)	(0.049)	(0.043)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Third quintile	-0.005	0.069	0.047	0.065	-0.004	0.037	0.084*	0.066*	0.002	-0.032*	0.037	0.001
	(0.025)	(0.054)	(0.049)	(0.045)	(0.023)	(0.049)	(0.043)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Fourth quintile	0.033	0.101*	-0.046	0.026	0.042*	0.095*	0.029	0.033	0.009	-0.006	0.075**	0.006
	(0.025)	(0.054)	(0.049)	(0.045)	(0.023)	(0.049)	(0.043)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Fifth quintile	0.067**	0.105*	0.049	0.081*	0.043*	0.088*	0.082*	0.093**	-0.025*	-0.017	0.034	0.012
	(0.025)	(0.054)	(0.049)	(0.045)	(0.023)	(0.049)	(0.043)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Constant	0.134***	0.381***	0.773***	0.788***	0.141***	0.383***	0.780***	0.805***	0.007	0.002	0.007	0.017
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.185	0.099	0.094	0.079	0.138	0.099	0.11	0.143	0.141	0.076	0.138	0.019
Education: union strength												
Second quintile	-0.003	0.073	0.066	0.073	0.006	0.066	0.114***	0.072*	0.009	-0.007	0.048	-0.001
	(0.026)	(0.054)	(0.050)	(0.044)	(0.024)	(0.050)	(0.039)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Third quintile	0.006	0.055	0.064	0.117**	0.019	0.044	0.137***	0.094**	0.013	-0.011	0.073**	-0.023
	(0.026)	(0.054)	(0.050)	(0.044)	(0.024)	(0.050)	(0.039)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Fourth quintile	0.065**	0.021	0.089*	0.078*	0.054**	0.027	0.135***	0.072*	-0.011	0.006	0.046	-0.007
	(0.026)	(0.054)	(0.050)	(0.044)	(0.024)	(0.050)	(0.039)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Fifth quintile	0.022	0.081	0.069	0.05	0.013	0.071	0.097**	0.064*	-0.009	-0.01	0.028	0.014
	(0.026)	(0.054)	(0.050)	(0.044)	(0.024)	(0.050)	(0.039)	(0.036)	(0.013)	(0.018)	(0.030)	(0.023)
Constant	0.137***	0.404***	0.730***	0.768***	0.140***	0.396***	0.730***	0.791***	0.003	-0.007	0	0.023
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.166	0.065	0.075	0.144	0.12	0.056	0.272	0.147	0.1	0.027	0.125	0.055

Independent variable: Continuous

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Education: collective bargaining coverage rate												
CBC	0.084**	0.141*	0.044	0.083	0.068*	0.125*	0.130**	0.105*	-0.016	-0.016	0.086*	0.022
	(0.039)	(0.078)	(0.074)	(0.067)	(0.035)	(0.072)	(0.062)	(0.054)	(0.020)	(0.026)	(0.044)	(0.033)
Constant	0.098***	0.353***	0.756***	0.774***	0.112***	0.352***	0.736***	0.778***	0.014	0.000	-0.020	0.004
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.088	0.063	0.007	0.031	0.073	0.058	0.081	0.073	0.013	0.008	0.072	0.009
Education: union strength												
Fordham ranking (+)	0.001**	0.001	0.002	0.001	0.001	0.001	0.002**	0.001	0.000	0.000	0.001	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.000)
Constant	0.123***	0.424***	0.747***	0.810***	0.137***	0.417***	0.771***	0.822***	0.014	-0.007	0.024	0.012
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.089	0.013	0.039	0.012	0.049	0.01	0.093	0.033	0.042	0.005	0.013	0.006

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
**NAEP 2011 estimates

Note: High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. M=math, R=reading, 4=4th grade, 8=8th grade.

