



# Teachers' unions and compensation: The impact of collective bargaining on salary schedules and performance pay schemes

Kristine Lamm West<sup>a,\*</sup>, Elton Mykerezzi<sup>b,1</sup>

<sup>a</sup> University of Minnesota, Department of Applied Economics, Twin Cities, 313 Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108-6040, United States

<sup>b</sup> University of Minnesota, Department of Applied Economics, Twin Cities, 218f Classroom Office Building, 1994 Buford Avenue, St. Paul, MN 55108-6040, United States

## ARTICLE INFO

### Article history:

Received 30 July 2009

Received in revised form 19 July 2010

Accepted 22 July 2010

### JEL classification:

I22

J51

J33

J41

### Keywords:

Teacher salaries

Educational finance

Resource allocation

## ABSTRACT

This study examines the impact that collective bargaining has on multiple dimensions of teacher compensation, including average and starting salaries, early and late returns to experience, returns to graduate degrees, and the incidence of different pay for performance schemes. Using data from the School and Staffing Survey (SASS) and a more recent data set, the Teacher Rules, Roles and Rights (TR3), we find that collective bargaining has a significant impact on all aspects of current, qualification-specific salary schedules. Further, we find some evidence that bargaining impacts the design of performance pay plans. Specifically, unions tend to encourage teacher bonuses that are based on additional qualifications or duties, but discourage bonuses that directly reward improved student test scores.

© 2010 Published by Elsevier Ltd.

## 1. Introduction

The No Child Left Behind Act has intensified the nation's focus on schooling outcomes and, as a result, teachers and teachers' unions are subject to ever increasing public scrutiny. Politicians and interest groups who call for accountability often point to unions as a barrier to change. For instance, the Center for Education Reform's website states: "Unions claim to promote teacher professionalism, yet crusade against salary and merit rewards for teachers." The president of the American Federation of Teachers (AFT), the nation's second largest teachers' union, however, has publically stated her willingness to consider merit pay and other reforms (New York Times, Nov 18, 2008).

There is no doubt that teachers' unions are an important stake holder in education and their support or opposition can be the deciding factor for any proposed education policy. An improved understanding of how collective bargaining impacts economically relevant aspects of teacher compensation will enhance policy makers' ability to enact successful education reform. In particular, further research into the impact of unions and collective bargaining on the structure of teacher compensation is necessary if we are to separate political rhetoric from fact.

There is mounting evidence that teacher quality plays a critical role in student achievement (e.g. Rivkin, Hanushek & Kain, 2005). The structure of teacher compensation likely plays a central role in school districts' ability to attract and retain quality teachers. Currently, teacher compensation is dominated by the single salary schedule which rewards only formal education and experience, both of which have been shown to be poor proxies for quality. Hanushek (1986, 2003) finds that experience does not improve teacher quality at a significant rate beyond the first few years of

\* Corresponding author. Tel.: +1 612 360 8730.

E-mail addresses: [kwest@umn.edu](mailto:kwest@umn.edu) (K.L. West), [myker001@umn.edu](mailto:myker001@umn.edu) (E. Mykerezzi).

<sup>1</sup> Tel.: +1 612 625 2749.

teaching, leading some to propose decreasing returns to experience late in a teacher's career in exchange for larger annual increases early on (e.g. Vigdor, 2008). Formal education, in particular master's in education, also has little to no effect on teacher quality. Goldhaber and Brewer (1997, 1998) show that the only instance when a master's degree makes a significant difference in student performance is when the degree is in the teacher's subject area. The typical single salary schedule, however, rewards all master's degrees uniformly.

While there is agreement that traditional compensation schemes reward poor predictors of teacher quality, there is no consensus on what should replace the current system. Popular proposals include: increasing starting salaries, steepening the salary schedule (a steeper schedule would reduce returns to experience late in a teacher's career in exchange for larger salary increases in the early years (e.g. Ballou & Podgursky, 2002; Vigdor, 2008)), and detaching compensation from education and experience altogether in favor of alternative measures of teacher quality. The latter option encompasses a range of proposals that are often lumped together under labels such as "performance pay" or "merit pay." These policies, however, can be very different in terms of how they operate, who they benefit, how they alter teacher behavior, and the reaction that they attract from teacher unions. Despite the importance of variations in policy and the importance of unions in K-12 education, we are aware of no empirical research that examines the impact of collective bargaining on the adoption of different types of performance pay schemes. Importantly, we expect that the reaction of teachers' unions depends on whether the policy links the performance reward to a schooling input or an output directly related to student achievement, such as test scores.

Plans that reward inputs, such as professional development, are theoretically very similar to rewarding master's degrees and, in fact, this study shows that the presence of collective bargaining increases the return teachers earn for a master's degree and favors returns to "merit pay" plans that reward teacher inputs. Plans that directly reward outputs, namely student test scores, provide a different set of incentives and this study presents evidence suggesting that such plans garner union opposition. Elected union officials may oppose output based pay because they represent risk-averse teachers. Linking bonuses to inputs provides more certainty for teachers than output based pay which depends, at least in part, on student factors beyond the teacher's control. Further, teachers may value cooperation and collegiality and believe that output based incentives will introduce undesirable competition for favorable teaching assignments. Teachers may also resist linking pay to outputs because they feel that the standardized tests that are currently used are a poor measure of student learning. If teachers' preferences reflect any or all of these concerns, then union officials will seek to negotiate a contract that does not include output based incentives. Unions may also be opposed to output based pay for strategic reasons related to the union's effectiveness as an institution. With input based pay, the union can maintain a degree of control over the pay scheme by negotiating the details of, or even providing for, professional development opportunities. For

example, in Minneapolis the performance pay contract stipulates rewards for completing "Pro-pay" classes that are designed and delivered in cooperation with the union. Lastly, performance pay schemes that are output based award teachers different wages depending on their individual productivity. Collective bargaining, however, is more effective with a single wage that evokes member solidarity. If workers are paid according to their individual productivity, there is little room for collective negotiations. Indeed, union opposition to output based pay is not unique to the education sector; unions tend to disfavor piece rates in general (Brown, 1989; Freeman, 1982).

