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Abstract

In many school districts the policies that regulate personnel are governed by collective bargaining agreements (CBAs) negotiated between teachers' unions and school boards. While there is significant policy attention and, in some cases, legislative action that has affected the scope of these agreements, there is relatively little research that assesses how CBAs vary over time, or whether they change in response to states' legislative reforms. In this paper we compare CBAs in three states at two points in time: before and after substantial reforms in Michigan and Washington impacting collective bargaining and in California where there were no major statutory changes affecting CBAs. We find that few district characteristics predict changes in CBA restrictiveness over time, other than institutional spillovers from local bargaining structures. However, we observe that reforms to the scope of bargaining in Michigan and Washington drastically reduced the restrictiveness of Michigan and Washington CBAs relative to California.

1. Introduction

In recent years, research has increasingly confirmed what practitioners have long suspected: teachers matter more to student learning than any other school-based input (e.g., Aaronson et al., 2007; Chetty et al., 2014; Goldhaber et al., 1999; Rivkin et al., 2005). Guided by this evidence, education reformers in the last decade have advocated for and implemented policies aimed at increasing student achievement through personnel policy changes that should, in theory, create a more effective teacher workforce and eventually improve student achievement. These reforms have targeted teacher quality throughout the teacher pipeline, including new requirements for teacher preparation programs, changes to teacher licensure policies, and changes to evaluation systems that are in turn tied to new forms of compensation and high stakes decisions concerning retention and promotion.[1]

Many of the policies that regulate in-service personnel are governed by collective bargaining agreements (CBAs, or contracts), i.e. the binding agreements negotiated at the local level between teachers' unions and school boards (Eberts, 2007; Strunk, 2012). Contracts may influence teachers' working conditions, compensation and benefits, class size, preparation time, evaluations, seniority rules, and transfer policies. Not surprisingly, then, nearly all recent reforms have included changes to the laws governing teacher collective bargaining, with changes proposed in every state and enacted in 49 of them (Marianno, 2015).

A theme of these reforms is that restrictive contracts limit administrators' abilities to manage school and district workforces, create undue costs and erect significant barriers to local improvement efforts (e.g., Hess & Loup, 2008; Moe, 2009, 2011, 2014; Paige, 2007; Whitmire &

[1] For instance, see examples from Colorado (Code of Colorado Regulations 1 CCR 301-87), Michigan (Michigan Compiled Laws 380.1249), and Washington (Revised Code of Washington 28A.405.100).

Rotherham; 2009). Others, chiefly the teachers' unions themselves, assert that CBAs intentionally limit the ability of administrators to make arbitrary staffing decisions, and that the regulations negotiated into contracts are critical for protecting teachers' rights and working environments (e.g. Bascia & Rottmann, 2011).

Whether or not these recent reforms will, as advocates hypothesize, improve the efficiency of school and district operations and thus improve student achievement, or, as opponents posit, diminish important protections and harm school outcomes, is a question for empirical study (see, for example, Anderson, Brunner, Cowen, & Strunk (2018)). For either argument to come to fruition, however, these reforms must first cause substantive changes to the CBAs themselves. In this paper we examine the extent to which CBAs – overall and in specific subareas – change over time within and across three states California, Michigan, and Washington. Using these three states as a comparative case, we expand on a previously developed method (e.g., Strunk and Reardon, 2010; Marianno & Strunk, 2018) to assess the degree to which CBAs restrict management control over district operations, how CBA restrictiveness changes over time in the three states, and to what extent these changes can be explained by district and state characteristics, including state reforms (in Michigan and Washington) intended to reduce the scope of collective bargaining.

We find that once fixed district characteristics are taken into account, very few district traits significantly predict changes in CBA restrictiveness in California, Michigan, or Washington. We find that contracts are growing more restrictive in California districts where the proportion of students qualifying for free-and-reduced price lunch is growing. Additionally, Michigan CBAs increase in restrictiveness in school districts where the teacher population is becoming more experienced over time. Consistent with prior research (Goldhaber et al., 2014), we also show

that institutionalized union bargaining structures are predictive of contract restrictiveness levels and changes; that is, contracts under the same union Uniserv council are similar in levels of restrictiveness (in California, Michigan, and Washington) and grow collectively more restrictive over time (in Washington and Michigan but not in California). Moreover, we find that state reforms to the scope of bargaining in Michigan and Washington drastically reduced the restrictiveness of Michigan and Washington CBAs relative to California where corresponding state reforms did not take place. Importantly, it appears that in Washington, where the evaluation components of CBAs were affected by legislative reform but other aspects of collective bargaining were left unchanged, unions and districts negotiate greater protections into non-evaluation components of the CBAs. Together, these findings provide new insights into the ways regulatory changes affect collective bargaining agreements, and thus the structures that govern teachers' work.

The remainder of this paper proceeds as follows: Section 2 briefly reviews the relevant literature pertaining to how CBAs vary and their relationship with district characteristics and Section 3 describes the three state contexts in which we situate our study. Section 4 describes the data that will be used to address the research questions. Section 5 outlines the methods used to explore the research questions. Section 6 provides results from these analyses and Section 7 concludes with a discussion of these results and directions for future research.

2. Prior Literature on Collective Bargaining Agreements

Given the wide range of policies determined in negotiations between teachers' unions and school boards, CBAs are perhaps the most important policy documents in district governance and operations (Hill, 2006). Studies exploring the content of CBAs conclude that they vary widely across districts and restrict administrator flexibility in some ways while

enhancing it (and potentially improving working conditions) in others (Ballou, 2000; Eberts, 1983, 1984; Eberts & Stone, 1984; Hess & Kelly, 2006; Hess & Loup, 2008; Johnson, 1984; McDonnell & Pascal, 1979, 1988; Strunk, 2012). Other work has focused on the relationship between district characteristics and the content of contracts, finding that urban and large districts have both stronger unions and more restrictive CBAs (Brunner & Squires, 2013; Goldhaber, Lavery & Theobald, 2014; Marianno et al., 2018; McDonnell & Pascal, 1979; Moe, 2011; Rose & Sonstelie, 2010; Strunk, 2012; Strunk et al., 2018). Both Strunk (2012) and Goldhaber et al. (2014) find that many of the hardest to staff districts (i.e., not just large or urban, but also those with high proportions of minority and low-income students) have more restrictive CBAs; and Goldhaber et al. (2014) also provide evidence of geographic spillover effects in terms of the contract restrictiveness of nearby districts, particularly for districts who share union bargaining support from local Uniserv councils.

There has also been growing attention to the relationship between CBAs and district outcomes. The most rigorous studies that examine the effects of CBAs on operations and outcomes find that districts with stronger unions and more restrictive contracts have greater expenditures (Eberts 1983; Eberts & Stone 1984; Strunk 2011; Marianno, Bruno & Strunk, 2018), stemming in part from higher teacher salaries and benefits (Brunner & Squires, 2013; Hoxby, 1996; Winters, 2011). Existing research has also shown that restrictive CBAs have either null or adverse effects on student outcomes (Moe, 2009; Strunk, 2011; Strunk & McEachin, 2011; Marianno & Strunk, 2018). (See Cowen and Strunk (2015) for a more complete review of this literature.)

Although this literature has provided ample evidence about the content of CBAs and the relationships between contract restrictiveness and various outcomes, far less attention has

been paid to whether and why CBAs change over time. Only five studies of which we know explicitly examine the same districts' CBAs in more than one time period. The first study, by McDonnell and Pascal (1988), uses a national sample of 151 labor agreements taken from two time periods: 1970 through 1975 and 1980 through 1985. Examining the individual provisions within the CBAS, they show that very few CBAs change substantially over time, and few gain provisions that would make teachers' working conditions more professional. A more recent study by Cowen and Fowles (2013) examines one district in Kentucky's CBA over a thirty-year period. They conclude that the CBA has stayed largely the same over the three decades, even as education policy at the national and state levels shifted dramatically. Ingle and Wisman (2018) expand this work to all collective bargaining districts in Kentucky and similarly find little change in CBAs across the state. In California, Strunk and Marianno (2018) examine how CBAs change as a result of the Great Recession and find that CBAs in districts that are less affected by recessionary pressures grow less restrictive in the areas of school schedule, grievance, and non-teaching duties over this time period, relative to CBAs in districts that were harder hit by the Great Recession. In a separate study, Marianno and Strunk (2018) look at the same sample of California CBAs from the 2005-6 through the 2011-12 school year to study how the relationship between CBAs and student achievement measures change over time. They find that, while across the sample more restrictive CBAs are *associated* with lower student performance, changes in CBAs restrictiveness do not appear to lead to decreases in student achievement.

As is evident from the above review, the far majority of studies examine CBAs in one state context and/or in only a single year. The current study is the first to utilize data garnered from a large sample of CBAs in more than one year *and* in more than one state to provide

descriptive empirical evidence that addresses questions regarding how contracts change over time, the relationships between contract restrictiveness and district characteristics, and how these things differ across states facing different policy contexts. Section 3 describes the three state policy contexts.

3. Three State Context

We situate our study in three states in which regulatory contexts changed to varying degrees and at different points over the time period we examine here (2010-11 to 2014-15). In this section we provide a brief overview of the policy changes relevant to our study in the three states. More detail is provided in Appendix 1. California did not legislate any major personnel reforms, although several ongoing high-profile court cases focused public attention on potential relationships between California state and district regulations and teacher quality and distribution. In contrast, a 2012 state law change in Washington substantially shifted the way that teachers are evaluated and the consequences of teacher evaluations in that state (RCW 28A.405.100), mandating a new teacher evaluation system that was more restrictive than any existing state policy and eliminating districts' local bargaining power over teacher evaluation (ESSB 5895).

The Michigan context has changed the most of the three states: a series of reforms reduced the scope of collective bargaining, leaving most of the provisions that govern teacher evaluation, transfers, and discipline, to the sole discretion of the public school employer, and replacing a few with statewide policies. In particular, in 2012 the state legislature shifted the state from an agency shop to a Right-to-Work state, so unions may no longer require teachers to join their organization or pay agency shop fees regardless of membership. Prior to that, in 2011, the state enacted substantial reforms that fundamentally changed the scope of collective

bargaining and removed or lessened a number of protections prioritized by unions and union advocates. In particular, there are new requirements for teacher tenure and teacher evaluation, and new prohibitions on bargaining over teacher placement, discipline, merit pay standards, parental notification of ineffective teachers, or personnel decisions following the elimination of a position, and instead these policies were regulated by the state (Public Acts 100-103, 2011).

We focus on these three states because the policy changes in Michigan and Washington described above dramatically changed the scope of bargaining in those two states between the two years of CBA data we consider. In contrast, in California there were no actual legislative reforms and only the threat of judicial reforms. We would expect the Michigan and Washington CBAs may grow somewhat less restrictive, especially relative to California, when evaluation (Michigan and Washington) and other working conditions (Michigan) are taken off the bargaining table. A more nuanced view may be that both unions and districts in the reform states would reallocate their bargaining resources to other areas of the contract once prohibited subjects were taken off the bargaining table. In this instance, impacted areas of the CBAs should become less restrictive to administrators, and other subareas unaffected by the reforms may become more restrictive as unions and district administrators worked to compensate teachers for protections that were removed from them, or simply because there was more time in negotiations to discuss different contract areas. In addition, in both states, the general feeling that unions were "under attack" could have caused them to strengthen workplace protections where they were still able.

