

Effects of Teachers' Unions on Qualification-Specific and Incentive-Based Teacher Compensation

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Abstract:

This study examines the impact that teachers' unions have on multiple dimensions of teacher compensation, including average and starting salaries, returns to tenure and graduate degrees, benefits, and the incidence of different pay for performance systems. Using data from the School and Staffing Survey (SASS) and a more recent data set, Teacher Rules, Roles and Rights (TR3), we find that unions have a significant impact on all relevant aspects of current, qualification-specific, compensation schemes. Further, we find some evidence that unions impact the design of incentive-based plans. Specifically, they encourage teacher bonuses that are based on additional qualifications or duties, but discourage bonuses that reward improved student outcomes.

Introduction:

Since its passage, 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 have intensified calls for accountability and reform and often point to unions as a barrier to change. For instance, the Center for Education Reform's website states: "The unions claim to promote teacher professionalism, yet crusade against salary and merit rewards for teachers." Recently, however, the president of the American Federation of Teachers (AFT), the nation's second largest teachers' union, publically stated her willingness to consider merit pay plans and other reforms (New York Times, Nov 18, 2008). There is no doubt that teachers' unions are an increasingly important stake holder in education and their support or opposition can be the deciding factor for any proposed education policy.¹ An improved understanding of how unions impact all

aspects of schooling is likely to improve policy makers' ability to enact successful education reform. In particular, further research into the impact of unions on 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 (Goldhaber 2002, Rivkin et al. 2005), thus, research must focus on ways to ensure that every child has access to quality instruction. The structure of teacher compensation (both salary and benefits) 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 defines "steps and lanes" that reward only formal education and experience.² Policy makers and academics have long challenged the efficiency of such a compensation scheme. For instance, Hanushek (1986, 2003) finds that seniority does not improve teacher quality at a significant rate beyond the first few years of teaching. Ballou and Podgursky (2002) argue that current teacher pay schedules compensate seniority at a higher rate than can be justified by economic theory. The second input in current teacher payment schedules, the attainment of a graduate degree, is also a poor predictor of teacher quality. The only instance when a graduate degree makes a significant difference in student performance is when the degree is in the teacher's subject area (Goldhaber and Brewer 1997).

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. Researchers and practitioners have yet to settle on the most efficient compensation scheme, but popular proposals include: increasing starting salaries (a reform that is supported by both

major teaching unions), 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), and detaching compensation from the traditional steps and lanes 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 are likely to benefit, and in how they may alter teacher behavior. Little theoretical discussion, and almost no empirical research exists that examines the impact of unions on the adoption of different types of merit pay systems. Importantly, we expect that the reaction of the teachers' unions will depend on whether the reward is linked to a schooling input (such as teacher professional development) or the final output (namely student achievement).

In summary, the relevant aspects of teacher compensation are: 1) early returns to tenure; 2) late returns to tenure; 3) salary schedule steepness; 4) returns to degrees; 5) starting salary; 6) benefits; 7) input based performance pay and; 8) output based performance pay. Previous work has only considered the impact of unions on average salaries, early returns to tenure and early steepness of the salary grid. A few recent studies have also examined the determinants of performance pay, but none has distinguished between input versus output based pay. Average salaries, early returns to tenure 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 first provides a review of the current knowledge about the effect of unions on teacher pay. We then augment the literature by examining the effects of unions on all the aforementioned aspects with a large nationally representative dataset and also with a smaller, but more recent dataset that provides increased detail on the structure of teacher compensation. Specifically, we examine the effect that unions have on returns to master's degrees, benefits as a percent to salary, early and late returns to tenure and the steepness of the salary schedule (measured by the total number of years it takes a teacher to reach the maximum salary and the share of total career growth that is earned in the first few years of a teacher's career). In addition, we distinguish between merit pay schemes that are output versus input based as they are expected to generate different incentives and potentially elicit different responses from unions. Model specifications account for potential endogeneity of unionization as well as potential simultaneity of pay aspects.

Literature Review:

The exact mechanism via which unions impact teacher quality remains rather unexplored. Hanushek and Rivkin (2006) state that the interaction of teachers' unions with teacher quality is a neglected area of research. A few studies provide indirect evidence that unionization leads to pay schemes that under-compensate teachers of high aptitude. Hoxby and Leigh (2004), for example, use panel data from the surveys of Recent College Graduates to examine the causes of a well documented decline in the aptitudes of female teachers between 1963 and 2000 (as measured by the proportion of teachers who attended the most selective

colleges and universities). They find that compression in the return to aptitude in the teaching profession accounts for 80% of the decline. They show that, by 2000, the ratio of the highest-aptitude teacher's earnings to the mean teacher's earnings was close to one (not surprising given the reliance on the single salary schedule) and suggest that this makes it difficult to recruit and retain high aptitude teachers. The authors further postulate that salary compression came about because of union influence.³

Effect on average wages and general school inputs

Hoxby (1996) examines the relationship between unionization and the educational production function. Using panel data from the 1972, 1982 and 1992 Censuses of Government supplemented with 1960s data from individual districts, the author concludes that unions hinder productivity by increasing schooling inputs while simultaneously decreasing student performance.⁴ Hoxby finds that the presence of unions tends to increase school budgets and that the increased funds are devoted to higher average salaries and lower student-teacher ratios. The author then attempts to discern whether the union is motivated by superior knowledge of the educational production function or by rent-seeking behaviors. She finds evidence that supports the latter explanation.

