Teacher Union Wage Effects Revisions 1

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Abstract

This paper examines the relationship between the strength of teachers union and their impact on instructor wages at the district level. I find evidence of different incentives for strong union representatives when compared to their weaker counterparts. I use data from the 1999-2000 School and Staffing Survey (SASS) along with fiscal data from Common Core Data (CCD). I develop a proxy measure for union strength at the district level and find that stronger unions yield an expected increase of 3.52% in teachers' first year salaries. Further I find strong unions have returns as high as 4.95% for the first 10 years of experience compared to their weaker counterparts.

1. Introduction

American unions have been in decline since their heyday in the 1970's and 1980's; regardless, teachers unions remain an important part of the American education system and play a large role in the development of education policies. Despite large amounts of research regarding the effect of teachers unions in general, few have explored the impact of union strength on instructor wages. Teachers unions operate and largely bargain at a district level which gives evidence to suggest heterogeneity with respect to size, effect on outcomes, bargaining power and more; because of this heterogeneity we suspect there exists an underlying relationship between union strength and teacher compensation.

Teachers wages are most commonly decided with a pay schedule relying largely on total education and years of experience, but teacher compensation is not defined entirely by wages. Benefits such as life, dental, and medical insurance are all relevant to employment contracts and teacher compensation is unique in the non-pecuniary inputs. This study also considers the urbanicity of a district, racial composition of students and faculty, indicators of the district's economic health, and more. These inputs are discussed in depth in section 2. By using observed characteristics from the School and Staffing Survey along with Common Core Data we're able to reliably estimate teacher wages and determine the effect of union strength on teacher compensation.

This paper attempts to quantify the relationship between strong unions and teacher pay across varying levels of education and experience. The findings indicate strong unions increase pay as much as 5.73% when compared to their weaker counterparts. We also see a significant difference in wage increases comparing the various combinations of education and experience suggesting strong unions may provide different incentives to higher education and years of experience than weaker ones.

Many studies have worked to estimate teacher union impact on student achievement (Hoxby 1996; Eberts 2007) as well as the union wage effect (Merkle and Phillips, 2017), but few have examined the impact of union strength. This is an important derivative of studying unions that is often overlooked because of a lack of reliable measurements. I have created a proxy for union strength that is used to analyze the effect of union strength on teacher pay. This analysis uncovers the differences between strong and weak union effects on teacher pay and I believe similar proxies may be formed to analyze other institutions.

Section 2 will cover the data sources and shortcomings, the proxy measure for union strength, and econometric methods used in the analysis. Section 3 covers the results from our regressions as well as a discussion of the

findings. Finally section 4 is used to discuss the possible endogeneity of union strength with teacher pay, the significance of the research, and suggestions for future research.

2. Data and Methodology

2.1 Data

This study utilizes the School and Staffing Survey (SASS) dataset from 1999-2000, the most recent publicly available data from the National Center for Educational Statistics (NCES), as the primary source of data. The collection process for SASS data is unbias in the selection of school districts[1] and captures data from across the United States with access to unionization, population, and pay schedule information. The SASS dataset provides pay schedule data that allows my analysis to find the effect of union strength on teachers of varying tenure and levels of higher education, the two most commonly used indicators of pay schedule increases, as well as control for a number of district and community variables. We use a subset of this data containing only districts that are unionized.

I also use a Common Core Data (CCD) dataset regarding fiscal data at the district level from 1999-2000 to supplement the SASS data, which lacked key components relating to a districts financial health. The dataset provides a breakdown of district revenues and expenditures for nearly all of our SASS districts leaving us with 3,153 districts for analysis. The breakdown includes benefit and salary expenditures to compliment the SASS data and provides novel information on capital outlay spending.[2]

Unfortunately the data does not provide any information regarding performance based or merit based pay and does not provide the entirety of the pay schedule. The data instead offers pay schedule information for the following: a bachelors with no experience (BA.NoExp), a bachelors with 10 years of experience (BA.10yrs), a masters degree with no experience (MS.NoExp), a masters with 30 credits (MS.30Cr), and a masters degree with 20 years of experience (MS.20yrs). While this is far from a complete pay schedule it allows us to analyze key points that will provide insight as to the effect of union strength on teacher wages.

I've summarized our dependent variables data here.

