ESTIMATING THE UNION WAGE EFFECT FOR PUBLIC SCHOOL TEACHERS WHEN ALL TEACHERS ARE UNIONIZED

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INTRODUCTION

Less than 30 percent of all public school teachers were unionized in 1970; over two-thirds were unionized by 1980; and the National Education Association (NEA) reported that over 90 percent of all public school teachers were unionized in 1990. Presently, the two largest teachers' unions, the NEA and the American Federation of Teachers (AFT) cover roughly 3 million teachers in almost 15,000 school districts. In the *1984 Administrator Teacher Survey of the National Longitudinal Survey: High School and Beyond*, over 70 percent of school districts reported negotiating an employment contract with a teachers' organization [Zwerling and Thomason, 1995], and in many states, such as Michigan, New York, Ohio, Pennsylvania, and Wisconsin, every or virtually every public school district is unionized.

As unionism grew in the public sector, many studies estimated the union wage effect for public school teachers. Reviewed by Ehrenberg and Schwartz [1986] and Freeman [1986], with few exceptions this early work found no union differential in the mid- to late 1960s and a differential on the order of 5 percent from the late 1960s to the mid-1970s. Although some work was carried out at the state level [Kasper, 1970; Balfour, 1974], most studies used school district data and identified the union wage effect by including each district's union status as an explanatory variable [Thornton, 1971; Baird and Landon, 1972; Gustman and Segal, 1977]. As unionism spread throughout the teaching profession, the union wage effect was estimated using teacher data by including each individual's union status in a typical wage regression. When using data from the late 1970s and early 1980s, the union wage effect for public school teachers was found to be as little as 5 to 8 percent [Gyourko and Tracy, 1991] and as much as 12 to 20 percent [Baugh and Stone, 1982; Freeman and Valletta, 1988].

Quantifying the effectiveness with which teachers' unions negotiate higher salaries is arguably an even more important task presently than it was when teachers' unions were in their infancy. In the last 25 years, membership in private sector unions has diminished substantially [Curme, Hirsch, and Macpherson, 1990; Even and Macpherson, 1993; Kokkelenberg and Sockell, 1985]. The burden of the labor movement has, in effect, shifted during this time to the public sector. Raising wages, though not the only issue of importance to teachers' unions, remains high on their agenda,

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TABLE 1
Salary Distributions for Three States

	Salary Percentiles						
	Min	10th	25th	50th	75th	90th	Max
Entire State:							
Starting Salary:							
Pennsylvania	$18,500	$25,500	$27,333	$29,250	$31,555	$33,443	$39,822
South Carolina	21,856	22,056	22,356	23,178	23,792	24,042	24,731
Virginia	21,624	22,866	23,829	24,902	25,746	26,403	29,344
Lifetime Salary:							
Pennsylvania	309,752	402,264	420,542	448,861	483,066	513,953	607,542
South Carolina	330,436	332,877	339,188	352,138	362,685	368,300	391,092
Virginia	318,717	334,891	347,330	362,183	376,951	398,238	478,768
Non-MSA Districts:							
Starting Salary:							
Pennsylvania	18,500	25,500	27,009	28,480	30,666	32,595	35,179
South Carolina	21,856	21,856	22,256	22,660	23,275	23,900	24,731
Virginia	21,624	22,542	23,399	24,266	25,250	25,869	26,333
Lifetime Salary:							
Pennsylvania	329,485	391,740	409,224	429,439	448,790	468,999	500,237
South Carolina	330,436	330,436	335,339	342,694	353,613	362,691	380,234
Virginia	318,717	333,185	342,665	357,664	367,993	376,908	389,335

Local teachers' unions negotiate all salary schedules in Pennsylvania, whereas collective bargaining on the part of public school teachers is prohibited in South Carolina and Virginia.

and documenting their ability to do so strengthens their case as they try to expand unionization to other public employees and to nonunion states.

In addition to quantifying the effectiveness of teachers' unions in raising salaries, some observers of the public education system would question the social cost of this "effectiveness," as the debate over whether "money matters" in producing more highly educated students rages on [Burtless, 1996; Ladd, 1996; Hanushek et al., 1998a, 1998b]. Because the education industry is naturally labor intensive, union rents may be an important reason why money may not matter in education production functions. On average, almost 50 percent of public school budgets are allocated to teacher compensation [*1995 Digest of Education Statistics*]. With such a large portion of budgets designated to paying teachers, it is possible that rent-seeking teachers' unions prevent budget increases from substantially improving the quality of education. Removing a ten percent union wage effect from the school budget, for example, would allow ten percent more teachers to be hired and to lower student-teacher ratios commensurately.

One needs to consider only the salary distributions across unionized and nonunionized states to see striking differences in teacher pay. Table 1 presents, for all districts and again for all non-Metropolitan Statistical Area (MSA) districts, several points in the distributions of starting and discounted lifetime salaries for Pennsylvania, South Carolina, and Virginia. (The data are introduced formally below.) In Pennsylvania, all school boards negotiate a salary schedule with a local teachers'

union, whereas unions are prohibited from taking part in negotiations in South Carolina and Virginia. In all four comparisons, Pennsylvania's 10th percentile salary exceeds that of South Carolina and Virginia, and Pennsylvania's salary distribution increases much more rapidly than either South Carolina's or Virginia's. The difference between the 90th and 10th percentile starting salary in non-MSA districts in Pennsylvania, for example, is over $7,000, whereas this difference barely exceeds $2,000 and $3,000 for South Carolina and Virginia respectively. Notice too that whereas Pennsylvania's lifetime salaries range from $310,000 to over $607,000, lifetime salaries range from $330,000 to only $391,000 in South Carolina and from $319,000 to $479,000 in Virginia. In fact, the maximum starting salary in South Carolina is lower than the 10th percentile salary in Pennsylvania, and the maximum starting salary in Virginia is within $100 of the median starting salary in Pennsylvania. Although many factors are certainly at work in determining these salary distributions, unionization may be a very important one.

The purpose of this paper is to quantify, as best as possible, the union wage effect achieved by the teachers' unions in Pennsylvania. As the legal right for local teachers' organizations to collectively bargain remains controlled by state legislatures, it tends to be the case that either all contracts in a state are collectively bargained locally or none are. Consequently, a wage regression cannot separately identify the union wage effect from a state-wide compensating differential.[1] Instead of relying on interstate salary variation, therefore, intrastate salary variation will be analyzed. In particular, the minimum salary paid across a small group of geographically close, non-urban, and relatively homogeneous school districts will be taken as an upper bound on the competitive teacher salary for all such districts.[2] This upper bound will then be used to place a lower bound on the union rent paid by each district.