Empirical evaluation of the effects of collective bargaining on performance pay design is hindered by the fact that current experiments in performance pay are often a mix of input and output based rewards. Anecdotal evidence suggests that this mix may be the result of district negotiations with local unions. For example, the performance pay plan in Minneapolis includes some rewards for student achievement but also rewards teacher responsibilities like serving as a department chair or even for serving as the building's union representative. To deal with this problem we use a recent data set that provides information on whether performance pay is based on student performance, other measures of teacher performance, or a mix of the two. This detail allows us to examine the effect that unions have on different teacher incentive schemes.

In summary, the relevant aspects of teacher compensation examined in this study include: (1) starting salary, (2) early returns to experience; (3) late returns to experience; (4) returns to master's degrees; (5) input based performance pay; and (6) test score based performance pay. Previous work has primarily focused on the impact of unions on average salaries (e.g. Freeman, 1986; Hoxby, 1996). The only exception we are aware of is Ballou and Podgursky (2002) who examine the determinants of several aspects of pay such as the steepness of the pay schedule, but do not consider performance pay plans. Few studies (e.g. Ballou, 2001; Goldhaber, DeArmod, Player, & Choi, 2008) have examined the determinants of performance pay, but none has distinguished between teacher input versus student test score based pay. Average salaries and the incidence of performance pay are incomplete descriptions of teacher compensation packages, both from a theoretical stand point and for policy relevance. This study attempts a more detailed look at how unions and collective bargaining<sup>2</sup> impact teacher compensation.

## 2. Data and empirical methodology

### 2.1. The data

This study uses two datasets, one is a small but recent dataset compiled by the National Council for Teacher Quality called Teacher Rules, Roles and Rights (TR3). It pro-

<sup>2</sup> Throughout the paper we use the terms unions and collective bargaining interchangeably. To be more specific, in this paper we test the impact of the presence of a union that collectively bargains with the district on various aspects of teacher compensation. In some districts teachers may belong to a union that does not bargain with the district.

vides significant detail on traditional teacher compensation and the structure of performance pay plans. The second dataset, the School and Staffing Survey (SASS) compiled by the National Center for Educational Statistics (NCES), is a nationally representative sample of over 4000 school districts. It, however, has limited information on traditional teacher compensation and virtually no information on performance pay.

The TR3 reports information gathered from the teacher contracts of 100 of the largest public school districts in the country.<sup>3</sup> At least one district from each state is included in the sample. The TR3 reports salary schedules for each school district as well as information on whether teachers may receive additional compensation on the basis of performance and how that performance is measured. The TR3 also summarizes state level collective bargaining provisions. The data were collected for the 2006–07 school year. One drawback of the TR3 is that it is not designed to be a representative sample of school districts. Researchers often focus on the largest districts in the nation (e.g. Ballou & Podgursky, 2002) because, although they comprise less than 1% of districts, they serve and employ 22% of the nation's students and teachers (Tang & Sable, 2009). The TR3, however, did not sample the 100 largest districts, but rather the largest district in each state, and then the largest remaining 50 districts in the nation. To investigate the possibility of bias arising from the unusual sampling procedures of the TR3 we exploited crossover between the SASS and the TR3 (93 of the districts in the TR3 are also in the SASS). We find that TR3 districts have pay schemes that are very similar to the 100 largest districts in the SASS. A comparison of the means of the dependent variables used in this study reveals little difference. Additionally, the estimates of the effect of collective bargaining on the dependent variables that are available in both datasets reveal no notable differences between the TR3 and the largest 100 districts in the nation.

As noted, the SASS is a nationally representative sample of over 4000 public school districts,<sup>4</sup> but it does not have complete teacher salary schedules or detail about the design of performance pay systems so it is not able to provide the level of detail we capture with the TR3. Districts in the SASS were simply asked if they use incentives to reward “excellence in teaching.” This is vague terminology that encompasses many definitions of merit pay. Studies relying on SASS (e.g. Ballou, 2001; Belfield & Heywood, 2008; Goldhaber et al., 2008) can only shed light on the impact of

unions on the incidence of *any* performance pay plan (and the definition of what is classified as such is left to the survey respondent) and cannot not reveal anything about the structure of the pay scheme.

## 2.2. Model specification

We assume that, in each district,  $d$ , teacher pay is a function of unionization and other district level student, teacher, and community attributes; specifically pay is expressed as:

$$Pay_d = \beta_0 + \beta_1 U_d + \beta_2 S_d + \beta_3 T_d + \beta_4 C_d + \varepsilon_d$$

where  $Pay$  is some aspect of teacher compensation,  $U$  is an indicator of a union and collective bargaining agreement,  $S$  is a vector of student characteristics,  $T$  is a vector of teacher characteristics,  $C$  is a vector of community demographics and  $\varepsilon$  is a district specific error component. Student characteristics include total enrollment, racial composition of the student body and the share of students that receive free or reduced lunch. Teacher characteristics include the total number of teachers in the district, racial composition of the teaching force and the percent of new teachers. The community demographics include the number of school age children, the share of college educated residents, per capita income, and indicator variables for census region (West, South, Northeast, and Midwest) and for census locale (city, suburb, and rural). Summary statistics for each variable are available in [Appendix A](#).