Due to the use of observational data, establishing a causal effect of unions on pay structure is difficult. Certain pay schemes, for instance, may induce teachers to organize, or perhaps unobservable district attributes affect both teacher compensation and unionization. Hoxby suggests that incompetent administrators may simultaneously influence input decisions and lead teachers to seek the protections of a union. The author employs an instrumental

variable estimation strategy that uses state level timing of union friendly legislation as an instrument to address these endogeneity concerns.

Hoxby's finding that unions increase salaries while decreasing student performance suggests that higher average salaries may not necessarily buy higher quality teachers. Figlio (2002) uses data from the 1987-88 and 1993-94 rounds of the School and Staffing Survey (SASS) to provide evidence that salary increases *are* significantly related to the probability of hiring well-qualified teachers. However, his findings only hold for nonunion school districts thus corroborating Hoxby's hypothesis. Neither of these studies examines compensation details beyond average salary and, as previously noted, reform proposals are not limited to calls for increased pay but rather often attempt to modify how salary is determined and when raises are earned.

Effects on returns to tenure and steepness

Ballou and Podgursky (2002) provide important details about the economic rationale and the structure of the pay schedule by examining the rate at which returns to seniority are apportioned at various stages of a teacher's career. Using the 1987-88 and 1990-91 rounds of the SASS as well as data from a Department of Defense survey of the 200 largest school districts, they conclude that teacher salary schedules are consistent with rent-seeking behavior. Ballou and Podgursky argue that the wage-tenure profile for teachers, while consistent with other white-collar workers, is not supported by economic theory. They consider three different theoretical rationales for the current salary construct: human capital theory, high monitoring costs, and high turnover costs. The authors point out that research shows that on the job

learning is concentrated in the first few years of teaching yet salary schedules often reward experience at the same rate over the first 15 to 20 years of a teacher's career. Next, they argue that monitoring job performance in education is not prohibitively challenging. Finally, they reject arguments that the traditional salary schedule is designed in such a way as to enhance retention and thus minimize turnover costs.

Ballou and Podgursky find that unions increase early returns to tenure and steepen the salary schedule. Specifically, they find that collective bargaining increases the ratio of fifth year salary to starting salary and also increases the share of total salary growth that is obtained in the first five years of a teacher's career. This is not at odds with an economically sensible pay schedule such as the reform proposal put forth by Vigdor (2008) that argues for a steeper salary schedule. In the current study we update elements of Ballou and Podgursky's analysis of salary steepness using newer data and add to the inquiry by accounting for endogeneity of unionization as well as potential simultaneity of pay aspect determination. Our data also allow us to define late returns to tenure in a way that is comparable to the early returns measure.

Effects on returns to education

No study that we are aware of examines how unions influence the return to a graduate degree. While some (e.g. Ballou and Podgursky, 2002) claim that a master's in education should be considered as part of the returns to tenure because obtaining a graduate degree is similar to tenure in the sense that it amounts to investing ones time, we prefer to differentiate between returns to tenure 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 tenure (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 requirements and/or obtaining certificates that can be used for input based merit pay. Earning a degree and pursuing other teacher qualification involves an investment decision on the part of the teacher, while tenure accumulates for all who are in the teaching force. Therefore, union response to input based merit pay is likely similar to the union response to higher pay for advanced degrees.

Effects on benefits

We are also unaware of any study that provides an empirical evaluation of the impact of teachers' unions on non-wage benefits. Focusing only on salary does not reveal the effect of unions on the full compensation package offered by districts. Teachers, and their unions, may be willing to trade lower salaries in exchange for more generous benefits such as health insurance and retirement plans. Benefit plans are an important part of union negotiations with the district thus we include them in our analysis.

Effects on performance pay

There are two studies that directly examine the impact of unions on the existence of merit pay: Ballou (2001) and Goldhaber, et al (2008). While acknowledging that both major teachers' unions officially endorse merit pay, Ballou argues that, in practice, the failures of merit pay initiatives are due in large part to the opposition of teachers' unions. The author uses

three consecutive waves of the SASS to compare private schools with public schools and, finding that private schools are significantly more likely to use merit pay, he concludes that unions have used their political influence in the public sector to defeat performance pay plans. Ballou strengthens this assertion by comparing the incidence of merit pay in public school districts that are unionized to those where there is no bargaining unit. He finds that nonunionized districts are more likely to use merit pay and that merit pay is more likely to survive over multiple years in such districts. Goldhaber et al also find that merit pay is less likely in districts that are unionized but note that union opinion about merit pay is not monolithic. The authors attempt to reconcile Ballou's findings with the work of other scholars who have suggested that the cooperative nature of teaching and the difficulty in measuring output make teaching a poor fit for performance based compensation. The authors use SASS data to test a principal agent model and conclude that, while the difficulty in measuring teacher output is in fact a problem, unions are a more serious barrier to merit pay.

A third study by Belfield and Heywood (2008) indirectly assesses unions' impact on performance pay. This study also uses SASS data to examine the determinants of merit pay. Although Belfield and Heywood focus on the collaborative aspects of teaching, their analysis controls for union membership. They report that while union members earn significantly higher salaries, they are significantly less likely to receive performance based pay. This supports the findings of Ballou and Goldhaber et al. One shortcoming of all three merit pay studies is their reliance on the SASS. While the SASS is a large and nationally representative data set, its data on merit pay are coarse. In recent rounds, districts were simply asked if they use incentives to reward "excellence in teaching". This is vague terminology that encompasses many definitions

of merit pay. Therefore, studies relying on SASS can only shed light on the impact of unions on the incidence of *any* merit pay plan (and the definition of what is classified as “merit pay” is left to the survey respondent) and cannot not reveal anything about the structure of the pay scheme.