The paper is organized as follows. In the next section, we derive the estimation equations and detail the necessary assumptions for interpreting salary variation as union rents. Properly attributing wage variation to union rents requires a comparison of school districts that are homogeneous from the teachers' perspective and requires that educational output not be positively related to salaries. We continue by providing empirical evidence supporting these assumptions. We then carry out the analysis and present lower-bound estimates of union rents using data from the 1996-97, 1997-98, and 1998-99 school years in Pennsylvania. The following section discusses the results and concludes that, on average, public school teachers' unions in rural Pennsylvania increase salaries by at least 7.6 percent, and possibly by substantially more than this. The final section concludes the paper.

BOUNDING UNION RENTS FROM BELOW: THE ESTIMATION EQUATIONS

The model underlying the estimation equations is straightforward. Suppose there are many workers of equal ability who choose employment in one of two sectors of production, $z \in \{0,1\}$. Facing wages w_0 and w_1, worker i decides in which sector to work to maximize her utility, $U_i(z,w)$. Each worker is indexed by her preference for working in sector 0 over sector 1. Following Rosen [1986], let d_i denote this sectoral preference,

so that $U_i(0, w) = U_i(1, w+d_i)$. Letting d, therefore, denote the difference in wages between the two sectors, $d = w_1 - w_0$, worker i's optimal employment decision is to choose sector 1 if and only if $d > d_i$.

Sector 0 consists of many firms that competitively produce output Q. There are no barriers to entry and the marginal product of labor is constant at one unit of output for each worker. Supposing that market demand for Q is perfectly elastic at a price of P, the equilibrium wage in sector 0, w_0^*, must equal P. In sector 1, there are J public firms (school boards) that produce output E (education). Each firm is publicly funded by local tax revenues, is required to produce one unit of output as cheaply as possible, and has the same continuous, convex production function that converts labor and capital inputs into output. Other firms are prohibited from entering the industry, but the J firms do compete for labor. This competition, along with the distribution of worker preferences, determines the equilibrium wage in sector 1, w_1^*, and an equilibrium sectoral preference of $d^* = w_1^* - w_0^*$.

Now suppose the workers in the public sector unionize. That is, sector 1 now represents many school districts that hire teachers who are unionized locally. Let μ_j represent the non-negative union rent a worker receives when employed by school district j. In equilibrium, all sector 0 firms still pay $w_0^* = P$ while each school district in the union sector pays a wage of w_j where

$$w_j = w_1^* + \mu_j = w_0^* + d^* + \mu_j. \tag{1}$$

Notice that the lowest teaching salary must be at least as large as the outside competitive wage plus the sectoral preference differential. Therefore, if $\hat{w}_1^*$ is taken to be the minimum salary paid by the J unionized school districts, that is,

$$\hat{w}_1^* = \min_{j=1,..,J} \{w_j\} = \min_{j=1,..,J} \{w_0^* + d^* + \mu_j\} = w_0^* + d^* + \min_{j=1,..,J} \{\mu_j\}, \tag{2}$$

then $\hat{w}_1^*$ places an upper bound on $w_0^* + d^*$ and $\hat{\mu}_j$ is a lower bound for the union rent received by all teachers in school district j where

$$\hat{\mu}_j = w_j - \hat{w}_1^*, j=1,2. ...,J. \tag{3}$$

In principle, equations (2) and (3) can now be used to place lower bounds on each district's union rent, while $\hat{\mu}_j/\hat{w}_1^*$ provides a lower bound estimate for each district's union wage effect as a percentage of the competitive wage. The procedure, however, is particularly sensitive to underreporting of salaries that would cause the competitive wage to be underestimated and, in turn, the union rent to be overestimated. To caution against this possibility, the union wage effect will be calculated below by estimating the competitive wage by the 10th percentile wage in place of the minimum wage.

Notice that, under the right conditions, equations (2) and (3) can hold even if ability is not constant across workers. First, it must be that workers are paid according to observable traits (such as years of experience or educational attainment) and not paid according to ability. This is precisely the case for public school teachers, as

district-wide salary schedules specify the salary for all teachers based on their years of experience and educational achievements. Second, average worker quality must be identical across firms. If high-paying firms attract more able workers, comparing wages across firms would fail to reveal a meaningful competitive wage. In the case of school teachers, the question comes down to whether higher-paying districts systematically attract higher-ability teachers and in turn produce more highly educated students. If so, then at least some of the salary variation quantified by equations (2) and (3) is demand driven. If student outcomes are not positively associated with salaries, however, the salary variation quantified by equations (2) and (3) cannot be attributed to demand differences across school districts and should be interpreted as a rent due primarily to the local union's salary negotiations.

There are, therefore, two main requirements for interpreting salary variation across school districts as union rents:

(A1) The school districts being compared to one another must offer similar working conditions so that no district needs to provide a higher salary to compensate its teachers for undesirable characteristics.

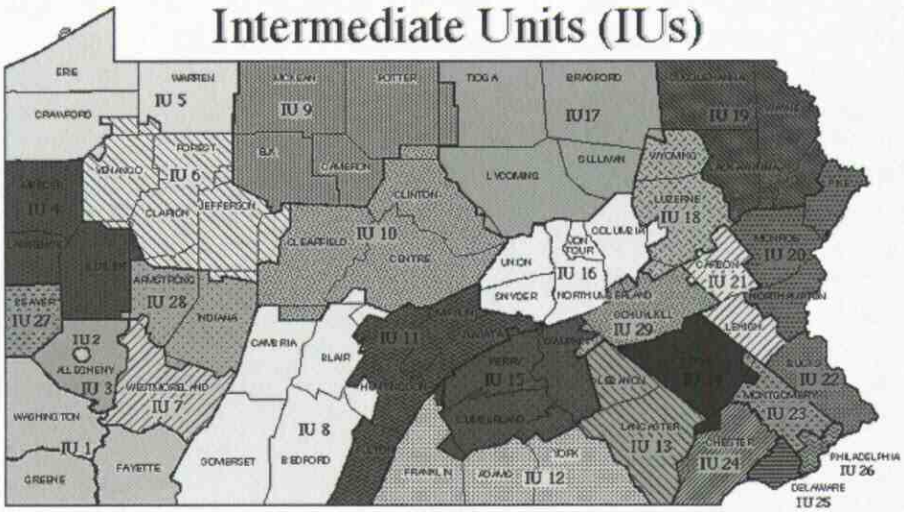
(A2) Educational output across districts cannot be positively related to salaries.

Three measures will be undertaken to insure that (A1) holds for the empirical work in this paper. First, attention will be restricted to rural school districts. Second, among the rural districts, further subdivisions will be made according to the same classification scheme used by the Pennsylvania Department of Education when evaluating students, schools, and various programs. Third, several school district characteristics that teachers likely care about (and therefore potentially affect the inter-district wage structure) will be controlled for in a regression analysis. To support (A2), we use test score data to show that the higher-paying districts in rural Pennsylvania are not producing above-average students when compared to the lower-paying districts.

