# State Intervention and Contract Choice in the Public Teacher Labor Market

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**Abstract**

State policymakers incompletely specify the terms of the teacher labor contract through policy interventions, and may also indirectly alter the negotiation dynamic between districts and teachers. Primarily using data on 100 of the largest school districts in the U.S. assembled by the National Council on Teacher Quality, I find relatively small variance in contract outcomes within the state on wage and time use provisions but considerably more within-state variance on provisions governing teacher evaluations and seniority rules, suggesting more local discretion in the latter set of outcomes. Further, I find significant effects of both policy decisions and collective bargaining on contract provisions across various sets of outcomes. The evidence presented here suggests a strong interrelation between various aspects of the labor contract, which has largely been ignored in the literature on teacher contracts previously.

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## I. Introduction

The human capital embodied in teachers is critical to educational outcomes, and policymakers from the federal level to the local level are involved in managing teacher labor in some way. The management of teacher labor through policy ranges from the general—such as the freedom of associating with a union as guaranteed in the U.S. constitution—to the very specific—such as the detailed expectations for teachers established by some local school boards. In spite of using various methods to govern teacher labor, however, changing practice is often difficult to implement (Cochran-Smith & Fries, 2001). Commonly, powerful teachers unions, rigid labor contracts, and collective bargaining arrangements are singled out as the main barrier to critical reforms that are expected to otherwise improve public education.[i]

Certainly, unions and collective bargaining play important roles in the relationship between teachers and school districts; however, in spite of the heated criticism, both districts and teachers continue to enter into employment agreements under the same criticized arrangements. Even where collective bargaining is prohibited by law, the functional form of the teacher contract is still similar to those bargained through unions (Cohen, Walsh, & Biddle, 2008; Hess & Loup, 2008). These observed behaviors suggest something beyond the presence of unions and collective bargaining are significant in determining contract choice, but previous studies on teacher contracts have not shown what these determinants may be. This paper investigates the determinants of contract choice in the public teacher labor market; specifically, I analyze how variation in education policies at the state level may affect the provisions ultimately included in the formal teacher labor contract negotiated at the district level.

In its essence, the relationship between public school teachers and their public school employers is governed by a contract wherein both sides agree to the services teachers provide, the terms of employment, compensation, and other issues. Because ultimately the state bears the constitutional responsibility for providing public education to its citizens, this labor contract could conceivably be determined entirely in state legislative chambers, leaving districts no room for negotiation or adaptation. In practice, however, all states regulate some aspects of the labor contract and, where applicable, define the scope of collective bargaining, but leave the remainder of the teacher's labor contract unspecified.[ii] By doing so, legislators are implicitly (or in some cases explicitly) establishing the boundaries for further negotiation or specification of the employment contract between teachers and schools. Subsequent negotiation of the contract occurs at a more local level, and could be formal (i.e. union-represented negotiations) or informal (i.e. a verbal agreement between a teacher and a principal). This practice of only partially determining the contract, while leaving the remaining provisions subject to subsequent negotiation is known as incomplete contracting (Tirole, 1999).

Importantly, incomplete contracting at the state level implies supplementary contracts at the district level are determined largely beyond state policymakers' control—and contractual outcomes may or may not be desirable for the state. For all states, these negotiated contracts, which are supplementary to policymakers' initial "contracts" determined in the state legislature, delineate many of the most important aspects of the teacher's employment.

How are these second-round contracts determined? Contract provisions are not likely chosen at random from the available scope unaddressed in the legislature's primary contract; rather, in most cases many involved parties on both sides of the transaction jointly determine them. As I show in this analysis, these employment contracts vary in somewhat predictable ways. Some of the factors that partially determine contract choice are beyond the reach of state policymakers' influence: variables such as student demographics and wages in competing industries are truly exogenous. Other factors, however, can be manipulated by state legislators: tenure rules, teacher compensation reform, and other policies directly alter the teacher contract and may also indirectly change the political dynamics that determine contract choice in the negotiations at the district level.

This indirect effect of state intervention—whether and how state policies influence other aspects of the teacher labor contract—is the driving policy question of this study. This indirect correlation between state policies and district outcomes has been documented previously, but principally as an aside; for instance, Goldhaber, Player, DeArmond, & Choi, (2008) show districts in right-to-work states evidence a significantly higher likelihood of using merit pay programs to compensate teachers. In a similar vein, over half of all states have mandated various methods of compensation reform, and all states grant tenure to teachers but vary in the minimum experience required. These policies, and others, may indirectly influence contract choice on other contract issues that the legislature does not explicitly address. Unless state legislators choose to fully specify labor contracts in legislative chambers, any partial policy intervention has the potential to alter contract choice at the district level. And in practice, because no state fully specifies the teacher labor contract, all education policies have the potential to indirectly help or hinder states' educational policy goals through altering contract outcomes at the district level.

Primarily using a database of teacher contracts assembled by the National Council on Teacher Quality (NCTQ), I investigate the correlation between state policies and contracts entered into at the district level. This paper serves two purposes. First, my investigation is a descriptive analysis of the correlation between varying state policy environments and the contractual outcomes at the district level. Also, I investigate the within-state variation in outcomes to make a relative comparison of the influence of local-level decision-making in the subsequent negotiation process. A straightforward comparison of policy decisions and contract outcomes, however, may be misleading because state policy decisions may be influenced by local-level contract outcomes. For instance, teachers unions may lobby for various education reforms when past negotiations with the district prove ineffective in securing their desired outcomes; thus, state-level education policies are endogenous variables.

The second purpose of my analysis, then, attempts to overcome this endogeneity of state policy to uncover a more explicit link between it and contract outcomes. I do this by instrumenting state policy decisions with election results, the state population, the state's land area, and the policies of bordering states, which are all correlated with policy decisions but, I argue, are not directly correlated with local decisions. Further, because contract provisions are simultaneous decisions that are likely dependent on other contractual agreements, estimation through three-stage least squares can provide consistent and efficient estimates of the influence of state policies on contract provisions.

In summary, I exploit variation across states in education policies and labor laws to identify differences in contract choice at the local level. I find relatively small variance in contract outcomes within the state on wage and time use provisions but considerably more within-state variance on provisions governing teacher evaluations and seniority rules, suggesting more local discretion in the latter set of outcomes. Further, I find significant effects of both policy decisions and collective bargaining on contract provisions across various sets of outcomes. The evidence presented here suggests a strong interrelation between various aspects of the labor contract, which has largely been ignored in the literature on teacher contracts previously.

The paper proceeds in the following manner. Section II presents relevant research on collective bargaining and teacher contracts. Section III discusses the model and identification strategy I employ. Section IV presents the data and Section V reports my empirical results. Section VI concludes with a recapitulation of the findings and a discussion of their policy relevance.

## II. Relevant Literature and Contributions

Teacher labor contracts are inextricably linked to collective bargaining and teachers unions. The influence of labor unions and collective bargaining on the teacher contract has been analyzed in various ways for decades. Many of the early papers on union influence focused primarily on wage differentials for teachers in collective bargaining states compared against those where collective bargaining is not practiced (Hall & Carroll, 1973; Kasper, 1970; Moore & Raisian, 1987). Others still have investigated how changes in the salary schedule itself may reflect the influence of unions in determining the schedule (Grissom & Strunk, 2008; Lankford & Wyckoff, 1997).

More recent studies have investigated the influence of unions on various facets of education beyond the teacher labor contract. For instance, Peltzman (1993) suggests union influence has both positive and negative benefits on education outcomes, as some but not all of unions' objectives directly benefit students. Hoxby (1996) uses the timing of collective bargaining laws to identify measures of union influence, and concludes labor unions increase educational spending in districts but simultaneously reduce productivity sufficiently to decrease educational outcomes for students overall.[iii] Loveless (2000) presents evidence of union opposition to various policies of education reform, but stops short of placing blame on unions for the perceived lack of productivity in K-12 education.

Many of the studies above take union influence as a given variable; however, unions are only one party determining the outcomes of contract negotiations. Other studies attempt to investigate the dynamics of negotiation between unions and districts. For instance, Hosken & Margolis (1996) analyze teacher contracts in New York and estimate significant bargaining power for unions, but their parameter estimate suggests union power is far from absolute. Babcock, Wang, & Loewenstein (1996) investigate how school districts and labor unions in Pennsylvania choose comparison groups that bias the outcomes in self-serving ways, and the magnitude of the bias may predispose districts to bargaining impasses. The scope of my paper extends beyond a simple investigation into union power or collective bargaining laws; rather, I investigate how state policy, which incompletely specifies the terms of teacher employment in public schools, may influence subsequent contractual negotiations.

Various studies in contract economics investigate this type of contracting behavior. For instance, Crocker & Reynolds (1993) investigate when "incomplete contracting" is optimal: when the outcome is complex, or various outcomes of the contract are unforeseeable. Because virtually all contracted relationships could potentially have an infinite number of outcomes, negotiating an agreement for each one of these outcomes grows increasingly costly and provides diminishing marginal benefit to either party; thus, virtually all contracts are intentionally incomplete contracts. State policymakers' decisions to leave most labor contract provisions subject to negotiation may, in fact, be cost minimizing, as suggested in Arrunada, Garcia, & Vasquez (2001). Importantly, from a perspective of social justice, fully determining teachers' employment contracts in the state legislature may itself not be a desirable policy, as it marginalizes input from teachers who are being managed under such policies (Casey, 2006).

The provisions of teacher contracts themselves have been the subjects of education research for decades; however, the research in this area has been primarily descriptive in nature. A series of reports from McDonnell & Pascal (1979, 1988) investigate how teacher contract provisions change as collective bargaining became the standard of determining contracts during the 1970s, and extend the analysis into the 1980s after the trend stabilized. Ballou (2000) analyzes teacher contracts in Massachusetts, supplementing the descriptive report with qualitative findings from local school administrators and union officials. Importantly, he reports that even though contract provisions varied considerably within the state, actual practice appeared more uniform; for instance, principals with flexible contract provisions on teacher compensation rarely took advantage of such flexibility. A more recent report on teacher contracts in Washington, California, and Ohio comes to similar conclusions (Price, 2009). Hess & Kelly (2006) performs a similar descriptive analysis of teacher contracts from a stratified random sample of districts across the U.S. They found contracts are generally less restrictive than commonly believed, and districts' collective bargaining status seems to have only a modest effect on the inclusion of various contract provisions.