We expect the bargaining process to be conducted by district officials who are overseen by an elected school board and union officials who are elected by their membership. By adding controls for student, teacher and community characteristics we attempt to hold constant preferences for various pay elements and test the importance of unionization and collective bargaining on the outcomes.

## 2.3. Measures of “pay”

Various dependent variables are constructed to measure different aspects of teacher pay in each district. Summaries of these variables are reported in [Table 1](#).

We report starting salaries in log form. The mean for a beginning teacher with a bachelor's degree is 10.15 for the SASS (approximately \$25,600 in USD 2000) and 10.52 for the TR3 (approximately \$31,300 in USD 2000). The real dollar difference between the two samples is likely in part due to the fact that the TR3 focuses on large, often urban districts. The difference may reflect some spatial cost of living differences.

Several variables that measure the returns to experience and the shape of the experience-pay profile are constructed. The return to experience is measured by the annual pay increase expressed as a percentage of the base salary. Returns to experience are measured in percent terms to control for expected differences in the cost of living and provide a measure that can be interpreted across geographic locales. Two measures of returns to experience, one of early returns and one of late returns, are generated

<sup>3</sup> Two districts in the TR3 were missing one or more salary component and five districts were missing one or more demographic variable; as a result most of the models only use 95 observations and two only use 93. Sample sizes for each model are provided in each table's notes.

<sup>4</sup> In the SASS, districts that did not have a salary schedule were dropped. This impacted 86 districts leaving us with a sample size of 4605. Further, 32 districts had salary data that seemed to indicate coding errors (for example, a teacher with a master's degree and no experience had a higher salary than a teacher with a master's degree and 20 years of experience). We tested our results with and without these observations and there was no notable difference. The results reported do not include these districts thus the final sample size is 4573. Of these, 257 districts were missing demographic variables so models with demographic controls have 4316 observations.

in order to examine whether collective bargaining presents any barriers to rewarding experience early in a teacher's career (when research indicates that teachers accrue the most human capital). Using the SASS we compute the mean return to experience over the first ten years to be 3.0% per year. TR3 data allows us to calculate the mean return to experience over the first five years of a teacher's career, arguably a better measure of "early" career, which is 2.4% per year.<sup>5</sup> To compute late returns to experience using the TR3 we compare the salary at year five to the highest possible salary for a teacher with a bachelor's degree. As with early returns to experience, we compute average yearly increases and express the return in percent terms. The mean late return to experience is nearly identical to the mean early return to experience at 2.5% annually. Computing late returns to experience is possible with the detailed TR3 because the number of years it takes to reach the maximum salary is reported; however, we are unable to construct this measure with the SASS.

An alternative measure of the steepness of the salary schedule is the number of years it takes for a teacher to reach the maximum salary (holding constant degree level). The mean for teachers with a bachelor's degree is approximately 20 years, but there is a large variation; in some districts salaries continue to increase for 40 years (effectively every year of experience is rewarded with a salary increment) and in others a teacher with a bachelor's will not see any salary increase linked to experience. The number of years to maximum salary is a measure of overall steepness; however, the effect of unionization on steepness may not be uniform over one's career. We, therefore, compute the share of total salary growth obtained in the early part of a teacher's career to differentiate early steepness. TR3 data indicate that, on average, teachers with a bachelor's degree will be awarded 27% of the total growth in wages over their careers within the first five years.

The return to earning a master's degree is defined as the additional salary a new teacher would earn if she holds a master's degree over what the teacher would have earned if she had only a bachelor's. With the SASS, the mean return to a degree is 9.8%; the mean for the TR3 is lower, only 7.8%. Note, however, that TR3 data indicate that the return to a degree after five years of teaching experience is higher, 9.6%, suggesting that salary schedules are constructed to provide incentives for midcareer teachers to obtain additional education. Ballou and Podgursky (2002) do not consider returns to formal education separately, instead they assume that returns to formal education can be considered as part of the returns to experience because obtaining a graduate degree amounts to investing ones time. We prefer to differentiate between returns to experience and returns to a degree for two reasons. First, we can test whether unions favor one over the other. For instance, we are able to test whether time spent obtaining a degree is rewarded at the same pace as time spent earning experience by comparing returns to a degree with the returns to

two years of experience (roughly the amount of time that it takes to obtain a master's degree if one attends college full time). Second, we are interested in how unions affect the return to a master's degree because earning a graduate degree is theoretically similar to completing professional development requirements and/or obtaining certificates that can be used for input based performance pay. Earning a degree and pursuing other teacher qualifications involves an investment decision on the part of the teacher, while experience accumulates for all who are in the teaching force. Therefore, union response to input based performance pay is likely similar to the union response to higher pay for master's degrees.

The final measure of traditional compensation is the benefits ratio. The SASS defines this as a percentage of payroll including district contributions on behalf of employees' Social Security and other payroll taxes; retirement; medical, dental, disability, unemployment, and life insurance; and all other fringe benefits. The mean is approximately 25%.<sup>6</sup>

Lastly, a series of indicator variables for performance pay were constructed for the TR3 sample. A district is classified as having performance pay if the question "Can a teacher earn additional pay on the basis of performance?" is answered in the affirmative, or if the notes for this question indicated that any such arrangement is pending. Additionally, the TR3 data provide information on how performance is measured. Specifically, we are able to identify districts that have plans that include compensation based on student test scores as part of the package and districts that fully base additional compensation on student test scores. Table 2 summarizes the incidence of any performance pay and the incidence of test score based performance pay for union and non-union school districts.

