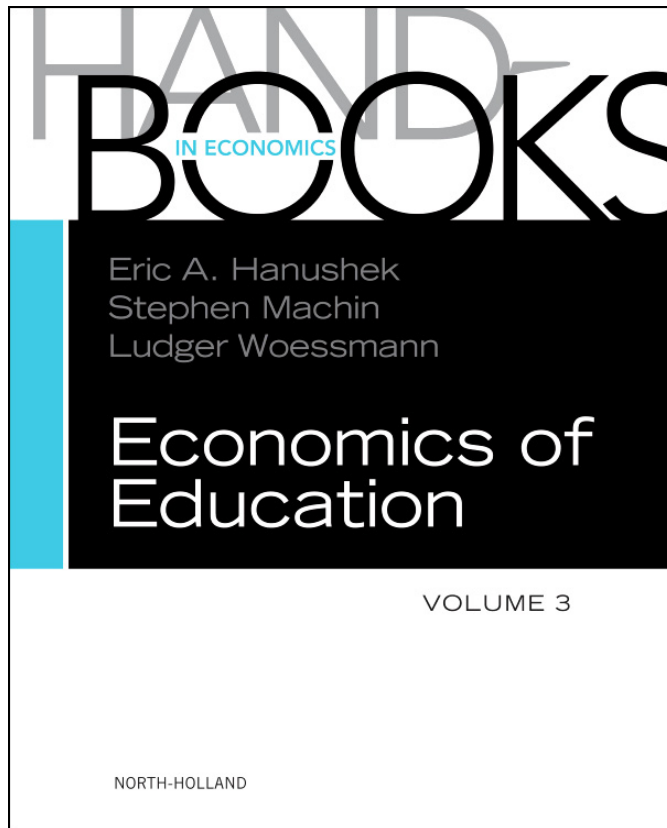


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# CHAPTER 5

## Teacher Compensation and Collective Bargaining

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### Abstract

While compensation accounts for roughly 90% of K-12 instructional costs, there is little evidence of rational design in these systems. This chapter reviews the nature of teacher compensation systems in developed economies and research on their performance effects. Since these compensation schemes typically arise out of collective negotiations, this chapter also surveys the smaller literature on the effect of teacher collective bargaining on earnings and school outcomes.

*JEL classification:* I21, I22, J31, J32, J33, J45

### Keywords

Teacher Compensation  
 Teacher Pay  
 School Finance  
 Teacher Collective Bargaining

## 1. INTRODUCTION

During the 2006–07 school year, the most current year for which national data are available, U.S. public schools spent \$187 billion for salaries and \$59 billion for benefits for instructional personnel. These compensation payments account for 55% of K–12 current expenditures and 90% of instructional expenditures ([U.S. Department of Education \(2009\)](#)). As large as these expenditures are, they do not fully capture the resources committed to K–12 compensation, since they do not include billions of dollars of unfunded liabilities of pension funds and retiree health insurance for teachers and administrators ([Pew Center on the States \(2010\)](#)). If productivity doubles for an input accounting for 1% of total cost, the overall social gain will be modest. However, given the large share of K–12 costs that arise from educator compensation, even small gains in efficiency can yield large social dividends.

There is ample reason to believe that significant efficiency gains can be found. Educator compensation “systems” are neither strategic nor integrated. In a well-run organization, the total compensation package—salaries, current and deferred benefits—would be structured with an eye toward overall firm performance. Tradeoffs between different types of salary and benefits would be carefully scrutinized. Not only the level, but the structure of salaries would take account of market benchmarks, as well as performance effects. In public education, however, overall teacher compensation arises not out of a rational planning process, but rather emerges as an amalgam of different components or “silos,” reflecting pressures from different constituencies, legislative mandates, legacies from earlier vintages of collective bargaining agreements, and other institutional and political factors, with little or no consideration for overall efficiency. Neither starting nor senior salaries are market-based. In the United States, teacher pay is set by salary schedules that have evolved over decades of collective bargaining agreements or, in many nonbargaining states, legislative fiat. Base pay is augmented by various types of district or statewide salary supplements (e.g., coaching, career ladder). Deferred compensation in the form of retirement pay inhabits another silo altogether, with policy set by statewide pension boards often dominated by senior educators and administrators. Teacher compensation is the sum of all of these parts (plus fringe benefits such as health insurance, typically negotiated at the district level). There is no evidence that educator pay is market based or strategic in other developed nations. As compared to the U.S., teacher pay setting is usually more centralized, at a regional or prefectural level, often with differences by school level or type, but not market-driven.<sup>1</sup>