Using the same NCTQ database of teacher contracts that I use in this study, Hess & Loup (2008) evaluates labor contracts on the flexibility afforded district leadership, and finds a tendency for more flexible contracts in states where collective bargaining is not mandatory. Cohen et al. (2008) also use this database to address the interplay of state policy and legal decisions on provisions included in the district contract (or excluded from the contract). As mentioned above, virtually all of these studies on teacher contracts above are largely descriptive in nature, and discuss the form of teacher contracts generally without addressing the determinants of contract choice. The only study that uses state-level variation in collective bargaining laws to address differences in teacher contracts (aside from wages) through empirical estimation is McDonnell & Pascal (1979).[iv]

Because the literature on teacher contracts has heretofore been primarily descriptive, the interrelation between provisions within the contract has not been duly appreciated in most previous studies. Hall & Carroll (1973) is the first study to suggest a tradeoff in negotiations between teacher salaries and class size provisions; Hosken & Margolis (1996) models union power with a tradeoff between wages and employment levels.[v] Aside from these studies, however, teacher contracts have generally been analyzed along one dimension at a time (i.e. wages or working conditions) without addressing the joint decision along multiple dimensions at once. Such an approach fails to capture the substitutability (or complementarity, as the case may be) of various combinations of contract provisions. Though the research on these tradeoffs is comparatively thin, practitioners understand the importance of this concept: in Washington D.C., Chancellor Michelle Rhee recently proposed to substitute higher teacher salaries in exchange for a suspension of tenure privileges for one year—an explicit substitution between contract provisions (Haynes, 2008).

**III. Model and Identification Strategy**

Various theoretical models of collective bargaining have been proposed in the economics literature; however, the one paper that empirically tests these models in a teacher labor setting suggests none of the theoretical models accurately describe collective bargaining outcomes in education (Hosken & Margolis, 1996). Given this result, I hesitate to employ any of these models here. Moreover, the incomplete contracting initiated through state policy and then subsequent negotiation at the district level follows a similar process across all states, regardless of whether the state actually allows collective bargaining.[vi]

Instead, I suggest a relatively simple framework with which to describe this two-stage negotiation process. First, consider a contract that spans only two dimensions, $x_1$ and $x_2$ (I will generalize this contract to n-dimensions momentarily). For convenience in conceptualizing this contracting tradeoff, allow $x_1$ to represent labor and $x_2$ to represent wages. Without loss of generality, assume wages and labor may take on values in the range of $x_1 = l \quad [0,\bar{l}]$ and $x_2 = w \quad [0,\overline{w}]$ only, where $\bar{l}$ and $\overline{w}$ represent the maximum values of labor teachers may supply and wages districts are able to pay, respectively.

Figure 1, I depict the contracting space using an Edgeworth Box, with labor along the horizontal axis and wages along the vertical axis, and the space in the box represents all combinations of labor and wages *(l,w)* in this framework. The district sits in the lower left-hand corner, with the teachers opposite in the upper right-hand corner. The district wishes to hire teachers' labor in exchange for wages—its utility increases in labor and decreases in wages. Graphically, the district's indifference curves are convex to the northwest corner and increase in the southeast direction. The opposite relation holds for teachers—their utility decreases in labor and increases in wages and utility increases in the northwest direction. The contract curve (the dotted line in the figure), which marks every point along the continuum of labor and wages where both parties' indifference curves are tangential to each other, represents pareto-optimal contacts where no party can be made better off without making the other worse off. Contracts A, B, and C all lie on the contract curve, and favor districts more (teachers less) in that order. The choice of contract is ultimately decided through negotiation—to which there are many involved parties, including teachers unions, local school boards, superintendents, and parents' organizations.

Now, consider the role of various education policies that alter the space in which negotiations take place (depicted in Figure 2). The state first makes some binding stipulation along one dimension of the contract but not one the other in this two-dimensional framework; assume the state specifies teachers' labor will not exceed some level, $\tilde{l}$, (for instance, the contract year will not exceed 200 school days). Implicitly, this decreases the width of the box along the labor dimension such that the negotiation space decreases (labor is now bounded between 0 and $\tilde{l}$). Following this policy declaration, districts and teachers complete the contract through negotiations in the second stage. The state's (incomplete) intervention in the contracting process has the potential to change the range of feasible contracts, depending on where the regulated level of labor lies in relation to the original set of feasible contracts. Consider a level of regulated labor to the right of Contract B, but to the left of Contract C. Contract C, because it prescribes a level of labor greater than the state's regulated level, is no longer a feasible contract; however, Contracts A and B are still both feasible. Conceivably, this regulated level of labor could have no bearing on contract choice between these two contracts, since it is greater than the labor levels specified in either contract. However, the specification of a restriction on labor inputs guarantees a minimum level of reservation utility to teachers, which was not present before, thus potentially changing the dynamics of the second-round negotiations and, ultimately, contract choice at the local level.

The actual negotiation process between districts and teachers is beyond the scope of this paper; rather, I presume the potential to change the contractual outcome through intervention is present but I am agnostic on how it may change the dynamic. Imaginably, the new guaranteed level of utility may induce teachers (or their union representatives) to negotiate more intensively in the reduced negotiation space, resulting in better contracts for teachers. On the other hand, the guaranteed utility resulting from the regulation may satisfy teachers sufficiently to result in less aggressive negotiations in the second round, making contracts favoring districts more likely. In either case, the driving question I investigate here is empirical, not theoretical—how state-level intervention may influence contract choice at the district level, if at all.

The above framework represents a two-dimensional contract. Real labor contracts, on the other hand, could potentially have an infinite number of dimensions.[vii] This negotiation space framework presented above applies to all dimensions of the district-teacher relationship—any intervention in any one dimension without fully specifying all other dimensions has the potential to alter the subsequent negotiations of the formal labor contract in all remaining dimensions.

The potential infinite-dimensionality of the labor contract makes empirical testing of the interrelationship between provisions difficult. In light of this difficulty, I move forward using the following strategy to identify the influence of state intervention. First, some provisions of the contract are commonly determined at the state level—label these $X_S$.[viii] Other contract provisions, conversely, are critical to the contract, but commonly determined in subsequent negotiations at the district level—these are $X_D$.

For econometric identification, $X_S$ and $X_D$ are mutually exclusive and are subsets of the universe of contract provisions (which is greater than the linear sum of $X_S$ and $X_D$). This does not mean policymakers cannot legislate elements of $X_D$, or districts cannot subsequently negotiate elements of $X_S$; rather, this is a classification I establish to facilitate empirical testing. Occasionally states determine elements of $X_D$; when this is observed empirically, I include indicator variables noting this intervention to allow those regulated levels to vary from those determined in negotiations. Also, if some states choose not to specify some element of $X_S$ and the provision is negotiated at the district level (or the state specifies a limit which is superseded in district-level negotiation), I only code the value legislated at the state level. The basic regression model on the association between $X_S$ and elements of $X_D$ is estimated using the following specification:

$$(1) \qquad x_d = {}_0 + X_S {}_1 + W_D {}_2 + {}_d$$

In this specification, $x_d$ represents various individual contract provisions determined at the district level (these are individual elements of $X_D$), $X_S$ is the vector of state-level education policies, $W_D$ is a vector of district-level variables exogenous to the contract that may help determine contract choice, and $\varepsilon_d$ is the contract-specific error term, assumed independently distributed.[ix] Estimation of this model, provision by provision, provides estimates of the association between state-level policy decisions and district-level provisions. Such estimates, however, can only be viewed as descriptive (non-causal) associations between these variables as they neglect to capture the tradeoff inherent in contract choice. Additionally, these estimates treat state-level policies as exogenous—an unrealistic assumption. Both of these issues will be addressed through using a three-stage least squares strategy below.

Before discussing this approach, however, I wish to exploit an additional feature of the single-equation approach presented in Equation (1). As specified, Equation (1) neglects the fact that districts are clustered within states, and a component of the error may be shared across all districts within a state, as specified in the following equation.

$$(2) \qquad x_d = W_D {}_2 + {}_S + {}_d$$

This specification estimates a state-specific intercept ($\eta_s$) in the place of the constant term and state-level variables. Because my variables on state-level policy are now confounded with the state-specific intercept, this specification is uninformative about specific state policies; however, this approach can provide estimates of variation in contract outcomes. Where more than two districts are located within a single state, I can use state fixed effects to quantify the level of variation in given contract outcomes that is due to between-state variation ($Var(\ _S)$) as a percentage of the overall variation ($Var(\ _S)+Var(\ _S)$) in contract outcomes. State policy may partially influence contract outcomes, and district leadership may also be influence contract choice. Comparing the estimates of the between-state versus overall variation, I can provide a general description of the relative influence of district leadership versus state legislation in determining contract choice. Large between-state variance relative to total variance would suggest district leadership plays a small role in determining contractual outcomes, while the reverse would suggest state policy is a smaller (relative) determinant of contract outcomes.

As described above, single-equation models of contract choice fail to capture the tradeoffs inherent in contract negotiation by implicitly assuming all other contract provisions are determined independently. Returning to my two-dimensional example, districts may choose to enter a contract to pay higher wages to teachers if they contract to receive a greater level of labor input from teachers in return. In other words, both labor and wages are both dependent variables and endogenous independent variables in a system of simultaneous equations, which can be estimated via three-stage least squares. This hypothetical system could be specified in the following way:

$$\text{(3)} \qquad \begin{aligned} wages_d &= \ _0 + X_S \ _1 + W_D^{wages} \ _2 + labor_d \ _3 + \ _d \\ labor_d &= \ _0 + X_S \ _1 + W_D^{labor} \ _2 + wages_d \ _3 + \ _d \end{aligned}$$

Here, wages are a function of labor, just as labor is a function of wages. Both equations include the same state policy variables ($X_S$), and include vectors of exogenous district-level variables ($W_D$), though the latter vectors may vary between the two equations (noted by the superscripts). This system of equations as specified is underidentified, and needs exogenous variation from instruments to produce valid estimates.

Additionally, in my application I suggest state policy is another endogenous variable in this system, and is predetermined prior to the labor and wage equations. For instance, a recent, well-publicized case of unions influencing state legislation is that of New York, in which unions successfully lobbied to remove students' test performance as a criterion for awarding tenure (Hakim & Confessore, 2008). I address this endogeneity, and also identify the entire system by augmenting the two equations with a third equation on policy determination:[x]

$$(4) \qquad x_s = \ _0 + W_S \ _1 + \ _s$$

At minimum, identification requires my vector of exogenous instruments on state policy, ($W_S$), to have at least as many variables as the system has endogenous variables (three in the present example). Identification also requires the total number of endogenous variables in any single equation may not exceed the number of exogenous variables omitted from that equation.[xi] In my case, where I investigate the tradeoffs along three simultaneous dimensions, I include an additional equation in the system of simultaneous equations, but defer to detail the specification until Section V.

As suggested by the name, estimation of this model follows a three-step process: first, I use the full vector of exogenous variables in the system as instruments on the endogenous variables; second, I use the residuals from the instrumented variables to obtain a consistent estimate of the variance matrix; and third, I use the instrumented variables and consistent estimate of the variance to estimate parameters via a generalized least squares approach. So long as the identification requirements are met, and the system is not misspecified, the resulting parameter estimates are consistent and efficient. Appropriate instruments in my study will be correlated with state policies, but uncorrelated with contractual outcomes at the district level. In the following section, I present additional information on these instruments, the NCTQ database I use for this study, and the specific contract provisions I analyze.