Source: Data on teacher education are from the 2011 National Assessment of Educational Progress; union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and collective bargaining data are from EPI's analysis of Current Population Survey data

TABLE 6

Association between measures of union strength and the levels of/gaps in allocation of teachers who are certified

Independent variable: quintiles, reference: first (lowest) quintile (states where unions are the least strong)

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Certification: collective bargaining coverage rate												
Second quintile	0.006	0.000	0.024	-0.019	0.002	0.001	0.008	-0.021	-0.004	0.001	-0.016	-0.002
	(0.013)	(0.013)	(0.032)	(0.033)	(0.009)	(0.010)	(0.025)	(0.031)	(0.008)	(0.008)	(0.018)	(0.011)
Third quintile	-0.016	-0.013	-0.011	-0.067**	-0.004	0.000	-0.017	-0.047	0.011	0.013*	-0.005	0.019*
	(0.013)	(0.013)	(0.032)	(0.033)	(0.009)	(0.010)	(0.025)	(0.031)	(0.008)	(0.008)	(0.018)	(0.011)
Fourth quintile	0.000	0.000	0.047	0.019	-0.007	0.000	0.013	0.003	-0.007	0.000	-0.034*	-0.015
	(0.013)	(0.013)	(0.032)	(0.033)	(0.009)	(0.010)	(0.025)	(0.031)	(0.008)	(0.008)	(0.018)	(0.011)
Fifth quintile	0.013	0.008	0.027	-0.024	0.005	0.007	0.014	0.000	-0.009	-0.001	-0.014	0.024**
	(0.013)	(0.013)	(0.032)	(0.033)	(0.009)	(0.010)	(0.025)	(0.031)	(0.008)	(0.008)	(0.018)	(0.011)
Constant	0.944***	0.945***	0.886***	0.931***	0.953***	0.948***	0.918***	0.940***	0.009	0.003	0.032**	0.009
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.095	0.056	0.082	0.137	0.042	0.014	0.041	0.077	0.137	0.092	0.083	0.263
Certification: union strength												
Second quintile	-0.012	-0.013	-0.028	-0.047	-0.002	0.000	-0.012	-0.042	0.010	0.014*	0.017	0.006
	(0.014)	(0.013)	(0.031)	(0.034)	(0.009)	(0.010)	(0.024)	(0.030)	(0.009)	(0.007)	(0.018)	(0.013)
Third quintile	-0.004	-0.003	0.020	0.006	0.007	0.014	0.025	0.015	0.011	0.017**	0.006	0.010
	(0.014)	(0.013)	(0.031)	(0.034)	(0.009)	(0.010)	(0.024)	(0.030)	(0.009)	(0.007)	(0.018)	(0.013)
Fourth quintile	0.009	0.008	0.038	0.011	0.006	0.013	0.029	0.016	-0.003	0.005	-0.009	0.004
	(0.014)	(0.013)	(0.031)	(0.034)	(0.009)	(0.010)	(0.024)	(0.030)	(0.009)	(0.007)	(0.018)	(0.013)
Fifth quintile	-0.011	-0.013	0.042	-0.009	-0.004	0.000	0.022	0.009	0.007	0.013*	-0.020	0.018
	(0.014)	(0.013)	(0.031)	(0.034)	(0.009)	(0.010)	(0.024)	(0.030)	(0.009)	(0.007)	(0.018)	(0.013)
Constant	0.948***	0.948***	0.889***	0.921***	0.950***	0.944***	0.909***	0.928***	0.003	-0.004	0.020	0.007
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.060	0.083	0.125	0.073	0.046	0.084	0.082	0.094	0.073	0.135	0.091	0.048

Independent variable: Continuous

	High poverty				Average				Average minus high poverty			
	M4	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**	**M4**	**R4**	**M8**	**R8**
Certification: collective bargaining coverage rate												
CBC	0.009	0.008	0.069	0.002	0.001	0.012	0.039	0.025	-0.008	0.004	-0.029	0.023
	(0.020)	(0.019)	(0.047)	(0.050)	(0.014)	(0.015)	(0.036)	(0.045)	(0.013)	(0.011)	(0.026)	(0.018)
Constant	0.938***	0.938***	0.857***	0.912***	0.951***	0.941***	0.895***	0.910***	0.012	0.003	0.039**	-0.001
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.004	0.004	0.042	0.000	0.000	0.014	0.024	0.006	0.007	0.003	0.025	0.031
Certification: union strength												
Fordham ranking (+)	0.000	0.000	0.001**	0.000	0.000	0.000	0.001	0.001	0.000	0.000	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Constant	0.944***	0.943***	0.866***	0.903***	0.951***	0.945***	0.902***	0.908***	0.008	0.002	0.035***	0.005
Observations	51	51	51	51	51	51	51	51	51	51	51	51
R-squared	0.000	0.000	0.083	0.006	0.000	0.011	0.044	0.027	0.000	0.014	0.054	0.034

*Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1
**NAEP 2011 estimates

Note: High-poverty schools are those in which more than 50 percent of students are eligible for free or reduced-price lunch. M=math, R=reading, 4=4th grade, 8=8th grade.