Concern over school performance and teacher quality is stimulating interest in more efficient and performance-oriented teacher compensation regimes. This, in turn, has stimulated research on the performance effects of teacher compensation and collective

<sup>1</sup> However, there is growing interest in market-based reforms of educator compensation. Experiments and pilot programs are under way in a number of countries. For surveys see [Sclafani and Tucker \(2006\)](#) and [Podgursky and Springer \(2007\)](#).

bargaining. This chapter provides a survey of several strands of this literature, with a focus on economic studies. Our discussion proceeds from a more aggregate, or “macro,” perspective on overall levels and trends in teacher compensation to a more disaggregated, or “micro,” discussion of the structure of teacher pay. First, we examine research on the overall level of teacher pay and possible quantity–quality tradeoffs with pay and staffing ratios. This is closely related to the issue of the overall decline in teacher quality associated with reduced labor market barriers for women. Then we turn our attention to the structure of teacher pay and the “single salary schedule,” which is the primary determinant of teacher salaries in the U.S., and consider other institutional features of the labor market that exacerbate or dampen the effects of these salary schedules. We then examine the incentives produced by teacher retirement benefit systems. Since teacher compensation is largely structured by collective bargaining, it is appropriate to conclude the survey with a review of the small, but important, literature on the effects of collective bargaining on resource allocation in K–12 education. Given the central role of teachers in school performance and of compensation in K–12 school spending, we conclude that educator compensation is a surprisingly undeveloped area of education policy research. However, research can only progress in this area if education authorities create “regulatory space” for experimentation with teacher compensation models and permit their evaluation.

## 2. STUDIES OF RELATIVE TEACHER PAY

There has been a lively debate about the overall level of teacher salaries and a corollary discussion as to whether teachers are “underpaid.” In the United States, this discussion has been related to the question of whether the elimination of labor market barriers for women (and the ensuing higher earnings opportunities) lowered the quality of the public school teaching workforce. The “crowding thesis” holds that, prior to advances in civil rights and anti-discrimination legislation, barriers to entry in other professions crowded well-educated and academically talented women into K–12 teaching positions. With the decline of discriminatory barriers in other professions such as accounting, management, law, and medicine, teachers who would have been pushed into teaching were now able to escape to other professions. In the absence of significant increases in relative pay for teachers, the relative quality of the teaching workforce fell.

One problem in examining long-term trends in teacher quality is that even rudimentary measures of teacher quality, such as test scores or academic credentials, are not available in a long time series. Several studies have taken up the empirical challenge of documenting the hypothesized secular decline in the relative quality of female teachers.<sup>2</sup> Several authors have made use of various waves of longitudinal studies to

<sup>2</sup> In theory, the same quality decline should have been observed in other “crowded” female dominated occupations such as nurses and librarians. We are unaware of any evidence in this regard.

examine long-term changes in the quality of the female teaching workforce. [Corcoran, Evans, and Schwab \(2004\)](#) draw on five different longitudinal surveys of high school graduation cohorts from 1957 to 1992 to document the decline in female teacher quality as measured by high school test scores. They find only a slight decline in the average academic quality of female teachers relative to the universe of female high school graduates. However, they find a substantial drop in the share of females in the highest academic quintile who become teachers. Interestingly, they find no such drop for male teachers. The female finding is replicated in [Hoxby and Leigh \(2004\)](#), who examine nine cohorts of the Recent College Graduates survey, spanning 1963 to 2000. They, too, find that the probability a new college graduate from the highest academic quintile (as measured by college selectivity) enters teaching falls from 20% to 4%—a much larger drop than any other quintile. [Bacolod \(2007a\)](#), examines several waves of the National Longitudinal Survey, and compares the probability of entry into teaching across different birth cohorts (1940–49 through 1960–69). She finds a sharp relative drop in the probability that high ability teachers (as measured by the Armed Forces Qualification Test, or AFQT) become teachers. (See also, [Bacolod \(2007b\)](#) for an analysis of further longitudinal data analysis.)