Table 1: Teacher Wages Summary Table

Statistic	St. Dev.	Median	Min	Pctl(25)	Mean	Pctl(75)	Max
BA.NoExp	4,219.534	25,716	16,350	23,422	26,279.500	28,945.5	45,000
BA.10yrs	7,486.732	33,630	18,600	29,291	34,981.160	39,722.5	79,202
MS.NoExp	4,679.656	28,549	18,000	25,553	28,978.400	31,672	57,000
MS.30Cr	5,435.622	30,317	18,300	27,000	30,765.490	33,780.5	67,000
MS.20yrs	10,169.850	45,452	22,039	38,356.5	46,086.810	52,310.5	87,709

2.2 Measuring Union Strength

I measure union strength at the district level using two constructions. Firstly we rank the state level union strength using an analysis from (Wenkler, Scull, and Zeehandelaar, 2012) which takes into account five factors. These factors are resources and membership, involvement in politics, scope of bargaining, state policies, and perceived influence. They generate a composite score and rank each state accordingly. Second, due to a lack of available data at this time we measure district level union strength as a function of expenditures on teacher salary, benefits, and community improvements. The following equation creates a proxy measure of union strength.

[1] For more information please visit https://nces.ed.gov/surveys/sass/methods9900.asp

[2] Capital outlay, as defined by the CCD, is the direct expenditure for construction of buildings, roads, and other improvements, and for purchases of equipment, land, and existing structures. Includes amounts for additions, replacements, and major alterations to fixed works and structures.

$$UnionStrength = \frac{1}{2} \times ((1 - 0.2 \times S) + ((I + C + B)/T))$$

Where S is state rank, I is instructor salary, C is capital outlay, B is employee benefits, and T is total expenditures. This measure gives equal weight to the state rank and the proxy measure for district level union strength. It returns a value between 0 and 1 that approximates union strength. We then use this value to assign unions to be either strong or weak based on the median strength across all districts. Because $UnionStrength$ is based on ratios of fiscal data and state ranking it is not biased towards larger districts which appropriates the choice to use medians as an assignment factor.

I would like to note there exists new methods of measuring union strength, the Partial Item Independent Response (Strunk and Reardon, 2010), which more accurately measures the strength of teachers union. Unfortunately due to the novelty of PIIR and sparseness of data there is no publicly available dataset including PIIR measurements at this time. Further work on this topic would be best served using a dataset to measure district strength using the PIIR method.

2.3 Econometric Model

I use a model similar to West and Mykerezi (2009) to estimate the effects of union strength on teacher pay. We estimate teacher pay with teacher characteristics i corresponding to the teachers education and years of experience using a set of vectors to hold constant student, school district, and community effects. The student characteristics include the student body racial composition, eligibility for free or reduced price lunch, the total enrollment of K-12 students in the district, and the number of migrant students. The school district array includes the number of schools, the number of continuing teachers, the core and total expenditures per pupil, the expenditures on instructional salaries, the revenue split by source, total expenditures, the racial composition of teachers, and the benefit rate[3]. The community array captures the region, state, urbanicity, related children in poverty, national and state size ranking, total population in the district, and capital outlay expenditures. The equation is given as follows.

$$Pay_i = \beta_{0,i} + \beta_{1,i} * UnionStrength + \beta_{2,i} * DistrictControls + \varepsilon$$

The district controls discussed above explain a significant amount of teacher pay ($R^2 = 0.77$). Because of this I'm confident in the findings made although I recognize the possibility of endogeneity between union strength and teacher pay. I use lagged union strength estimates along with an instrumental variable approach to examine this problem in depth in section 4.

3. Results

Table 2 shows the results from a regression of pay onto the district controls and union strength. It uses dummy variables for the levels of tenure and higher education and finds varying affects of union strength on pay with respect to these characteristics. We use this regression to guide the following results.

[3]The benefit rate is a constructed measure from SASS that uses spending on all benefits (dental, life, etc.) as inputs and returns the strength of this benefit package.

Table 2: Union Strength Effects

	Dependent variable:
	log(Pay)
StrongUnion	0.0352***
	(0.0046)
ExpAndEducBA.10yrs:StrongUnion	0.0143**
	(0.0063)
ExpAndEducMS.20yrs:StrongUnion	0.0221***
	(0.0063)
ExpAndEducMS.30Cr:StrongUnion	−0.0027
	(0.0063)
ExpAndEducMS.NoExp:StrongUnion	−0.0039
	(0.0063)
Observations	15,530
Adjusted R^2	0.7778

*p<0.1; **p<0.05; ***p<0.01

3.1 Starting Salary

I find strong teachers unions increase starting salary, defined as having no previous teaching experience, by 3.52% for teachers with a bachelors degree and 3.25% for those with a masters degree when compared to weak unions. This finding is statistically significant at the 99% confidence level, as presented in table 2 above. These findings isolate the difference in pay for strong unions when compared to weak unions, which when compounded with West and Mykerezi(2009) greatly increase teacher pay. This would mean a teacher who earns $25,000 annually could be earning as much as $26,500 if they were to join a strong teachers union. For teachers in a weak union earning earning $25,000 the increase in pay for strengthening the union can be as much as $880 annually. Due to the non-trivial pay increases in starting salary more research should be done on the effect of union strength with respect to salary in a teachers first 5 years should this data become publicly available.