**IV. Data**

The primary data for this study comes from the Teacher Rules, Roles, and Rights database, compiled and maintained by the National Council on Teacher Quality.[xii] This database contains information on teacher contract provisions from 100 unique school districts. The 100 school districts represented include the 75 largest school districts in the country by student enrollment, and the largest districts in the remaining 25 states that are not included in the top 75 districts.[xiii] The entire database thus represents the largest districts in all 50 states.

For each district's contract, over 300 unique contract provisions are coded—these provisions span 12 distinct areas of the labor contract, including the school calendar, evaluation, pay and benefits, and working conditions. Not every district contract addresses all of the provisions on which data is collected (in fact, virtually all contracts have missing data on some provisions); however, his does not necessarily mean either party is uninhibited along this dimension. Rather, the omission of such provisions may suggest informal district policies may be in place that sufficiently address this issue; or alternatively, the issue may be so infrequent in the district that negotiating an agreement and specifying it in the contract is not worth the cost involved with negotiation. Because of this, incomplete contracts are expected. Additionally, policies do not necessarily indicate practice—Ballou (2000) finds school administrators do not routinely utilize the flexibility afforded in some provisions explicitly stipulated in the labor contract. Further, any agreement requires monitoring and enforcement to uphold its provisions—inasmuch as monitoring and enforcement is costly for either party and parties may benefit from violating the contract, both parties are expected to routinely violate the terms of the agreement to some extent.

Of the coded contract provisions available in the data, I focus my efforts on four general areas that are commonly determined in district-level negotiations: wages, time use, evaluation policies, and seniority rules. Clearly, though, each of these areas have several different dimensions along which I may compare contracts—for instance, most districts' compensation schedules typically have over 10 pay steps (corresponding to experience levels) and multiple lanes (dependent on education). Thus, even within a focused contract issue such as wages, many comparisons could be made across contracts.

Of the four contract areas, I choose several measures along which the comparisons seem the most informative—and these are my dependent variables throughout the analysis. Under the compensation area, I compare i) starting wages (short name: starting wages), ii) wages for a bachelor's degree holder with five years' experience (BA 5 wages), iii) the maximum wages that can be paid to a bachelor's degree holder (BA max wages), and iv) the wage return to a master's degree (master's premium). In work hours, I compare i) the number of working days in the school year (school days), ii) the amount of time provided to teachers each week for preparation (weekly prep time), and iii) the amount of time beyond the scheduled school day teachers are required to be at school (time beyond school). In the category on evaluation policies, I compare i) whether teachers have a right to grieve, appeal, or receive a second opinion after receiving a negative evaluation (right to grieve), ii) whether school administrators can freeze a teacher's wages as punishment for receiving a negative teaching evaluation (salary freeze), and iii) whether contracts clearly specify a procedure where teachers with negative evaluations can be moved to dismissal (policy to dismissal). Finally, in the seniority rules classification, I compare

i) whether layoffs are primarily determined by reverse seniority (reverse seniority), ii) whether more senior teachers are able to "bump" junior teachers under involuntary transfer rules (senior bump), and iii) whether seniority advantages teachers in requesting a voluntary transfer (senior transfer). Finally, I obtain data on class size restrictions (class size), that I will use as a measure of working conditions. In the Appendix, I formally define each of these variables, document the database questions from which I derive these variables, and detail my coding protocol for each. I refer the reader there for more details.

In addition to the contract provisions, the NCTQ database also contains supplementary information on various characteristics of the school district—racial composition of the student body, the percentage of students eligible for free or reduced-price lunch, total student enrollment, the number of employed teachers, and union affiliation. I further supplement the district variables with data on the distribution of wages for registered nurses and physician's assistants within the metropolitan statistical area in which the district is located—these measures provide an exogenous measure of wages that vary across localities within states and provide reasonable proxies for outside wages in a comparable professional service industry, as shown in Harris & Adams (2007).[xiv] Registered nurses, like teachers, must complete a training program that generally concludes with a vocational bachelor's degree and must be licensed by the state to practice. Physician's assistants complete the equivalent of a master's degree, and provide a basis to comparison for the returns to education in the healthcare industry. Last, I extracted data from the 2006 Congressional (house) elections at the congressional-district level; I input the share of the popular vote in favor of the democratic-party candidate, as the local political environment may indicate local union influence, as in Hosken & Margolis (1996).[xv] I argue that these supplementary variables are exogenous to the contract, but likely influence outcomes.

In Table 1, I present a descriptive look at these district-level contract provisions and other exogenous variables. For each of the endogenous contract provisions, I report the number of states which somehow regulate this provision (*Regulated states*), the number of contracts this represents (*Regulated contracts*), the number of districts which fail to address this issue in either the state- or district-level contract (*Incomplete*), and the means and standard deviations of these provisions.[xvi] Inspection of Panel A presents some interesting features of the contracts: for instance over half of the contracts do not clearly specify how a teacher is determined to be sufficiently incompetent in order for the district to recommend him or her for dismissal—though this seems that it would be a particularly relevant provision for both parties to the employment contract. In Panel B, I also report the mean values (and standard deviations) of select exogenous variables, which are observed in all districts.

Next, I move to a discussion on state-level variables. First, all states have laws governing collective bargaining—whether collective bargaining in public school districts is required, allowed, or prohibited. However, within these classifications, states vary on whether they permit teachers (who are public employees) to strike and on right-to-work status. These labor laws are consequential in assessing union power in either the district or the state; in particular, illegal strikes and right-to-work status should suggest lower levels of union power. For the analysis I assume these variables are strictly exogenous to contract choice, because these labor laws in most states are considerably more comprehensive than the education sector only. In Panel A of Table 2, I report two tables showing the variation in both of these labor rights, given the state's collective-bargaining law (the total number of districts represented by the state tabulations is reported in parentheses).[xvii]

Aside from these basic labor laws, however, states choose to intervene in the labor contract through various education policies. Conceivably, states may intervene in any of the many dimensions of the labor contract; however, Cohen et al. (2008) identify six general areas in which states commonly establish policies for the teacher labor contract. Of these, I will use variables coding three areas of intervention: i) pay reform policies including subject pay, combat pay, or performance pay (short name: compensation reform); ii) policies requiring tenured teachers to be evaluated at minimum once every two years (tenured evaluation); and iii) minimum experience requirements for tenure (tenure year). In Panel B of Table 2, I detail the number of states specifying such a policy, and the correlation matrix between these values—showing reasonably low levels of correlation and moderately negative between tenure year and tenured evaluation.

Finally, I supplement my dataset with variables that I will use to instrument for endogenous state policy decisions. Ideally, my instruments will be correlated with state educational policies, but uncorrelated with local-level decisions. As general indicators of state policy intervention, I use state-level electoral results from the 2004 presidential election, as the political sway of the state may indicate a predisposition to higher levels of educational intervention. Also, I use the state population from 2007 and each state's area (in square miles) as instruments, because from a contracting perspective, larger numbers of parties in a contract imply greater collective value to specifying various contract outcomes, while spreading the same population over an increasing land area diffuses that value. Third, I use policy-specific instruments indicating the percentage of bordering states that have specified such a policy at the state level, as states often look to bordering states' policy decisions for informing their own decisions.[xviii] All of these instrumental variables should likely influence state policies; and I find significant correlations between these instruments and the state policy variables. Such variables, however, should not influence district-level contract choices, as past state-level elections, the state's population and land area, and other states' educational policy decisions likely have little bearing on either districts' or teachers' preferences between competing contracts. Further, I conducted a test of over-identifying restrictions, which failed to reject the null, supporting the assertion that these instruments are valid here. With the final dataset assembled, I proceed to the results of these empirical analyses in the following section.

## V. Empirical Results

### *A. Wage Outcomes*

The empirical literature on teacher contracts has focused almost exclusively on wages and salary schedules, so I begin my analysis by addressing wage issues as well. In Table 3, I present estimates from an ordinary least squares model of contract choice, using as dependent variables the following measures from the district salary schedule: starting wages (columns 1 and 2), BA 5 wages (columns 3 and 4), BA max wages (columns 5 and 6), and the master's premium (columns 7 and 8). I also estimate each model on the full sample of districts where the outcome is determined at the district level (labeled 'full') and on the 75 largest districts in the nation ('largest'). I remind the reader that these models, because they isolate each contract provision and exclude any changes in other provisions, are going to provide inconsistent estimates; however, they are useful in describing some of the cross-sectional variation in contracts.

The explanatory variables are generally common across all specifications: compensation reform, tenured evaluation, and tenure year are all state-level education policies where higher values are generally good for the state; right-to-work status and strike legality are also state-level variables, though I treat them as exogenous throughout the analysis. The remaining four variables are local measures: an indicator on whether the contract was collectively bargained, the demographics of the student body, and 2006 election results from the local congressional districts. In each successive specification, I include roughly comparable measures from the healthcare industry to help explain variation in teachers' wages.

Several findings here are noteworthy. First, states with policies requiring regular evaluation of tenured teachers appear to pay starting teachers significantly higher wages, but marginally lower master's premiums. Tenure year policies are generally uncorrelated with all outcomes except BA max wages, which are significantly higher. Right-to-work states appear to pay lower wages generally (though only some of which are significant); surprisingly, collectively bargained contracts show a similar negative estimate on wages (the master's premium excluded). I also find a large and generally significant compensating differential paid to teachers on the bachelor's salary schedule for working in districts with higher levels of minority students. Finally, I find teachers' wages reasonably well correlated (though not always significant) with various measures from the distribution of nurses' wages in these specifications—a noteworthy exception to this is the correlation with the return to physician's assistants, which is near zero.

On the bottom two lines for each model, I also report the variation on the particular outcome due to states as a percentage of the total variance in the outcome, as well as the results of an F-test on the joint hypothesis of no state-level effects. These two measures are computed using the fixed effects model described in Equation (2), using only states with two or more districts (which are a subset of the 75 largest districts). These results suggest differences between states account for most of the variation in these outcomes—local-level errors account for less than half of the total variation. This suggests state budgetary constraints may drive this process, which varies the level of funding considerably across states, but is approximately equally distributed (relatively speaking) within the state's school systems.