Although the sample sizes of teachers in each of these studies are modest, the findings are largely consistent with one another and are relatively robust to different measures of quality. Each of these studies find modest declines in the quality of teachers at the mean, but much sharper declines at the upper tails of the distribution. With the large increase in college attendance and completion rates for females between 1960 and 2000, the probability of a female graduate becoming a teacher declines over time, but the proportionate drop is greatest in the top ability quintiles. This is a nuanced version of the “overcrowding” thesis. Relative teacher quality at the median has not greatly declined. The major loss has been in the upper academic tail.

Given the paucity of data providing direct measures of teacher quality such as academic test scores, some researchers ([Hanushek and Rivkin \(1997\)](#); [Lakdawalla \(2006\)](#); [Stoddard \(2003\)](#)) treat relative teacher pay (e.g., teacher pay relative to all college graduates) as a measure of relative teacher quality. The most reliable of these pay measures is annual earnings data from the Decennial Census. Using these Census data, [Hanushek and Rivkin \(2006, figure 1\)](#) compute the percent of college graduates earning less than the average teacher. For women, this percentage fell from roughly 55% in 1950 to 45% in 2000, with most of this decline occurring from 1950 to 1970. A similar pattern occurs for men, although they start from a much lower base. Note that these calculations of annual relative earnings take no account of current and deferred benefits, or annual hours of work, two issues we will consider in more detail below.<sup>3</sup>

The coincidence of the decline in relative teacher pay for females and the decline in the relative academic quality of teachers naturally leads many researchers to infer a

<sup>3</sup> [Leigh and Ryan \(2008\)](#) document a similar decline in academic skills for Australian teachers that coincides with a decline in teacher relative pay.

causal relationship from the former to the latter. [Hoxby and Leigh \(2004\)](#) provide a more comprehensive analysis of this issue by examining the roles of both the level of teacher pay relative to nonteacher earnings and the changes in dispersion of teacher pay within teaching. The insight here is that a high ability woman contemplating entry into a profession is likely less concerned with pay at the median than at the upper deciles. Thus, Hoxby and Leigh estimate an occupational choice model that decomposes the relative pay variable into several components: median female teacher pay, the dispersion of female teacher pay, male–female pay in nonteaching, and a trend (male) in nonteaching earnings. They highlight a factor often ignored in relative teacher pay discussion—a large compression of intrastate teacher pay that coincided with the rise of teacher collective bargaining. This had the result of producing a large compression of pay between the highest and lowest ability quintile of teachers. In their decomposition, they distinguish the “push” of wage compression from the “pull” of relative pay outside of teaching. They find that roughly 80% of the decline in the share of high ability candidates entering teaching is explained by the “push” of intrastate compression in teacher pay between 1963 and 2000.<sup>4</sup>

Several studies examine trends in earnings and measures of teacher academic quality in the U.K. [Nickell and Quintini \(2002\)](#) examine public sector pay and workforce quality from 1975 through 1999 based on two longitudinal surveys. They find clear evidence of slippage in the relative pay of both male and female teachers in the overall pay structure. This coincides with a significant decline in the level of academic ability for male teachers but not for female teachers. [Chevalier, Dolton, and McIntosh \(2007\)](#) provide a wider window on teacher quality by examining survey data on graduating cohorts of college students from 1960 through 1995 (surveyed six to seven years after graduation). They, too, find a larger quality decline for females. However, by 2002 (i.e., the 1995 cohort) teacher quality had actually improved vis-à-vis nonteachers.<sup>5</sup>