In both union and non-union districts, fewer than a third have any type of performance pay and fewer than a fourth base rewards on student test scores. Despite the low incidence, the possibility of union aversion to output based performance rewards is highlighted in this dataset. It is noteworthy that the share of districts with performance pay is similar for non-unionized and unionized districts (29% and 28% respectively). However, the incidence of performance pay based on student test scores is lower in unionized districts (only 16% relative to 25% in non-union districts). Framed another way, all but one of the non-union districts that have performance pay include an incentive based on student test scores. Among unionized districts with performance pay only about half of the districts include such incentives. The effect of unions on performance pay needs to be examined in more detail in a multivariate framework and possibly with a larger dataset, so we caution that these statistics be considered as simply suggestive.

<sup>5</sup> Ballou and Podgursky (2002) state that the fifth year is a good benchmark because after five to seven years of teaching experience attrition rates begin to fall as "survivors settle in as career teachers."

<sup>6</sup> The TR3 provides some details on health insurance, tuition reimbursement and life insurance but we leave the analysis of union impact on these for future research. We did not attempt this analysis here because the TR3's small sample size is exacerbated for questions regarding benefits because of the wide variability in how plans are structured and whether or not they are addressed in collective bargaining agreements.

**Table 1**

Summary of dependent variables, traditional compensation.

	Mean (standard deviation)	
	SASS N = 4573	TR3 N = 100 <sup>a</sup>
Starting salary (Log)	10.15 (0.14)	10.52 (0.27)
Early returns to experience <sup>b</sup> (annual increase/base salary)	0.030 (0.014)	0.024 (0.019)
Late returns to experience (annual increase/base salary)	n/a	0.025 (0.014)
Years to maximum salary	n/a	20.29 (9.80)
Early growth (share of salary growth obtained in the first five years)	n/a	0.277 (0.226)
Returns to degree (salary increase/base salary)		
No experience	0.098 (0.062)	0.078 (0.047)
Five years of experience	n/a	0.096 (0.054)
Benefits ratio	24.87 (25.02)	n/a

Results reported are for a teacher with a bachelor's degree. The SASS does not provide a detailed breakdown of district salary schedules, thus some dependent variables are not available (n/a) for this data set.

<sup>a</sup> The measures of late returns to experience, years to maximum salary and early growth have N = 98 due to missing data for two districts.

<sup>b</sup> "Early" career is defined as the first 10 years for SASS data and five years for the TR3 data.

**Table 2**

Summary of dependent variables, performance pay (TR3 only).

	All districts N = 100	Union N = 76	Non-union N = 24
Performance pay plan exists	0.28	0.28	0.29
Performance measure includes test scores	0.18	0.16	0.25
Performance measure is entirely test scores	0.11	0.08	0.21
Performance measure is entirely other measures	0.10	0.12	0.04
Performance measure is a mix of test scores and other measures	0.07	0.08	0.04

### 3. Results

Regression results show that collective bargaining plays an important role in determining the structure of teacher pay. The main results are reported in Tables 3–5. Table 3 presents the estimated effect that collective bargaining has on starting salaries, returns to experience, the steepness of the schedule and returns to a master's degree using the TR3 data. Table 4 presents the same results estimated with the SASS. Table 5 focuses on the effect that collective bargaining has on the incidence and structure of performance pay. Results are reported for three different levels of controls: first a simple model with no controls shows

the raw correlation between each dependent variable and unionization; next a partially controlled model accounts for student, teacher and district attributes with the exception of census region; the final model includes census region indicators. The region controls are singled out for exclusion because they are strongly correlated with unionization. The states where collective bargaining is illegal (Virginia, North Carolina, South Carolina, Georgia and Texas) are exclusively in the south (although not every southern state outlaws collective bargaining). The inclusion of region indicators, thus, presents collinearity concerns, especially in the smaller TR3 sample. Therefore the discussion of our results focuses on the model with partial controls.

**Table 3**

The effect of teachers' unions on various measures of traditional compensation.

TR3 results	OLS regressions		
	None N = 100	Partial N = 95 <sup>b</sup>	Full N = 95 <sup>b</sup>
Controls <sup>a</sup>			
Starting salary (Log)	–0.115*** (0.039)	–0.107 (0.070)	–0.027 (0.038)
Early returns to experience (annual increase/base salary)	0.011*** (0.003)	0.012** (0.004)	0.000 (0.004)
Late returns to experience (annual increase/base salary)	0.010*** (0.002)	0.011*** (0.003)	0.013*** (0.003)
Years to max salary	–12.3*** (1.5)	–12.9*** (1.9)	–9.0*** (2.1)
Early growth (share of salary growth obtained in the first five years)	0.141*** (0.048)	0.132** (0.059)	0.014 (0.060)
Returns to degree (salary increase/base salary)			
0 yrs	0.016 (0.010)	0.006 (0.011)	–0.000 (0.012)
5 yrs	0.036*** (0.012)	0.037*** (0.014)	0.006 (0.014)

\*\* $p < 0.05$ , \* $p < 0.1$ .

Complete regression results are available from the authors upon request.  $R^2$  for the partially controlled models are: starting salary, 0.165; early returns, 0.515; late returns, 0.321; yrs to max, 0.428; early growth, 0.207; returns to degree (0 years) 0.252; returns to degree (five years) 0.254.

<sup>a</sup> Full controls include: total enrollment, racial composition of the student body, the share of students that receive free or reduced lunch, and indicator variables for census region (West, South, Northeast, and Midwest). Partial controls include all of the aforementioned with the exception of census region.