The structure of the pay scheme, specifically, whether the pay scheme rewards inputs or outputs is theoretically relevant. Podgursky and Singer (2007) provide a review of work on performance pay that includes a discussion of relevant elements of personnel economics (focusing on the work of Lazear (2000, 2003)). Importantly, they draw attention to the fact that the results of a performance pay plan will differ depending on whether the plan rewards teacher inputs or student outcomes. Plans that reward inputs, such as professional development, are theoretically very similar to rewarding advanced degrees and we will show that unions are supportive of rewarding such teacher inputs. Plans that reward outputs, such as student achievement growth, may better align teacher and district incentives and may be more likely to attract and retain high quality teachers. Many expect that performance pay will have its main effect on teacher effort by providing current teachers with incentives to work harder. However, a more important effect may be performance pay’s impact on labor market sorting (that is who becomes a teacher and who stays in the classroom). Intuitively, individuals with a high aptitude for teaching are more likely to be attracted to a pay system that rewards them based on results. Conversely, those for whom teaching is not a good fit will likely be rewarded at a greater pace in other professions.

We expect that unions will be more resistant to output based performance pay because it introduces risk into the pay calculus and because a number of current union members may not benefit from the plan. Teachers may also resist linking pay to student outcomes because unions know that students and teachers are not randomly assigned to classrooms. If students are not randomly assigned, teachers will compete for the highest ability students (or for those with the most potential for growth). This may create a situation where the most at-risk students are left with the least experienced teachers. Teachers and their unions may also resist output based rewards because they do not believe that the measures of outputs (i.e. standardized tests) are fair representations of student learning. Linking bonuses to inputs provides much more certainty and control for teachers.

Current experiments in performance pay are a mix of input and output based rewards; thus it is difficult to draw empirical conclusions about the impact of unions on performance pay. Many performance pay plans currently in place are the result of district negotiations with the local teachers union. For example, a performance pay plan in Minneapolis was largely drafted by the teachers' union and includes rewards for student achievement but also such teacher responsibilities as serving as the building's union representative. To deal with this problem we use a data set that provides information on whether performance pay is based on teacher inputs, student outcomes, or a mix of the two. This detail allows us to examine the effect that unions have on different teacher incentive schemes.

Data and Empirical Methodology:

The current study uses data from two main sources. We begin with a data set created by the National Council for Teacher Quality called the Teacher Rules, Roles and Rights (TR3) which catalogs and codes detailed information from the teacher contracts of 100 of the largest public school districts in the country. At least one district from each state is included in the sample.⁵ 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 during for the 2006-07 school year making our sample more recent than the studies previously reviewed.

One drawback of the TR3 is that it is not designed to be a representative sample of school districts. Further, the small sample size of the TR3 may make statistical inference challenging. For a more robust analysis we also use a larger data set when applicable. Following previous authors, we use the SASS. Collected by the National Center for Education Statistics, the SASS sample of 4,691 public school districts is designed to be representative at the state and national level.⁶ The SASS does not have complete teacher salary schedules but does report salaries for a few cells on the salary grid. Further, the SASS provides a mechanism to link districts to the Common Core of Data and the 2000 decennial census, which together provide a more thorough set of district level demographic variables. The survey is conducted periodically; the most recent data (which would better coincide with the TR3) is not yet available for public use so the 1999-2000 survey data are used here.

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

$$Pay = \beta_0 + \beta_1 U + \beta_2 S + \beta_3 T + \beta_4 C + \varepsilon$$

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 ε 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, Midwest) and for census locale (city, suburb, rural).⁷

Summary statistics for each variable are included in the appendix.

We expect the bargaining process to follow a median voter model where district officials are overseen by an elected school board and represent the median voter in the community and the union officials are elected by their membership and represent the median teacher. By adding controls for student, teacher and community characteristics we attempt to hold constant preferences for various pay elements and test the importance of collective bargaining on the outcomes.

Various dependent variables are constructed to measure the different aspects of teacher pay in each district. Summaries of these variables are reported in Table 1. We start by

constructing several variables that measure the overall returns to tenure and the shape of the tenure-pay profile. As noted, the shape of the profile has been the focus of several recent reform proposals. We measure the return to tenure for teachers by the annual pay increase expressed as a percentage of the base salary.⁸ We construct separate measures for teachers whose highest degree is a bachelor's (BA) or a master's (MA) degree respectively. Returns to tenure are measured relative to starting salaries 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 tenure, one of early returns and one of late returns, are generated. Using the SASS we compute the mean return to tenure over the first ten years for a teacher with a BA to be 3.1%.⁹ TR3 data allows us to calculate the returns to tenure over the first five years of a teacher's career for both degree levels, a better and more consistent measure of early returns to tenure.¹⁰ The mean return to tenure over the first five years is 2.4% for a teacher with a BA and 2.8% for a teacher with an MA. To compute late returns to tenure using the TR3, we compare the salary at year five to the highest possible salary for a given degree. As with early returns to tenure, we compute average yearly increases and express the return in percent terms. The mean late return to tenure is slightly higher than the mean early return to tenure at 2.6% and 2.8% for BA and MA respectively. As noted, high late returns to tenure are more consistent with rent seeking behavior than other plausible economic rationales (Ballou and Podgursky, 2002). Computing late returns to tenure is possible with the detailed TR3 because the number of years it takes to reach the maximum salary is reported. For the SASS we are unable to construct a measure for late returns to tenure.