Source: Data on teacher certification are from the 2011 National Assessment of Educational Progress; union strength rankings are from the Fordham Institute (Winkler, Scull, and Zeehandelaar 2012) and data on collective bargaining are from EPI's analysis of Current Population Survey data

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Conclusion

It is important to address the persistent nature of achievement gaps between advantaged and disadvantaged students (see Reardon 2011, among others). If individual, school, community, institutional, and contextual factors could be contributing to these gaps, exploring all the factors and disentangling their relative importance in explaining educational inequality would constitute a prime step in guiding policy.

Our research sheds light on both the extent of teacher misallocation in high-poverty schools and whether such misallocations are associated with strong teachers unions. Our findings reveal three important facts or patterns in this regard.

First, 47.7 percent of U.S. public schools are high-poverty schools, defined as those in which more than half of the student body is eligible for free or reduced-price lunch. The concentration of high-poverty schools varies significantly across the states: for example, in Mississippi, Washington, D.C., New Mexico, Louisiana, Arkansas, Alabama, Oklahoma, Tennessee, and Florida, over two-thirds of the schools are high-poverty schools. In Nebraska, Utah, Iowa, Minnesota, Wyoming, North Dakota, and New Hampshire, the proportion of high-poverty schools is less than 20 percent (and only 5 percent in New Hampshire). Obviously, the dimensions of the problem pose multiple challenges for education policy. Indeed, high student poverty and high concentrations of poor children within schools constitute the main obstacle to education equity and performance (Garcia 2015; Putnam 2015; Morsy and Rothstein 2015, among others), and it is important to continually examine how the concentration of poverty and relative poverty may affect students' performance as well as how equitable finance policies (in education and public policy) have successfully compensated for these disadvantages. An exploration of the economic and public policies that have led to lower proportions of high-poverty schools and better student performance across states would be our first recommendation for educational improvement.

Second, we find that the credentials of teachers in schools overall are better than the credentials of teachers in high-poverty schools. Our analysis does not assess whether these gaps are modest or large or what the impact may be for student performance and achievement gaps. Nevertheless, any inequitable allocation (of teacher quality or any other resource) that does not benefit disadvantaged students would increase rather than decrease opportunity gaps.

Third, our analyses examine the relationship between two measures of union strength (and measure each one in two ways, continuous and categorical) and three teacher quality credentials for four grade/subject combinations (reading/math, 4th/8th grades) and consistently find that there is no relationship between union strength and teacher quality misallocations adversely affecting disadvantaged students.

For further research, we propose to examine the correlation between indicators of union strength and student performance across the states in an attempt to explore whether stronger unions correlate with higher or lower state educational performance. We also propose using other types of analysis—such as longitudinal analyses of changes in credentials of teachers in specific districts and/or states and changes in the presence of unions, or perhaps the specific provisions in collective bargaining agreements—to tackle the causal links between unions, the allocations of teachers, and student performance. To reduce inequities, it would also be valuable to gain further insights into why teachers sort the way they do, and the role teachers unions can play in observing and improving teacher quality—through supportive policies that make teaching in high-poverty schools more feasible, less burdensome, or more attractive, or through policies like professional development (see Annenberg Institute for School Reform 2011; Moore-Johnson et al. 2007; Tucker 2012). Finally, with the aim of shrinking achievement gaps, it will be important to address the extent to which other aspects of school finance and school quality—including facilities, access to advanced classes, curriculum, climate, etc.—differ between high-poverty schools and others; how they influence student performance and gaps; and whether their influence is compounded by teacher misallocation.

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Endnotes

1. Collective agreements usually operate at the school district and not the state level. However, state legislative and policy rules can impact teacher allocation. This analysis is a first cut exploring any evidence supporting or rejecting the mentioned claims that strong teacher unions are associated with skewed teacher quality allocations for high-poverty schools.

2. The analysis also shows that most of the inequities come from teachers sorting across districts and schools as opposed to within schools/across classrooms.