THE DATA

Pennsylvania has 500 public school districts. All but two service at least one high school. The Pennsylvania Department of Education groups its school districts into 29 intermediate units (IUs). See Figure 1 for a map detailing the borders of the intermediate units. The IUs were initially chosen to help school districts economize on the costs of providing special education. Presently, the IU classification system also plays a key role in adopting technology improvements, evaluating schools and students, and operating migrant student programs. To be most assured that comparisons are being made across homogeneous districts, we only compare school districts within the same IU and consider only the non-metropolitan counties of the nine mostly rural IUs. Throughout the paper, these will be referred to as the nine rural IUs. The counties associated with the nine rural IUs are listed in Table 2. Four of these IUs contain districts that fall within an MSA's borders. These districts are omitted from the analysis.[3]

FIGURE 1
Intermediate Unit Classifications by the Pennsylvania Department of Education



Pennsylvania Department of Education, http://www.pde.psu.edu/iumap.html

In each public school district in Pennsylvania, a local teachers' union negotiates a salary schedule with the local school board, subject only to a minimum salary schedule as stipulated by the Pennsylvania state legislature. Salary schedules report the salary to be paid to each teach1er based solely on each teacher's level of education and years of experience. The system has no merit pay. The salary data used here span the academic years 1996-97, 1997-98, and 1998-99, during which time the state minimum salary was $18,500.

The Pennsylvania State Education Association collects the contracts for each school district and has made available the starting salary for a teacher with a Bachelor's degree and the maximum possible salary paid to a teacher with a Master's degree. When negotiating the salary schedules, the union and school board can agree to leave a cell "open", in which case the salary paid for that cell is later determined by the school board subject only to the state minimum salary. The salary schedules for thirty-two school districts (thirteen of which are located in the nine rural IUs) have an open cell for a starting teacher for at least one of the three academic years. These 32 districts are omitted throughout the paper, leaving 94 districts in the nine rural IUs (and 466 districts state-wide). If we had kept these districts in the analysis and assumed that each pays the state-mandated minimum salary of $18,500, the estimates of the union wage effect would increase by as much as 50 percent.

Two definitions of salary are used throughout the paper. First, the three-year average of starting salaries is called the "starting salary". Taking salary averages over three academic years minimizes the extent to which salary variation comes about from districts signing multiyear contracts at different times. Second, a measure of each district's lifetime discounted salary is called "lifetime salary". Specifically, the lifetime salary is calculated using the three-year averages for the starting salary and

TABLE 2
Pennsylvania Intermediate Units by County

Intermediate Unit	Non-MSA Counties (Used)	MSA Counties (Omitted)
IU 6	Clarion, Clearfield, Forest, Venango	None
IU 9	Cameron, Elk, McKean, Potter	None
IU 11	Fulton, Huntingdon, Juniata, Mifflin	None
IU 12	Adams, Franklin	York
IU 16	Montour, Northumberland, Snyder, Union	Columbia
IU 17	Bradford, Sullivan, Tioga	Lycoming
IU 19	Susquehanna, Wayne	Lackawanna, Wyoming
IU 28	Armstrong, Indiana	None
IU 29	Schuylkill	None

the maximum salary for a teacher with a Master's degree. The lifetime of a teacher is assumed to be 31 years (0 years experience through 30 years experience). The difference between the maximum salary and the starting salary divided by 30 gives the yearly increase. Assuming an annual discount rate of 8 percent, the lifetime salary is the discounted sum of all 31 salary figures. (The results are fairly insensitive to reasonable choices of the discount rate.) Summary statistics for the salary variables are given in Table 3 for all non-MSA school districts in the nine rural IUs and again for all Pennsylvania public school districts.

In addition to restricting attention to rural school districts in the same IU, a regression procedure will control for school district characteristics that teachers likely care about and therefore might affect the inter-district wage structure. Specifically, teaching may be an easier and/or more rewarding job in wealthier districts that have safe schools and ample supplies, when students are serious, attend class regularly, and graduate, and when class sizes are kept low. To control for such influences on the wage structure, each district's percentage of students receiving reduced-price or free lunch, attendance rate, 12th grade dropout rate, enrollment, and number of teachers for the 1997-98 academic year have been obtained from the Pennsylvania Department of Education. The free lunch, attendance, and dropout variables are all measured as a percentage from 0 to 100. Enrollment is the district's average daily October enrollment. And the district's student-teacher ratio is calculated as enrollment divided by the number of teachers.[4] (See Table 3 for the summary statistics.)

Each district's average score from four standardized tests—an eleventh grade math test, an eleventh grade reading test, and the math and verbal sections of the SAT—are also used below to support (A2). The most notable difference between the grade 11 tests and the SAT is that the SAT is optional whereas all 11th graders are required to take the grade 11 tests. To have a measure of value added in the education process, the difference between each district's average grade 11 and average grade 8 test score is also used. As is common in the literature, all test scores are normalized to have a mean of zero and standard deviation of 1. (See Table 3 for the summary statistics.)

Notice in Table 3 that the highest and lowest salaries throughout Pennsylvania are in the urban districts. The same is true for percent students receiving free lunch

TABLE 3
Pennsylvania Summary Statistics: 1997-98

		Nine Intermediate Units: Non-MSA Districts (N=94)				Entire State (N=466)			
		Mean	Stnd Dev	Minimum	Maximum	Mean	Stnd Dev	Minimum	Maximum
Starting Salary Average (in $1,000s)[a]		28.83	2.66	20.93	35.18	29.26	3.32	18.50	39.82
Highest Salary for an MA (in $1,000s) [a]		49.40	3.25	40.56	62.34	54.59	6.69	40.56	74.45
Lifetime Salary (in $1,000s) [a,b]		429.52	28.94	353.31	500.24	452.40	45.60	309.75	607.54
Students Rec. Reduced/Free Lunch (%)		33.26	12.07	10.30	62.90	27.22	18.10	0.20	100.00
Attendance Rate (%)		94.43	1.42	89.11	100.00	94.40	1.60	86.22	100.00
12th Grade Dropout Rate (%)		3.63	2.53	0.00	11.70	3.31	2.38	0.00	11.90
Enrollment		2,112	1,318	247	7,941	3,715	10,154	247	212,865
Student-Teacher Ratio		17.30	1.55	11.49	22.09	17.43	1.57	11.49	23.26
Grade 11 Math Test:	Level	1272	57	1080	1420	1294	81	1000	1550
	Normalized	0.00	1.00	−3.38	2.59	0.38	1.43	−4.78	4.88
Grade 11– 8 Math Test[c]	Level	−11.0	54.2	−140.0	130.0	−15.4	48.8	−280.0	130.0
	Normalized	0.00	1.00	−2.38	2.60	−0.08	0.90	−4.96	2.60
Grade 11 Reading Test	Level	1284	57	1100	1390	1298	62	1070	1440
	Normalized	0.00	1.00	-3.24	1.86	0.24	1.09	−3.76	2.74
Grade 11–8 Read Test[c]	Level	−7.0	54.9	−180.0	110.0	−14.2	54.1	−300.0	120.0
	Normalized	0.00	1.00	−3.15	2.13	−0.13	0.99	−5.34	2.32
SAT Math Score	Level	486	23	418	532	493	32	348	594
	Normalized	0.00	1.00	−2.91	1.96	0.31	1.37	−5.90	4.61
SAT Verbal Score	Level	491	23	380	537	495	28	378	579
	Normalized	0.00	1.00	−4.90	2.01	0.14	1.22	−4.98	3.85