Next, I simultaneously estimate the system of equations on contract outcomes, as outlined in Equations (3) and (4). Here, the simultaneous contract equations are various points on the negotiated salary schedule:

$$(5)\qquad \begin{aligned} &(\text{Starting wages})_{\mathrm{d}} = {}_0 + X_S\ {}_1 + W_d^{\mathit{Starting}}\ {}_2 + (\text{BA max})_{\mathrm{d}}\ {}_3 + (\text{Master's})_{\mathrm{d}}\ {}_4 + \ {}_d \\ &(\text{BA max wages})_{\mathrm{d}} = {}_0 + X_S\ {}_1 + W_d^{\mathit{BA}\ \max}\ {}_2 + (\text{Starting})_{\mathrm{d}}\ {}_3 + (\text{Master's})_{\mathrm{d}}\ {}_4 + \ {}_d \\ &(\text{Master's premium})_{\mathrm{d}} = {}_0 + X_S\ {}_1 + W_d^{\mathit{Master's}}\ {}_2 + (\text{Starting})_{\mathrm{d}}\ {}_3 + (\text{BA max})_{\mathrm{d}}\ {}_4 + \ {}_d \end{aligned}$$

Here, different points of the salary schedule are simultaneously determined in the negotiation process. In the regression, I treat BA 5 wages as predetermined to pin down a level of wages on the schedule, and compare all other points on the salary schedule relative to this measure; the vector of exogenous variables is generally shared across all equations, but each equation includes the comparable compensation level from the healthcare industry. Further, the vector of state policies is comprised of three educational policy variables: compensation reform, tenured evaluation, and tenure year. Each of these are instrumented with the following system of equations on state policy determination:

$$(6)\qquad \begin{aligned} &(\text{Compensation Reform})_{\mathrm{S}} = {}_0^1 + W_S^1\ {}_1^1 + \ {}_S^1 \\ &(\text{Tenured Evaluation})_{\mathrm{S}} = {}_0^2 + W_S^2\ {}_1^2 + \ {}_S^2 \\ &(\text{Tenure Year})_{\mathrm{S}} = {}_0^3 + W_S^3\ {}_1^3 + \ {}_S^3 \\ &(\text{Regulates Wage Schedule})_{\mathrm{S}} = {}_0^4 + W_S^4\ {}_1^4 + \ {}_S^4 \end{aligned}$$

The first three equations presented here are the primary state policies of interest, and I will be using these equations in each of the three-stage least squares estimates throughout the paper. The fourth equation, however, is unique to this specification—it captures the effect of state regulation on the wage schedule (given the endogeneity of this regulation). The instrument vector in each of the equations above includes each state's 2007 population, land area, 2004 election results, and the percentage of bordering states that have adopted similar education policies (this latter variable varies across each equation). By estimating with three-stage least squares, I address the endogeneity of state policy and the simultaneity of contract provisions, and produce consistent and efficient estimates of the link between policy decisions and contract choice. The results of these models are presented in Table 4, with those calculated on the full sample reported in columns 1-3, and those calculated on the sample of the largest districts reported in columns 4-6. I find wages (however measured) higher in districts with compensation reform policies, and the estimates are largely significant. Tenured evaluation policies show no significant effect on any wage measures. I also find significant effects of tenure year policies, but the effects vary depending on the dependent variable and the sample used—this may indicate systematic differences between the largest districts and the others included in the data. Estimates on all remaining state-level variables are not significant.

Inspecting the endogenous variables from other provisions, I show an interrelation at different points along the salary schedule—a general complementarity between wages at different points along the bachelor's schedule (using the estimates from the largest districts); though wages increase substantially faster on the higher end than they do for new teachers, as found in Lankford & Wyckoff (1997). I also find a significant tradeoff between the master's premium and starting wages—suggesting the premium is paid generally at the expense of new teachers' salaries.

Finally, I wish to point out the point estimates on healthcare wages in comparison with my first round of estimates. In these models, I find correlations with outside wages are much smaller in magnitude and all are now not significant in predicting teachers' wages, in contrast to the reasonably strong correlations previously noted. This suggests salary schedules may have more internal validity in determining the wage, and is not well correlated with external wage pressures. While this finding is not surprising, given that wages are generally determined through parsing a predetermined budget, it warrants more research into how wage schedules are determined—both under collectively bargained contracts and in districts where the school board determines the wage schedule.

*B. Teacher Time Use Outcomes*

In Table 5, I present OLS estimates on various time use provisions in contracts: the number of working days in the year (columns 1 and 2), the amount of weekly individual preparation time guaranteed to teachers (columns 3 and 4), and the amount of time teachers are required to stay beyond regularly scheduled class time (columns 5 and 6). Here, state policies on compensation reform, tenure evaluation, and tenure year appear to make little significant difference in outcomes. And as one might expect, states that regulate the amount of individual preparation time significantly increase its predicted value in practice. Collectively bargained contracts and the legality of teacher strikes appear to be large determinants in these provisions, suggesting unions may play a significant role in establishing these rules. All of these time-use provisions show little within-state variation—suggesting local decision-making likely plays a relatively smaller role in this domain of contract outcomes.

As before, I also wish to address both the endogeneity of state policy and the simultaneity of contract provisions by using a three-stage least squares estimation approach. In this setting, the three simultaneous contract equations are those analogous to Equation (5) where I use the time-use outcomes rather than the salary schedule outcomes as the simultaneous variables. The system of state policy determination is generally the same as specified in Equation (6), where instead of the final equation on wage schedule regulation, I include two additional equations on regulation in school day and weekly prep time regulation.[xix] In Table 6, I present the results from these models. The estimates on state-level policies suggest compensation reform policies appear to decrease the number of school days for teachers while tenured evaluation policies have the opposite effect; however, these point estimates may be poorly identified from multicollinearity. Unions appear to have an influence on school days: the indicator on collectively bargained contracts estimates significantly fewer school days in these districts, and in right-to-work states (where union power is likely lower) this is countered with significantly more school days. I also detect tradeoffs in these provisions, though the significance of these tradeoffs is not consistent across the sample of contracts, so I am hesitant to draw any strong conclusions here.

*C. Negative Evaluation Outcomes*

Next, I investigate the consequences of negative teacher evaluations in various district contracts. The contract provisions I investigate here are the right to grieve, salary freeze, and defined policy to dismissal, all of which are coded as binary indicators on whether the contract contains such a clause. When states regulate these policies, they generally determine the practice (i.e. states guarantee teachers a right to grieve), thus including those observations with indicator variables perfectly predicts the outcomes, so in this table I omit those observations to see how the choices on these provisions are made when the outcome is not predetermined.

The estimates presented in Table 6 are the estimated odds ratios from a logit model predicting the likelihood of a district contract of containing this clause. For odds ratios, values greater than (less than) one indicate a higher (lower) likelihood of having the specified clause in the contract. For instance, districts in states with tenure evaluation policies appear to have a significantly higher likelihood of adopting a provision granting teachers the right to grieve a negative evaluation, while those in right-to-work states have a significantly lower likelihood of adopting this provision. Generally speaking, however, very few of the variables do not significantly predict the presence of these contract outcomes. I also wish to note what appear to be the symptoms of multicollinearity in the models where the defined policy for dismissal is the dependent variable: estimated odd ratios are both very large and very small and significant, suggesting poorly identified individual effects due to small sample size. However, because these results control for neither the endogeneity or simultaneity of the explanatory variables, they are only descriptive. Below the logit estimates, I again report the percentage of total variation due to the state and find only a small portion of it is attributable to variation between states, and the joint significance of state fixed effects do not reject the null. These two results suggest state-level differences appear to be less consequential (relatively speaking) in determining contract outcomes, and likely rely to a greater extent on variations in the local negotiation environment—i.e. where unions may have more or less power or district leadership may be more influential.

In Table 7, I present the estimated parameters for these contract outcomes in a three-stage least squares framework, where the three dependent variables are all determined simultaneously, using with state policy rules analogous to those specified in Equation (6) for identification. Note that I can indirectly control for a state's intervention by including the state's regulation in other outcomes to help predict the current outcome, which allows me to include all observations.[xx] The estimated results presented are parameter estimates on the linear probability of adopting such a provision. Using the results on the largest districts, compensation reform policies appear to decrease the likelihood both the adoption of the right to grive and policies leading to dismissal, while increases in tenure year decrease the likelihood of adopting a salary freeze but increases the likelihood of adopting policies for dismissal. When the state regulates the right to grieve, this appears to significantly increase the probability of adopting salary freeze policies but decreases the likelihood of adopting policies to dismissal. Notably, collectively bargained contracts have a significantly lower likelihood of adopting clauses on both the right to grieve or appeal a negative evaluation and freezing a teacher's salary in response. Looking at the interrelation of these provisions, I find a complementary effect between salary freezes and dismissal policies (consistent across both samples). The interrelation between some of the other provisions, however, is not consistent across samples, and is thus indeterminate

*D. Seniority Rules in Transfers and Layoffs*

The final domain of outcomes I investigate contains the rules establishing preferences for seniority in transfers or layoffs. The dependent variables here are binary indicators on adopting provisions on reverse seniority, senior bump, and senior transfers. Like Table 7, I omit observations where state regulation predetermines the outcome. I present the estimated odds ratios from a logit model in Table 9. The most notable correlation with state policies is the significantly lower likelihood of adopting senior bump policies in districts with state policies requiring tenured evaluation. Tenure year policies also appear to have a marginally lower correlation with both reverse seniority and senior bumping. The most consequential estimates are the large and significant correlations of senior bumping and senior transfers with collectively bargained contracts. Finally, the percentage of variation due to states in these outcomes is again somewhat small—contract outcomes may be more sensitive to the local negotiation environment than any state-level decision.

In Table 10 I present the three-stage least square estimates of these simultaneous contract decisions, which are consistent and efficient estimators of contract choice.[xxi] Compensation reform policies appear to have a significantly lower likelihood of adopting senior bump provisions, and increasing the tenure year policy appears to decrease the likelihood of adopting any of these rules favoring teacher seniority. Surprisingly, the union variables do not appear to be strong predictors of outcomes here—the legality of teacher strikes and right-to-work status appear to make little difference in these outcomes, and collectively bargained contracts only appear to have a marginally significant effect in increasing the probability of adopting these seniority rules. As for the interrelation between these provisions, using the estimates from the largest districts, these three privileges appear to be substitutes (though not all estimates are significant).

*E. Comparisons of Outcomes across Multiple Domains*

Heretofore, I have focused on how contract provisions vary within a fairly narrowly defined domain; however, the motivating question of my analysis explicitly looks at the tradeoff across domains (the hypothetical labor vs. wages presented in Section III). Due to the complexity of the contract, a comprehensive analysis of the tradeoffs between contract dimensions across all domains is simply not feasible with the available data, because the complexity of the analysis increases exponentially with the dimensionality of the contract. In spite of this complexity, I attempt to make two basic comparisons across multiple domains: the first looks at the tradeoffs inherent in wages, work, and conditions, the second links seniority rules with wages to senior teachers.

As a starting point, I want to look at the interrelationship of teacher wages, the amount of work, and working conditions—suggested to be the most critical issues in negotiations (Hess & Kelly, 2006; McDonnell & Pascal, 1979). While working conditions can cover a myriad of attributes, I take limits on class size in elementary schools as my proxy. Twenty-four states regulate class size at the elementary level, and in those cases where the state doesn't limit class size many contracts still specify a certain limit.[xxii] Inspection of the contract language suggests these limits are not particularly binding in many cases (violating a limit generally involves a minimal punishment to the school, which is less costly than hiring additional teachers to come into compliance); however, the tradeoff between class size and wages has been studied commonly in the prior literature as well (Hall & Carroll, 1973; Hosken & Margolis, 1996). In Table 11, I present the results from this cross-domain comparison. As expected, I find significant tradeoffs between these provisions: wages and class sizes are complimentary, as are the number of school days and class size, while wages and school days are substitutes. Each of these outcomes are consistent with constrained optimization: for an additional day of work, teachers' daily wages fall, given a set payroll; lowering class sizes lowers teachers' wage requirements; and smaller class sizes (increasing the number of teachers for the student body) results in fewer school days to balance a given payroll budget. Other findings in this table are also noteworthy—for instance, all of the state-level policies have significant effects on one or more of these outcomes, and variables on collectively bargained contracts, right-to-work status, and strike legality are significant on multiple outcomes as well.