3. As the Institute of Education Sciences points out, in addition to the fact that the correlation between credentials and teacher effectiveness is small, "even existing studies that do measure access to effective teaching using learning gains do so in different ways, making it difficult to synthesize the lessons learned" (NCEE 2014).

4. Regarding how teacher preferences may be driving the misallocation of teachers, the explanations include that teachers are more likely to leave schools with higher concentrations of poor, minority, and/or low-performing students; schools with students with more behavioral problems; schools in which the teachers have less autonomy; and schools in which the teachers receive lower salaries (Guarino, Santibáñez, and Daley 2006). Although it is not clear whether those more willing to leave are of higher quality than those staying (i.e., whether there is selection bias, in which teachers leaving these schools are more likely to be either more credentialed or more effective, or both), research documents that, in general, high teacher turnover in lower-performing schools could disadvantage students in those schools. Since the effectiveness of teachers increases over the first few years of their careers, higher turnover in high-poverty schools would result in a higher proportion of novice teachers in those settings. According to the evidence, 27 percent of first-year teachers in New York City's lower-performing schools do not return the following year, compared with 15 percent in schools with the highest student achievement (see Boyd et al. 2005). On salaries, for example, a study of North Carolina schools found that bonuses awarded to teachers reduced turnover in high-poverty schools by 17 percent (Clotfelter et al. 2008), and experienced teachers (those with 10–19 years of experience) were most likely to benefit from the program (31 percent). A more comprehensive summary of these studies is provided by Imazeki and Goe (2009). The literature on turnover is summarized in Ronfeldt, Loeb, and Wyckoff (2013) and Hughes (2012).

5. This list is not exhaustive. For example, two quotes reflecting this approach state that: "teacher unions [that are doing what unions] are expected [to do by trying] to protect the less effective of their members from the consequences that follow from exposing their ineptitude in the classroom" (Whitehurst et al. 2015); and "teacher unions are at the heart of these problems" (Moe 2011, 6; "these" refers to "the nation's education problems"). An allusion to problems aggravated by unions include delaying negotiations for implementation of comprehensive evaluation systems (in New York) that would allow "addressing teacher quality deficiencies, generally, and will create an important tool to address inadequacy and inequity in teacher talent and the way it is distributed across schools" (StudentFirstNY 2013).

6. Tenure provides teachers with due process in the event of dismissal. Teacher transfer rights vary by district and, when based on seniority, give teachers with more experience the option to transfer if an opening in the same school or in another school in the same district is available. The role of seniority in voluntary and involuntary transfers in the contracts or as stated by management varies from district to district.

7. Goldstein (2014) writes that, "Even as unions argued for job security protections that few parents could support, organized teachers were (and remain) potent advocates for many of the education policies that most benefit disadvantaged children, from tuition-free pre-K to better training for teachers."

8. See main effects of CBA provisions in models with district controls.

9. Anzia and Moe (2014) found similar results, though they argue that the results are sensitive to school district size. Their findings contrast with the findings of Koski and Horng (2007) for California and Cohen-Vogel and Li (2013) for Florida; these California and Florida studies found no evidence of the seniority-inequality relationship.

10. The first two columns of Appendix table A-1 are used to construct the correlation graph shown in Figure A. They are, in various forms, the independent variables in our regression analyses. See details below.

11. This index is measured as a ranking in Fordham's study. The ranking is re-ordered in our study so that a stronger union (a lower ordinal number) is associated with a higher value of the index. We are aware of the limitations of using an ordinal variable when doing the calculations. The analyses were confirmed using the School and Staffing Survey's proportion of unionized teachers and an index of resources/members, and other Fordham indices (see values in other columns in Appendix Table A-1). Results are available upon request.

12. Results using indicators of teacher quality from the U.S. Department of Education's Educator Equity Profiles are available upon request.

13. All these gaps are slightly larger if we compare high- with low-poverty schools: the percentages of teachers with over five years of experience, educational background in subject taught, and certification are 5.4, 9.9, and 5.0 percentage points lower in high-poverty schools than in low-poverty schools, on average.

14. Results are available upon request.

15. The only exception of the slope of the math-8th grade/education background versus collective bargaining agreement coverage regression, which has a positive slope of 0.086, statistically significant at the 10 percent significance level, suggests union strength leads to less misallocation.

16. With the exception noted above.

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