Summary statistics are given for all districts serving a high school and for which complete salary data is known. Two districts fail to serve a high school, and salary data is incomplete for thirty-two others, thirteen of which are in the intermediate units analyzed in the paper.

a. Salary data are three-year averages taken from the salary schedules negotiated in each district for the 1996-97, 1997-98, and 1998-99 school years.

b. Lifetime salary computes the lifetime discounted (8 percent yearly discount rate) salary for a teacher earning the starting salary in her first year and the maximum salary for a teacher holding a Master's degree in her 31st year and assumes a linear wage profile between the two.

c. The difference between the district's average Grade 11 test score and its average Grade 8 test score.

and all average test scores. Alternatively, the distributions of attendance rates, dropout rates, and student-teacher ratios in the nine rural IUs appear roughly the same as throughout the state.

STUDENT OUTCOMES VS. TEACHER SALARIES

To properly attribute wage variation to unions, it must be the case that the higher-paying districts are not attracting better teachers who in turn produce better educated students (requirement (A2)).[5] This issue is at the heart of the "does money matter" debate.[6] Note, the issue is not whether individual teachers make a difference in the education process; certainly individual teaching is a key element to educational advancement—probably the single most important element after the home environment. The issue is also not, at least for the purposes of estimating union rents, if extreme differences in educational spending matter in producing more highly educated students. The highest spending states (or nations), for example, may very well be producing more highly educated students than the lowest spending states (or nations), and part of this difference is likely due to spending differences. What matters here, however, is much more local. Can a district intentionally pay higher salaries to its current and future teachers as compared to its neighboring districts to attract and retain better teachers and eventually to have a more highly educated student body because of this policy? The purpose of this section is to show that the answer to this question, at least for the rural districts in Pennsylvania, is no.

The "Does money matter" literature cannot be summarized to any useful extent because the issue remains hotly contested. Rather, focus must be on how previous findings should be extended to rural Pennsylvania in the late 1990s. Ferguson [1991] and Ferguson and Ladd [1996], using school district observations from Texas and Alabama respectively, document statistically strong relationships between "teaching quality" and student performance on standardized tests. Their measures of teaching quality include, among other things, average scores by a district's teachers on a standardized test, percent of teachers with a Master's degree, and student-teacher ratios. Only Ferguson [1991], however, finds that higher salaries buy greater teaching quality, which in turn leads to greater student achievement. Although both links (higher salaries buy better teachers and better teachers produce more highly educated students) are statistically significant in certain specifications, neither is overwhelmingly economically significant. In the best scenario, a ten percent increase in average salary buys less than one-tenth of a standard deviation increase in average teacher scores, which in turn buys roughly 2.5 percent of a standard deviation increase in student test scores.[7] Additionally, Ferguson's study includes almost 900 school districts throughout Texas without including regional variables. Districts in Texas can be separated by over 800 miles. The role that teacher quality or salary could play across such a wide-ranging and diverse set of school districts is undoubtedly much greater than what would be observed in smaller groups of similar school districts. Finally, because teachers' unions in Texas "do not exercise much influence over salaries or hiring practices" [Ferguson 1991, 480], administrators in Texas are likely to have much more flexibility in hiring than in Pennsylvania where teachers' unions dictate, at least to some extent, hiring and firing practices [Strauss et al., 2000].

TABLE 4
The Relationship between Test Scores and Salaries in Pennsylvania

	Grade 11 Test				Grade 11– Grade 8 Test				SAT			
	Math		Reading		Math		Reading		Math		Reading	
Starting Salary	0.0892[a]		0.0540		0.0533		0.0443		0.0566		0.0784[a]	
	0.0466		0.0511		0.0490		0.0516		0.0483		0.0436	
Lifetime Salary		0.0085[a]		0.0038		0.0055		0.0029		0.0062		0.0077[a]
		0.0046		0.0050		0.0048		0.0051		0.0047		0.0043
Lunch	−0.0207	−0.0205	−0.0147	−0.0146	−0.0101	−0.0099	−0.0022	−0.0022	−0.0226	−0.0224	−0.0251	−0.0249
	0.0085	0.0085	0.0094	0.0094	0.0090	0.0090	0.0094	0.0095	0.0088	0.0088	0.0080	0.0080
Attendance Rate	0.0916	0.0700	0.1260	0.1165	0.0476	0.0335	0.0354	0.0283	0.1413	0.1251	0.0284	0.0086
	0.0684	0.0697	0.0751	0.0766	0.0719	0.0730	0.0758	0.0773	0.0710	0.0721	0.0641	0.0653
Dropout	−0.0623	−0.0641	−0.0425	−0.0411	−0.0334	−0.0353	−0.0223	−0.0206	−0.0151	−0.0178	−0.0346	−0.0366
	0.0387	0.0390	0.0425	0.0429	0.0407	0.0409	0.0429	0.0433	0.0400	0.0402	0.0362	0.0364
Enrollment ×100	−0.0021	−0.0071	−0.0295	−0.0308	−0.0738	−0.0774	−0.0626	−0.0634	0.0054	0.0013	0.0062	0.0016
	0.0219	0.0225	0.0240	0.0247	0.0230	0.0236	0.0242	0.0249	0.0023	0.0232	0.0205	0.0210
(Enrollment×100)^2	0.0002	0.0002	0.0005	0.0005	0.0009	0.0009	0.0008	0.0009	0.0002	0.0005	−0.0005	−0.0002
	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Student-Teacher	0.1096	0.0796	−0.5204	−0.4807	−0.2816	−0.3195	−1.3849	−1.3410	0.1888	0.1321	1.1617	1.1233
	0.8192	0.8256	0.8983	0.9072	0.8602	0.8649	0.9073	0.9155	0.8499	0.8541	0.7677	0.7733
Student-Teacher^2	−0.0017	−0.0011	0.0156	0.0143	0.0091	0.0100	0.0393	0.0379	−0.0009	−0.0005	−0.0300	−0.0291
	0.0232	0.0234	0.0255	0.0257	0.0244	0.0245	0.0257	0.0259	0.0241	0.0242	0.0218	0.0219
Constant	−11.2537	−9.8394	−7.8799	−7.3562	−1.7063	−0.7470	9.1783	9.5426	−17.1310	−15.9880	−15.2495	−13.9072
	9.4707	9.5487	10.3858	10.4918	9.9449	10.0031	10.4896	10.5882	9.8479	9.9017	8.8955	8.9651
R^2	.3541	.3522	.2897	.2848	.3182	.3194	.2782	.2743	.3361	.3388	.3793	.3789

Each regression uses 94 observations. Standard errors are reported beneath the coefficient estimates. All regressions include either the district's starting salary or its lifetime salary as an explanatory variable. All regressions include eight dummy variables designating each district's intermediate unit (IU 6 is omitted). Each observation is weighted by the square root of district enrollment to correct for heteroskedasticity.