<sup>b</sup> Late returns to tenure, years to max salary and early growth have N = 93 due to missing data for two districts.

\*\*\*  $p < 0.01$ .



**Table 4**

The effect of teachers' unions on various measures of traditional compensation.

SASS results Controls <sup>a</sup>	OLS regressions		
	None N = 4573	Partial N = 4316	Full N = 4316
Starting salary (Log)	0.079*** (0.006)	0.039*** (0.005)	0.039*** (0.006)
Early returns to experience (annual increase/base salary)	0.009*** (0.000)	0.006*** (0.000)	0.005*** (0.000)
Returns to degree (salary increase/base salary)	0.023*** (0.003)	0.021*** (0.003)	0.009** (0.003)
Benefits ratio	3.722*** (0.806)	4.478*** (0.927)	4.225*** (1.185)

\* $p < 0.1$ .Complete regression results are available from the authors upon request.  $R^2$  for the partially controlled models are: starting salary, 0.470; early returns, 0.137; returns to degree 0.120; benefits, 0.028.<sup>a</sup> Full controls include: total enrollment, racial composition of the student body and the share of students that receive free or reduced lunch; total number of teachers in the district, racial composition of the teaching force and the percent of new teachers; the number of school age children, the share of college educated residents, per capita income, and indicator variables for census region (West, South, Northeast, and Midwest) and for census locale (city, suburb, and rural). Partial controls include all of the aforementioned with the exception of census region.\*\*\*  $p < 0.01$ .\*\*  $p < 0.05$ .**Table 5**

The effect of teachers' unions on various types of performance pay plans.

TR3 results Controls <sup>a</sup>	Probit regressions (marginal effects reported)		
	None N = 100	Partial N = 95	Full N = 95
Performance measure includes student test scores	−0.092 (0.098)	−0.201* (0.120)	−0.090 (0.116)
Performance measure is entirely student test scores	−0.129 (0.088)	−0.167 (0.108)	−0.178 (0.145)
Performance measure is entirely other measures	0.076 (0.055)	0.064 (0.050)	0.032* (0.017)

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ .Complete regression results are available from the authors upon request. Pseudo- $R^2$  are: Entirely input 0.239; Entirely test score 0.092; Includes test score 0.187.\*  $p < 0.10$ .<sup>a</sup> Full controls include: total enrollment, racial composition of the student body, the share of students that receive free or reduced lunch, and indicator variables for census region (West, South, Northeast, and Midwest). Partial controls include all of the aforementioned with the exception of census region.

### 3.1. Starting salary

Estimates suggest that unions have a positive effect on starting salaries. The TR3 results show no significant effect if demographic control variables are included, however, the SASS results indicate a statistically significant increase of 3.9%.

### 3.2. Returns to experience and salary schedule steepness

Regression results also indicate that unions increase the return to experience. The models that use the TR3 indicate that unionization increases early returns to experience by 1.2 percentage points per year. These results are consistent with Ballou and Podgursky's (2002) findings; they estimate unions' impact on cumulative returns over the first five years to be 5.4 percentage points (approximately 1.1 percentage points per year). The SASS estimates are also positive and significant, and they indicate a 0.6 percentage points per year higher return in unionized districts. For the TR3 sample, the union premium on late returns to experience is 1.1 percentage points ( $p < 0.01$ ) which is statistically identical to the estimated impact on the early return. Thus we do not find evidence that unions favor increases for more experienced teachers. This suggests that districts and unions may find common ground in attempts to increase returns to

experience for new teachers; a policy that may be both economically sensible and not likely to garner union opposition.

Unions also significantly reduce the number of years it takes for teachers to reach the maximum salary. A teacher in a unionized district reaches the maximum salary 12.9 years sooner than a comparable teacher in a non-unionized district. If unions seek to maximize their members' lifetime earnings, then a steeper salary schedule moves teachers up the salary ladder quickly and provides them a longer plateau at maximum earnings. The union effect on the other measure of steepness, early growth as a share of total career growth, provides supporting evidence to this end. Estimates that use the TR3 show that unions increase the share of growth obtained in the first five years by 13.2 percentage points. These estimates are consistent with the Ballou and Podgursky's finding of an 11 percentage point union impact on the early share of total pay growth.

### 3.3. Returns to degree

Our analysis suggests that unions increase the returns to earning a master's degree for teachers with some experience. TR3 data indicate that for a teacher with five years of experience, collective bargaining increases the return to a degree by 3.7 percentage points but no

statistically significant union effect is found on returns to a graduate degree for teachers with no experience. Specifications using the SASS also indicate a somewhat smaller (2.1 percentage points  $p < 0.01$ ) impact of collective bargaining on the return to graduate degrees. We conclude that unions increase rewards to obtaining graduate degrees for those who have been in the teaching force for at least five years but we do not find conclusive evidence that they do the same for new entrants.

Our results show that the premium for earning a degree is larger than the salary increase associated with two years of experience. For teachers with five years of experience, the mean return to a master's degree is more than three times the return to an additional year of experience (9.6% compared to 2.4%, Table 1 column 2) and the union premium for a master's is also three times the union premium for one year of experience (3.7 percentage points compared to 1.2 percentage points, Table 3 column 2).<sup>7</sup> So, if a master's demands two years of full time studies, then both the market and the union influence reward a master's degree at a higher rate than teaching experience. This may be an attempt to help teachers cover the costs of obtaining a degree. Further, it should be noted that most master's programs are part time and designed to work around a teaching schedule; teachers would most likely earn both increases simultaneously. This finding supports the conclusion that unions favor rewards for teacher inputs.