4. Data and Measures

4.1 Measures of Contract Restrictiveness

The main source of data for the paper that enables us to construct a measure of contract restrictiveness comes from the CBAs negotiated between district administrators or school boards and their local teachers' unions in California, Michigan, and Washington school districts.[2] In California, we focused data collection on districts with four or more schools.[3] We collected 490 (84 percent) of California school district contracts with four or more schools from the 2011-12 school year and 495 (86 percent of districts with four or more schools) in the 2014-15 school year. We have CBAs from 462 (83 percent of districts with four or more schools) districts in both years of study. Contract collection was spaced three years apart because California law holds that districts must renegotiate contracts at least every three years, and most district contracts cover three-year time spans. In Michigan, we collected the last CBA ratified before the 2011 evaluation reforms and the first CBA ratified after the 2013 Right-to-Work legislation from all 517 public school districts with operational CBAs in both time periods (96% of all public school districts). In Washington, we collected CBAs from all 270 school districts with an operational CBA during the 2010-11 school year (before the evaluation reforms took place) and from all 268 school districts with an operational CBA during the 2014-15 school year, post-reform.[4] Together, our database includes 2,492 CBAs from 1,246 districts across three states in both a pre-reform and a post-reform year.

[2] Before we begin a discussion of our primary measure of interest in this paper, it is important to highlight two important considerations. First, we do not use the terms "restrictiveness" in a normative way. For instance, a CBA might include provisions that mandate that a district adheres to specific teacher evaluation procedures. Whether this is beneficial for students depends on the relationship between those evaluation procedures and teacher effectiveness and what would have been done in the absence of the CBA provisions. Second, as illustrated by the aforementioned example, we describe the measure as restricting administrator's actions, but many provisions also restrict (or at least have implications) for how teachers carry out various work tasks.

[3] We focus on districts with four or more schools for both practical and empirical reasons. First, there are nearly 1,000 districts in California, and the smallest districts (those with fewer than four schools, N=363, or 39% of all California districts, in 2014-15) often do not have websites and it can be difficult to contact human resources or other central office staff to respond to requests for the CBAs. Second, many of the provisions in CBAs should necessarily differ between larger and smaller districts, and some will be more or less binding depending on the size. For comparability in such a large state, we choose to remove from our sample the smallest districts.

[4] Washington has 295 school districts; 25 districts in 2010-11 and 27 districts in 2014-15 reported that they do not have an operational CBA.

Much of the literature that examines CBA content and restrictiveness relies on somewhat *ad hoc* means of measuring the extent to which CBAs restrict administrator flexibility. These methods often focus on the presence or absence of high profile provisions in each contract (e.g. Cowen & Fowles, 2013; Hess & Kelly, 2006; Hess & Loup, 2008; Ingle & Wisman, 2018). However, these contract measures cannot assess the degree to which the CBAs as a whole constrain administrators' actions. A smaller set of studies are based on the construction of more systematic analyses of CBA content. For instance, Eberts (1983) and Eberts and Stone (1984), in their studies of New York teachers' union contracts in 1976-77, generate two measures of contract restrictiveness, or contract "strength." They first define restrictive contracts as those with the most included provisions (up to a maximum of 53). They also create a second measure of CBA restrictiveness using a Guttman scaling technique. This method highlights the hierarchical nature of union contracts by generating a unidimensional measure of contract restrictiveness based on the difficulty of negotiating each of a set of 18 items within the contract.

The Partial Independence Item Response (PIIR) model we use in this paper builds on this second set of more systematic measures of CBA strength. In earlier work, Strunk and Reardon (2010) generated the PIIR measure based on a set of California CBAs that governed district operations at a single time point (the 2005-6 school year), measuring the underlying latent restrictiveness of a teachers' union contract. This measure was later replicated by Goldhaber and colleagues (2013) in Washington state. More recent work expands this method to examine CBA restrictiveness in California across several iterations of the contract (Marianno, Bruno & Strunk, 2018; Marianno & Strunk, 2018; Strunk & Marianno, 2018). In what follows, we describe the PIIR model and associated CBA measures at a high level, *focusing on how we amend the PIIR*

measure for use both longitudinally and across states (we describe the PIIR model in more detail in Appendix 2).

For this analysis we create a cross-state longitudinal measure of overall contract restrictiveness. The measure uses Cronbach's Alpha analysis to reduce a set of 88 contract provisions to 39 that appear in CBAs from all three states and cover several different policy areas. While all of these provisions are subject to the collective bargaining process in the pre-reform year in all three states, as we discussed in Section 3, several were affected by reform legislation in Michigan and Washington and are no longer negotiated in post-reform contracts. In particular, while administrators in Washington lost flexibility over determining evaluation policies and administrators in Michigan gained flexibility over determining policies in several areas, the changes in both states reduced local bargaining power. Some post-reform CBAs in both states still include provisions that are no longer locally negotiable or refer to statewide policies; for the purpose of our analyses, we code provisions that are nonnegotiable or unenforceable as absent from the contract.

Given that CBAs contain policies governing a wide range of workplace procedures, we also disaggregate the overall contract restrictiveness measure into component parts that represent major policy areas. We do this for two main reasons. First, it is possible, if not likely, that teachers' unions and school boards/administrators may negotiate more restrictive provisions in some areas and compensate by becoming more flexible in other areas. We can examine this by creating and analyzing separate measures for main areas of the contract. Second, it is likely that CBAs will change in in some subareas more than in others in response to implemented (Michigan and Washington) or threatened (California) state policy changes. For instance, we might expect that, once teacher evaluation was "off the bargaining table" in

Michigan and Washington, unions and districts would devote their resources to bargaining over other parts of the contract in ways that could influence the restrictiveness of these different sub-areas.

To assess the potential for spillovers across provisions negotiated in CBAs, we generated cross-state longitudinal restrictiveness measures for four of the most importance contract subareas: association rights, evaluation, leaves, and transfers and vacancies. We standardize all contract restrictiveness measures across states with respect to the pre-reform year, allowing us to interpret changes over time in base year standard deviation units. Appendix Table 2 A-B lists the provisions included in each of the restrictiveness measures used in this paper.

The PIIR approach has a number of advantages over other more ad hoc or subjective ways of measuring contract restrictiveness (e.g. choosing particular provisions from a CBA to code), three of which are particularly pertinent to this project. First, this method provides a more objective and systematically derived measure than other approaches because items selected for inclusion arise from correlations with the latent restrictiveness factor rather than from pre-defined assumptions about which items are most likely to be associated with restrictiveness. Second, the PIIR model allows for the creation of a transparent and probability-based interval scale along which individual contracts are placed according to their specific level of restrictiveness, as well as standard errors of measurement for each contract. Lastly, this method has been shown to have both external and internal validity. Specifically, the PIIR-generated measures of contract restrictiveness are associated with district characteristics associated with union restrictiveness (i.e., district size) as well as with external measures of union power (Strunk, 2012; Strunk & Grissom, 2010), and is replicable in multiple state contexts

(i.e., in California, where the measure was developed, and in Michigan and Washington (Goldhaber, Lavery, Theobald, D'Entremont & Fang, 2013; Marianno et al., 2018).

4.2 District Characteristics

In addition to the contract data, we use a set of district-level covariates in our models that are hypothesized to predict contract restrictiveness. In California, these data come from the publicly-available district-level data from the California Department of Education. In Michigan, data are derived from both publicly-available district-level and administrative data from the Michigan Department of Education. And in Washington, these data come from publicly-available district-level files from the Washington State Office of the Superintendent of Public Instruction (OSPI).

In all three states, we receive information on district demographics, achievement (as measured by math achievement scores) [5], district size, the proportion of students that have an IEP (special needs), district location (urban, rural, town, suburban), teacher experience, and the proportion of students eligible for free-or-reduced-price lunch. We have measures for district level (elementary, unified and high school, in California only, as in Michigan and Washington nearly all districts are unified). We use lagged measures of these variables from the year before we collect the CBA data, as the district characteristics from the year *before* contract negotiation should be relevant for the negotiations more than the year *of* negotiation.[6] Table 1 shows summary statistics for these variables in each year before contract data collection as well as the average change between the pre- and post-periods.

[5] We standardize test scores by grade and year and average within districts in both states to ensure that these measures are comparable.
[6] A limitation of this work is that we collect CBAs in a given year. Despite the CBA being operational at the time of collection, not all CBAs are *negotiated* in this year.

5. Methods

5.1 Changes in District Characteristics

We use several descriptive methods to assess the extent to which changes in district characteristics and state policy context are associated with differential changes across states in CBA restrictiveness. First, we estimate a series of models that examine the relationship between changes in district characteristics and contract restrictiveness in each state. These models, at their most complete, take the following form:

$$CR_{dt} = \beta_0 + \boldsymbol{X_{dt-1}}\beta_1 + \beta_2 post_t + \delta_d + e_d \qquad \textbf{(1)}$$

Where $CR_{dt}$is either the overall contract restrictiveness measure or the subarea measure. $\boldsymbol{X_{dt}}$is a vector of school district characteristics that have been shown in previous work to be associated with contract restrictiveness, including the proportion of students in the district who qualify for free- and reduced-price lunches,[7] district average math achievement on standardized tests, district size (measured as the natural log of total enrollment), the percent of students who qualify for special education (have Individual Education Plans, or IEPs), and measures of teachers median experience and the variation (standard deviation) in experience. We also including $post_t$ as an indicator that turns on in the post-year, 2014-15, which controls for any variation in CBA restrictiveness associated with the post-reform period that is common to all districts (i.e. the state reforms to the scope of bargaining). δ_d is a district fixed effect. All covariates are taken from the year before the CBAs were negotiated.[8] Standard errors are clustered at the district level.

[7] We include the percent of free- or reduced-price eligible students in our models. In so doing, we are unable to include measures of the proportion of students from under-represented minority groups (i.e., Black and Hispanic) due to collinearity.