[a]Indicates that the coefficient on the salary variable is greater than zero (one-sided) with 95 percent confidence.

A series of papers by Card and Krueger [1992; 1996a; 1996b] has also received considerable attention. They match statewide education data from 1920 to 1949 to wage data from the 1980 census to investigate the returns to schooling. By looking at several teaching quality variables measured at the state level, they find that students educated in states with relatively higher average teacher salaries experienced a greater return to their education in the labor market. Putting their results in the best light suggests that money mattered before 1950 and before teachers' unions. There is no foundation, however, to extend these results to the Pennsylvania public school system of the 1990s.

Focusing specifically on Pennsylvania, Strauss et al. [2000] provides an in-depth look into the public school system, teacher preparation, and recruiting/hiring procedures. Their findings are striking. Nepotism looms large in the hiring practices throughout Pennsylvania—on average, 40 percent of a district's teachers were students in the district in which they teach. Likewise, the hiring procedures of most districts are nebulous at best. Sufficient emphasis is not placed on hiring high knowledge/content teachers or teachers well-suited for the classroom. And the ability and willingness of potential candidates to lead extracurricular activities can enter heavily into the hiring decision. As a consequence of poor hiring practices by many school districts, the authors find that high-quality teachers are not systematically pursued and hired by the highest paying districts.

Given the hiring practices throughout Pennsylvania as documented by Strauss et al. [2000], it is not surprising to find that higher-paying districts fail to systematically produce higher student achievement on standardized tests. In Table 4, the estimated coefficients from 12 empirical specifications using the 94 school districts in the nine rural intermediate units are reported.[8] In each case, the dependent variable is each district's (normalized) average test score. The independent variables are either starting or lifetime salary, percent students receiving free or reduced lunch, the district's attendance and dropout rates, enrollment and enrollment squared, the student-teacher ratio and its square, and eight IU dummy variables. All variable units, except for enrollment, which has been multiplied by 100, are as reported in Table 3 so that a $1,000 increase in starting salary is associated with a .0892 increase of one standard deviation in the district's average grade 11 math score. In all 12 specifications, salaries are positively related to test outcomes, but the effects are significant at the five percent level in a one-sided test only for the grade 11 math test and the verbal portion of the SAT.[9] Regardless of statistical significance, however, the effects are small. Increasing lifetime salary by $100,000 is predicted to boost grade 11 math scores by 0.85 standard deviation and math SAT scores by 0.62 standard deviation. The predicted effects on grade 11 reading and the verbal portion of the SAT are equally paltry, increasing average test scores by 0.38 and 0.77 standard deviation respectively. Given that one standard deviation is less than 24 points on the math portion of the SAT and less than 23 points on the verbal portion, a district that purposely increases its salaries to increase its test scores will make a very expensive decision since Kaplan, a company that charges roughly $750 for a single 39-hour SAT preparatory program, advertises that it increases SAT scores by an average of 120 to 170 points.

Even though the relationship between test scores and salaries is sometimes statistically significant, salary variation is rural Pennsylvania is clearly not being driven

TABLE 5
Salary Distributions in Pennsylvania by Intermediate Unit

District's Salary	# of Districts	Salary Percentiles($1,000s) Min	10^{th}	25^{th}	50^{th}	75^{th}	90^{th}	Max	Average Union Wage Effect
Starting Salary:									
IU 6	15	24.50	25.24	26.86	27.50	28.88	30.70	30.97	10.11%
IU 9	13	26.25	26.65	27.50	28.52	29.49	30.44	30.48	7.33
IU 11	8	25.00	25.00	25.40	27.83	28.80	29.95	29.95	9.51
IU 12	11	25.73	26.74	28.00	28.67	29.80	31.45	32.53	8.52
IU 16	10	25.40	25.90	27.01	29.83	32.36	34.28	35.18	15.38
IU 17	11	27.98	30.00	30.09	30.93	31.97	32.60	32.60	3.85
IU 19	9	26.37	26.37	27.65	30.02	30.70	33.54	33.54	11.53
IU 28	8	28.98	28.98	30.08	32.32	33.61	34.91	34.91	10.40
IU 29	9	20.93	20.93	24.20	26.13	26.50	27.57	27.57	19.94
Lifetime Salary:									
IU 6	15	384.7	386.0	399.1	415.7	430.3	445.9	448.7	7.83
IU 9	13	393.5	415.8	418.8	429.8	441.1	454.7	457.6	4.13
IU 11	8	385.1	385.1	387.2	406.1	412.7	437.3	437.3	4.98
IU 12	11	378.9	391.7	410.7	419.8	433.7	448.9	465.0	7.60
IU 16	10	391.3	398.2	417.5	430.7	459.5	487.6	497.4	10.05
IU 17	11	411.4	436.5	444.1	454.4	462.5	477.0	478.3	4.15
IU 19	9	423.7	423.7	434.3	441.7	446.8	469.0	469.0	4.63
IU 28	8	434.3	434.3	452.2	465.7	475.7	500.2	500.2	7.12
IU 29	9	353.3	353.3	386.6	399.2	423.7	437.8	437.8	13.40

The union wage effect for each district is the difference between its salary and the 10^{th} percentile salary expressed as a percentage of the 10^{th} percentile salary.

by a greater demand for successfully producing more highly educated students. Thus, assumption (A2) is satisfied for the data that will be used to bound the union wage effect from below.

THE UNION WAGE EFFECT

Table 5 provides a cross-tab of the starting and lifetime salary distributions and the average lower-bound union wage effect for each of the nine rural intermediate units in Pennsylvania. Let the upper bound on the competitive salary as in equation (1) be estimated conservatively by the 10^{th} percentile salary instead of the minimum salary.[10] A lower bound on each district's union rent is then calculated as the difference between its salary and the competitive salary (that is, the 10^{th} percentile salary in its IU) as indicated by equation (2).[11] Finally, a lower-bound estimate for each district's union wage effect can be calculated as the lower bound on its rent expressed as a percent of the district's competitive wage. Averaging this percent over all districts in the IU yields the average union wage effect as reported in the final column of Table 5. Depending on the intermediate unit, the average union-wage effect on starting salaries ranges from at least 3.85 to at least 19.94 percent. The average union wage effect on lifetime salaries ranges from at least 4.13 to at least 13.4 percent.