As a final test, I make a comparison between seniority rules and BA max wages, which would be paid to the most senior teachers. The results of this specification are presented in Table 12. State policies on tenured evaluations and tenure year appear to have the largest influence on BA max wages (using the estimates from the largest districts), possibly suggesting that as states control the workforce through such policies that senior teachers may be able to demand higher wages in a quid-pro-quo trade for higher performance standards. These same state policies, however, appear to lower the likelihood of adopting seniority rules. I also note the reasonably strong interrelationship between these provisions: max wages are generally complementary with seniority privileges.

While the two comparisons presented here are an incomplete picture, at best, of the tradeoffs inherent in the teacher labor contract across multiple domains, they illustrate the complexity of the labor contract.

**VI. Conclusion and Policy Discussion**

Inflexible teacher contracts are commonly singled out as one of the primary barriers to education reform, but I show here that state legislators play no small role in determining the outcomes of these contracts. For instance, I find wage and time use outcomes have a relatively large level of between-state variation, suggesting state policies play a large role in determining contract outcomes on these dimensions. These findings suggest various critical aspects of the labor contract can be reasonably well controlled through legislation, rather than simply allowing these outcomes to be arrived at through district-level negotiations, which may not necessarily arrive at outcomes aligned with policy intentions.

However, this study also shows that regulation may have unintended consequences: I wish to again emphasize that state policymakers, through incomplete intervention, may inadvertently alter the local-level negotiations that actually determine how teachers are employed in education production. Understanding the influence of these policies on other aspects of the contract are critical for informed policy decisions, and this paper takes an important first step in linking state-level policy decisions with district-level contract outcomes. In this paper, I advance the literature by controlling for the endogeneity of state policies and the simultaneity of contract provisions to make a more explicit link between policies and contracts.

Several findings deserve highlighting here. Using a three-stage least squares approach, I show the premium paid to teachers holding master's degrees appears to be funded, in part, through starting teachers' wages; and, districts' wage schedules are not well correlated with comparable measures from the healthcare industry. These two findings—the tradeoff in the salary schedule and the poor correlation with outside wages—bring to head an important policy question: why reward teachers who hold a master's degree? Research on teacher quality suggest teachers who hold master's degrees are no more effective in raising student achievement (i.e. Aaronson, Barrow, & Sander, 2007). Districts' persistence in paying the extra reward, however, could still be justified to retain teachers who have higher outside opportunities. My results suggest this justification is false—rewards for master's degrees are much more strongly correlated with other wages on the salary schedule than comparable rewards in a comparison industry.

Returning to the results, collectively bargained contracts appear to significantly influence provisions across all domains (particularly time use and evaluation provisions). Collective bargaining and unions, however, are by no means the only factor influencing outcomes—state-level policies are important contributors to various provisions across all domains as well.

Further, this paper presents a framework and empirical methodology that facilitates the empirical investigation into contract outcomes and how state policy may influence these outcomes. The results reported here inform policymakers as to the expected outcomes of policy intervention, because the incomplete specification of the labor contract from state legislators has the potential to alter the form of the contract in subsequent negotiations. A relevant example of this is state-imposed limits on class size, which have been the topic of policy debate for years—and where nearly half of all states actively intervene. While my results show a direct decrease in class size practice as a result of this state-level policy decision, it also shows smaller class sizes are correlated with fewer school days (likely resulting from the need to control payroll expenditures). Thus, the intended benefit of policies regulating smaller class sizes appear to be somewhat mitigated through spending fewer days in the classroom.

While the results I present here are informative, and are a unique contribution to the literature on teacher contracts, I note the following limitations of my analysis. First, because the sample is drawn from the largest school districts in the nation, the results reported here are representative of the largest, most urbanized districts. As demonstrated in the results, the point estimates sometimes shifted dramatically when the smaller school districts were excluded from the sample, so I hesitate to generalize these results to smaller, rural districts, which constitute the large majority of school districts in the United States. Second, due to the small sample of district contracts for which I have data, some of the estimates are not well identified, and further research with larger samples will likely improve the estimates reported here. Third, I investigate the outcomes of only a few educational policies on a limited set of contract outcomes. Certainly, these are not the only policies that vary across states, nor are these the only outcomes of interest; thus, my results may be subject to bias from omitted variables—both omitted state policy variation and omitted contract provisions. The possibility of this bias acknowledged, I attempt to counter the endogeneity and simultaneity problems with an estimation method that produces both consistent and efficient estimates, which is the most feasible solution given the complexity of the problem. Finally, I wish to again note the inclusion of specific contract provisions does not necessarily imply binding practice, as noted in prior studies on teacher contracts. Thus, my results presented here reflect changes in contract outcomes, not necessarily practice outcomes.

On a final note, the analysis I present here is the first attempt to understand the tradeoffs inherent in contract outcomes and linking those with policy decisions. I hope this research serves as a springboard into various meaningful aspects of education research—fully understanding the consequences of policy intervention, identifying the link between policy and implementation, determining the optimal level of policy intervention at the state level, and understanding how contracts can both help and hinder state legislators' education policy goals.

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**Tables and Figures**

**Figure 1**

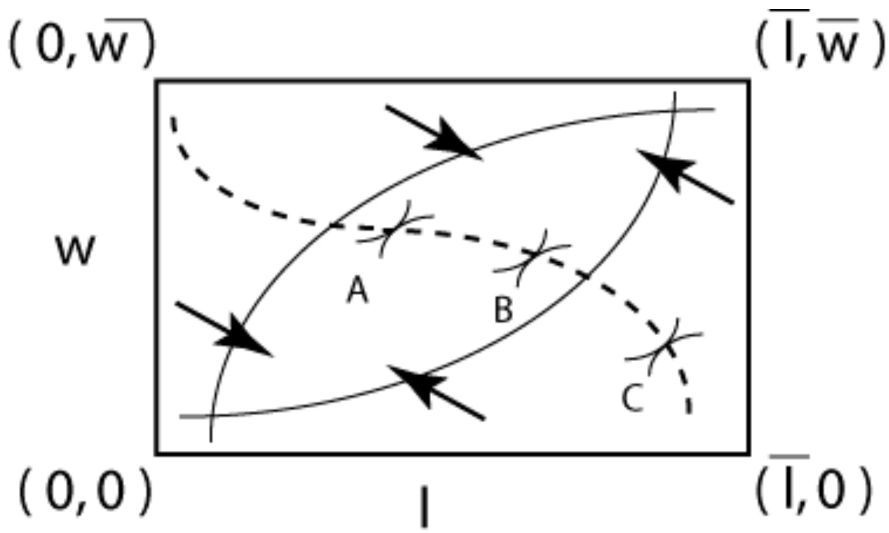


**Figure 2**

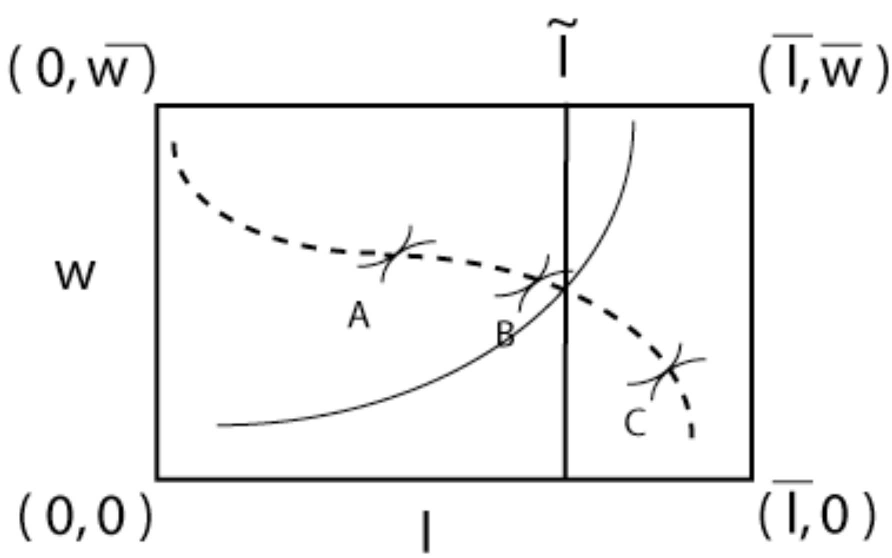

**Table 1. Descriptive Summary of District-level Variables**

Panel A. Negotiated Contract Provisions

| Wage Provisions[a] | Regulated states | Regulated contracts | Incomplete | Mean | Standard Deviation |
|---|---|---|---|---|---|
| Starting wages | 18 | 36 | 0 | 38,594.2 | 4,877.8 |
| BA 5 wages | 18 | 36 | 0 | 42,993.0 | 5,861.3 |
| BA max wages | 18 | 36 | 0 | 57,725.0 | 10,720.8 |
| Master's premium | 18 | 36 | 0 | 4,078.7 | 2,533.3 |
| **Time Use Provisions** | | | | | |
| School days | 18 | 44 | 0 | 187.2 | 4.0 |
| Weekly prep time | 9 | 25 | 18 | 181.57 | 103.25 |
| Time beyond school | 1 | 8 | 60 | 13.61 | 19.88 |
| **Consequences of Negative Evaluation** | | | | | |
| Right to grieve | 5 | 22 | 44 | 0.44 | 0.499 |
| Salary freeze | 2 | 2 | 78 | 0.22 | 0.416 |
| Defined policy to dismissal | 11 | 25 | 54 | 0.46 | 0.501 |
| **Transfer/Layoff Policies** | | | | | |
| Reverse seniority | 16 | 35 | 6 | 0.79 | 0.409 |
| Senior transfers | 2 | 2 | 29 | 0.39 | 0.490 |
| Senior bump | 1 | 1 | 69 | 0.17 | 0.378 |
| **Working Conditions** | | | | | |
| Class size | 24 | 58 | 17 | 27.38 | 6.82 |

[a] Wages are reported here in annual dollars. Throughout the analysis, I use the log of the daily rate of pay (annual wage / working days).

Panel B. Exogenous Characteristics of District

| | Full Sample | Largest Districts |
|---|---|---|
| Percentage of minority students | 0.601<br>(0.261) | 0.643<br>(0.232) |
| Percentage of students eligible for free or reduced-price lunch | 0.490<br>(0.199) | 0.485<br>(0.197) |
| Total student enrollment (thousands) | 102.792<br>(132.8) | 128.187<br>(146.0) |
| Collectively bargained contract | 0.720<br>(0.451) | 0.662<br>(0.476) |

Standard deviations reported in parentheses.