Next, we provide alternative measures of the steepness of the salary schedule. We measure overall steepness by the number of years it takes for a teacher to reach the maximum salary holding a constant degree level. The mean for BA holders 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 BA 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.¹¹ TR3 data indicate that, on average, teachers with a BA will be awarded 27% of the total growth in wages over their careers within the first five years. Teachers with a master's degree will realize 23% percent of the total lifetime salary growth in the first five years. SASS data, in turn, indicate that the average teacher will realize 36% percent of their total wage growth by year ten.

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 BA. Within the SASS sample, the mean return to a degree is 9.5%; the mean for the TR3 sample 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, 9.7%, suggesting that salary schedules are constructed to provide incentives for midcareer teachers to obtain additional education. Because we measure other aspects of pay while holding the degree constant, we can test whether unions negotiate higher returns to tenure for teachers with master's degrees. This

would indicate that in addition to an instant premium for a degree, one receives prolonged returns associated with an increase in formal education.

We report starting salaries in log form. The mean for teachers with a BA is 10.15 for the SASS (approximately \$25,591 in 1999-2000) and 10.53 for the TR3 (approximately \$37,346 in 2006-07).¹² The National Education Association (NEA), the nation’s largest teachers’ union, advocates a “40K right away” campaign that seeks \$40,000 starting salaries nationwide. Both data sets show that this stated goal has not been reached. The union argues that higher starting salaries are crucial to recruiting highly qualified teachers.

The final measure of traditional compensation is the benefits ratio. The SASS survey 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%.¹³

TABLE 1: Measures of Salary Structure		Mean	
		(Standard Error)	
		SASS	TR3
Early returns to tenure* (Annual increase/Base salary)	BA	0.0307 (0.0003)	0.0244 (0.0019)
	MA	n/a	0.0281 (0.0019)
Late returns to tenure (Annual increase/Base salary)	BA	n/a	0.0259 (0.0014)
	MA	n/a	0.0281 (0.0013)
Years to maximum salary	BA	n/a	20.29 (0.9900)
	MA	n/a	21.95 (0.8693)
Early growth*	BA	0.3594 (0.0035)	0.2766 (0.0229)

(Share of total salary growth obtained in early career)	MA	n/a	0.2346 (0.0156)
Starting salary	BA	10.150 (0.0034)	10.528 (0.0271)
	MA	10.238 (0.0033)	10.627 (0.0118)
Returns to degree (Salary increase/Base salary)	No experience	0.0947 (0.0015)	0.0786 (0.0047)
	5 yrs of experience	n/a	0.0967 (0.0054)
Benefits ratio		24.87 (0.37)	n/a

*"Early" career is defined as the first 10 years for SASS data and 5 years for the TR3 data

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

Lastly, a series of indicator variables for performance pay were constructed for the TR3 sample.¹⁴ A district is classified as having performance pay if the district is coded as "yes" for the question: "Can a teacher earn additional pay on the basis of performance?", or if the notes for this question indicated any future such arrangement. Additionally, the TR3 data provide information on how performance is measured. Specifically, we are able to identify districts that have performance pay that includes compensation based on student outcomes as part of the package and districts that fully base additional compensation on student outcomes. Table 2 summarizes the incidence of any performance pay and the incidence of output based performance pay for union and non-union school districts.

Table 2: Unions and Performance Pay	Mean	Union	Non-union
Performance pay plan exists	0.28	0.28	0.29
Performance measure includes output	0.18	0.16	0.25
Performance measure is entirely output	0.11	0.08	0.21

Performance measure is entirely input	0.10	0.12	0.04
Performance measure is a mix of input and output	0.07	0.08	0.04

In both union and non-union districts, less than a third have some type of performance pay and fewer than a fourth base rewards on student performance. 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 some performance pay is similar for non-unionized and unionized districts (29% and 28% respectively). However, the incidence of output based performance pay is significantly lower in unionized districts (only 16% relative to 25% in non-union districts). Framed another way, almost all non-union districts that have performance pay include an output based incentive in the package (6 out of 7 districts). Among unionized districts with performance pay only a little more than half of the districts include output based incentives (12 out of 21 districts). The effect of unions on merit 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.

Model specifications

All of the aforementioned pay characteristics are likely decided jointly. District officials or district-union negotiations draft overall teacher compensation packages that provide all the above mentioned aspects of compensation. It is therefore possible that negotiations result in tradeoffs among the different pay aspects. For instance, they may trade a lower starting salary for teachers with a BA for additional returns to a degree, or they might negotiate for higher late returns to tenure in exchange for lower early returns. Further, we expect that any omitted

variable that explains variation in one pay aspect will likely have explanatory power for other pay aspects as well. If this is the case, the error term in each equation will be correlated so we supplement our OLS estimates of the effect of unions on pay with estimates derived from a seemingly unrelated regressions (SUR) system.