[8] Many of these covariates capture characteristics of difficult-to-staff districts. Several researchers have speculated that hard-to-staff districts may adopt more restrictive contracts as these could be more desirable to teachers (McDonnell and Pascal, 1988; Strunk, 2012; Johnson and Kardos, 2000; Koppich, 2006), though Cowen and Fowles (2013) also find that schools with more difficult working

5.2 Institutional Spillovers

One issue with the models described above is that they assume independence across bargaining outcomes in different districts. However, prior work has shown that there are "spillover effects" between nearby districts both in union-negotiated wages (Babcock, Engberg, & Greenbaum, 2004; Winters 2011) and CBA contract restrictiveness (Goldhaber, Lavery, & Theobald, 2014). Most relevant for this paper, Goldhaber et al. (2014) use the same 2010-11 contracts from Washington used in this paper and find strong spatial relationships between bargaining outcomes in nearby districts, and further find that these spatial relationships are driven by two "institutional bargaining structures": Education Service Districts (ESDs), which support school districts; and Uniserv councils, which determine who is bargaining on behalf of local teachers' unions. Thus, we explore potential spatial correlations within the pre and post periods in each state by following Babcock et al. (2004), Goldhaber et al. (2014), and Winters (2011) and estimating variants of the following "spatial lag model" (Anselin, 1988):

$$\boldsymbol{\theta} = \rho \boldsymbol{W\theta} + \boldsymbol{X\beta} + \boldsymbol{e} \qquad \textbf{(2)}$$

In equation (2), $\boldsymbol{\theta}$ is a vector in which each entry θ_i is the restrictiveness (or change in restrictiveness) of the CBA in district *i*; ρ is the spatial lag coefficient (the parameter of interest) describing the direction and magnitude of spatial correlation; $\boldsymbol{W}$ is a weighting matrix in which the (i,j)th entry is a measure of the proximity between districts *i* and *j*; and $\boldsymbol{X}$ is a vector of the same district control variables used in previous models (or the change in these control variables between the post and pre periods). The intuition behind this model is that the restrictiveness of

conditions are more likely to have higher union membership rates. As noted above, we include size as a covariate in model (1) because earlier work (Anzia & Moe, 2014; Goldhaber, Lavery, & Theobald, 2014; Moe, 2011; Strunk, 2012) finds that district size is positively associated with contract restrictiveness and union power.

each CBA may be a function of the district's location and observable district covariates, but may also be a function of the restrictiveness of CBAs in nearby districts.

Following Goldhaber et al. (2014), we consider up to three measures of district proximity in each period and state: a linear distance measure in which W_{ij} = 1 if districts *i* and *j* are within 50 miles of each other; a district bargaining structure measure in which W_{ij} = 1 if districts *i* and *j* are in the same district bargaining structure (ESD in Washington or ISD in Michigan); and a union bargaining structure measure in which W_{ij} = 1 if districts *i* and *j* are in the same union bargaining structure ("uniserv council" in all states). Since all matrices $\boldsymbol{W}$ are row standardized, the i^{th} entry of $W\theta$ is simply a weighted average of the restrictiveness of all the other CBAs within 50 miles, in the same ESD/ISD, or in the same Uniserv council, depending on the measure being considered.

The primary challenge in estimating equation (2) is that the lag term $\rho\boldsymbol{W\theta}$ is endogenous. We therefore follow Babcock et al. (2004), Goldhaber et al. (2014), and Winters (2011) and estimate these models as two-stage least squares (2SLS) models using $\boldsymbol{WX}$ (i.e., the average characteristics of nearby districts) as instruments. The identifying assumption in these models is that the average characteristics of nearby districts do not affect the restrictiveness of a district's contract except through the average restrictiveness of those nearby districts' contracts.

We also try to establish the *primary* source of spatial correlations by including multiple spatial lag terms in the same model:

$$\boldsymbol{\theta} = \rho_1\boldsymbol{W_1\theta} + \cdots + \rho_k\boldsymbol{W_k\theta} + \boldsymbol{X\beta} + \boldsymbol{e} \qquad \textbf{(3)}$$

We estimate this model by 2SLS using $W_1X,\ldots,W_kX$ as instruments. As described in Goldhaber et al. (2014), we are interested in establishing the primary source of spatial dependence

because spatial correlation along different measures of proximity are associated with different explanations for spatial dependence. If the spatial dependence is due to competition for teacher labor, we might expect to see that the primary source of spatial dependence is geographic proximity. On the other hand, if the spatial dependence is due to the relationships between districts and unions, then we might expect institutional structures to be more important in determining bargaining outcomes.

5.3 Changes in State Policy Context

We last turn to our comparison *across* states, asking if the different state policy context (e.g. the Washington reform of teacher evaluation) might have driven any differences in changes in CBA restrictiveness, overall or by subarea. To assess differences in restrictiveness, for CBAs overall or in specific subareas, across states, we use a form of difference-in-difference (DiD) estimation strategy. Specifically, we compare the difference in Michigan and Washington CBA restrictiveness to the difference in California CBA restrictiveness in pre and post-periods. This is shown in equation (4):

$$CR_{dst} = \beta_0 + \boldsymbol{X_{dst-1}}\beta_1 + \beta_2 MI_s + \beta_3 WA_s + \beta_4 post_t + \beta_5 MI_s * post_t + \beta_6 WA_s * post_t + e_d \quad \textbf{(4)}$$

Where CR_{dst} and $\boldsymbol{X_{dst}}$ are defined as above. $post_t$ remains an indicator for the post year (2014-15 for California and Washington, and the first post-reform negotiated contract for Michigan). We include indicators for districts in Michigan, MI_s and Washington, WA_s, and an interaction between the state indicators and the post-year indicator. The parameters of interest are β_5 and β_6, which represents the differential average change in contract restrictiveness in Michigan and Washington CBAs relative to California.

We note that β_5 and $\beta_6$do not necessarily identify the causal effect of the state reforms, as we cannot rule out the possibility that changes that are observed in states over time are a result of other concurrent, but unmeasured, state-level factors. Moreover, we understand that the three states under study are not particularly comparable on observable and unobservable characteristics, and we cannot assess pre-trends in CBA restrictiveness in the years before the reform to enable an assessment of the differences in states' CBAs over time. As such, we consider these analyses descriptive comparisons of the three states' pre- to post-reform changes in CBA restrictiveness relative to each other.

6. Results

Table 1 and Figure 1 provide a descriptive picture of our findings. Table 1 presents our measures of contract restrictiveness for both pre- and post- years in each state (in the first and second panels), as well as the average change in restrictiveness between negotiation years (third panel) for the overall contract restrictiveness measure (the first row) and for each subarea restrictiveness measure (the following four rows). More positive values indicate more restrictive contracts and more negative values are less restrictive CBAs. Recall that we standardize all contract restrictiveness measures across states with respect to the pre-reform year, so that changes in contract restrictiveness equate to base year standard deviation units. A negative change, as is found in all three states (panel 3) indicates reductions in CBA restrictiveness. Figure 1 plots the average level of restrictiveness for contracts in each year, along with the spread (minimum/maximum) in restrictiveness in the samples (shown by the bars).

Three initial findings emerge from these analyses. First, both Table 1 and Figure 1A make clear that California CBAs are, on average, more restrictive than those in the other two

states before the reforms, and they are largely unchanged over the time period under study. Washington CBAs are, on average, less restrictive than those in Michigan before the reforms, and although they become even less restrictive post-reforms, they do not decrease to nearly the extent Michigan CBAs do.

Second, we see how tradeoffs may be occurring within CBA subareas. The overall lack of change in overall CBA restrictiveness in California masks significant increases in association rights and transfers and vacancies, and decreased restrictiveness in evaluation provisions. These changes are overshadowed, however, by the changes in Washington CBA subarea restrictiveness; in Washington, CBAs become both significantly and substantively less restrictive in evaluation policies (as expected post-reform), and to a lesser extent in association rights. By contrast, Washington CBAs, on average, became slightly more restrictive in transfer and vacancy policies and substantially more restrictive in the leave policies provided to teachers. Michigan saw the greatest changes in subarea restrictiveness of any of the three states; evaluation provisions became considerably less restrictive post-reforms, as did transfer and vacancy policies. This was expected as a result of the Michigan reforms. However, whereas in Washington, some subareas became *more* restrictive in the face of the reforms, suggesting possible tradeoffs in negotiations, all four subareas of Michigan CBAs became significantly *less* restrictive.

Figures 1A and 1B also highlight another interesting difference in post-reform contracts. As the bars in Figure 1A show, there is substantial variation in CBA restrictiveness even *within* individual states. However, while the California and Washington CBAs retain this variation, Michigan CBAs become more similar in the post-reform era. This is largely driven by drastic

reductions in Michigan CBA variation in the areas of teacher evaluation and transfers and vacancies, as would be expected by the changes dictated by Michigan's policy reforms.

Table 2 reports results from model (1), which includes a district fixed effect (so the model is identified by within district over time changes in the district characteristics). This is broken out by state (Columns 1 for California, 2 for Michigan, and 3 for Washington). Notably, in general there is little evidence, that changes in district characteristics are associated with changes in CBA restrictiveness from the pre- to post-periods. We find that districts with greater proportions of students in poverty have more restrictive CBAs in California. In Michigan, we also see that districts with more experienced teachers, on average, had more restrictive CBAs.

We examine the relationship between CBA restrictiveness and geographic location and institutional bargaining structure via the estimated spatial lag coefficients from equations (2) and (3). We present these results in Table 3. We omit the estimated coefficients for each district characteristic for parsimony but note that these coefficients are very similar to the coefficients already reported in Table 2. Within Table 3, the estimates in columns 1-4 are from the pre period, the estimates in columns 5-8 are from the post period, and the estimates in columns 9-12 consider the change in CBA restrictiveness between the post- and pre- periods.

The estimated spatial lag coefficients largely support the earlier findings of strong spatial relationships in bargaining outcomes (Babcock et al., 2004; Goldhaber et al., 2014; Winters, 2011). In California, for example, there are large, positive, and statistically significant spillover effects in contract restrictiveness between districts within 50 miles of each other and between districts in the same Uniserv council in both the pre and post period. Moreover, models including both spatial lag measures show that there are spillover effects for districts in the same Uniserv council even controlling for geographic proximity, suggesting that belonging

to the same Uniserv in California drives the similarities between geographically proximate districts. Although these similarities exist in both pre- and post-periods, there appear to be no spatial drivers of *changes* in CBA restrictiveness.[9]

In Michigan, all three spatial lag measures are significant and positive when considered individually, but only the spillover effects within Uniserv councils are statistically significant in models that include all three measures of proximity, and only in the pre-reform year. All three remain individually statistically significant in predictions of changes in CBA restrictiveness over the time period under study, and again, the Uniserv measure remains significant when all three are included in the regression.

Not surprisingly given prior work in Washington (Goldhaber et al., 2014), there are statistically significant spillover effects for all three measures of proximity in Washington in both time periods, although all three shrink in magnitude and lose statistical significance when simultaneously entered into the model in the pre-period.[10] These relationships remain in the post-period, as well. Moreover, all three measures of geographic proximity are associated with changes in CBA restrictiveness, suggesting that CBAs grow more and less restrictive in accordance with the districts close to the and that are represented by the same EDS and Uniserv organizations.

Together, our spillover analyses reinforce the conclusion from Goldhaber et al. (2014) that shared institutional bargaining structures on the union side are particularly important in

[9] The lack of a relationship between geographic / structural bargaining indicators and changes in CA CBA restrictiveness may be a result of the relatively small overall change in restrictiveness in California CBAs. In addition, we note that some of the models of changes in CBA restrictiveness are not well-identified. Specifically, the F-statistic on the first-stage regression is less than 10 for the within-50 miles change model in Washington, the Uniserv change model in Washington, and the Uniserv change model in Michigan, suggesting that weak instruments are a concern in these models (Bound et al 1995; Staiger and Stock 1997).