**Table 2. Summary of State Labor Law and Educational Policy Status**

Panel A. Strike Legality and Right-to-work Status by Collective Bargaining Rules

| | Teacher strike legal | Teacher strike illegal | No right-to-work law | Right-to-work state | Total |
|---|---|---|---|---|---|
| Collective bargaining mandatory | 13<br>(21) | 23<br>(41) | 24<br>(36) | 12<br>(26) | 36<br>(62) |
| Collective bargaining permissible | 4<br>(7) | 7<br>(8) | 4<br>(5) | 7<br>(10) | 11<br>(15) |
| Collective bargaining illegal | 0<br>(0) | 4<br>(23) | 0<br>(0) | 4<br>(23) | 4<br>(23) |
| Total | 17<br>(28) | 34<br>(72) | 28<br>(41) | 23<br>(59) | 51<br>(100) |

Panel B. Education Policies Determined by the State

| | States | Correlation Matrix | | |
|---|---|---|---|---|
| Compensation reform | 29 | 1.000 | | |
| Tenured evaluation | 18 | 0.063 | 1.000 | |
| Tenure year | 51 | 0.007 | -0.230 | 1.000 |

**Table 3. Descriptive Determinants of Wage Schedule in Contract Negotiation**

| | Starting wage | | BA 5 wage | | BA max wage | | Master's premium | |
|---|---|---|---|---|---|---|---|---|
| | Full | Largest | Full | Largest | Full | Largest | Full | Largest |
| Compensation reform | 0.029<br>(0.020) | 0.035<br>(0.038) | 0.017<br>(0.025) | 0.011<br>(0.043) | 0.076<br>(0.048) | 0.079<br>(0.061) | 0.015<br>(0.017) | 0.005<br>(0.021) |
| Tenured evaluation | 0.084***<br>(0.025) | 0.089**<br>(0.035) | 0.036<br>(0.028) | 0.063<br>(0.039) | 0.050<br>(0.043) | 0.086<br>(0.057) | -0.034*<br>(0.018) | -0.031**<br>(0.015) |
| Tenure year | 0.009<br>(0.020) | -0.017<br>(0.044) | 0.023<br>(0.021) | 0.031<br>(0.042) | 0.082**<br>(0.031) | 0.149***<br>(0.046) | -0.018*<br>(0.010) | -0.014<br>(0.016) |
| State regulates wage schedule | -0.010<br>(0.025) | 0.019<br>(0.037) | -0.015<br>(0.025) | 0.046<br>(0.036) | -0.055<br>(0.054) | 0.044<br>(0.052) | 0.014<br>(0.014) | -0.009<br>(0.016) |
| Teacher strikes illegal | -0.037<br>(0.024) | 0.003<br>(0.030) | -0.008<br>(0.029) | 0.022<br>(0.038) | 0.043<br>(0.039) | 0.018<br>(0.047) | -0.010<br>(0.018) | -0.017<br>(0.016) |
| Right-to-work state | -0.018<br>(0.033) | -0.082<br>(0.052) | -0.088**<br>(0.039) | -0.154***<br>(0.050) | -0.086<br>(0.062) | -0.073<br>(0.072) | -0.014<br>(0.018) | -0.007<br>(0.020) |
| Collectively bargained contract | -0.121***<br>(0.040) | -0.145***<br>(0.040) | -0.085**<br>(0.039) | -0.114***<br>(0.037) | -0.153***<br>(0.057) | -0.090<br>(0.061) | 0.043**<br>(0.020) | 0.023<br>(0.020) |
| Percentage of students eligible for free or reduced-price lunch | -0.033<br>(0.088) | 0.034<br>(0.104) | 0.002<br>(0.096) | 0.090<br>(0.099) | -0.116<br>(0.148) | -0.174<br>(0.173) | -0.013<br>(0.049) | 0.004<br>(0.059) |
| Percentage of minority students | 0.196**<br>(0.076) | 0.158<br>(0.102) | 0.162*<br>(0.082) | 0.035<br>(0.102) | 0.274**<br>(0.129) | 0.214<br>(0.169) | -0.077*<br>(0.042) | -0.037<br>(0.057) |
| Percentage of Democratic vote in 2006 congressional election | -0.004<br>(0.049) | -0.008<br>(0.052) | -0.041<br>(0.059) | -0.031<br>(0.064) | -0.122<br>(0.104) | -0.065<br>(0.121) | 0.042<br>(0.029) | 0.000<br>(0.044) |
| Registered nurse's wages: 25th percentile | 0.386***<br>(0.138) | 0.182<br>(0.154) | | | | | | |
| Registered nurse's wages: 50th percentile | | | 0.426***<br>(0.148) | 0.418**<br>(0.175) | | | | |
| Registered nurse's wages: 75th percentile | | | | | 0.234<br>(0.219) | 0.282<br>(0.250) | | |
| Return to physician's assistants | | | | | | | -0.004<br>(0.031) | 0.018<br>(0.043) |
| Observations | 100 | 74 | 100 | 74 | 100 | 74 | 100 | 74 |
| R-squared | 0.63 | 0.62 | 0.61 | 0.63 | 0.42 | 0.43 | 0.33 | 0.19 |
| Percent of variation due to state | 0.62 | | 0.56 | | 0.67 | | 0.56 | |
| F-statistic on state effects jointly zero | 4.25*** | | 2.21** | | 3.18*** | | 2.79*** | |

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses.
Note: Additional regressors in each equation include enrollment, enrollment squared, and indicator variables on salary schedule year. Percent of variation due to state calculated using fixed effects on states with more than one district.

**Table 4. Three-stage Least Squares Estimates on Wage Schedule Determination**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | Starting wage | BA max wage | Master's premium | Starting wage | BA max wage | Master's premium |
| Compensation reform | 0.157***<br>(0.039) | 0.281***<br>(0.076) | 0.094***<br>(0.029) | 0.092**<br>(0.036) | -0.096<br>(0.072) | 0.058**<br>(0.029) |
| Tenured evaluation | 0.065<br>(0.050) | 0.031<br>(0.110) | -0.016<br>(0.053) | 0.017<br>(0.038) | 0.058<br>(0.075) | -0.014<br>(0.030) |
| Tenure year | 0.121***<br>(0.035) | 0.214***<br>(0.066) | 0.001<br>(0.034) | -0.071***<br>(0.027) | 0.175***<br>(0.046) | -0.053**<br>(0.024) |
| State regulates wage schedule | -0.041<br>(0.042) | -0.129<br>(0.085) | -0.054<br>(0.044) | 0.013<br>(0.032) | -0.052<br>(0.064) | -0.015<br>(0.025) |
| Teacher strikes illegal | -0.014<br>(0.024) | 0.002<br>(0.050) | -0.015<br>(0.024) | -0.011<br>(0.027) | -0.020<br>(0.051) | -0.012<br>(0.021) |
| Right-to-work state | -0.017<br>(0.031) | -0.042<br>(0.060) | -0.022<br>(0.024) | -0.038<br>(0.041) | 0.123<br>(0.078) | -0.036<br>(0.032) |
| Collectively bargained contract | -0.065<br>(0.041) | -0.099<br>(0.087) | -0.026<br>(0.038) | -0.033<br>(0.035) | -0.002<br>(0.071) | -0.023<br>(0.029) |
| Percentage of students eligible for free or reduced-price lunch | -0.135*<br>(0.070) | -0.247*<br>(0.142) | -0.099<br>(0.061) | 0.002<br>(0.078) | -0.168<br>(0.141) | 0.010<br>(0.061) |
| Percentage of minority students | 0.120*<br>(0.064) | 0.200<br>(0.131) | 0.070<br>(0.063) | 0.061<br>(0.079) | 0.128<br>(0.152) | 0.031<br>(0.062) |
| Percentage of Democratic vote in 2006 congressional election | 0.022<br>(0.044) | -0.006<br>(0.088) | 0.027<br>(0.036) | 0.010<br>(0.046) | -0.043<br>(0.088) | 0.004<br>(0.037) |
| Starting wage | | -1.231**<br>(0.498) | -0.608**<br>(0.307) | | 0.750*<br>(0.413) | -0.657***<br>(0.151) |
| BA 5 wage | 0.935***<br>(0.129) | 1.416***<br>(0.340) | 0.482**<br>(0.215) | 0.426***<br>(0.130) | 0.321<br>(0.305) | 0.220*<br>(0.129) |
| BA max wage | -0.493***<br>(0.131) | | -0.237**<br>(0.108) | 0.153<br>(0.102) | | 0.101<br>(0.086) |
| Master's premium | -1.043***<br>(0.273) | -1.633***<br>(0.595) | | -0.928***<br>(0.262) | 0.090<br>(0.677) | |
| Registered nurse's wages: 25th percentile | 0.127<br>(0.121) | | | -0.064<br>(0.122) | | |
| Registered nurse's wages: 75th percentile | | 0.206<br>(0.235) | | | 0.009<br>(0.225) | |
| Return to physician's assistant | | | 0.015<br>(0.071) | | | 0.021<br>(0.040) |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.

Note: Additional regressors in each equation include enrollment, enrollment squared, and indicator variables on salary schedule year. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).

**Table 5. Descriptive Determinants of Teacher Time Use in Contract Negotiation**

| | School Days | | Weekly prep time | | Time beyond school | |
|---|---|---|---|---|---|---|
| | Full | Largest | Full | Largest | Full | Largest |
| Compensation reform | -0.858<br>(1.219) | -3.484**<br>(1.405) | -8.053<br>(26.858) | -24.431<br>(42.738) | 2.585<br>(5.529) | 6.862<br>(6.858) |
| Tenured evaluation | 1.672<br>(1.210) | 1.069<br>(1.558) | 30.142<br>(23.425) | 24.535<br>(36.865) | -0.255<br>(6.157) | -1.220<br>(7.514) |
| Tenure year | 0.315<br>(0.845) | -0.533<br>(0.973) | 10.375<br>(23.787) | -0.258<br>(30.302) | 0.639<br>(2.944) | -6.656<br>(5.635) |
| State regulates school days | 0.403<br>(1.307) | -1.384<br>(1.868) | | | | |
| State regulates weekly prep time | | | 52.385<br>(41.887) | 107.751**<br>(48.641) | | |
| Teacher strikes illegal | 2.875**<br>(1.333) | 3.738*<br>(1.965) | 44.513**<br>(21.406) | 73.996**<br>(28.432) | -16.279***<br>(5.636) | -10.569<br>(7.021) |
| Right-to-work state | -1.147<br>(1.533) | 0.624<br>(1.483) | -39.126<br>(31.768) | -22.282<br>(41.829) | -1.757<br>(5.952) | -5.513<br>(7.042) |
| Collectively bargained contract | -3.232*<br>(1.891) | -3.203*<br>(1.782) | 55.934<br>(43.181) | 111.716**<br>(54.361) | 1.869<br>(7.100) | -4.923<br>(8.801) |
| Percentage of students eligible for free or reduced-price lunch | 0.315<br>(3.641) | 1.143<br>(2.886) | -112.435<br>(73.292) | -63.617<br>(96.092) | -9.997<br>(14.649) | 13.963<br>(17.246) |
| Percentage of minority students | -2.363<br>(3.473) | -7.050**<br>(2.669) | -28.276<br>(65.813) | -71.179<br>(83.539) | 4.143<br>(12.886) | -15.530<br>(17.843) |
| Percentage of Democratic vote in 2006 congressional election | -1.479<br>(2.293) | 3.329*<br>(1.747) | 85.848<br>(63.277) | 139.572*<br>(74.390) | 1.838<br>(10.038) | 5.059<br>(12.052) |
| Observations | 100 | 74 | 100 | 74 | 100 | 74 |
| R-squared | 0.27 | 0.45 | 0.23 | 0.30 | 0.17 | 0.16 |
| Percent of variation due to state | 0.76 | | 0.55 | | 0.72 | |
| F-statistic on state effects jointly zero | 10.40*** | | 3.57*** | | 1.96* | |

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses.