Because of concerns about endogeneity, we also estimate the effect of unions on each aspect of pay using a treatment effects model (Maddala, 1983). Pay and unionization are jointly expressed as:

$$Pay = \beta_0 + \beta_1 U + \beta_2 S + \beta_3 T + \beta_4 C + \varepsilon$$

$$U^* = \gamma_0 + \gamma_1 S + \gamma_2 T + \gamma_3 C + \gamma_4 Z + \omega$$

Where Z is a vector of variables that have explanatory power on unionization but not pay, ε and ω are random errors that are assumed to approximate a bivariate normal distribution, and all other variables are as previously defined. Z contains variables that indicate the longevity of state laws facilitating teachers' unionization and the percent of workers in all professions in the state who are members of unions. These variables are used as predictors in the unionization equation but are excluded from the pay equations.

The state law variables 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; 4) states where laws do not support teachers' right to unionize. The timing of state law is an appealing instrument because it 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). We believe that teachers' unions would have had more time and opportunity to form in states where union friendly legislation has been on the books longer. We argue, however, that the longevity of existing state legislation is not influenced by any factor that is related to current teacher compensation in any given school district.

A second instrument was constructed from the Current Population Survey measure of percent of employed workers who are members of unions. 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 pay and the presence of unions in a state. First stage results are reported along with the full regression results in Appendix 2.

Results:

Regression results show that unions play 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 unions have on returns to tenure, the steepness of the schedule, returns to advanced degrees and starting salaries. Table 4 presents the same results estimated with the larger SASS dataset. Table 5 focuses on the effect that unions have on the incidence and structure of performance pay. OLS results are reported for three different levels of controls: first a simple model with no controls shows the raw correlation between the dependant

variable and unionization; next a partially controlled model accounts for important 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 are exclusively in the south (although not every southern state outlaws collective bargaining). The inclusion of region indicators may induce collinearity, especially in the smaller TR3 sample. Treatment regression results are then presented with and without region dummies.

Table 3: TR3 Results		OLS Regressions			Treatment Regressions	
		<i>None</i>	<i>Partial</i>	<i>Full</i>	<i>Partial</i>	<i>Full</i>
Early Returns to Tenure	BA	0.011*** (0.003)	0.012** (0.004)	0.000 (0.004)	0.009* (0.005)	0.000 (0.335)
	MA	0.015*** (0.003)	0.018*** (0.004)	0.002 (0.004)	0.016*** (0.005)	0.002 (1.785)
Late Returns to Tenure	BA	0.010*** (0.002)	0.011*** (0.003)	0.013*** (0.003)	0.014*** (0.004)	0.013 (0.271)
	MA	0.012*** (0.002)	0.014*** (0.002)	0.010*** (0.002)	0.016*** (0.003)	0.009 (0.803)
Years to Max Salary	BA	-12.3*** (1.5)	-12.9*** (1.9)	-9.0*** (2.1)	-15.1*** (2.3)	-9.9 (4552)
	MA	-10.5*** (1.3)	-10.1*** (1.5)	-5.7*** (1.4)	-11.8*** (2.0)	-6.3 (2810)
Early Growth	BA	0.141*** (0.048)	0.132** (0.059)	0.014 (0.060)	0.124** (0.061)	0.013 (6.582)
	MA	0.139*** (0.022)	0.124*** (0.027)	0.002 (0.024)	0.125*** (0.041)	0.008 (30.75)
Returns to Degree	0 yrs	0.016 (0.010)	0.006 (0.011)	-0.000 (0.012)	0.014 (0.012)	0.002 (12.98)
	5 yrs	0.036*** (0.012)	0.037** (0.014)	0.006 (0.014)	0.049*** (0.015)	0.011 (23.57)
Starting Salary	BA	-0.115*** (0.039)	-0.107 (0.070)	-0.027 (0.038)	-0.086 (0.076)	-0.034 (31.04)
	MA	-0.072*** (0.021)	-0.052* (0.029)	-0.031 (0.033)	-0.014 (0.029)	-0.032 (6.220)

*** p<0.01, ** p<0.05, * p<0.1

^Full controls include: total enrollment, racial composition of the student body and the share of students that receive free or reduced lunch, and indicator variables for census region (west, south, northeast, Midwest). Partial controls include all of the aforementioned with the exception of census region.

Table 4: SASS Results		OLS Regressions			Treatment Regressions	
		<i>Controls</i> [^] : <i>None</i>	<i>Partial</i>	<i>Full</i>	<i>Partial</i>	<i>Full</i>
Early Returns to Tenure	BA	0.009*** (0.001)	0.006*** (0.001)	0.005*** (0.001)	0.008*** (0.001)	0.013*** (0.002)
Early Growth	BA	0.006 (0.007)	-0.000 (0.008)	0.027*** (0.010)	-0.015 (0.014)	0.076*** (0.027)
Returns to Degree	Oyrs	0.023*** (0.003)	0.021*** (0.003)	0.009** (0.003)	0.023*** (0.005)	-0.010 (0.009)
Starting Salary	BA	0.079*** (0.006)	0.039*** (0.005)	0.039*** (0.006)	0.098*** (0.011)	0.135*** (0.009)
	MA	0.101*** (0.005)	0.058*** (0.005)	0.047*** (0.006)	0.119*** (0.010)	0.137*** (0.012)
Benefits		3.72*** (0.80)	4.78*** (0.92)	4.22*** (1.18)	5.75*** (1.05)	5.542*** (1.30)

*** p<0.01, ** p<0.05, * p<0.1

[^]Full controls include: total enrollment in the district, 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, Midwest) and for census locale (city, suburb, rural). Partial controls include all of the aforementioned with the exception of census region.