[10] Specifically, the estimated coefficient on the spatial lag term for Uniservs that we report for the pre period in Washington (0.294) is smaller than the equivalent term (0.512) that was published using the same year of data (Goldhaber et al., 2014). However, the difference between these estimates is not statistically significant.

determining bargaining outcomes. This provides further evidence of the importance of institutional bargaining structures, not only in determining the overall restrictiveness of CBAs, but also for the extent to which CBAs become more or less restrictive over time.

Finally, we turn to our difference-in-difference regressions that examine relative changes in state CBA restrictiveness over time. Table 4 reports these results. The top panel compares changes in CBA strength pre- and post-the CBA reforms in Michigan and Washington relative to California without including covariates in the model, and the bottom panel includes the full slate of covariates described in Section 5. The first column in Table 4 reports findings for the overall CBA restrictiveness and columns 2 through 5 show results for subarea analyses. Because we standardize the contract restrictiveness across states relative to the pre-year, we can interpret the coefficients in the interactions as the change in contract restrictiveness in standard deviation units in Michigan or Washington relative to changes in California.

As expected given our initial results in Table and Figure 1, Michigan and Washington CBAs grew less restrictive in the post-year (2015), relative to changes in California CBAs over the same time period. This is the case whether we do or do not include controls in our model. In the models presented in Panel B (with controls), we find that, relative to California, Michigan became 3.78 SD units less restrictive after state reforms to the scope of bargaining, and CBAs in Washington became 0.64 SD units less restrictive.

Across all four subareas, Michigan CBAs also grow less restrictive relative to California's, with the greatest differences in the Evaluation (-11.61 SD) and Transfers and Vacancies (-5.84 SD) subareas. Washington CBAs become even less restrictive than California's in the association rights (-0.86 SD) and evaluation subareas (-1.46 SD), as well, but *more* restrictive relative to changes in California CBAs in the remaining two subareas (leave (1.11 SD) and

transfers and vacancies (0.16 SD). This again speaks to potential tradeoffs occurring in local negotiations occurring in Washington, whereas in Michigan all areas of CBAs were simply becoming less restrictive. Chi-squared tests of the difference between the Michigan and Washington trends show that they are always significantly different than each other.

7. Discussion and Policy Implications

Teachers' unions and their rights to negotiate contracts have taken center-stage in recent policy reforms, with a number of states implementing legislation that limits the collective bargaining rights of teachers' unions and removes or lessens protections for which teachers' union have long fought. This paper examines the restrictiveness of teacher contracts across three states both before and after a set of reforms that, to varying degrees, policymakers intended would minimize the ability of local actors to set policy and practice that govern teachers' working conditions and protections. We also examine predictors of contract restrictiveness in the pre- and post-reform time periods, and the changes between the two time periods. We consider district characteristics that have been traditionally examined as reflective of working conditions, as well as geographic and institutional proximity and changes to state policies themselves.

As the first work to examine how CBA restrictiveness *changes* in multiple states over time and what factors may be associated with those changes, this paper contributes new knowledge about teachers' union contracts in important ways. We show that very few changes in district characteristics typically observable to researchers in administrative data predict changes in CBA restrictiveness. This suggests that, contrary to some of the earlier work on this topic, unions and their district bargaining partners are not, writ large, negotiating CBA protections and flexibilities in response to changing local working conditions. However, our

study confirms that there are geographic spillovers and patterns in collective bargaining. This highlights an important and understudied role for higher-order agencies, especially unions' Uniservs and Intermediate School Districts or Education Service Districts that provide services to local districts. As policymakers and advocates continue to attempt to reform how local policies are generated and implemented, it will be important to consider how intermediate actors are assisting and shaping local collective bargaining negotiations.

More importantly, our study is the first to document how policy reforms that were specifically intended to remove discretion from local actors and place greater responsibility for policymaking in the hands of state actors are associated with the content of local CBAs. By comparing changes in CBAs in reform states (Michigan and Washington) to a non-reform state (California), we show that overall and across subareas of the contracts, reforms intended to lessen the overall strength of CBAs in Michigan and Washington accomplished this purpose. While CBAs in Washington could no longer contain items governing teacher evaluation, unions and local administrators compensated by increasing the strength of CBAs in other ways. Such changes may moderate any impacts – positive or negative – of the state-level reform on district outcomes, as CBAs are shaped in response to state policies in perhaps unanticipated ways. In Michigan, however, where changes to the scope of collective bargaining were more substantial, CBAs became significantly less restrictive overall and across all subareas. It is in Michigan therefore that we might expect to see more substantial impacts on other district outcomes such as teacher staffing and ultimately student achievement.

We acknowledge that California as a control for Michigan and Washington has its limitations, primarily (but not solely) because California was facing *threats* of fundamental changes to state education code regulating important teacher protections even if legislative

actions were not taken. Moreover, we cannot test differences across the states in terms of pre-trends in contract restrictiveness. Nonetheless, the California context does provide a baseline to highlight how Michigan and Washington CBAs change in the period after substantial teacher quality and union membership policy reforms. Given the national prevalence of conversations about and proposed changes to policies intended to improve teacher quality and alter union membership rights, this comparison provides unique new insight into the extent to which changes of the sort the Michigan and Washington legislatures enacted may affect CBAs in other states. More generally, our results provide confirmatory evidence that legislative reforms can intervene in local labor market conditions, at least in the proximate outcome of changing local regulations governing employee working conditions.

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Figures

Figure 1A. Average overall contract restrictiveness by year and state

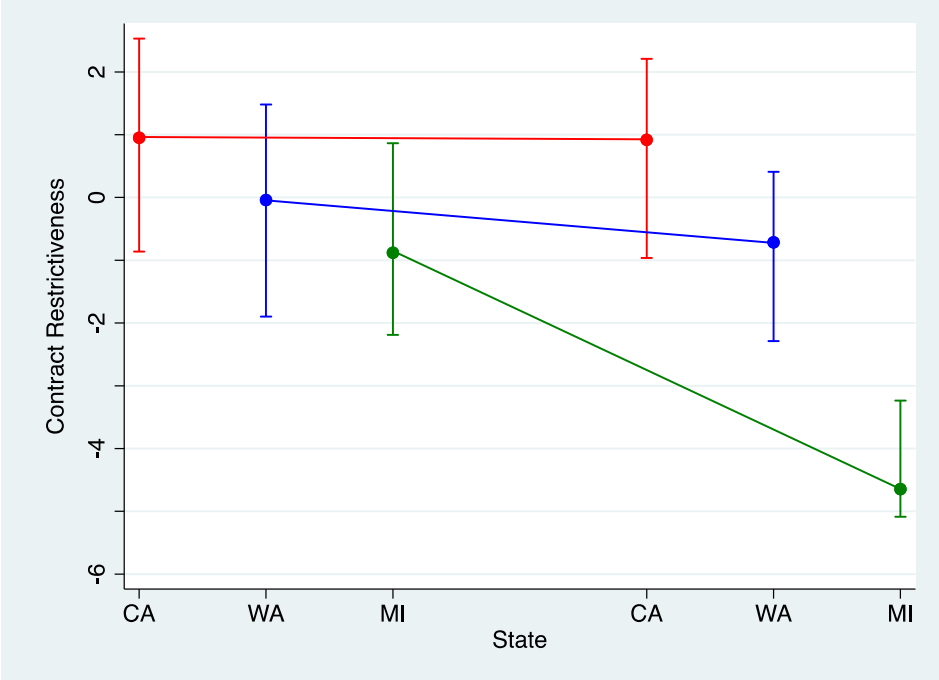


Figure 1B. Average subarea contract restrictiveness by year and state

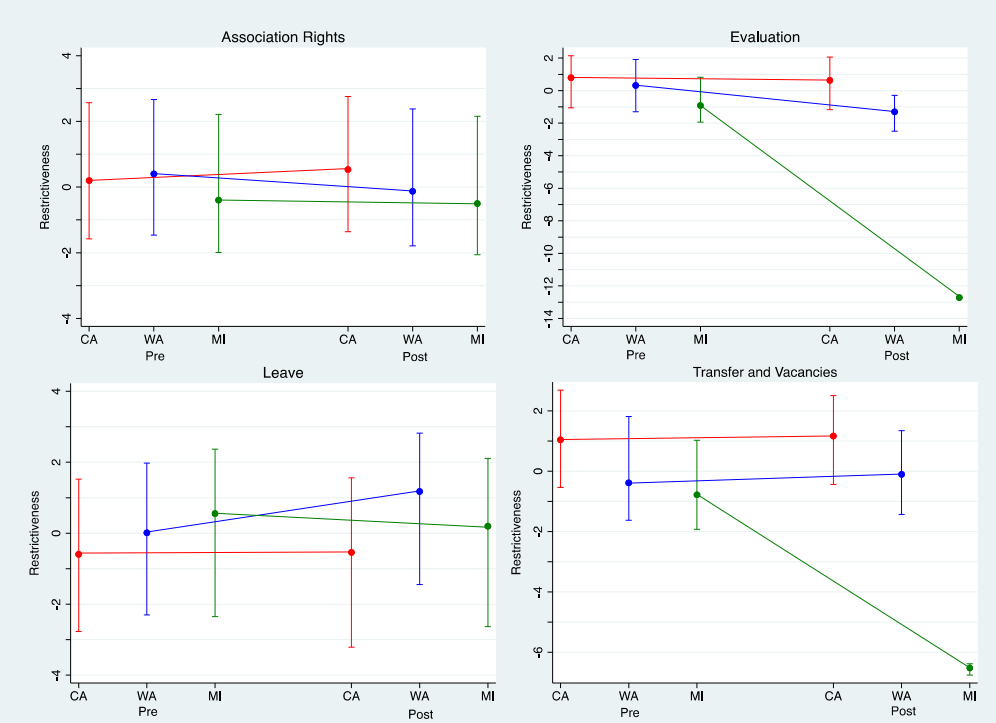


Table 1. Summary statistics for all dependent and independent variables, by contract year and state