Note: Additional regressors in each equation include enrollment and enrollment squared. Percent of variation due to state calculated using fixed effects on states with more than one district.

**Table 6. Three-stage Least Squares Estimates on Teacher Time Use**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | School days | Weekly prep time | Time beyond school | School days | Weekly prep time | Time beyond school |
| Compensation reform | -2.240<br>(2.610) | -77.185<br>(48.583) | -18.643*<br>(9.749) | -7.451***<br>(1.967) | -222.106***<br>(59.630) | -5.129<br>(12.699) |
| Tenured evaluation | 3.433<br>(2.593) | 55.945<br>(55.952) | -11.971<br>(11.210) | 7.050***<br>(2.168) | 185.200***<br>(55.810) | -3.034<br>(11.755) |
| Tenure year | -1.378<br>(2.125) | -96.787**<br>(42.249) | -21.810***<br>(8.120) | 0.254<br>(1.369) | -1.566<br>(37.539) | -6.498<br>(6.902) |
| State regulates school days | 5.657**<br>(2.786) | | | 1.424<br>(1.631) | | |
| State regulates weekly prep time | | 157.292***<br>(53.904) | | | 181.842***<br>(55.089) | |
| Teacher strikes illegal | -0.887<br>(1.831) | 36.383<br>(37.067) | -7.005<br>(6.773) | 1.501<br>(2.095) | 75.962<br>(46.260) | -10.830<br>(9.056) |
| Right-to-work state | -0.793<br>(1.882) | -10.062<br>(36.005) | 3.671<br>(7.281) | 3.056*<br>(1.762) | 35.554<br>(53.480) | -3.009<br>(10.023) |
| Collectively bargained contract | -1.724<br>(2.596) | 76.274<br>(62.219) | -4.466<br>(10.652) | -3.926**<br>(1.689) | -8.840<br>(65.488) | -7.000<br>(10.107) |
| Percentage of students eligible for free or reduced-price lunch | 1.805<br>(4.310) | -25.195<br>(90.750) | 4.321<br>(18.703) | 0.531<br>(3.840) | -37.639<br>(115.402) | 19.354<br>(21.619) |
| Percentage of minority students | -4.391<br>(3.842) | -104.195<br>(73.885) | -3.278<br>(15.641) | -6.672*<br>(3.791) | -194.699<br>(121.144) | -18.870<br>(22.751) |
| Percentage of Democratic vote in 2006 congressional election | 0.167<br>(2.890) | 86.053<br>(56.575) | -4.428<br>(12.713) | 4.695*<br>(2.580) | 202.433***<br>(73.336) | 7.690<br>(16.228) |
| School days | | -0.047<br>(4.909) | -2.646***<br>(0.710) | | -16.610***<br>(4.416) | -0.673<br>(1.054) |
| Weekly prep time | -0.005<br>(0.011) | | 0.007<br>(0.051) | -0.009<br>(0.007) | | 0.001<br>(0.050) |
| Time beyond school | -0.192***<br>(0.051) | -0.854<br>(1.552) | | -0.010<br>(0.039) | -0.420<br>(1.231) | |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.

Note: Additional regressors in each equation include enrollment and enrollment squared. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).

**Table 7. Odds Ratio Estimates on Outcomes of Negative Teacher Evaluations**

| | Right to grieve | | Salary freeze | | Defined policy to dismissal | |
|---|---|---|---|---|---|---|
| | Full | Largest | Full | Largest | Full | Largest |
| Compensation reform | 0.884<br>(0.643) | 2.897<br>(3.965) | 0.687<br>(0.462) | 0.278<br>(0.342) | 0.282<br>(0.230) | 0.080<br>(0.128) |
| Tenured evaluation | 3.544*<br>(2.484) | 2.897<br>(3.841) | 2.274<br>(2.063) | 3.792<br>(3.652) | 1.511<br>(1.816) | 11.123<br>(29.123) |
| Tenure year | 0.974<br>(0.432) | 0.365<br>(0.248) | 1.089<br>(0.489) | 1.544<br>(0.992) | 2.114<br>(1.299) | 26.169*<br>(51.231) |
| Teacher strikes illegal | 0.727<br>(0.585) | 5.127<br>(8.199) | 0.611<br>(0.506) | 1.137<br>(1.355) | 0.090**<br>(0.085) | 0.019**<br>(0.031) |
| Right-to-work state | 0.715<br>(0.610) | 0.046*<br>(0.076) | 3.236<br>(2.748) | 4.073<br>(5.295) | 5.370**<br>(4.419) | 4.362<br>(7.134) |
| Collectively bargained contract | 0.505<br>(0.447) | 0.356<br>(0.556) | 0.284<br>(0.235) | 0.223<br>(0.251) | 3.300<br>(3.488) | 1.913<br>(3.613) |
| Percentage of students eligible for free or reduced-price lunch | 0.692<br>(2.084) | 1.190<br>(4.826) | 0.220<br>(0.447) | 0.376<br>(0.970) | 0.300<br>(0.749) | 0.088<br>(0.232) |
| Percentage of minority students | 3.145<br>(7.842) | 0.112<br>(0.437) | 2.585<br>(4.837) | 7.045<br>(19.015) | 0.157<br>(0.346) | 0.007*<br>(0.021) |
| Percentage of Democratic vote in 2006 congressional election | 1.365<br>(2.279) | 2.675<br>(6.371) | 2.090<br>(2.788) | 1.045<br>(1.887) | 936.559**<br>(2282.298) | 8,347.727**<br>(26410.934) |
| Observations | 78 | 53 | 98 | 72 | 75 | 54 |
| Percent of variation due to state | 0.31 | | 0.20 | | 0.46 | |
| F-statistic on state effects jointly zero | 1.15 | | 0.47 | | 1.33 | |

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses.
Note: Additional regressors in each equation include enrollment and enrollment squared. Percent of variation due to state calculated using fixed effects on states with more than one district.

**Table 8. Three-stage Least Squares Estimates on Evaluation Consequences**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | Right to grieve | Salary freeze | Policy for dismissal | Right to grieve | Salary freeze | Policy to dismissal |
| Compensation reform | -0.796** (0.353) | 0.305 (0.261) | -0.537 (0.467) | -0.927** (0.420) | 0.217 (0.303) | -0.586** (0.296) |
| Tenured evaluation | 0.957*** (0.349) | -0.351 (0.293) | 0.659 (0.524) | 0.563 (0.439) | -0.057 (0.309) | 0.284 (0.299) |
| Tenure year | 0.253 (0.283) | -0.192 (0.185) | 0.352 (0.332) | -0.240 (0.392) | -0.466** (0.193) | 0.451*** (0.160) |
| State regulates right to grieve | | -0.282 (0.236) | 0.501 (0.418) | | 0.458* (0.238) | -0.442* (0.268) |
| State regulates policy for dismissal | 0.203 (0.403) | -0.035 (0.029) | | 0.216 (0.376) | 0.099 (0.129) | |
| Teacher strikes illegal | -0.563** (0.275) | 0.313** (0.153) | -0.575** (0.273) | -0.109 (0.405) | 0.416* (0.221) | -0.542*** (0.199) |
| Right-to-work state | 0.318 (0.268) | -0.081 (0.170) | 0.151 (0.305) | 0.428 (0.368) | -0.183 (0.258) | 0.343 (0.258) |
| Collectively bargained contract | -0.279 (0.483) | 0.100 (0.285) | -0.177 (0.510) | -0.773** (0.363) | -0.443* (0.255) | 0.253 (0.296) |
| Percentage of students eligible for free or reduced-price lunch | 0.167 (0.637) | -0.263 (0.424) | 0.468 (0.764) | -0.025 (0.700) | 0.084 (0.516) | -0.087 (0.540) |
| Percentage of minority students | 0.034 (0.573) | 0.104 (0.352) | -0.195 (0.634) | 0.882 (0.862) | 0.748 (0.511) | -0.674 (0.549) |
| Percentage of Democratic vote in 2006 congressional election | 0.261 (0.479) | -0.195 (0.276) | 0.350 (0.495) | 0.164 (0.583) | -0.445 (0.375) | 0.629* (0.360) |
| Right to grieve | | 0.660*** (0.253) | -1.214*** (0.448) | | -0.546* (0.322) | 0.269 (0.372) |
| Salary freeze | 1.203 (1.206) | | 1.812*** (0.160) | -1.466* (0.779) | | 0.722** (0.292) |
| Defined policy to dismissal | -1.007 (0.693) | 0.551*** (0.051) | | 0.127 (0.605) | 0.849*** (0.207) | |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.
Note: Additional regressors in each equation include enrollment and enrollment squared. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).

**Table 9. Odds Ratio Estimates on Seniority Treatment in Transfers or Layoffs**

| | Reverse seniority | | Senior bump | | Senior transfers | |
|---|---|---|---|---|---|---|
| | Full | Largest | Full | Largest | Full | Largest |
| Compensation reform | 0.591<br>(0.555) | 0.253<br>(0.514) | 0.906<br>(0.800) | 1.898<br>(2.344) | 2.156<br>(1.278) | 2.154<br>(2.296) |
| Tenured evaluation | 2.015<br>(1.716) | 0.580<br>(0.939) | 0.255*<br>(0.189) | 0.109**<br>(0.122) | 1.278<br>(0.834) | 1.861<br>(1.748) |
| Tenure year | 1.138<br>(0.720) | 0.047*<br>(0.083) | 0.541<br>(0.339) | 0.178*<br>(0.168) | 0.628<br>(0.261) | 0.802<br>(0.606) |
| Teacher strikes illegal | 0.590<br>(0.615) | 1.513<br>(3.002) | 0.995<br>(0.769) | 2.781<br>(3.251) | 0.540<br>(0.343) | 0.192<br>(0.193) |
| Right-to-work state | 0.398<br>(0.417) | 0.279<br>(0.516) | 2.248<br>(2.001) | 1.166<br>(1.452) | 1.095<br>(0.883) | 1.753<br>(2.606) |
| Collectively bargained contract | 0.960<br>(1.136) | 0.190<br>(0.342) | 35.430**<br>(50.401) | 52.271**<br>(88.150) | 14.630**<br>(16.336) | 10.786**<br>(12.709) |
| Percentage of students eligible for free or reduced-price lunch | 0.075<br>(0.240) | 100.793<br>(606.349) | 0.946<br>(2.457) | 5.156<br>(15.831) | 0.504<br>(1.100) | 0.193<br>(0.542) |
| Percentage of minority students | 1.715<br>(5.345) | 0.532<br>(2.864) | 3.731<br>(9.511) | 0.727<br>(2.498) | 3.055<br>(5.606) | 12.307<br>(34.571) |
| Percentage of Democratic vote in 2006 congressional election | 0.188<br>(0.451) | 0.017<br>(0.055) | 0.021**<br>(0.038) | 0.007**<br>(0.016) | 1.334<br>(2.099) | 0.798<br>(1.696) |
| Observations | 65 | 47 | 99 | 74 | 98 | 74 |
| Percent of variation due to state | 0.46 | | 0.35 | | 0.56 | |
| F-statistic on state effects jointly zero | 0.80 | | 0.68 | | 1.90* | |

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in parentheses.