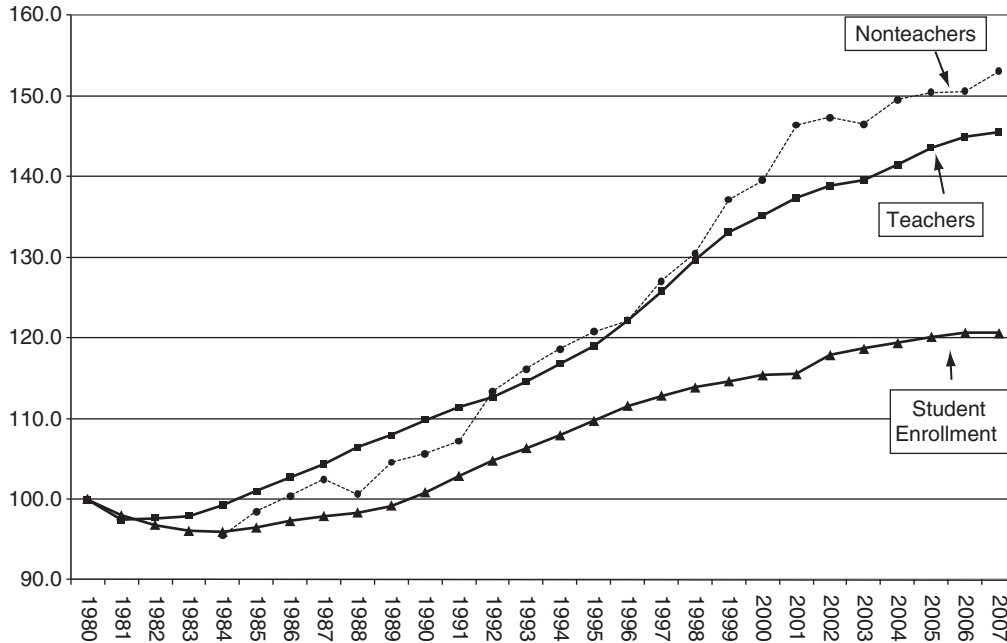
### 3. QUANTITY VERSUS QUALITY TRADEOFFS

Given that pay is set by governments and not by markets, a question arises as to how school districts have chosen to trade off the level of teacher pay with staffing ratios (i.e., the student–teacher ratio).<sup>6</sup> When spending per student rises by 10%, other things being equal, school administrators can raise teacher pay by 10% and hold staffing ratios constant, hold teacher pay constant and lower staffing ratios by 10%, or any

<sup>4</sup> Leigh and Ryan (2008) attempt a similar decomposition for Australian teachers over a smaller time span, 1983–2003. As noted in fn. 3, they find a similar decline in high ability males and females entering teaching. In their decomposition, relative pay rather than pay compression within teaching mattered much more. This is primarily due to the fact that little pay compression within teaching occurred over this time interval.

<sup>5</sup> See also [Dolton \(2006\)](#). International data on relative teacher salaries are reported in [OECD \(2001, 2009\)](#).

<sup>6</sup> Of course, if staffing ratios fall and relative teacher pay falls, applicant queues will fall as well. Whether, and to what extent, this lowers teacher quality is taken up below.



**Figure 5.1** Student enrollment, teacher and nonteacher employment in U.S. public schools: Fall, 1980 to Fall, 2007. *Source:* U.S. Department of Education. National Center on Education Statistics. *Digest of Education Statistics*. Various years.

combination of the two that adds up to 10%. [Figure 5.1](#) presents data for U.S. staff and enrollments in public schools, indexed to Fall 1980 levels. It clearly shows the dip in enrollments by the mid-'80s and the subsequent rise as the baby boom echo entered the school system. By 2007 enrollments had grown by 21%. The upper two lines show the level of teacher and nonteacher employment. Clearly the growth in staff far outstripped the growth in enrollments. Teacher employment grew by 46%, nonteacher employment grew by 53%, and the student-teacher ratio fell from 18.7 to 15.7 over the period. Over the same period, real spending per student grew on average by 2.3% per year. If the staffing ratio had been held constant, real teacher compensation could have grown by 78% over this period and would have produced an average 2007 teacher salary of \$78,574. In fact, teacher salaries grew by only 7% over this period, and the average teacher salary was \$52,578.<sup>7</sup> This is not a phenomenon unique to the U.S. ([U.S. Department of Education \(2009\)](#)). [Lakdawalla \(2006\)](#) presents data showing that student-teacher ratios have been falling at least since the 1950s in all of the major industrial nations.

<sup>7</sup> Our choice of 1980 as a benchmark is benign. [Hanushek \(1986, table 3\)](#) shows that the trend toward declining student-teacher ratio was underway at least several decades earlier—falling from 25.8 in 1960 to 19.0 by 1980.