	Pre			Post			Contract Cycle Change					
	CA n=490	MI n=516	WA n=270	CA n=495	MI n=515	WA n=268	CA		MI		WA	
Dependent Variable	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Diff	Sig	Diff	Sig	Diff	Sig
Overall Contract Restrictiveness	0.95 (0.54)	-0.88 (0.61)	-0.04 (0.60)	0.92 (0.52)	-4.65 (0.46)	-0.71 (0.56)	- 0.03		- 0.67	***	-3.77	***
Association Rights	0.20 (0.90)	-0.40 (0.96)	0.40 (0.99)	0.53 (0.92)	-0.50 (0.96)	-0.13 (0.89)	0.34	***	- 0.53	***	-0.10	+
Evaluation	0.79 (0.60)	-0.92 (0.65)	0.32 (0.65)	0.63 (0.63)	-12.71 (0.00)	-1.30 (0.60)	- 0.16	***	- 1.62	***	- 11.80	***
Leave	-0.59 (0.76)	0.56 (0.87)	0.01 (1.00)	-0.54 (0.78)	0.20 (0.87)	1.18 (0.93)	0.05		1.16	***	-0.36	***
Transfers and Vacancies	1.04 (0.52)	-0.78 (0.56)	-0.39 (0.61)	1.16 (0.49)	-6.52 (0.18)	-0.11 (0.57)	0.13	***	0.28	***	- 5.74	***
Independent Variables	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)	Diff	Sig	Diff	Sig	Diff	Sig
% FRL	50.71 (24.96)	46.27 (17.73)	48.33 (19.75)	53.83 (25.09)	49.33 (18.62)	51.74 (21.26)	3.12	+	3.41	+	3.06	**
Achievement (Math)	0.11 (0.81)	0.00 (0.98)	0.00 (0.89)	0.13 (0.84)	-0.01 (0.98)	0.04 (0.87)						
Enrollment (ln)	8.71 (1.09)	7.39 (1.08)	7.13 (1.63)	8.75 (1.04)	7.33 (1.09)	7.13 (1.64)	0.03		- 0.01		-0.06	
Urban District	0.27 (0.44)	0.07 (0.25)	0.08 (0.27)	0.26 (0.44)	0.07 (0.25)	0.08 (0.27)						
Suburban District (ref)	0.62 (0.49)	0.42 (0.49)	0.39 (0.49)	0.66 (0.47)	0.45 (0.50)	0.39 (0.49)						
Rural District	0.11 (0.31)	0.51 (0.50)	0.53 (0.50)	0.08 (0.27)	0.48 (0.50)	0.53 (0.50)						
Elementary District	0.34 (0.47)			0.33 (0.47)								
Unified District (ref)	0.57 (0.50)			0.59 (0.49)								
High District	0.09 (0.29)			0.08 (0.28)								
% of students with IEPs	9.93 (2.53)	13.27 (3.38)	13.04 (3.12)	10.34 (2.53)	12.75 (3.70)	14.12 (3.83)	0.41	*	1.08	***	-0.49	*
Median yrs. experience	12.68 (2.55)	12.39 (2.38)	13.77 (3.48)	13.01 (2.62)	13.59 (2.19)	13.93 (3.56)	0.33	*	0.17		1.19	***
Stan. dev. yrs. experience	8.68 (1.07)	8.75 (1.38)	9.52 (1.11)	8.68 (0.96)	8.06 (1.21)	9.64 (1.35)	0.00		0.12		-0.69	***

*+p<.10 *p<.05 **p<.01 ***p<.001 Values for the independent variables are one year lags of the restrictiveness measures presented. Contract cycle change results are from two-tailed t-tests on change in the independent variables between time periods. The pre year is 2011-2012 for California and 2010-2011 for WA. The post year is 2014-2015 for CA and WA. For MI, the pre year is defined as the school year before the CBA was subject to the 2011 reforms, and the post year is defined as the first school year after the CBA was subject to the 2011 reforms. This varies by district depending on when their pre-reform CBA expired. Contract restrictiveness measures are standardized with respect to the base year across the entire distribution of state-district observations.*

Table 2. Regression of overall contract restrictiveness on one year lag district characteristics

	California (1)	Michigan (2)	Washington (3)
% FRL	0.004*	0.006	0.003
	(0.002)	(0.004)	(0.003)
Achievement (Math)	-0.015	-0.042	0.005
	(0.052)	(0.056)	(0.058)
Ln (Enrollment)	0.025	0.037	-0.004
	(0.328)	(0.238)	(0.169)
% of students with IEPs	0.009	-0.005	0.002
	(0.015)	(0.009)	(0.008)
Median yrs. Experience	0.001	0.023*	0.007
	(0.011)	(0.011)	(0.014)
Stan. dev. yrs. Experience	-0.014	-0.008	0.019
	(0.031)	(0.019)	(0.025)
2015	-0.017	-1.909***	-0.349***
	(0.010)	(0.017)	(0.017)
District FE	X	X	X
Constant	0.568	2.237	0.234
	(2.919)	(1.808)	(1.348)
R-squared	0.877	0.983	0.855

*+p<.10 *p<.05 **p<.01 ***p<.001 Values for the independent variables are one year lags of the restrictiveness measures. The pre year is 2011-2012 for California and 2010-2011 for WA. The post year is 2014-2015 for CA and WA. For MI, the pre year is defined as the school year before the CBA was subject to the 2011 reforms, and the post year is defined as the first school year after the CBA was subject to the 2011 reforms. This varies by district depending on when their pre-reform CBA expired. Contract restrictiveness measures are standardized with respect to the base year. Consequently, we interpret the coefficient in column (1), row 1 as indicating that a 1 percent increase in % FRL is associated with less than 1 percent of a base year standard deviation increase in contract restrictiveness in CA.*

Table 3. 2SLS spatial lag regressions of overall contract restrictiveness

	Pre (1)	Pre (2)	Pre (3)	Pre (4)	Post (5)	Post (6)	Post (7)	Post (8)	Change (9)	Change (10)	Change (11)	Change (12)
Panel A: California												
Spatial Lag (Within 50 miles)	0.290			-0.044	0.342*			-0.097	-0.129			-0.286
	(0.180)			(0.213)	(0.166)			(0.216)	(0.454)			(0.510)
Spatial Lag (Uniserv)			0.490***	0.524**			0.566***	0.642***			0.268	0.619
			(0.138)	(0.171)			(0.135)	(0.177)			(0.492)	(0.469)
N	490		490	490	494		494	494	462		462	462
Panel B: Michigan												
	Pre (1)	Pre (2)	Pre (3)	Pre (4)	Post (5)	Post (6)	Post (7)	Post (8)	Change (9)	Change (10)	Change (11)	Change (12)
Spatial Lag (Within 50 miles)	0.352***			0.031	0.394***			-0.057	1.122*			-0.031
	(0.093)			(0.180)	(0.091)			(0.166)	(0.540)			(0.733)
Spatial Lag (ESD)		0.307***		0.106		0.364***		0.286		0.977*		0.509
		(0.085)		(0.190)		(0.081)		(0.176)		(0.421)		(0.431)
Spatial Lag (Uniserv)			0.358***	0.296+			0.418***	0.245			1.032**	0.712*
			(0.095)	(0.152)			(0.091)	(0.154)			(0.349)	(0.282)
N	513	513	513	513	511	511	511	511	510	510	510	510
Panel C: Washington												
	Pre (1)	Pre (2)	Pre (3)	Pre (4)	Post (5)	Post (6)	Post (7)	Post (8)	Change (9)	Change (10)	Change (11)	Change (12)
Spatial Lag (Within 50 miles)	0.294**			-0.051	0.226*			0.055	1.081+			0.201
	(0.106)			(0.151)	(0.105)			(0.150)	(0.587)			(0.424)
Spatial Lag (ISD)		0.394***		0.369+		0.282**		0.181		0.959**		0.224
		(0.091)		(0.196)		(0.087)		(0.160)		(0.346)		(0.491)
Spatial Lag (Uniserv)			0.294**	0.074			0.255**	0.080			0.916+	0.647
			(0.101)	(0.187)			(0.092)	(0.146)			(0.513)	(0.413)
N	269	269	269	269	268	268	268	268	266	266	266	266

*+p<.10; *p<.05; **p<.01; ***p<.001. The models in columns 1-8 control for one-year lags of the district controls shown in Table 4, while the models in columns 9-12 control for the change in these district controls from the pre to the post period. The pre year is 2011-2012 for California and 2010-2011 for WA. The post year is 2014-2015 for CA and WA. For MI, the pre year is defined as the school year before the CBA was subject to the 2011 reforms, and the post year is defined as the first school year after the CBA was subject to the 2011 reforms. The "Spatial Lag (Within 50 miles)" term is the average restrictiveness (or change in restrictiveness) of the contracts of other districts within 50 miles, the "Spatial Lag (ESD/ISD)" term is the average restrictiveness (or change in restrictiveness) of the contracts of other districts within the same state ESD/ISD, and the "Spatial Lag (Uniserv)" term is the average restrictiveness (or change in restrictiveness) of the contracts of other districts within the same state uniserv. The instruments in the 2SLS model are the average district characteristics (or change in district characteristics) of other districts within the measure(s) of proximity considered in each model.*

Table 4. Difference-in-Difference Estimates, Pre vs. Post, CA vs. MI & WA

	Overall (1)	Association Rights (2)	Evaluation (3)	Leave (4)	Transfers and Vacancies (5)
Panel A. No Controls					
Michigan (ref=California)	-1.831***	-0.595***	-1.706***	1.149***	-1.821***
	(0.036)	(0.059)	(0.039)	(0.052)	(0.034)
Washington (ref=California)	-0.992***	0.202**	-0.472***	0.606***	-1.425***
	(0.044)	(0.072)	(0.048)	(0.070)	(0.044)
2015	-0.032+	0.337***	-0.162***	0.052	0.125***
	(0.019)	(0.037)	(0.025)	(0.037)	(0.020)
2015 X Michigan	-3.733***	-0.441***	-11.637***	-0.411***	-5.864***
	(0.030)	(0.041)	(0.038)	(0.044)	(0.033)
2015 X Washington	-0.642***	-0.866***	-1.457***	1.111***	0.156***
	(0.037)	(0.059)	(0.054)	(0.079)	(0.040)
Panel B. Controls					
Michigan (ref=California)	-1.594***	0.777***	-0.421***	0.741***	-1.259***
	(0.040)	(0.070)	(0.052)	(0.074)	(0.044)
Washington (ref=California)	-0.694***	0.334***	-0.155***	0.051	0.123***
	(0.042)	(0.036)	(0.025)	(0.038)	(0.021)
2015	-0.031	-0.144*	-1.662***	1.273***	-1.682***
	(0.020)	(0.062)	(0.046)	(0.061)	(0.038)
2015 X Michigan	-3.686***	-0.386***	-11.612***	-0.374***	-5.840***
	(0.031)	(0.043)	(0.039)	(0.048)	(0.033)
2015 X Washington	-0.644***	-0.863***	-1.463***	1.107***	0.157***
	(0.037)	(0.059)	(0.054)	(0.080)	(0.040)
Chi^2 test that MI difference = WA difference	$Chi^2(1)$= 5486.05***	$Chi^2(1)$= 75.30***	$Chi^2(1)$= 32225.25***	$Chi^2(1)$= 363.83***	$Chi^2(1)$= 18096.63***

*+p<.10 *p<.05 **p<.01 ***p<.001 Models in Panel A include no controls. All models in Panel B control for % FRL, achievement (Math), ln (enrollment), % of students with IEPs, median yrs. experience, stan. dev. yrs. experience. The pre year is 2011-2012 for California and 2010-2011 for WA. The post year is 2014-2015 for CA and WA. For MI, the pre year is defined as the school year before the CBA was subject to the 2011 reforms, and the post year is defined as the first school year after the CBA was subject to the 2011 reforms. This varies by district depending on when their pre-reform CBA expired. CBA restrictiveness measures are standardized with respect to the base year. Consequently, we would interpret the coefficient in Panel B, column (1), row 6 as indicating that contracts in WA are 69 percent of a base year SD less restrictive in WA than in CA in the pre period (conditional on covariates). The coefficient in Panel B, column (1), row 8 indicates that California CBAs are 3 percent of a base year SD less restrictive in the post period. The coefficient in column (1), row 10 indicates that MI CBAs are 3.7 base year SDs less restrictive (370 percent decrease) in the post period than CA CBAs. Row 11 contains a chi2 test, testing the equality of the difference-in-difference estimate for WA compared to the difference-in-difference estimate for MI (rows 9 and 10). Column 1, row 9, for example, indicates that WA CBAs grew significantly more restrictive than MI CBAs.*