Returns to tenure and salary schedule steepness

Regression results indicate that unions increase the returns to additional experience. In the TR3 sample, unionization increased early returns to tenure by approximately one percentage point per year for a teacher with a BA and between 1.5 and 1.8 percentage points for a teacher with an MA. The SASS sample yields a similar coefficient for a teacher with a BA. 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 0.0542 (which is approximately one percentage point per year). For late returns to tenure the union premium is also statistically significant and positive. The presence of a union increases annual returns to tenure for teachers with more than five years of experience by just over one percentage point for teachers at the bachelor's level and between 1 and 1.6 percentage points for those with master's. This union impact is very similar in magnitude to that afforded to teachers with less than five years of

experience, thus we do not find evidence that unions favor increases for more experienced teachers.

Unions also significantly reduce the number of years it takes for teachers to reach the maximum possible salary for their degree level. A teacher with a bachelor's in a unionized district reaches the maximum salary almost thirteen years sooner than a comparable teacher in a nonunionized district. A teacher with a master's reaches the maximum salary ten years faster. 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 some 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 approximately 12-13 percentage points, and the effect is very similar for teachers with BAs and MAs. 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.

Returns to degree, starting salaries and benefits

Our analysis also suggests that unions increase the returns to earning a master's degree for teachers with some experience. This finding suggests that unions are not opposed to rewards for teacher specific qualifications. Unions support rewarding teachers who invest the time and efforts necessary to earn a master's degree which leads us to believe that unions may not be opposed to input based performance pay plans. Earning a master's degree is theoretically very similar to inputs like professional development because both require

additional hours and efforts invested towards qualifications that may increase teacher quality but are not directly tied to student outcomes. In terms of magnitude, TR3 data indicate that for a teacher with five years of experience, union presence increases the return to a degree by 3.7 percentage points. Results on the impact that unions have on returns to a degree for teachers with no experience are less conclusive. In the models that use the SASS, the coefficient on unionization ranges from 0.9 to 2.3 percentage points and is significant in every specification except the instrumented model that includes region controls. TR3 data does not indicate a statistically significant union effect on returns to a graduate degree for teachers with no experience under any specification. So 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 tenure. For teachers with a BA and 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 (9.7% compared to 2.6%) and the union premium for a master's is also more than three times the union premium for one more year of experience (3.7 percentage points compared to 1.1 percentage point). So, if a master's demands two years of full time studies, then both the market and the union influence reward an MA degree at a higher rate than they reward 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 the step and the lane increases simultaneously. This finding supports the conclusion that unions favor rewards for teacher inputs.

As noted, returns to a degree may not be fully captured by “lane” increases, but the returns to tenure, or “steps” may also be higher for those with an MA (so the schedule is both elevated and steepened for degree holders). The TR3 results do show that the union premium for returns to both early and late tenure is higher for teachers with a master’s degree. This may indicate that unions not only seek to increase the immediate reward for earning a degree but also negotiate for prolonged increases for teachers who make this investment. This result lends support to the idea that unions favor qualification specific rewards.

As reported in Table 4, districts that are unionized receive approximately 5.5 percentage point higher benefits ratios. This result, like those for other pay aspects, is statistically significant and of notable magnitude, therefore, we conclude that unions seek to increase all aspects of teacher compensation, including benefits.

Summary of findings regarding union effect on traditional compensation

In general, these results provide strong evidence that teachers’ unions increase traditional teacher compensation. This conclusion supports the findings of Hoxby (1996) and others who find that unions increase average teacher salaries. Additionally, we have provided a detailed look at how those increases are apportioned across the “steps” and the “lanes” of a salary schedule. We find that unions increase, rather uniformly, early and late returns to tenure. They also increase the returns to a degree at a rate exceeding a two year time commitment to earn an MA. The 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 their maximum salary.

Performance pay plans

Table 5 reports estimates of the union impact on the incidence of different performance pay plans using the TR3 data set. Overall the results suggest that unions may react differently to input based and output based plans.

Table 6: Performance Pay Results (TR3)	Probit Regression coefficients reported			
	<i>Controls[^]:</i>	<i>None</i>	<i>Partial</i>	<i>Full</i>
Performance pay plan exists		-0.045 (0.312)	-0.411 (0.392)	0.356 (0.469)
Performance measure includes output		-0.329 (0.329)	-0.810* (0.435)	-0.428 (0.505)
Performance measure is entirely output		-0.600* (0.359)	-0.843* (0.472)	-0.721 (0.540)
Performance measure is entirely input		0.549 (0.497)	0.543 (0.601)	1.117 (0.771)
Performance measure is a mix of input and output		0.319 (0.506)	0.147 (0.653)	0.927 (0.825)

*** p<0.01, ** p<0.05, * p<0.10

[^]Full controls include: total enrollment, racial composition of the student body and the share of students that receive free or reduced lunch, and indicator variables for census region (west, south, northeast, Midwest). Partial controls include all of the aforementioned with the exception of census region.

We find that union presence reduces the probability of the existence of a pay plan that rewards student performance (p< 0.10). Marginal effects computed at the sample mean indicate that unions decrease the probability that such a plan exists by 20.1 percentage points. Unions also reduce the likelihood of the existence of performance pay plans that appropriate rewards fully based on student outcomes (p< 0.10). Marginal effects indicate a 16.7 percentage points lower probability of such a plan in unionized districts. On the other hand, the estimated

union effect on the existence of entirely input based performance plans and plans that reward a mix between inputs and output is positive but not statistically significant at conventional levels.