This human resource policy on the part of school districts is perplexing, especially given complaints about low teacher pay and “teacher shortages” that have occurred in the U.S. and abroad. The universality of this trend begs parochial explanations. Several researchers have proposed economic explanations for this phenomenon. [Flyer and Rosen \(1997\)](#) argue that individualized attention by school staff and parent household time are substitutes in consumption. As family incomes and the shadow value of females’ time rise, households substitute schooling for mother’s time. They examine state level data and find that declines in the student-teacher ratio are positively associated with increases in the labor force participation of women.<sup>8</sup> However, we are aware of no data suggesting that more direct measures of substitutes for a mother’s time, such as the length of the school day or school year, rose over time or in response to higher female labor force participation rates. [Stoddard \(2003\)](#) and [Lakdawalla \(2006\)](#) locate an explanation in K-12 education production. Rising skill premia economy-wide have increased the price of academically-skilled teachers. However, the relative productivity of academically skilled teachers in the K-12 education sector has not risen at the same rate. Thus, schools rationally substitute unskilled for skilled teachers and quantity over quality.

Anticipating our discussion of collective bargaining below, theories of “efficient contracts” in the general labor economics literature may also shed light on this phenomenon. In these models, unions value both higher earnings and more jobs and bargain to an efficient contract with employers that involves more jobs but lower wages as compared to a simple monopoly model ([Ashenfelter and Brown \(1986\)](#)).<sup>9</sup>

A common feature of the above analyses is the assumption of efficient, cost-minimizing behavior on the part of public school administrators. However, public schools have considerable monopoly power in local markets, and public school administrators operate in a political environment. Jobs are a reward that school boards and superintendents can distribute to purchase votes or otherwise expand political influence, which may lead public sector employers to favor more labor intensive production. Union dues income also rises with employment.<sup>10</sup> A public choice approach seems fruitful, but we are unaware of studies that have developed this line of inquiry regarding school staffing ratios.<sup>11</sup>

<sup>8</sup> However, there are no data suggesting that the school day or school year have increased over time.

<sup>9</sup> [Ehrenberg and Smith \(1991, p. 494\)](#) note express skepticism about the general relevance of these models, but note that teacher union contracts are one of the few examples where the union bargains over both earnings and employment (i.e., maximum class size).

<sup>10</sup> Teacher union dues in the United States are in dollars and not a percent of salaries. Thus an increase in dues revenue that arises from increases in teacher employment is automatic, whereas an increase arising from higher salaries requires a vote of the membership to raise per capita dues. This provides an incentive for union officials to favor lower staffing ratios over higher salaries. [Hoxby \(1996\)](#) finds a negative effect of teacher unionization on student-teacher ratios.

<sup>11</sup> [Moe and Chubb \(2009\)](#) provide an extensive discussion of teacher union efforts to resist adoption of computer-based instruction and distance learning technologies.



#### 4. COMPARING TEACHER AND NONTEACHER COMPENSATION

As noted above, many researchers have examined the level and trend of teacher and non-teacher earnings (e.g., [Hanushek and Rivkin, 1997](#); [Stoddard, 2003](#); [Allegretto, et al., 2004](#)). Static or dynamic comparisons of salaries or compensation between teachers and other professionals present challenges. The implicit assumption is that the remuneration gap, however measured, is the relevant price for an individual considering teaching versus another career. Yet the differences in some pecuniary and nonpecuniary factors between teaching and other careers are large, and may not be stable over time, from one cohort to the next, or over a work career. The most obvious comparability problem concerns the much smaller number of annual work hours in teaching as compared to other professions. Data from the Bureau of Labor Statistics finds that the work week for teachers (on site) is considerably shorter than that for other professionals (37.1 hours for public school teachers versus 40.7 for management occupations in the private sector, [U.S. Department of Labor \(2008, tables 4 and 6\)](#)). A much bigger difference, however, is the annual weeks of work. The typical teacher contract in the U.S. calls for roughly 185 days of work, or only 37–38 annual weeks. Virtually all other professionals (except college professors) have 52-week contracts. Even adjusting for the fact that other professionals have paid time off and summer vacations, annual work hours (on site) are much lower for teachers ([Podgursky and Tongrut \(2006\)](#)). Data from 2006 find that annual hours on site for teachers average 1411 versus 2116 for managers—a gap of 705 hours annually ([U.S. Department of Labor \(2008\)](#)). At a minimum, this yields major savings on day care for women with young children.<sup>12</sup> Moreover, this annual hours gap may not have been stable over the longer term either, since the mix of nonteacher professions constituting the relevant opportunity set for females has shifted over time toward more time-intensive professions such as management, medicine, and law, as compared to clerks, librarians, and retail sales occupations.<sup>13</sup>

Teaching will tend to attract individuals who value short and predictable hours of work on site and long summer vacations. Women with young children or who plan to have children fit that description. In fact, Census data show that teachers have more (own) children than do other college-educated women in the workforce ([Podgursky \(2003\)](#)). Thus, it is not surprising that teaching is a female-dominated occupation and, unlike many other professions, increasingly so. Between 1961 and 2001, the most recent national data available in this series, the female share increased from 69% to 79% ([U.S. Department of Education \(2007, table 69\)](#)).