Appendix 1- Information on State Law Changes in Washington and Michigan

Washington

A state law change in Washington in 2012 (ESSB 5895) superseded a number of teacher evaluation provisions that were collectively bargained in the prior period. Specifically, the law states that: 1) student growth data must be a substantial factor in evaluating teacher performance; 2) teachers must be evaluated using one of three preferred instructional and leadership frameworks, each of which includes four final rating categories (unsatisfactory, basic, proficient, and distinguished); 3) districts may use a focused evaluation for those who have received a Level 3 rating, as long as comprehensive evaluations are completed once every four years; 4) formal evaluations must include at least 90 minutes of classroom observation; 5) teachers whose performance is judged "not satisfactory" must be placed on a probationary period of 60 school days and given a program for improvement in specific areas of deficiency, and "Lack of improvement is grounds for a finding of probable cause for nonrenewal of contract or discharge"; and 6) teachers who receive less than a Level 2 rating in their third year must remain in provisional status until they receive a Level 3 rating. The table below outlines each of the provisions that was prohibited from bargaining in the post-reform period, and therefore coded as absent from the contracts.

Provision prohibited from post-reform CBAs	Post-reform determination
Evaluation	
CBA defines final rating categories	ESSB 5895 (2012)
Permanent/tenured members can use an alternative evaluation process	ESSB 5895 (2012)
CBA specifies the length of formal observations	ESSB 5895 (2012)
CBA defines consequences of a negative evaluation	ESSB 5895 (2012)
Members with negative evaluations get more formal observations	ESSB 5895 (2012)
CBA allows for teachers to rebut or appeal a negative evaluation	ESSB 5895 (2012)

Michigan

A series of law changes in Michigan drastically changed the scope of collective bargaining agreements for the post-reform period. Public Act 103 of 2011 designated several negotiation topics as "prohibited subjects of bargaining." Among these prohibited subjects are all decisions about the development, content, standards, procedures, adoption, and implementation of a public school employer's performance evaluation system, the format, timing, and number of classroom observations, and decisions about the placement, discharge, and discipline of teachers. Decisions concerning the evaluation content, classroom observations, discharge, discipline, or placement of any individual teacher and the impact of these decisions, either on an individual employee or the bargaining unit, are prohibited subjects as well. Nearly every evaluation, transfer, and discipline provision that was observed in typical pre-reform CBAs falls within one of these prohibited categories. While these provisions still appear in some CBAs in the post-reform period, they are superseded by state law. For the purpose of our analyses, we code unenforceable provisions as being absent from the contracts.

PA 103 states that the prohibited subjects are "within the sole authority of the public school employer to decide." However, other law changes do set prescriptive policies in some of

these areas. The table below outlines each of the provisions that was prohibited from bargaining in the post-reform period, indicating which are determined at the discretion of the employer and which are dictated by state laws.

PA 205 of 2009 and PA 102 of 2011 outlined several requirements for teacher evaluation systems, however, deadlines for implementing many of these changes were multiple years after the laws were enacted, and further delayed by PA 257 of 2014 and PA 173 of 2015. As a result, most evaluation policies were determined at the sole discretion of the employer at the time that post-reform CBAs were negotiated. Post-reform CBAs are subject to a state requirement for the use of student achievement in evaluations, a four-tier final rating system (ineffective, minimally effective, effective, highly effective), consequences for negative evaluations, and a process by which teachers may appeal negative evaluations. The rights of districts to discipline teachers are addressed in PA 100 of 2011, which affects all post-reform CBAs. While state regulations do dictate which factors are used in personnel decisions that result in or follow the elimination of a position, these do not affect transfer decisions in general, and these contract provisions remain at the discretion of the employer.

Provision prohibited from post-reform CBAs	**Post-reform determination**
Evaluation	
CBA does NOT say teachers are evaluated on student achievement	PA 205 (2009)
CBA defines final rating categories	PA 102 (2011)
CBA specifies a time limit for post-observation meetings	Employer discretion
CBA requires post-observation meetings to be held within 8 days	Employer discretion
CBA specifies evaluation completion timeline	Employer discretion
CBA allows a different evaluation schedule for high-quality tenured members	PA 102 (2011)
Permanent/tenured members can use an alternative evaluation process	Employer discretion
Probationary members must have pre-observation meeting with evaluator	Employer discretion
CBA specifies the length of formal observations	Employer discretion
CBA defines consequences of a negative evaluation	PA 101 (2011); PA 173 (2015)
Members with negative evaluations get more formal observations	Employer discretion
CBA allows for teachers to rebut or appeal a negative evaluation	PA 102 (2011)
Transfers	
CBA outlines factors considered when transferring members overall	Employer discretion
CBA does NOT state that needs of district/students are considered in transfers	Employer discretion
CBA does NOT state that member credentials must be considered in transfers	Employer discretion
CBA does NOT state that member qualifications must be considered in transfers	Employer discretion
CBA states that seniority in district is considered in transfer decisions	Employer discretion
Seniority in the district is considered in transfer decisions if all else equal	Employer discretion
CBA addresses seniority as a factor in voluntary transfer decisions	Employer discretion
Seniority is the deciding factor in voluntary transfer decisions if all else equal	Employer discretion
Seniority is the deciding factor in voluntary transfer decisions	Employer discretion
CBA addresses seniority as a factor in involuntary transfer decisions	Employer discretion
Seniority is the deciding factor in involuntary transfer decisions if all else equal	Employer discretion
Seniority is the deciding factor in involuntary transfer decisions	Employer discretion
CBA outlines specific causes for involuntary transfers	Employer discretion
CBA places any restriction on involuntary transfers	Employer discretion
CBA specifies <2 reasons why a member can be involuntarily transferred	Employer discretion
CBA specifies the order new employees can be considered for vacancies	Employer discretion
CBA prohibits district from filling vacancy until set time after posting	Employer discretion
Discipline	
CBA addresses the district's right to discipline teachers	PA 100 (2011)

Appendix 2 - Generating a Partial Independence Item Response (PIIR) Model of CBA Restrictiveness

A). Background

Administrative constraint in a district is measured relative to what is typical for other districts. In brief, the PIIR model is a generalized hybrid of a discrete time hazard model and a Rasch model that adjusts for the conditional structure of "response" patterns in a CBA (formal model is shown below). In this approach, we conceive of the individual regulations found within a contract as providing information about the extent to which CBAs constrain administrators in their decision-making, and we model the items in the CBA as a function of a contract specific latent level of restrictiveness (we discuss how these items are selected in more detail below). The model is then estimated as a multilevel random effects logistic regression with contract items nested within contracts, predicting the likelihood that a given provision is included in a contract, dependent on the inclusion of an earlier contract provision and as a function of some latent level of contract restrictiveness. This contract-level coefficient is captured as the measure of contract restrictiveness.[11]

This paper builds on previously-published research in several ways, not the least is the use of the PIIR measure generated to apply not only in multiple time periods but also across multiple states. The far majority of the published work that examines CBA restrictiveness does so in a single time period and in a single state (California, in the 2005-6 school year). Some recent work adjusts the PIIR measure for use longitudinally, but only in California (Marianno & Strunk, 2018; Strunk & Marianno, 2018). In addition, one study to date has used PIIR measures of CBA restrictiveness in a cross-state context but only in a single time period (Marianno et al., 2018). This study expands on this work by using CBAs from a set of districts across two separate time points and in Washington, California and Michigan. Doing so requires adjustments to the original PIIR model (Strunk & Reardon, 2010) both in the way the model is estimated and how individual contract items are selected for use in the model. We describe these extensions below.

The far majority of prior published work using the PIIR model to generate a measure of contract restrictiveness only employed two-levels: contract items (L1) nested within contracts (L2). As in Marianno and Strunk (2018) and Strunk and Marianno (2018), we adapt the model by adding a third-level: contract items are nested within contracts, which are themselves nested within districts. The third district level is a necessary addition because models used in the current work include two contracts from the same district, negotiated in two separate years. We further expand on this model by adding a fourth state level, allowing us to measure restrictiveness in three different states simultaneously. As in earlier work, the random intercept estimated by this model is the measure of latent contract restrictiveness to administrator discretion over policy and reform decisions.

[11] Greater detail on the PIIR measure can be found in Strunk and Reardon (2010) as well as in Strunk (2012) and Goldhaber et al. (2013). Amendments made to estimate the PIIR models across years are detailed in Strunk & Marianno (2018) and Marianno & Strunk (2018).

The model is formally estimated as follows: Let Y_{kigf} equal the outcome (0,1) of each item *k* in contract-year *i,* in district *g*, in state *f* and h_{kigf} represent the presence of the gate item for provision *k* in contract *i* in district *g* in state *f.* Let $\boldsymbol{\varphi_{kigf}}$ equal the probability that $\boldsymbol{Y_{kigf}}$ equals one conditional on $\boldsymbol{h_{kigf}}$ equaling one. The gate item represents the conditional structure of CBAs, where the presence of a given item in a CBA (in each year) is dependent on a higher order item being represented. For example, a contract can only specify the length of informal observations of tenured faculty members when it first stipulates that informal observations of tenured faculty members are allowed to take place. Thus, $\boldsymbol{\varphi_{kigf}}$ is the conditional probability of a positive response to item *k* for contract-year *i* in district *g* in state *f*, conditional on passing through the gate item h_{kigf}, where h_{kigf} is equal to 1 when the gate item is represented in the CBA in a given year (Strunk & Reardon, 2010, p. 645).

The structural model then takes the following form:

$$\boldsymbol{log}\left[\frac{\boldsymbol{\varphi_{kigf}}}{\boldsymbol{1-\varphi_{kigf}}}\right] = \boldsymbol{\theta_{igf}} + \sum_{\boldsymbol{j=1}}^{\boldsymbol{K}} \boldsymbol{\gamma_k D_{kigf}} + \boldsymbol{\tau_f} + \boldsymbol{\tau_{if}} \quad \textbf{(1)}$$

where the conditional probability of provision *k* appearing in contract-year *i* in district *g* in state *f* is a function of θ_{igf}, or the latent restrictiveness of CBA-year *i* in district g in state *f*, $\boldsymbol{\gamma_k}$, which is the coefficient on a vector of dummy variables for each contract item (D_{kigf}) and represents the conditional restrictiveness of each item, a state random effect ($\boldsymbol{\tau_f}$), and a state-by-year random effect ($\boldsymbol{\tau_{if}}$). In sum, the model is estimating the log likelihood that a given contract provision is included in the CBA, conditional on the gate contract provision being included and as a function of latent contract restrictiveness.