3.2 Returns to Higher Education

We can see that stronger unions reward getting a masters degree much less than 10 years of additional experience, a difference of around 1.43%. Notice that (Goldhaber and Brewer, 1997) find the return to a masters degree has negligible effects on student achievement unless the degree is in the subject they teach. Perhaps unions acknowledge this and instead promote gaining experience teaching rather than pursuing higher education. It may also be the case that strong unions are primarily controlled by the members with the longest tenure in the organization. If this is true then stronger unions are driven by those who have the most teaching experience as well and so it's reasonable to believe they promote their own interests first and concede on teacher pay increases for early experience.

West and Mykerezi(2009) find teachers with both a masters degree and some experience gain the most benefits from union presence. I find teachers pursuing a masters degree with at least 30 completed credits in a district with a strong union earn 3.25% more than those in a weak union. This finding is greater than those with a masters degree and no expereience (3.13%). However, the group most affected is teachers with a masters degree and 20 years of experience earning 5.73% more for being in a strong union.

3.3 Returns to Experience

We notice in table 2 that strong unions heavily reward experience regardless of higher education. For a teacher with a bachelors degree and 10 years of experience their is a 4.95% increase in pay associated with being in a strong union. This is 1.43% greater than a bachelors with no experience. For those with a masters degree the expected increase in pay is 5.73%, which is a 2.6% increase from no experience. Unsurprisingly the greatest expected increase associated with strong unions is for those with a masters and 20 years of experience. My finding that the average return for a year of experience (0.49%) is consistent with previous finding that returns to experience for a single year are around 0.6%. The difference could be due to the longer time horizon in my data comparing the first 10 years rather than the first 5 years as in West and Mykerezi(2009). These findings show strong unions may provide much different incentives than their weaker counterparts. While strong unions raise returns to early experience and starting salaries they increase pay in later years much more than their weaker counterparts. More work should be done with regards to the effect a strong union has on teacher pay using more granular pay schedules should this data becomes publically available.

4. Discussion

Here I discuss the possible endogeneity of union strength estimates with respect to teacher pay. We start by inspecting possible simultaneity issues through examining union strength estimates over time. I find that the measure for union strength used in this study is relatively time invariant and so it is unlikely to bias our regressions. Stronger unions may have formed at more union-friendly times or places rather than having gained strength over time. This is consistent with previous findings involving the effect of union presence on teacher pay. More information can be found in appendix A.

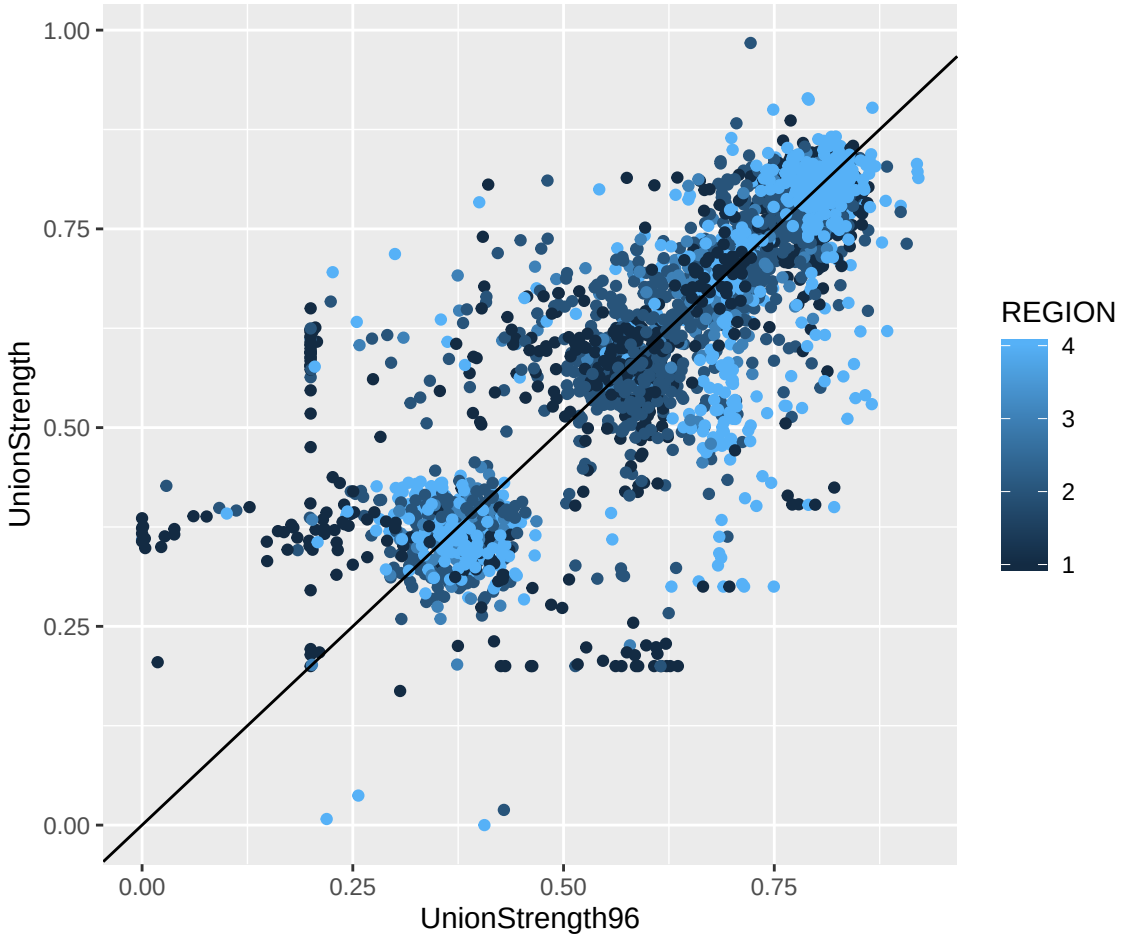
A second possible source of bias could be from omitted variables. (Hoxby, 1996) shows that OLS estimates of union presence on teacher pay are biased downwards. Accounting for endogeneity using instrumental variables she finds higher estimates of the effect union presence has on wages in general, which indicates a possible omitted variable bias with union strength as well. We use the state size ranking for the district as our instrumental variable. This is because district size is related to union strength and we're able to control for the effect it has on teacher pay by holding state and region variables constant.