### 3.4. Benefits

Districts that are unionized receive approximately four percentage point higher benefits ratios. This result, like those for other pay aspects, is statistically significant and of notable magnitude. This is also consistent with findings on the impact of collective bargaining in general (e.g. Buchmueller, DiNardo & Valletta, 2002; Budd, 2004; Freeman, 1981).

### 3.5. Summary of findings regarding union effect on traditional compensation

In summary, unions are found to increase starting salaries, to increase returns to experience and formal education, as well as to compress the salary schedule and to increase fringe benefits.<sup>8</sup> This conclusion consistent with findings from previous studies that find that unions

increase average teacher salaries (e.g. Freeman, 1986; Hoxby, 1996) as well as literature about the impact of unions on compensation in other sectors (e.g. Freeman, 1982).

Additionally, we have provided a detailed look at how increases are apportioned. We find that unions increase, rather uniformly, early and late returns to experience. They also increase the returns to a degree at a rate exceeding a two year time commitment to earn a master's. Unions do not appear to be trading off starting salaries or benefits in exchange for these increases; rather, unions are able to use their collective bargaining power to increase all aspects of teacher pay and to compress the salary schedule so that it takes fewer years for teachers to reach the maximum salary.

### 3.6. Performance pay plans

Table 5 reports estimates of the impact of collective bargaining on the incidence of different performance pay plans. The results show that unions react differently to input based and output (test score) based plans. We find that union presence reduces the probability of the existence of a plan that includes rewards for student test scores. Marginal effects computed at the sample mean indicate that unions decrease the probability that such a plan is adopted by 20.1 percentage points. We also find a similar, marginally significant effect on the existence of a plan that is *entirely* based on student scores ( $p < 0.15$ ). On the other hand, the estimated union effect on the existence of a performance plan that does not include student test scores is positive but only statistically significant at conventional levels in the model with full controls. The parameter estimate implies that unionized districts are 3.2 ( $p < 0.10$ ) percentage points more likely to have a performance pay plan with rewards that do not factor student test scores.

This finding is also consistent with research on unions in other industries. Private sector unions have also been shown to be opposed to output based performance pay (Brown, 1989). Within education, Ballou (2001) and Goldhaber et al. (2008) find a negative union impact on the incidence of "pay for excellence" and we assess that these plans are likely a combination of teacher input and student test score based rewards. Our results suggest that the negative union impact in previous studies may be primarily driven by union aversion to output based plans. Previous studies may underestimate the negative effect of unions on student test score driven performance pay.

As noted above, there are relatively few districts experimenting with performance pay. This fact, combined with the small sample size of the TR3, likely accounts for the imprecision of our estimates. The results we present are not meant to be taken as conclusive proof of the impact of unionization and collective bargaining on performance pay but rather as a sliver of evidence that shows the need for additional empirical research focusing on the distinction between input and output based performance pay.

<sup>7</sup> The numbers compared here are from the TR3 data and regression results. The same story, however, emerges in the SASS. In that case, for teachers with no experience, the mean return to a master's is 9.8% which is also more than three times the return to a year of experience, 3.0%. Likewise, the union premium is 2.1 percentage points for a master's and 0.6 percentage points for an additional year of experience (see Table 1 column 1 and Table 4 column 2).

<sup>8</sup> We also examined the effect that unions have on the returns to experience and salary schedule steepness for teachers with master's degrees. These results are not reported here but all support the conclusion that unions increase all economically relevant aspects of teacher compensation. These results are available from the authors upon request.

#### 4. Robustness and alternative specifications

While thus far we have based our discussion on OLS estimates, two specification issues merit further attention. First, it is possible that unionization may be endogenous, either due to true simultaneity or omitted variables. We are not particularly worried about reverse causality (true simultaneity) since the vast majority of districts that are unionized did so decades ago so there is no mechanism via which current pay could affect unionization. In terms of omitted variables, Hoxby (1996) asserts that lagged low pay and/or unfavorable working conditions (perhaps due to poor management) may have led teachers to unionize. If this were the case, OLS estimates will be biased downward. Indeed, Hoxby's IV estimates that account for endogeneity produce somewhat higher estimates of the union effect on wages than her OLS estimates. To test whether our findings may be biased due to omitted variables we estimated several IV models using the longevity of state laws on teachers' unionization and the percent of workers in all professions in the state who are members of unions as instruments. The state law instruments were adapted from Hoxby (1996). States are divided into four groups (1) states where legislation allowing for union activities was passed prior to 1970; (2) states where such laws were enacted between 1970 and 1980; (3) states with legislation passed between 1980 and 1990; and (4) states where laws do not support teachers' right to unionize (the omitted category). The timing of state law may impact the existence of a teachers' union but such legislation is unlikely to be correlated with teacher compensation other than through its impact on unionization (Hoxby, 1996). A second instrument was constructed using data from the Current Population Survey. Specifically, we used the percent of all employed workers who are members of unions in all professions. Teachers' unions are more likely to have formed in states where there is a strong culture of unionization among all professions. We prefer a lagged version of this measure because it is not influenced by contemporaneous events that may impact both teacher compensation and the level of unionization in a state.

As in Hoxby (1996), our two-stage least squares (2SLS) estimates indicate a somewhat higher impact of unions on compensation than the OLS estimates. First stage results and diagnostics indicate that the instruments are not weak and have the expected statistically significant predictive power on union presence. Some doubt is cast, however, on the validity of the conditional exogeneity assumption. Details about the IV results and diagnostic tests (using SASS data) are included in Appendix B. 2SLS estimates with the TR3 show similar results, but these are even more problematic because of the small sample size and the fact that a number of states in the TR3 are only represented by one district.