In previous cross-sectional work, $\boldsymbol{\theta_i}$ represented the latent level of CBA restrictiveness in a given year. Here $\boldsymbol{\theta_{igf}}$ is a random effect capturing the latent restrictiveness of each contract, $\boldsymbol{\tau_{if}}$ is a random effect capturing variation in restrictiveness over time common to all districts in a state, and $\boldsymbol{\tau_f}$ is a random effect capturing variation common to all contracts in a state. In order to accurately assess the overall restrictiveness of a contract in a given year and state, then, we now capture and add the state and state-by-year random effects back to our estimated latent contract restrictiveness ($\boldsymbol{\theta_{ig}} + \boldsymbol{\tau_f} + \boldsymbol{\tau_{if}}$) to obtain the total restrictiveness of each contract.

Not only does the model itself need adjustment as a result of the added time and state dimensions; the manner in which items are selected for inclusion in the PIIR model also needs modification. The original contract restrictiveness measure generated from the PIIR method was constructed with the objective of maximizing the ability of the measure to discriminate between contracts. Strunk and Reardon (2010) began with a content analysis of 100 randomly selected California CBAs in place during the 2005-06 school year and developed a set of "639 questions" regarding the presence of specific contractual provisions (e.g. does the CBA specify a maximum class size?). The list of 639 represent the defined set of items over which teachers' unions and school district bargain in California and are analogous to items on a survey or test with each contract serving as the answer sheet.

They then reduced the number of items 334 by selecting provisions based on the conditional probability of a positive response (i.e. the provision was found in the contract) across all CBAs, selecting cut-points for items to ensure maximum discriminatory power. In short, because the CBA restrictiveness measure is built on a conditionally structured framework in which items with a conditional probability of responding "yes" at or near .5 provide more information to the measure, they reduced the set of provisions from 639 to 334 based on a

given item's proximity to the .5 threshold. Finally, they used standard test item selection methods (exploratory Cronbach's alpha analysis) to winnow down the larger set of items to a final subset of items to include in the PIIR model. Using these procedures the number of final items included in the model are greatly reduced in ways that should align with the underlying level of latent contract restrictiveness. For example, Strunk (2011) ended up with a final set of 39 items for use in her PIIR model (See Strunk and Reardon (2010) and Strunk (2011) for additional details). This method of selection avoids one of the fundamental problems with previous contract-based measures by ensuring that items were selected objectively and not based on preconceived beliefs about which provisions were particularly constraining or flexibility-enhancing for administrators.

In the current analyses, we must adjust our item selection process to account for the fact that we have contracts from three different states and two different bargaining cycles -- a "pre" period (2011-2012 in California, 2010-11 in Washington and in Michigan in the last year of a CBA that was ratified before the 2011 evaluation reforms) and a "post" (2014-15 in both California and Washington and in the first year of a post-reform negotiated contract in Michigan). A good item selection procedure must be able to handle multiple years of contract data from multiple states, winnow out items that are only weakly related to latent levels of contract restrictiveness, and maintain enough content so as to ensure that the resulting measure still has a high degree of face validity. Such a process should yield a measure of contract restrictiveness that is relatively free of measurement error and have enough discriminatory power to distinguish between more and less restrictive contracts across states and over time.

Thus, in the current work we expand on the exploratory Cronbach's alpha analysis for item selection (described in Strunk and Reardon (2010) and referenced above) in several ways. First, as contracts change across bargaining cycles, the cutoff points mentioned above may no longer be adequate for maximizing the discriminatory power of the restrictiveness measure. In other words, certain provisions that operated at a conditional probability of 0.5 in the pre-period may be far more (or less) frequent in the post set of CBAs. We used California as a case to test whether or not this poses a problem in a multi-year iteration of the contract restrictiveness measure. To do this, we first used cut-offs generated in each separate year and measures that utilized common cut-offs based in a base year, and found that correlations were large enough to warrant maintaining common cut-offs across years (results available upon request).[12]

Second, it is conceivable that the items that are representative of latent levels of restrictiveness may differ across states or change within a state over time. To take into account the multiple years of data and multiple states, we modified the process by stacking the item-level data and treating each CBA year and state as independent, and then proceeding with the item selection process. We believe this method strikes a balance between maintaining some degree of continuity in the measure over time (e.g. keeping items at the same cut-points within states) while also allowing the measure to incorporate information from more than one year of contracts and more than one state (e.g. all states and years in the alpha item correlations).

Finally, we must address the cross-state nature of our intended analysis. If we again imagine that the set of provisions that can be included in CBAs make up a sort of test, such that

[12] The measures using baseline cutoff points were correlated with measures using cut-offs generated in each year at 0.99.

each provision included in the set of CBAs under study is analogous to a question on the test and the existence of each provision in a given CBA can be considered the district's response to the question in each year, then we now have three different tests – one offered in Washington and others in California and Michigan. Some of the "questions" (i.e., provisions) are "asked" in all three states, whereas others are only "asked" in one or two. For instance, Washington state law dictates a single-salary schedule for teachers. As a result, there is very little discussion in Washington CBAs about teacher compensation. In contrast, teacher compensation is primarily determined at the discretion of individual districts in California and Michigan. Because of this variation in topics up for collective negotiations, we adjust our "question pool" (or set of provisions) to incorporate regulations from all three states under study. The set of provisions coded for in each of the three states are slightly different, and there is a core set of provisions that remain constant across all three states.

We identified all contract provisions with conditional probabilities between 0.2 and 0.8 in the pre-reform year for all three states. However, several of these 88 provisions were affected by reform legislation in Michigan and Washington that either prescribed state-wide policies or dictated that certain policies are within the sole authority of the district. Although these provisions still appear in some post-reform CBAs in these states, they are superseded by state law. For the purpose of our analyses, we code unenforceable provisions as though they are absent from the contracts. After adjusting items to reflect post-reform legislative changes where applicable and stacking data across states and years, we conducted a Cronbach alpha analysis, reducing the initial pool of 88 eligible items to a final set of 39 internally-consistent items (α=0.92). Appendix Table 2 A-B lists each of the items that was considered for inclusion, denoting which items were recoded to reflect legislative changes in the post-reform year and which were retained for the overall restrictiveness measure.

Appendix Table 2A. Contract provisions included in the overall restrictiveness measure

		Post-reform determination	
	Subarea	**State-regulated**	**Employer discretion**
CBA length is above 1st threshold			
CBA length is above 2nd threshold			
Association president (or designee) gets additional time off	Assoc. rights		
District specifies the total amount of release time for the president/designee	Assoc. rights		
Association president gets full-time leave	Assoc. rights		
Specifies time limit for district action after class size ceiling is exceeded			
Requires district action before 2 weeks of exceeding he class size ceiling			
Does <u>not</u> say teachers are evaluated on student achievement	Evaluation	MI	
Defines final rating categories	Evaluation	MI & WA	
Specifies time limit for post-observation meetings (tenured teachers)	Evaluation		MI
Post-observation meeting must be before 1st threshold (tenured teachers)	Evaluation		MI
Specifies evaluation completion timeline for tenured teachers	Evaluation		MI
Allows high-quality tenured teachers to be evaluated on a different schedule	Evaluation	MI	
Allows tenured teachers to use an alternate evaluation process	Evaluation	WA	MI
Requires a pre-observation meeting for probationary teachers	Evaluation		MI
Specifies the length of formal observations	Evaluation	WA	MI
Specifies a time limit for post-observation meetings (probationary teachers)	Evaluation		MI
Post-observation meeting must be before 1st threshold (probationary teachers)	Evaluation		MI
Specifies evaluation completion timeline for probationary teachers	Evaluation		MI

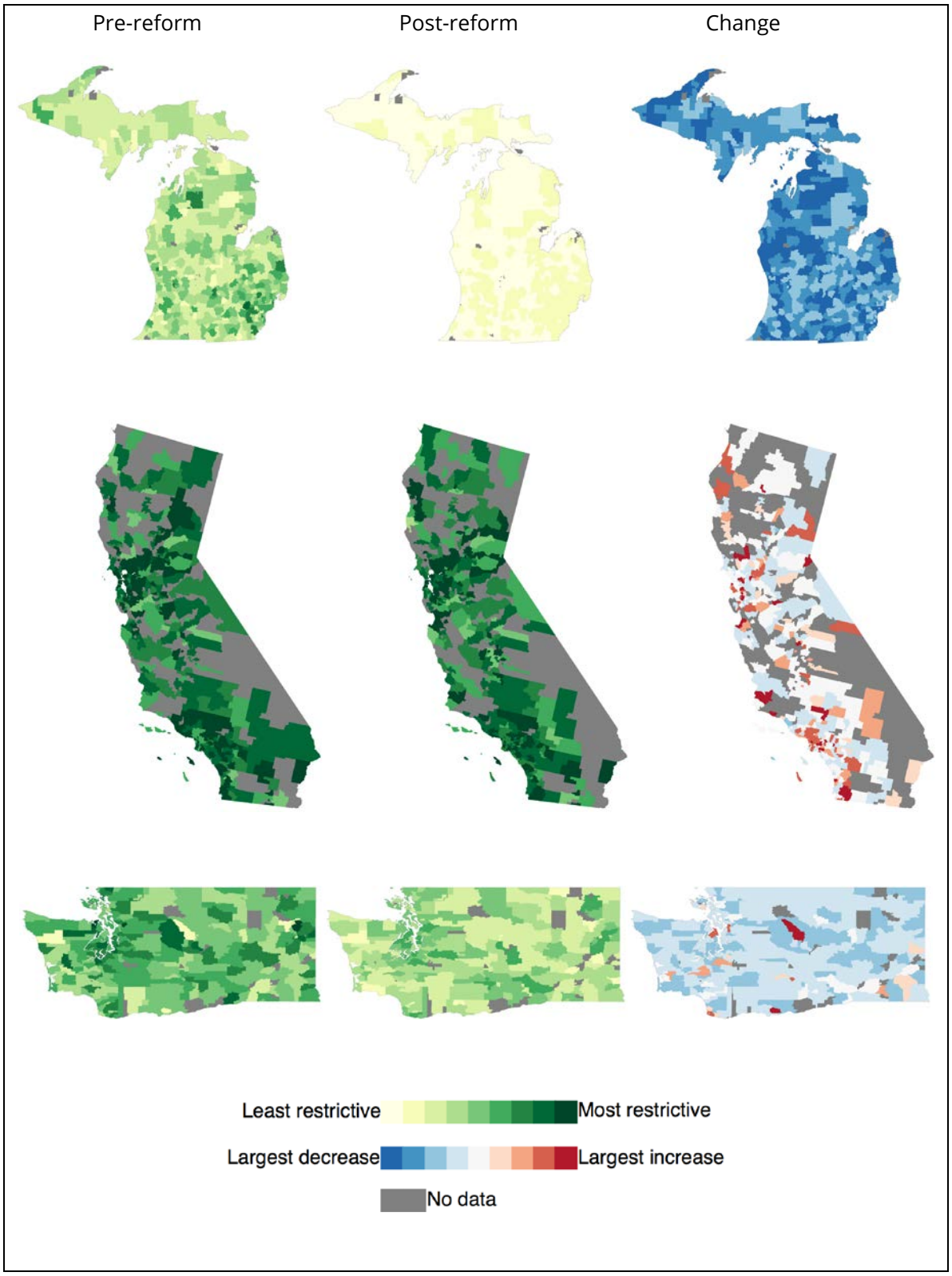
Defines consequences of a negative evaluation	Evaluation	MI & WA	
Teachers with negative evaluations get additional formal observations	Evaluation	WA	MI
Does not specify a board hearing in the grievance process			
Grievance process includes a mediation level			
Addresses district's right to discipline teachers		MI	
Teachers may grieve disciplinary action			MI
Outlines factors considered when transferring members overall	Transfers		MI
Does not state that district/student needs are considered in transfer decisions	Transfers		MI
Does not state that teacher qualifications are considered in transfer decisions	Transfers		MI
States that seniority in the district is considered in transfer decisions	Transfers		MI
Addresses seniority as a factor in voluntary transfer decisions	Transfers		MI
Seniority is considered in voluntary transfer decisions if all else is equal	Transfers		MI
Addresses seniority as a factor in involuntary transfer decisions	Transfers		MI
Seniority is considered in involuntary transfer decisions if all else is equal	Transfers		MI
Seniority is the deciding factor in involuntary transfer decisions	Transfers		MI
Outlines specific causes for which a teacher may be involuntarily transferred	Transfers		MI
Places restrictions on involuntary transfers	Transfers		MI
Restricts reasons for involuntary transfers to fewer than the 1st threshold	Transfers		MI
Specifies order in which new employees can be considered for vacancies	Transfers		MI
Prohibits filling vacancies until a set amount of time after posting	Transfers		MI