The IV estimates are unexpectedly smaller than the OLS findings which may lead us to believe we have some omitted variables which we should control for in our OLS estimates. One reason could be that the measurement of union strength is inaccurate. The measure of union strength is largely based on financial data for a single year which may bias our estimate. Consider a union which spent very little money in previous years in order to finance a new building for each school in the district. This would increase their percieved union strength for the year they choose to spend more on capital outlay and because I do not control for the spending habits across time it biases our regression. The IV estimates show a strong upward bias in my OLS regressions. For more information on the methods and results of the IV and 2SLS refer to appendix B.

This study finds union strength has a large effect on teachers wages when comparing strong unions to their weaker counterparts and provides insight into the groups most effected by this. It's important for both union members and district representatives to be aware of the strength a union holds when working towards restructured compensation. The results show how incentives differ between strong and weak unions with some speculation as to why these differences come about. Unions in general have a considerable impact on teacher pay, however, considering union strength is important as I have shown there is a significant difference in union strength across districts.

While this paper provides evidence to suggest that strong teachers unions can play a larger role in teachers wages than previously known I again note the proxy for union strength can be improved using a PIIR method. Once this data becomes more widely available additional research into the effect union strength plays on teachers wages should be conducted. Along with this an expanded pay schedule would help to provide better insight into the effect stronger unions have on teachers early wages. The first 2-3 years of teaching experience are important for teacher quality and research into the effect of union strength on these years should be conducted when data becomes available.

Appendix A



The above graph shows a lagged estimate of union strength from 1996 exhibiting a relatively time invariant measure of union strength. Points sitting on or near the line show the nature of union strength over time to be nearly perfectly time-invariant and because the majority of the points cluster around this line with relatively small variance I'm comfortable saying time does not affect union strength enough to bias the regressions.

Appendix B

Table 3: Instrumental Variable Summary Statistics

	Dependent variable:
	log(Pay)
StrongUnionIV	0.0201***
	(0.0014)
StrongUnion	0.0436***
	(0.0021)
ExpAndEducBA.10yrs:StrongUnion	0.0067**
	(0.0029)
ExpAndEducMS.20yrs:StrongUnion	0.0101***
	(0.0029)
ExpAndEducMS.30Cr:StrongUnion	−0.0014
	(0.0029)
ExpAndEducMS.NoExp:StrongUnion	−0.0026
	(0.0029)
Observations	77,375
Adjusted R^2	0.7748

*p<0.1; **p<0.05; ***p<0.01

We analyze the methods and results from the IV estimates here. I chose to use a lagged state ranking for size as the IV because of its strong correlation with union strength. We use a lagged instrument to take care of any contemporary events that affect teacher pay based on district size and union strength. Once we control for region and state as well we can be confident that the state ranking for size is uncorrelated with teacher pay at all education and experience levels. Performing this regression we find more exaggerated effects than with OLS. As table 5 shows we have much lower returns to all levels of education and experience. These findings give reason to believe the IV estimates form lower bounds for the actual effect of union strength on teachers wages. They follow previous findings of union presence affecting teachers wage, but more studies should be done with more accurate measures of union strength as well as different levels of the pay schedules.

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