Overall, the *a priori* expectation on why unions form and the empirical evidence in Hoxby (1996) only raise concerns that OLS estimates are more likely to understate the impact of unions on teacher pay, rather than overstate it. Our 2SLS results show similar patterns, but as noted, we have reason to doubt the validity of our instruments. Therefore we prefer the OLS estimates, with the caution that these are likely to be lower-bound estimates of the true union impact.

The second empirical concern is that several different aspects of pay may come as a result of a joint contract design process (that may or may not involve negotiations with unions). It is therefore likely that the errors of the different compensation components equations may be correlated. We estimated seemingly unrelated systems (SUR) for all aspects of pay, allowing for arbitrary correlation in the errors. The estimates from these models provide some evidence that errors may indeed be correlated, but the magnitude and significance of the estimates of the effect of unions and of other exogenous variables on compensation are virtually identical to the OLS estimates.

Additionally, we estimated the performance pay equations for measures based entirely on test scores and that for other measures only as a seemingly unrelated bivariate probit system and found that parameter estimates do not change. Within this joint specification, we are able to formally test if the impact of unions on the incidence of plans that reward test scores is statistically different from their impact on plans that do not reward test scores. We find the two effects to be statistically different ( $p < 0.10$ ) strengthening the evidence that unions have an impact on determining how performance pay plans are structured.

#### 5. Conclusion

We have shown that collective bargaining influences both qualification specific and incentive based teacher compensation that rewards student test scores. Collective bargaining impacts all economically relevant aspects of pay and, as such, when considering any modification to teacher compensation, policy makers must be cognizant of the union response. In particular, we find evidence that unions increase early returns to experience; this is important because teachers' productivity has been shown to increase in the early years so higher early returns to experience align well in marginal product gains. We think this is an area where districts and unions can find common ground.

Additionally, when researchers, policy makers and other stakeholders discuss performance pay plans it is paramount to be clear about how performance will be measured. We expect that unions are willing to talk about performance pay because they want to have a hand in determining how rewards will be allocated. This study finds that unions increase the reward for earning a graduate degree and suggests that they are also open to rewarding other measures of teacher inputs and credentials. However, unions may resist linking compensation to student test scores. This study clearly shows that future analysis of the union effect on performance pay plans and on the consequences of such plans must distinguish between input and output based rewards. We show that performance pay that rewards teacher efforts and credentials receives a union reaction similar to more traditional credentials like a master's degree. On the other hand, performance pay based on outputs is likely to be opposed. We also acknowledge that our findings on performance pay are based on a small dataset; however there is very little infor-



mation on the nature of performance pay plans in other datasets. Future research and data collection efforts need to provide more detail on the structure of performance pay plans.

### Acknowledgements

The authors thank Eric Hanushek, Steven Adamowski, Jane Hannaway, Susan Moore Johnson, Eugenia Kemble and Donald Langenberg for their time and input as jury members for the National Council on Teacher Quality (NCTQ)'s research competition. We also thank the NCTQ for their generous support and for access to the TR<sup>3</sup> data used in this paper. We are also grateful to the numerous seminar participants from the departments of Applied Economics and Human Resources & Industrial Relations at the University of Minnesota as well as two anonymous referees for insightful comments that significantly improved the paper. All errors and omissions are our own.

### Appendix A. Summary statistics for control variables

Mean values of control variables (standard deviation)	SASS			TR3		
	All (N = 4573 unless noted)	Union (N = 2851 unless noted)	Non-union (N = 1722 unless noted)	All (N = 100 unless noted)	Union (N = 76 unless noted)	Non-union (N = 24)
Total enrollment	3,403 (10,064)	3,574 (14,076)	3,070 (11,152)	102,793 (132,786)	106,325 (150,777)	91,607 (39,885)
Free and reduced lunch/poverty	0.349 (0.371)	0.294 (0.445)	0.453 (0.690)	0.479 (0.195)	0.499 (0.191)	0.421 (0.197)
Hispanic students	N = 4416 0.083 (0.410)	N = 2725 0.075 (0.574)	N = 1691 0.101 (0.478)	N = 95 0.235 (0.223)	N = 71 0.207 (0.202)	0.325 (0.264)
Black students	0.065 (0.185)	0.041 (0.195)	0.113 (0.418)	0.279 (0.237)	0.283 (0.258)	0.267 (0.155)
White students	0.783 (0.446)	0.818 (0.603)	0.714 (0.655)	0.408 (0.267)	0.432 (0.285)	0.334 (0.185)
Total teachers	221 (598)	225 (809)	213 (768)	n/a		
Black teaches	0.027 (0.101)	0.014 (0.097)	0.054 (0.262)	n/a		
White teachers	0.920 (0.229)	0.940 (0.273)	0.881 (0.427)	n/a		
New teachers	0.111 (0.129)	0.103 (0.136)	0.125 (0.269)	n/a		
School aged population	0.198 (0.057)	0.198 (0.070)	0.200 (0.099)	n/a		
College educated population	N = 4426 0.236 (0.245)	N = 2746 0.261 (0.344)	N = 1680 0.186 (0.210)	n/a		
Per capita income	N = 4425 19,486 (12,104)	N = 2745 20,976 (17,000)	N = 1680 16,627 (9,596)	n/a		
Region = west	N = 4426 0.183 (0.639)	N = 2746 0.198 (0.797)	N = 1680 0.154 (1.400)	0.25 (0.43)	0.32 (0.47)	0 (0)
Region = northeast	0.216 (0.678)	0.319 (0.924)	0.016 (0.375)	0.09 (0.28)	0.11 (0.32)	0 (0)
Region = south	0.232 (0.590)	0.039 (0.199)	0.606 (1.464)	0.53 (0.50)	0.38 (0.48)	1 (0)
Locale = city	0.059 (0.412)	0.061 (0.597)	0.055 (0.345)	n/a		
Locale = suburb	0.249 (0.625)	0.308 (0.825)	0.133 (0.832)	n/a		
Locale = rural	0.521 (0.774)	0.482 (0.947)	0.598 (1.264)	n/a		

### Appendix B. Instrumental variable estimates

As stated in Section 4, two sets of instruments were constructed, one based on longevity of union law at the state level and the other based on state unionization among all other professions. Both instruments present some potential concerns. Hoxby (1996) makes a convincing case that state legislation is an appropriate instrument for her panel

**Table A.1**

The effect of teachers' unions on various measures of traditional compensation (OLS and IV results using SASS data).