Additionally, we estimated the entirely-output equation and entirely-input equation as a seemingly unrelated bivariate probit system and found that parameter estimates do not change. Importantly, we then are able to test the hypothesis that unions have the same impact on input and output based incentives and we are able to reject this hypotheses ($p < 0.10$) thus providing further evidence that unions have an impact on determining how performance pay plans are structured.

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 input and output 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 thus underestimate the negative effect of unions on student outcome-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 on performance pay but rather as a sliver of evidence that shows the need for more research focusing on the distinction between input and output based performance pay.

Robustness of estimates

Treatment regressions that use the SASS reveal some evidence of endogeneity, thus simple OLS models may underestimate the impact of unions on compensation. With the exception of the returns to a degree, the magnitude of the union premium on the various pay aspects increases when unionization is instrumented. Estimates that use the TR3 are not systematically larger when a treatment regression is used, but we place little weight on these estimates given the small sample size of the TR3. We do not correct for potential endogeneity of unionization on the performance pay equations for two reasons. First, given that treatment models are rather demanding in terms of degrees of freedom and the small sample size of the TR3 we feel that these models would be of limited use. Second, unlike with other aspects of compensation, we are not concerned that the prospect of performance pay has affected unionization. Performance pay proposals are very recent while the formation of most unions can be traced to 20-40 years ago and the patterns unionization have remained rather constant over time, so these proposals couldn't have affected union creation.

The SUR specification did not produce large differences in the estimated coefficients and thus are not reported here but are available from the authors upon request.

Policy Implications and Suggestions for Future Research:

We have shown that teachers' unions influence both qualification specific and incentive based teacher compensation. Collective bargaining impacts all aspects of pay and, as such, when considering any modification to teacher compensation policy makers must be cognizant

of the union response. Importantly, when researchers, policy makers, or any other interested parties discuss a performance pay plan it is paramount to be clear about how performance will be measured. We expect that unions, such as the AFT, are willing to talk about merit 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. On the other hand, unions may resist linking compensation to student performance. This may hinder attempts to attract and reward highly effective teachers.

With respect to the shape of the tenure-pay schedule, Ballou and Podgursky's (2002) and Vigdor (2008) have noted that sacrificing late returns to tenure in exchange for higher salaries early in a teacher's career is economically sensible and may lead to a higher quality teaching force. We do not find that unions hinder the possibility for such reform in a significant way. In fact, our findings suggest that unions encourage all aspects of pay that may lead to higher lifetime earnings for teachers, including shifting pay to early in a teacher's career and shortening the number of years it takes teachers to reach maximum pay. Union support for such policies may be exploited by school districts to create front-loaded pay schedules that are economically sensible.

Recommendations for further inquiry

First this study shows that future analysis of the union effect on merit pay plans and on the consequences of such plans must distinguish between input and output based rewards. We show that merit 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 merit pay based on outputs is opposed. Towards that end, data collection efforts need to provide more detail on the structure of performance pay plans.

We must also note that the current study and the literature reviewed herein likely paint a very incomplete picture of how unions may affect teacher quality. While teacher compensation is a very important determinant of teacher effectiveness, the issue of job security is likely of equal importance. Lazear (2003) points out that “tenure, coupled with pay compression, results in difficulties primarily because it does not encourage the best to stay and the worst to leave.” We expect that any successful performance pay plan will also have to tackle the difficult issue of job security and that the unions will react strongly to any proposal to do away with tenure protections. The effect of unions on how tenure decisions are made and on the rigidity of the tenure system itself as well as the consequences of such a system are, however, unexplored in the current study and the literature in general. Anecdotal evidence suggests that unions are especially cautious in regards to the use of output based teacher evaluation criteria in tenure considerations.¹⁵

We believe that future research should extend the current study's analysis to investigate union effects on how tenure decisions are made, and how those decisions interact with pay plans. The TR3 provides some data that may be helpful to these ends. Further research in this area, combined with the results reported here, will provide policy makers the tools they need to craft successful education reform.

Notes:

¹ In 1974 only 22% of teachers were covered by collective bargaining agreements, today that number has risen to 67%. This is much higher than the average for all public sector employees (Eberts 2007).

²We use the terms tenure, seniority and experience interchangeably to refer to gaining an additional year of teaching experience, in some literature the distinction is important but here it is not.

³ Unions traditionally negotiate for higher average pay for their members and also for more compressed, or uniform, pay.

⁴ For our purposes we focus on Hoxby's (1996) findings related to schooling inputs, especially teacher salaries. See Eberts (2007) for a good summary of research related to unions and student performance.

⁵ The TR3 had some missing data and possible coding errors. Because of this, the sample size for some specifications is less than the full 100. Two districts were missing one or more salary components and five districts were missing one or more demographic variables.

⁶ Districts that did not have a salary schedule were dropped. This impacted 86 districts in the SASS leaving us with a sample size of 4,605. 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 4,573. 257 districts were missing demographic variables so models with full and partial controls have 4,316 observations.

⁷ The SASS offers a more complete set of demographic controls. The models relying on the TR3 data do not control for community demographics other than region (which, as discussed later in the paper, proved to be problematic) or for teacher characteristics. Future research should attempt to broaden the scope of the TR3 by increasing the sample size and adding teacher and community demographic information.