Three results from Table 5 are immediate. First, union rents can be quite large, especially considering that the estimation procedure places lower bounds on the union

TABLE 6
10th Percentile Regressions: Salary on District Characteristics

	Starting Salary	Lifetime Salary
Lunch	−35.4	−626.8
	55.7	278.7
Attendance Rate	−8.0	787.0
	480.6	2593.9
Dropout	144.3	1639.3
	223.7	1093.5
Enrollment x100	−1.274	−12.725
	2.312	11.400
(Enrollment x100)^2	0.0002	0.0020
	0.0003	0.0013
Student-Teacher	3405.1	55586.9
	4172.1	20558.5
Student-Teacher^2	−93.1	−1526.1
	121.3	600.1
Constant	2223.323	−104002.4
	50404.89	264207.4
Pseudo R-squared	.4188	.4882
N	94	94

Standard errors are reported beneath the coefficient estimates. Both regressions include eight intermediate unit dummy variables (omitting IU 17).

wage effect. Second, the union wage effect varies considerably across geographic locations. And third, the lower bound on the union wage effect on lifetime salary is lower than that for the starting salary in eight of the nine rural IUs. This last pattern is important, because it is indicative of union rents. If variation in starting salaries stems from compensating differentials or demanding high-quality teachers, it is likely that the variation would remain when considering salaries paid to the most experienced teachers and to any calculation of a lifetime salary. Alternatively, unions distribute rents first to their most tenured members and second to their new hires. Assuming all unions are successful at negotiating some rents, every district's lifetime salary will necessarily include a portion of these rents, and consequently the estimate of the competitive lifetime salary is always too high and the estimate of each district's union rent when considering lifetime salaries is too low. At the same time, if some unions fail to distribute rents to its starting teachers, the estimate of the competitive starting salary will be less susceptible to the bounding process, and will therefore provide a more accurate measure of the true union wage effect.

In further support of the cross-tabs reported in Table 5, we also use regression analysis. Unlike the cross-tabs, which are limited by the small sample sizes in each IU, regression analysis can examine several district characteristics that likely enter teacher preferences and therefore may affect the wage structure. Table 6 reports the estimated coefficients from 10th percentile regressions of starting and lifetime salary on several district characteristics, including percent of students receiving free lunch, attendance and dropout rates, enrollment and enrollment squared, the student-teacher ratio and its square, and eight of the nine intermediate units. The competitive salary

TABLE 7
Average Teacher Rents for Three States

	Starting Salary		Lifetime Salary	
	Mean	Median	Mean	Median
Pennsylvania (N=94)	10.11%	7.92%	6.38%	4.45%
South Carolina (N=46)	2.54	2.03	2.49	1.96
Virginia (N=36)	3.34	1.64	3.75	1.97

For each state, a 10th percentile regression provides an upper bound on the competitive salary. The difference between each district's actual salary and its estimated competitive salary provides an estimate of each district's rent (in dollars). The table reports the mean and median of these rents measured as a percentage of the estimated competitive salary.

for each district is then taken to be the predicted value from the 10th percentile regression, and the union rent associated with each district is the actual salary paid less the estimated competitive salary.[12] Using these estimates for all 94 school districts, Table 7 reports the mean and median of the lower bound on the union wage effect on starting and lifetime salary. The mean (median) union wage effect on starting salaries is at least 10.11 (7.92) percent, and on lifetime salaries is at least 6.38 (4.45) percent. Both sets of results, therefore, are comparable to those reported in Table 5.

For comparison, Table 7 also reports the "union wage effect" for South Carolina and Virginia, two non-union states, when using the identical bounding procedure.[13] Unlike Pennsylvania, it is common for school districts in Southern states to contain an entire county. Consequently, South Carolina has only 86 school districts while Virginia has only 132. As in Pennsylvania, the South Carolina state legislature imposes a minimum salary schedule. Virginia has no minimum salary schedule. Whereas some school districts in South Carolina have full taxing authority (others have limited authority and others have no authority), school districts in Virginia have no taxing authority. In Virginia, funds are appropriated directly from the state and are openly competed for when districts present their expenditure needs to the state.

The South Carolina Department of Education groups school districts into thirteen "hubs." Only the non-MSA districts from the five mostly rural hubs are used. Other than not having a measure of student-teacher ratios, the 10th percentile regressions for South Carolina are carried out identically as those for Pennsylvania. The results show some variation across districts but considerably less than in Pennsylvania. As shown in Table 7, the mean (median) salary dispersion in South Carolina is only 2.54 (2.03) percent for starting salaries and is only 2.49 (1.96) percent for lifetime salaries.

The Virginia Department of Education, unfortunately, does not define geographic groupings similar to Pennsylvania's intermediate units or South Carolina's hubs. Moreover, Virginia is scattered with MSAs. This severely limits the number of districts that can be considered in any analysis that requires comparing groups of homogeneous districts, as MSAs naturally contain fairly heterogeneous districts (see note 3). Yet, quantifying the salary dispersion throughout Virginia's rural school districts remains important because, unlike South Carolina, the state of Virginia does not impose a minimum salary grid. After eliminating school districts located in an MSA

or large town, four rural regions of Virginia are defined. These four regions, containing 36 school districts, are used in the estimation. The 10th percentile regression includes exactly the same measures of school characteristics as were included for Pennsylvania in Table 6. Table 7 reports that mean (median) salary dispersion in Virginia is 3.34 (1.64) percent for starting salaries and 3.75 (1.97) percent for lifetime salaries.

DISCUSSION

Table 5 and the first row of Table 7 suggest that public school teachers' unions in Pennsylvania, on average, negotiate sizeable rents for their members. The estimated effects on lifetime salary in both tables, however, are substantially less than that for starting salaries. As mentioned earlier, if unions are more likely to distribute rents to their more tenured members (that is, to the salary cells associated with more years of experience), the estimation procedure is more likely to overestimate the competitive salary for these cells. The decline in the estimated union wage effect from the starting salary to the lifetime salary, therefore, is likely due to the lower bound estimation procedure. This interpretation is further supported in Table 7 because dispersion associated with lifetime salaries is not significantly less than dispersion associated with starting salaries in the two non-unionized states of South Carolina and Virginia.

The presence of any salary dispersion in South Carolina and Virginia as indicated in Table 7 remains unexplained. The model above suggests that, if compensating differentials are properly accounted for, school boards are efficient, and higher salaries are not purchasing higher quality teachers, there should be no salary variation in non-union states. In South Carolina, where the absolute range of all salaries is small to begin with, demand for better teachers is almost surely not driving salary differences. The dispersion measured for South Carolina (at most 2.5 percent), therefore, is most likely due to non-measured compensating differentials, to improperly measured salary profiles (cell by cell) for each district, or inherent school district inefficiencies. The same holds for Virginia with a noted exception. School districts in Virginia, in essence, lobby the state for funding. Much, but not all, of the funding is formula determined. Each school district, therefore, essentially tries to negotiate a rent from the state. Given the political process involved, it is likely that some differences in salary grids would arise and easily produce salary dispersion in Virginia on the order 1 to 2 percent more than in South Carolina. Assuming that the root cause of salary dispersion in non-union states (for example, unmeasured compensating differentials) is the same across states, the mean lower bound estimate of the union wage effect on starting salaries in Pennsylvania should be reduced by 2.5 percent to 7.6 percent, and the median effect should be reduced by 2 percentage points to 5.9 percent.