Appendix Table 2B. Contract provisions excluded from the overall restrictiveness measure

		Post-reform determination	
	Subarea	**State-regulated**	**Employer discretion**
CBA length is above 3rd threshold			
There is no "no strike/lockout" clause			
Allows reopener for negotiations during contract term			
Allows reopener more than once per year			
Promises specific association leave	Assoc. rights		
Specifies the total amount of association leave given each year	Assoc. rights		
Total amount of association leave is above 1st threshold	Assoc. rights		
Total amount of association leave is above 2nd threshold	Assoc. rights		
Total amount of association leave is above 3rd threshold	Assoc. rights		
Specifies who pays for association leave	Assoc. rights		
Specifies that the association gets consultation rights	Assoc. rights		
Specifies which matters the association may consult	Assoc. rights		
Addresses class size			
Requires district action if class size ceiling is exceeded			
Specifies particular actions taken after class size ceiling is exceeded			
Teachers meet with administrator to negotiate solution to class size overload			
Teachers affected by overload receive increased aide and clerical time			
Teachers affected by overload receive take-home compensation			
Allows teachers to rebut or appeal a negative evaluation	Evaluation	MI & WA	
Grievant can skip the informal step of the grievance process			
Time limit for reporting a grievance is above 1st threshold			
Time limit for reporting a grievance is above 2nd threshold			
There are more than 3 formal levels in the grievance process			
Time limit for district response to level 2 grievance is below 1st threshold			
Time limit for district response to level 2 grievance is below 2nd threshold			
Does not disallow formal grievance procedure longer than 1st threshold			
Does not specify a final/binding board decision in the grievance process			
Grievance process includes an arbitration level			
Provides for recall rights after layoffs		MI	
Specifies how re-employment offers are made after layoffs		MI	
Specifies that re-employment offers are made in seniority order after layoffs		MI	
Specifies bereavement leave	Leaves		
No-travel bereavement leave time is above 1st threshold	Leaves		
Specifies leaves for Family Illness/Family Care Leave beyond what law requires	Leaves		
Specifies parenting/child-rearing leave	Leaves		
Specifies teachers' rights of return from parenting leave	Leaves		
Specifies pregnancy/maternity leave time beyond what is required by law	Leaves		
Specifies what teachers' rights of return from pregnancy/maternity leave	Leaves		
Specifies sabbatical or study leave	Leaves		
Does not require teachers to participate in faculty meetings			
Includes restrictions on the length or number of faculty meetings			
Places time constraints on faculty meetings			
Does not require members to be present before class longer than 1st threshold			
Specifies length of the school day in instructional time			
Specified length of school day is above threshold for "medium length"			
Does not state that teacher credentials must be considered in transfer decisions	Transfers		MI
Seniority in district is considered in transfer decisions if all else is equal	Transfers		MI
Seniority is the deciding factor in voluntary transfer decisions	Transfers		MI
Requires district to post all certificated vacancies	Transfers		

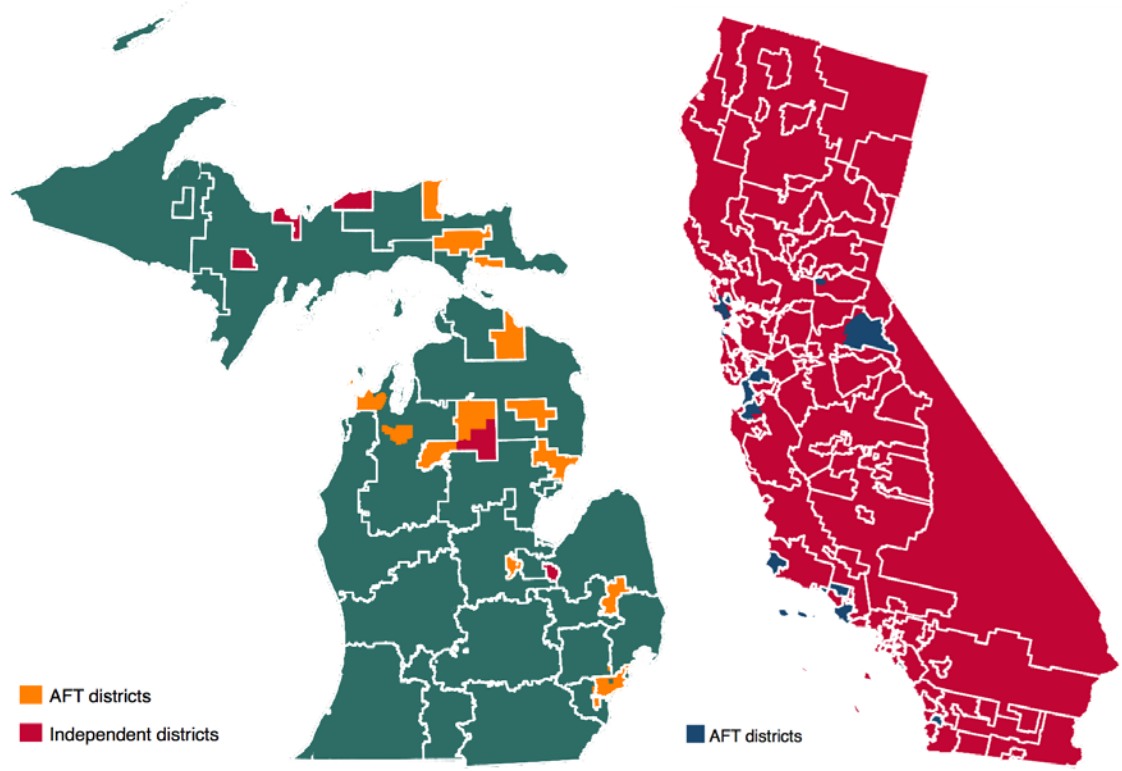
Appendix 3

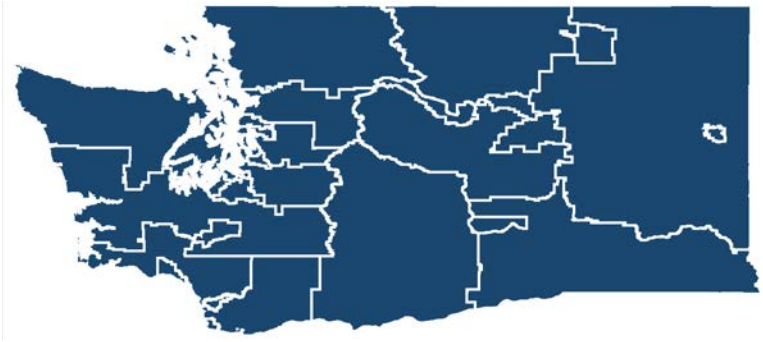
Appendix Figure 3a- Overall Contract Restrictiveness Heat Maps



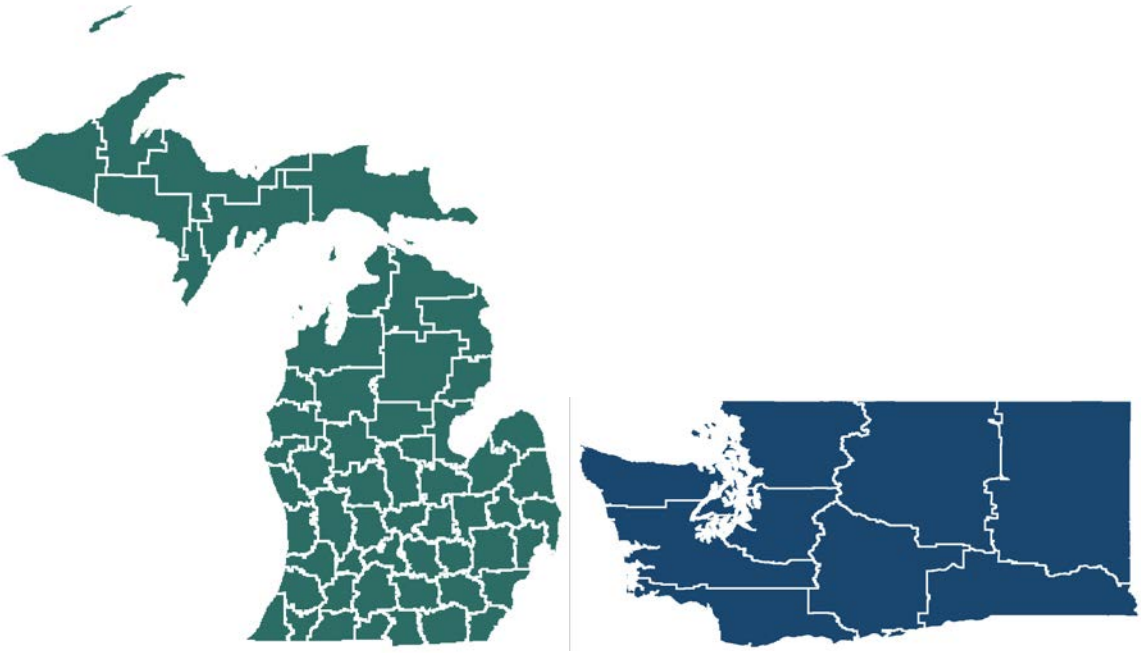
Appendix Figure 3b- Boundary Maps for Reference

Uniserv councils





Educational Service Districts (MI & WA only)



District types (CA only)