Dependent variable	OLS	IV
Starting salary	0.039*** (0.005)	0.085*** (0.007)
Returns to degree	0.021*** (0.003)	0.023*** (0.005)
Early returns to experience	0.006*** (0.000)	0.006*** (0.001)
Benefits	4.478*** (0.927)	6.193*** (1.252)
First stage results:	Dependent variable: unionization	
H1970	0.487*** (0.024)	
H1980	0.516*** (0.021)	
H1990	0.534*** (0.038)	
CPS1990	0.025*** (0.001)	
F-test: of all four instruments	826.03	
Prob > F	0.0000	

\*\* $p < 0.05$ , \* $p < 0.1$ .

This table presents results with partial controls. These controls are: total enrollment, racial composition of the student body and the share of students that receive free or reduced lunch; total number of teachers in the district, racial composition of the teaching force and the percent of new teachers; the number of school age children, the share of college educated residents, per capita income, and indicator variables for census locale (city, suburb, and rural).

\*\*\*  $p < 0.01$ .

data application. The use of these variables with our cross-sectional data, however, needs further testing. Also, the share of all employed workers who are unionized is a new instrument that must be subjected to scrutiny. The main concern is that a test of overidentification restrictions based on Sargan's statistic rejects the null hypotheses of

non-correlation of the instruments with the errors. This leads us to question the exogeneity of the instruments. The instruments performed well on all other diagnostic tests. Specifically, they do not appear to be weak, yielding a test statistic that easily surpasses the Stock and Yogo critical values. Additionally, reduced form estimates (OLS regressions of pay on the instruments and exogenous variables only) indicate that the instruments have the expected association with pay (longevity of legislation allowing for teachers to unionize and higher unionization in all professions are positively associated with current teacher pay).

Table A.1 presents an appended table analogous to Table 4 in Section 3. The instrumented results are, in general, slightly larger than the OLS results, however, no other notable pattern emerges. The table shows the coefficient of interest (unionization) for four separate dependent variables along with first stage results that show the impact of the instruments on unionization (the first stage is the same for each of the dependent variables because the same sets of controls and instruments are used).

## References

- Ballou, D. (2001). Pay for performance in public and private schools. *Economics of Education Review*, 20(1), 51–61.
- Ballou, D., & Podgursky, M. (2002). Returns to seniority among public school teachers. *Journal of Human Resources*, 37(4), 892–912.
- Belfield, C., & Heywood, J. (2008). Performance pay for teachers: determinants and consequences. *Economics of Education Review*, 27(3), 243–252.
- Brown, C. (1989). Firms' choice of method of pay. *Industrial and Labor Relations Review*, 43(3), S165–S182.
- Buchmueller, T., DiNardo, J., & Valletta, R. (July 2002). Union effects on health insurance provision and coverage in the United States. *Industrial and Labor Relations Review*, 610–627.
- Budd, J. (2004). "Non-Wage Forms of Compensation," *Journal of Labor Research*, Fall 2004, pp. 597–622.
- Freeman, R. (July 1981). The effect of unionism on fringe benefits. *Industrial and Labor Relations Review*, 489–509.
- Freeman, R. (1982). Union wage policies and wage dispersion within establishments. *Industrial and Labor Relations Review*, 36(1), 3–21.
- Freeman, R. (1986). Unionism comes to the public sector. *Journal of Economic Literature*, 24(1), 41–86.
- Goldhaber, D., & Brewer, D. (1997). Why don't schools and teachers seem to matter? *The Journal of Human Resources*, 32(3), 505–523.
- Goldhaber, D., & Brewer, D. (1998). When should we reward degrees for teachers? *Phi Delta Kappan*, 80.
- Goldhaber, D., DeArmod, M., Player, D., & Choi, H.-J. (2008). Why do so few public school districts use merit pay? *Journal of Education Finance*, 33(3), 262–289.
- Hanushek, E. (1986). The economics of schooling: production and efficiency in public schools. *Journal of Economic Literature*, 24(3), 1141–1177.
- Hanushek, E. (2003). "The Failure of Input-Based Resource Policies." *The Economic Journal*, Vol. 113, No. 485, Features (February), pp. F64–F98.
- Hoxby, C. (1996). How teachers' unions affect education production. *The Quarterly Journal of Economics*, 111(3), 671–718.
- Rivkin, S., Hanushek, E., & Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica*, 73(2), 417–458.
- Tang, J., & Jennifer, S. (2009). *Characteristics of the 100 largest public elementary and secondary school districts in the United States: 2006–07* (NCES 2009-342). Washington, DC: National Center for Education Statistics, Institute of Education Sciences, U.S. Department of Education.
- Vigdor, J. (2008). Scrap the Sacrosanct Salary Schedule: How about more pay for new teachers, less for older ones? *Education Next*, 8(4), 36–42.