Overall, a union wage effect for public school teachers in Pennsylvania of 7.6 percent is on the same order as that found for teachers' unions in the 1970s. It is also reasonably comparable to the union wage effect associated with other public sector unions (8 to 12 percent) and private-sector unions (10 to 14 percent) as reported by Lewis [1990]. Teachers' unions, therefore, have successfully negotiated higher salaries. Two questions remain. To what extent, if any, is the 7.6 percent figure underestimated? And, to what extent are union rents responsible for public education ineffi-

ciencies? The effectiveness of educational expenditures may be lessened somewhat in school districts paying annual union rents on the order of 7.6 percent, but a union wage effect of this magnitude would not likely be a candidate for explaining in full why money does not matter (or at most, matters very little) in the production of education. Without judging the attractiveness of teaching jobs across state lines, further refinements of the 7.6 percent lower bound cannot be achieved. If one is willing to stipulate that teachers do not have strong preferences for teaching in South Carolina over teaching in Pennsylvania, however, it is likely that the union wage effect is much greater than 7.6 percent. Referring to Table 1, notice that the 10th percentile lifetime salary in non-MSA school districts is almost 20 percent greater in Pennsylvania than in South Carolina or Virginia. If this entire difference is attributed to a common union rent throughout Pennsylvania, the 7.6 percent figure is underestimated by as much as 20 percentage points, and union rents may, in fact, be largely responsible for preventing expenditure increases from being converted into greater student achievement.

Finally, to what extent do school boards, through hiring and firing practices, avoid paying union rents in Pennsylvania? That is, do school districts respond to higher salaries by increasing class sizes or by targeting low-tenured, less educated (and less expensive) teachers to mitigate the financial cost of the union rents? To investigate this, the salary variables are regressed against student-teacher ratios, the average years of experience of a district's teachers, and percent of a district's teachers with a Master's degree.[14] The results reveal that student-teacher ratios and average years of experience are unrelated to salaries and that the percent of teaching staff with a Master's degree is positively associated with salaries, indicating that teachers, rather than school boards, are responding optimally to the salary grid. In all three cases, therefore, the composition of a district's faculty is not associated with hiring and firing patterns that would reduce the expenses associated with union rents.

CONCLUSION

The union wage effect for public school teachers has gone unestimated for twenty years due to the identification problem associated with having complete (or no) union coverage throughout individual states. This paper places a lower bound on the union wage effect by considering the salaries paid across small groups of homogeneous school districts. For the estimation procedure to be placing a lower bound on the union wage effect, higher-paying districts cannot be systematically hiring higher quality teachers. Data on student test scores and teacher salaries are used to demonstrate that student test scores are not significantly related to salaries across small sets of rural, geographically close school districts in Pennsylvania. Work by Strauss et al. [2000] also provides a detailed analysis of the hiring practices of school districts throughout Pennsylvania and finds that even the highest-paying school boards, by and large, fail to pursue the most highly able teachers. The estimation procedure is carried out on 94 rural school districts of Pennsylvania using salary data from the 1996-97, 1997-98, and 1998-99 academic years. After an adjustment for potential unobserved compensating differentials, the average union wage effect is estimated to be at least 7.6

percent. Comparing salaries across states, however, suggests that the union wage effect may, in fact, be as much as 20 percentage points higher. If so, the effectiveness with which teachers' unions negotiate rents may be a likely candidate for explaining at least some of the inefficiencies associated with public education expenditures.

NOTES

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1. Even when there is some variation in unionization within a state, spillover effects are likely to be large [Ehrenberg and Schwartz, 1986; Freeman, 1986; Lewis, 1990; Zwerling & Thomason, 1995]. Data problems are also pervasive when using teacher level data as some teachers will claim union membership in an organization like the NEA even though their local contract is not collectively bargained.
2. Data from South Carolina and Virginia, two non-union states, will be used to show that salary variation is very small in the absence of unionism when care is taken to classify homogenous districts.
3. If equations (2) and (3) are applied separately to all IUs, the estimated union wage effect would be much larger than the results reported later in section 5; however, the homogeneity of the school districts in the more urban IUs would be in serious doubt as district characteristics vary much more throughout metropolitan areas than in rural areas.This is especially poignant here, as 33 of the 67 counties in Pennsylvania are contained in a Metropolitan Statistical Area and Philadelphia is the fifth largest public school system in the U.S.
4. Number of teachers counts each part-time teacher as half a teacher. Non-teaching professional staff are not counted as teachers.
5. Suppose the highest-paying districts believe that their high salaries attract better teachers and produce better students, when in fact they do neither. To what should one attribute these higher salaries? The answer must be the negotiation process. For whatever reasons (ranging from vast stupidity on the side of the school board to extremely savvy teachers), the teachers of these districts have negotiated a higher salary for comparable work, and consequently, these higher salaries should be interpreted as union rents.
6. In addition to the references listed in the text, other contributors to the debate include Ballou and Podaursky [1997], Betts [1995; 1996], Hanushek [1986; 1991; 1996a; 1996b], Hanushek, Kain, and Rivkin [1998a; 1998b], Hedges and Greenwald [1996], Hoxby [1996], and Murnane and Levy [1996].
7. Ferguson [1991] fails to report enough summary statistics to pinpoint this calculation.
8. Each regression is weighted by the square root of district enrollment to correct for the heteroskedasticity associated with using a district-wide average test score as the dependent variable.
9. The magnitude of the estimated coefficients on the starting salary variables are roughly 10 times that of the coefficient on lifetime salary. Given the discount rate of 8 percent, a present-value increase in lifetime salary of $10,000 translates into slightly less than a $1,000 increase in every year's salary.
10. The 10th percentile offers a conservative lower bound on the estimated rents. If the actual minimum salary in each IU is used as an estimate of the competitive salary as suggested by equation (1), the lower bound on the union wage effect would increase but would also be more sensitive to outliers. On the other hand, using the 25th percentile in place of the 10th percentile would seem overly conservative as one in four districts should not be considered outliers. The difference between the 10th and 25th percentiles, however, is usually very small, so that the results are fairly insensitive to choosing any percentile in this range. Finally, it should be noted that four of the nine IU groups contain fewer than ten districts. For these four IUs, the 10th percentile salary is the minimum salary.
11. Districts paying below the 10th percentile salary are assigned a union rent of $0. Assigning a negative rent would reduce the average union rent only slightly.