⁸ We assume equal yearly increases over the period measured. If the salary for a teacher with five years of experience is 15% higher than the salary for a teacher with no experience we would express this as five 3% increases. Thus, when interpreting the results, please note that the increases do not compound.

⁹ Unfortunately, the SASS does not provide salary information for a teacher with an MA and 10 years of experience, only those with no experience or 20 years of experience. The mean return to tenure over the first twenty years for those with a master's is 2.7%. Because the 20 year mark is far into the average teaching career we do not consider this to be a measure of early returns to tenure, and it is excluded from the analysis reported here. Results for this measure are available from the authors upon request.

¹⁰ 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."

¹¹ This measure is comparable to Ballou and Podgursky (2002).

¹² The average SASS salary in 2007 USD is \$30,814. The real dollar difference of \$6,532 from the TR3 average may in part be because the TR3 focuses on large, often urban districts. The difference may reflect some spatial cost of living differences.

¹³ 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.

¹⁴ We did not re-examine performance pay in the SASS sample as our analysis would be very similar to that of Ballou (2001) and Goldhaber et. al. (2008).

¹⁵ Two recent anecdotal examples shed light on how unions interact with compensation reform proposals and suggest that the effect of unions on the tenure system is an important topic for future research. One example is from New York City where the district and the union negotiated a plan that involved offering monetary incentives to teachers based on gains in student achievement. However, the union also lobbied that the state legislature pass legislation making it illegal to consider student performance when awarding teacher tenure. Another recent example is attempts in Washington D.C. to implement performance pay. A National Public Radio story comments that Washington D.C. Public Schools Chancellor Michelle Rhee's proposal to do away with teacher tenure and replace it with an ambitious merit pay program has met some resistance from the teachers' union. Rhee's proposal not only targets pay but also the protections of tenure and the New York experience shows that even if unions are willing to attempt merit pay, they are more cautious about tenure protections.

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Appendix 1: summary of control variables

Appendix one summarizes the control variables available in the SASS and the TR3. The statistics listed for the SASS account for sample weights. The TR3 focuses on large, often urban, districts so it is not surprising that the TR3 sample has more black and Hispanic students and a higher share of students in poverty. The TR3 sample also under represents districts in the northeast and Midwest and oversamples in the south and west. We urge future rounds of the TR3 to cast a wider net and to collect more detailed information about the teaching force and surrounding community.

Mean values of control variables (standard errors)	SASS			TR3		
	All	Union	Non-union	All	Union	Non-union
Total Enrollment	3,403 (148)	3,574 (207)	3,070 (164)	102,793 (13,278)	106,325 (17,295)	91,607 (8,141)
Free & Reduced Lunch/Poverty	0.349 (0.005)	0.294 (0.006)	0.453 (0.010)	0.479 (0.020)	0.499 (0.022)	0.421 (0.040)
Hispanic Students	0.083 (0.006)	0.075 (0.008)	0.101 (0.007)	0.235 (0.022)	0.207 (0.002)	0.325 (0.005)
Black Students	0.065 (0.003)	0.041 (0.002)	0.113 (0.006)	0.279 (0.023)	0.283 (0.029)	0.267 (0.031)
White Students	0.783 (0.006)	0.818 (0.008)	0.714 (0.009)	0.408 (0.026)	0.432 (0.003)	0.332 (0.037)

Total Teachers	221 (8.8)	225 (11.9)	213 (11.3)	n/a		
Black Teaches	0.027 (0.001)	0.014 (0.001)	0.054 (0.003)	n/a		
White Teachers	0.920 (0.003)	0.940 (0.004)	0.881 (0.006)	n/a		
New Teachers	0.111 (0.002)	0.103 (0.002)	0.125 (0.003)	n/a		
School Aged Population	0.198 (0.001)	0.198 (0.001)	0.200 (0.001)	n/a		
College Educated Population	0.236 (0.004)	0.261 (0.005)	0.186 (0.003)	n/a		
Per Capita Income	19,486 (178)	20,976 (250)	16,627 (141)	n/a		
Region = West	0.183 (0.009)	0.198 (0.011)	0.154 (0.015)	0.25 (0.04)	0.32 (0.05)	0 (0)
Region = Northeast	0.216 (0.009)	0.319 (0.013)	0.016 (0.005)	0.09 (0.02)	0.11 (0.03)	0 (0)
Region = South	0.232 (0.008)	0.039 (0.002)	0.606 (0.021)	0.53 (0.05)	0.38 (0.05)	1 (0)
Locale = City	0.059 (0.006)	0.061 (0.008)	0.055 (0.005)	n/a		
Locale = Suburb	0.249 (0.009)	0.308 (0.012)	0.133 (0.012)	n/a		
Locale = Rural	0.521 (0.011)	0.482 (0.013)	0.598 (0.018)	n/a		
CPS union 1990	16.37 (0.14)	19.34 (0.11)	10.60 (0.23)	12.49 (0.58)	14.35 (0.63)	6.59 (0.20)
Hoxby 1970	0.421 (0.011)	0.577 (0.013)	0.118 (0.015)	0.35 (0.47)	0.421 (0.057)	0.125 (0.068)
Hoxby 1980	0.143 (0.006)	0.154 (0.007)	0.122 (0.010)	0.21 (0.04)	0.276 (0.051)	0 (0)
Hoxby 1990	0.163 (0.009)	0.216 (0.011)	0.061 (0.018)	0.06 (0.02)	0.078 (0.031)	0 (0)

Appendix 2: Full Regression Results

See attached excel files.