Note: Additional regressors in each equation include enrollment and enrollment squared. Percent of variation due to state calculated using fixed effects on states with more than one district.

**Table 10. Three-stage Least Squares Estimates on Seniority in Transfers or Layoffs**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | Reverse seniority | Senior bump | Senior transfer | Reverse seniority | Senior bump | Senior transfer |
| Compensation reform | -0.293<br>(0.252) | -0.553**<br>(0.273) | 0.347<br>(0.320) | 0.152<br>(0.233) | -0.184<br>(0.263) | 0.315<br>(0.328) |
| Tenured evaluation | -0.230<br>(0.249) | 0.217<br>(0.229) | -0.021<br>(0.260) | -0.167<br>(0.218) | -0.229<br>(0.231) | -0.080<br>(0.289) |
| Tenure year | -0.510**<br>(0.225) | -0.062<br>(0.239) | 0.056<br>(0.267) | -0.655***<br>(0.150) | -0.619**<br>(0.247) | -0.641**<br>(0.274) |
| State regulates reverse seniority | | 0.228<br>(0.232) | -0.084<br>(0.265) | | 0.301*<br>(0.159) | -0.170<br>(0.198) |
| Teacher strikes illegal | 0.003<br>(0.149) | 0.010<br>(0.140) | -0.070<br>(0.151) | -0.193<br>(0.183) | -0.086<br>(0.218) | -0.285<br>(0.218) |
| Right-to-work state | -0.009<br>(0.174) | 0.129<br>(0.200) | -0.001<br>(0.223) | 0.140<br>(0.224) | 0.320<br>(0.241) | 0.042<br>(0.327) |
| Collectively bargained contract | -0.346<br>(0.281) | -0.325<br>(0.253) | 0.457*<br>(0.237) | 0.331<br>(0.231) | 0.462*<br>(0.262) | 0.283<br>(0.327) |
| Percentage of students eligible for free or reduced-price lunch | 0.364<br>(0.470) | 0.531<br>(0.433) | -0.491<br>(0.488) | 0.216<br>(0.470) | 0.429<br>(0.523) | 0.125<br>(0.623) |
| Percentage of minority students | -0.382<br>(0.374) | -0.533<br>(0.346) | 0.464<br>(0.395) | 0.240<br>(0.472) | -0.058<br>(0.510) | 0.343<br>(0.598) |
| Percentage of Democratic vote in 2006 congressional election | -0.384<br>(0.298) | -0.524**<br>(0.260) | 0.430<br>(0.313) | -0.579*<br>(0.320) | -0.819**<br>(0.343) | -0.352<br>(0.532) |
| Reverse seniority | | -0.512<br>(0.353) | 0.480<br>(0.412) | | -1.223***<br>(0.406) | -0.736<br>(0.513) |
| Senior bump | -0.622*<br>(0.334) | | 0.798***<br>(0.277) | -0.578**<br>(0.270) | | -0.189<br>(0.558) |
| Senior transfer | 0.694*<br>(0.391) | 0.781***<br>(0.291) | | -0.679***<br>(0.233) | -0.318<br>(0.419) | |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.
Note: Additional regressors in each equation include district enrollment and enrollment squared. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).

**Table 11. Three-stage Least Squares Estimates of Wage, Work, and Conditions Tradeoffs**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | BA 5 wage | School days | Class size | BA 5 wage | School days | Class size |
| Compensation reform | 0.127***<br>(0.049) | 3.254<br>(2.069) | -1.181<br>(2.580) | 0.012<br>(0.055) | -3.570**<br>(1.451) | 3.502<br>(2.538) |
| Tenured evaluation | 0.076<br>(0.062) | 7.773***<br>(2.350) | 0.947<br>(3.048) | 0.098*<br>(0.051) | 4.024***<br>(1.352) | -5.337**<br>(2.223) |
| Tenure year | 0.145***<br>(0.044) | 5.693***<br>(1.671) | 7.456***<br>(1.874) | 0.056*<br>(0.033) | 0.442<br>(0.891) | 0.112<br>(1.385) |
| State regulates wage schedule | 0.017<br>(0.046) | | | 0.096**<br>(0.047) | | |
| State regulates school days | | 4.605***<br>(1.665) | | | -1.809*<br>(0.950) | |
| State regulates class size | | | -12.130***<br>(2.565) | | | -5.447***<br>(1.623) |
| Teacher strikes illegal | 0.054<br>(0.036) | 1.483<br>(1.616) | -2.720<br>(1.794) | 0.051<br>(0.039) | 4.027***<br>(1.332) | -5.422***<br>(1.889) |
| Right-to-work state | -0.166***<br>(0.040) | -7.053***<br>(1.821) | 3.860<br>(2.348) | -0.139**<br>(0.055) | 1.659<br>(1.802) | 1.010<br>(2.940) |
| Collectively bargained contract | -0.113**<br>(0.056) | -5.055**<br>(2.031) | -0.495<br>(2.888) | -0.113**<br>(0.052) | -3.771**<br>(1.509) | 4.617*<br>(2.492) |
| Percentage of students eligible for free or reduced-price lunch | -0.128<br>(0.099) | -3.603<br>(3.782) | 11.624**<br>(4.763) | -0.003<br>(0.112) | -2.142<br>(3.081) | 7.030<br>(4.853) |
| Percentage of minority students | 0.217**<br>(0.088) | 5.819<br>(3.692) | -17.716***<br>(4.577) | 0.096<br>(0.115) | 1.396<br>(3.264) | -8.424*<br>(5.050) |
| Percentage of Democratic vote in 2006 congressional election | -0.065<br>(0.061) | -1.197<br>(2.397) | 2.326<br>(2.961) | -0.036<br>(0.067) | 1.318<br>(1.916) | -0.765<br>(3.173) |
| Registered nurse's wages: 50th percentile | 0.348**<br>(0.158) | | | 0.418**<br>(0.183) | | |
| BA 5 wage | | -29.533***<br>(6.246) | 30.180***<br>(9.125) | | -10.743**<br>(5.202) | 20.455**<br>(8.473) |
| School days | -0.018***<br>(0.004) | | 0.762***<br>(0.248) | -0.008<br>(0.005) | | 1.371***<br>(0.195) |
| Class size | 0.006*<br>(0.003) | 0.158<br>(0.128) | | 0.008***<br>(0.003) | 0.468***<br>(0.069) | |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.

Note: Additional regressors in each equation include enrollment, enrollment squared, and indicator variables on salary schedule year. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).

**Table 12. Three-stage Least Squares Estimates of Seniority Tradeoffs across Domains**

| | Full Sample | | | Largest Districts | | |
|---|---|---|---|---|---|---|
| | BA max wage | Reverse seniority | Senior bump | BA max wage | Reverse seniority | Senior bump |
| Compensation reform | 0.497***<br>(0.119) | -0.538**<br>(0.222) | -0.738***<br>(0.248) | 0.059<br>(0.120) | -0.091<br>(0.193) | -0.313<br>(0.240) |
| Tenured evaluation | -0.106<br>(0.139) | -0.136<br>(0.232) | 0.277<br>(0.212) | 0.242**<br>(0.107) | -0.402**<br>(0.182) | -0.348<br>(0.213) |
| Tenure year | 0.478***<br>(0.090) | -0.711***<br>(0.183) | -0.250<br>(0.200) | 0.300***<br>(0.086) | -0.587***<br>(0.129) | -0.600***<br>(0.182) |
| State regulates wage schedule | -0.281**<br>(0.129) | | | -0.002<br>(0.063) | | |
| State regulates reverse seniority | -0.070<br>(0.091) | | 0.419**<br>(0.165) | -0.033<br>(0.093) | | 0.235**<br>(0.117) |
| Teacher strikes illegal | 0.107*<br>(0.064) | -0.190<br>(0.131) | -0.142<br>(0.125) | 0.034<br>(0.077) | -0.052<br>(0.146) | -0.044<br>(0.167) |
| Right-to-work state | -0.171*<br>(0.098) | 0.294<br>(0.179) | 0.366*<br>(0.200) | -0.078<br>(0.127) | 0.164<br>(0.189) | 0.353<br>(0.222) |
| Collectively bargained contract | -0.111<br>(0.106) | 0.083<br>(0.217) | 0.114<br>(0.204) | -0.132<br>(0.123) | 0.242<br>(0.187) | 0.436**<br>(0.203) |
| Percentage of students eligible for free or reduced-price lunch | -0.426**<br>(0.181) | 0.692<br>(0.437) | 0.559<br>(0.413) | -0.375*<br>(0.219) | 0.572<br>(0.410) | 0.607<br>(0.490) |
| Percentage of minority students | 0.593***<br>(0.185) | -0.913**<br>(0.391) | -0.716*<br>(0.404) | 0.326<br>(0.216) | -0.268<br>(0.426) | -0.317<br>(0.506) |
| Percentage of Democratic vote in 2006 congressional election | 0.103<br>(0.136) | -0.155<br>(0.276) | -0.432*<br>(0.241) | 0.160<br>(0.185) | -0.501*<br>(0.271) | -0.741**<br>(0.297) |
| Registered nurse's wages: 75th percentile | 0.239<br>(0.414) | | | -0.069<br>(0.241) | | |
| BA max wage | | 1.797***<br>(0.577) | 0.749<br>(0.642) | | 1.317***<br>(0.439) | 0.931<br>(0.638) |
| Reverse seniority | 0.424***<br>(0.137) | | -0.630***<br>(0.238) | 0.489**<br>(0.198) | | -1.163***<br>(0.240) |
| Senior bump | 0.429**<br>(0.175) | -0.600**<br>(0.248) | | 0.164<br>(0.186) | -0.621***<br>(0.176) | |
| Observations | 100 | 100 | 100 | 74 | 74 | 74 |

* significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors use degrees of freedom adjustment to compensate for small sample size.

Note: Additional regressors in each equation include enrollment, enrollment squared, and indicator variables on salary schedule year. Endogenous contract and state policy variables are identified through exogenous instruments from equations of state-policy determination (omitted).