12. To ensure outliers are not driving the results, a 90th percentile regression is also executed. Let w_j be the district's actual salary measure and w_j^{10} and w_j^{90} be the district's predicted values from the 10th and 90th percentile regressions respectively. Each district's union rent, $\hat{\mu}_j$, is then calculated as: $\hat{\mu}_j = \max\{0, \min\{w_j, w_j^{90}\} - w_j^{10}\}$. Thus, the rent is non-negative and cannot exceed the difference between the predicted 90th and the predicted 10th percentile salaries.
13. All data and results pertaining to South Carolina and Virginia are available from the author upon request.
14. The regression results are available from the author upon request.

REFERENCES

Baird, R. N. and Landon, J. H. The Effects of Collective Bargaining on Public School Teachers' Salaries. *Industrial and Labor Relations Review,* April 1972, 410-417.

Balfour, G. A. More Evidence that Unions do not Achieve Higher Salaries for Teachers. *Journal of Collective Negotiations,* Fall 1974, 289-303.

Ballou, D. and Podgursky, M. *Teacher Pay and Teacher Quality*. Kalamazoo, MI: W.E. Upjohn Institute, 1997.

Baugh, W. H. and Stone, J. A. Teachers, Unions, and Wages in the 1970s: Unionism Now Pays. *Industrial and Labor Relations Review*, April 1982, 368-76.

Betts, J. R. Does School Quality Matter? Evidence from the National Longitudinal Survey of Youth. *Review of Economics and Statistics*, May 1995, 231-50.

_____. Is There a Link between School Inputs and Earnings? Fresh Scrutiny of an Old Literature, in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by G. Burtless. Washington D.C.: Brookings Institution Press, 1996.

Burtless, G., ed. *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success.* Washington D.C.: Brookings Institution Press, 1996.

Card, D. and Krueger, A. B. Does School Quality Matter? Returns to Education and the Characteristics of Public Schools in the United States.? *Journal of Political Economy*, February 1992, 1-40.

_____. Labor Market Effects of School Quality: Theory and Evidence, in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by G. Burtless. Washington D.C.: Brookings Institution Press, 1996a.

_____. School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina. *Journal of Economic Perspectives*, Fall 1996b, 31-50.

Curme, M. A., Hirsch, B. T. and Macpherson, D. A. Union Membership and Contract Coverage in the United States. *Industrial and Labor Relations Review*, October 1990, 5-33.

Ehrenberg, R. G. and Schwartz, J. L. Public Sector Labor Markets, in *Handbook of Labor Economics, Vol. 1.*, edited by O. Ashenfelter and R. Layard. Amsterdam: North Holland, 1986.

Even, W. E. and Macpherson, D. A. The Decline of Private Sector Unionism and the Gender Wage Gap. *Journal of Human Resources*, Spring 1993, 279-96.

Ferguson, R. F. Paying for Public Education: New Evidence on How and Why Money Matters. *Harvard Journal on Legislation*, Summer 1991, 464-98.

Ferguson, R. F. and Ladd, H. F. How and Why Money Matters: An Analysis of Alabama Schools, in *Holding Schools Accountable: Performance-Based Reform in Education*, edited by H. F. Ladd. Washington D.C.: Brookings Institution Press, 1996.

Freeman, R. B. Unionism Comes to the Public Sector. *Journal of Economic Literature*, March 1986, 41-86.

Freeman, R. B. and Valletta, R. G. The Effects of Public Sector Labor Laws on Labor Market Institutions and Outcomes, in *When Public Sector Workers Unionize*, edited by R. B. Freeman and C. Ichniowski. Chicago: Chicago University Press, 1988.

Gustman, A. L. and Segal, M. Interstate Variations in Teachers' Pensions. *Industrial Relations*, October 1977, 335-44.

Gyourko, J. and Tracy, J. Public Sector Bargaining and the Local Budgetary Process. *Research in Labor Economics*, 1991, 117-36.

Hanushek, E. A. The Economics of Schooling Production and Efficiency in Public Schools. *Journal of Economic Literature*, September 1986, 1141-77.

_____. When School Finance "Reform" may not be a Good Policy. *Harvard Journal on Legislation*, Summer 1991, 423-56.

_____. School Resources and Student Performance, in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by G. Burtless. Washington D.C.: Brookings Institution Press, 1996a.

_____. Measuring Investment in Education. *Journal of Economic Perspectives*, Fall 1996b, 9-30.

Hanushek, E. A., Kain, J. F. and Rivkin, S. G. Teachers, Schools and Academic Achievement. NBER Working Paper #6691, 1998a.

_____. Do Higher Salaries Buy Better Teachers. Mimeo, presented at the 1999 American Economic Association Meetings in New York City, N.Y., December, 1998b.

Hedges, L. V., and Greenwald, R. Have Times Changed? The Relation Between School Resources and Student Performance, in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by G. Burtless. Washington D.C.: Brookings Institution Press, 1996.

Hoxby, C. M. How Teachers' Unions Affect Education Production. *Quarterly Journal of Economics*, August 1996, 671-718.

Kasper, H. The Effect of Collective Bargaining on the Public School Teacher's Salaries." *Industrial and Labor Relations Review*, October 1970, 57-72.

Kokkelenberg, E. C., and Sockell, D. R. Union Membership in the United States, 1973-1981. *Industrial and Labor Relations Review*, July 1985, 497-543.

Ladd, H. F. *Holding Schools Accountable: Performance-Based Reform in Education*. Washington D.C.: Brookings Institution Press, 1996.

Lewis, H. G. Union/Nonunion Wage Gaps in the Public Sector. *Journal of Labor Economics*, January 1990, S260-S328.

Murnane, R. J. and Levy, F. Evidence from Fifteen Schools in Austin, Texas, in *Does Money Matter? The Effect of School Resources on Student Achievement and Adult Success*, edited by G. Burtless. Washington D.C.: Brookings Institution Press, 1996.

NEA Constituent Group Relations and NEA Research. *NEA Membership Trends: Growth and Declines 1979 - 1992*. August, 1993.

Rosen, S. The Theory of Equalizing Differences, in *Handbook of Labor Economics, Vol. 1.*, edited by O. Ashenfelter and R. Layard. Amsterdam: North Holland, 1986.

Strauss, R. P., Bowes, L. L., Marks, M. S., and Plesko, M. R. Improving Teacher Preparation and Selection: Lessons from the Pennsylvania Experience. *Economics of Education Review*, October 2000, 387-415.

Thornton, R. J. The Effects of Collective Bargaining on Teachers' Salaries. *Quarterly Review of Economics and Business*, Spring 1971, 37-46.

U.S. Department of Education. National Center for Education Services. *1995 Digest of Education Statistics*. Washington, D.C., 1995.

Zwerling, H. L., and Thomason, T. Collective Bargaining and the Determinants of Teachers' Salaries. *Journal of Labor Research*, Fall 1995, 467-84.