<sup>12</sup> The argument is sometimes made that work at home by teachers offsets this difference. The most extensive U.S. data on household time allocation is the American Time Use Survey (ATUS). A recent ATUS study examined work time allocation for full-time teachers and other professionals. [Krantz-Kent \(2008\)](#) found that more teachers were likely to report work at home during a weekday than other professionals. However, combining home and on-site work, teachers worked 24 minutes per weekday less than other professionals, and 42 fewer minutes on Saturdays. On Sundays teachers and other professionals worked about the same amount of time (roughly one hour).

<sup>13</sup> Nor is there evidence that most teachers who leave the profession earn more in their new occupations. See [Stinebrickner, Scafani, and Sjordquist \(2002\)](#), [Podgursky, Monroe, and Watson \(2004\)](#), [Goldhaber and Player \(2005\)](#).

Taylor (2008) highlights another important factor often overlooked in comparisons of teacher to nonteacher pay. She conducts an analysis of annual earnings gaps between teachers and nonteacher college graduates (with a rough control for annual hours of work). Taylor notes that teachers are spread throughout the country roughly in proportion to the population (i.e., wherever there are children). This contrasts with many professions routinely compared to teaching (e.g., medicine, management, engineering, accounting, advertising), which are more heavily concentrated in urban areas. She finds that, as compared to other college-educated workers, teachers are more heavily concentrated in (low-wage) rural areas. As a consequence, estimates of teacher–nonteacher earnings gaps are biased upward if detailed controls for locale type are omitted. Taylor reports an 8% teacher–nonteacher gap if geographic controls are omitted. This falls to just 5% when geographic controls are included. Unfortunately, she includes private school teachers in her definition of “teachers.” Omitting private school teachers would nearly extinguish this gap.

The discussion above focuses on comparisons of teacher and nonteacher *salaries*. However, fringe benefits account for a large and growing share of professional compensation. Any attempt to understand the effects of compensation on recruitment and retention of teachers must take account of current and deferred benefits. While anecdotal evidence suggests that the fringe benefit package for public school teachers is relatively more generous than for comparable private sector professionals, until recently reliable national data on this issue were lacking. The Bureau of Labor Statistics of the [U.S. Department of Labor](#) has for some time been collecting data on employee benefit costs as part of its employer-based National Compensation Survey.<sup>14</sup> However, only recently have they begun to release some of these data at a level of disaggregation that would identify public school teachers.

[Table 5.1](#) reports employer contributions for fringe benefits as a percent of earnings for teachers and private sector management and professionals. These are quarterly data starting in March 2004, the first quarter in which BLS released them, to the most recent available, March 2009. The BLS reports these on an hourly basis. The first thing to note is that the hourly pay for managers and professionals is roughly comparable to that of teachers. The major difference in annual salaries arises from a difference in annual hours of work. The BLS reports that the on-site work hours of public K–12 teachers are only 67% those of managers (i.e., 1411 versus 2116 hours). This hours gap is the primary explanation for the earnings gap.

Our focus, however, is on fringe benefits as a percent of salary. The BLS data are aggregated into three broad groups: insurance (primarily health insurance for current employees), retirement, and legally required (primarily Social Security). Comparisons of public school teachers and private sector professionals are complicated by the fact that roughly 30% of teachers are not covered by Social Security. For these teachers,

<sup>14</sup> The NCS is an establishment survey of employee salaries, wages, and benefits. It is designed to produce reliable earnings and benefit estimates at local levels, within broad regions, and nationwide (<http://www.bls.gov/ncs/methodology.htm>).

**Table 5.1** Salary and fringe benefits: Teachers and private-sector managerial, professional, and technical jobs

March 2004	Teachers		Mgmt & Prof.	
	\$/hr	%	\$/hr	%
Salary	\$35.92	100.00	\$33.40	100.00
Insurance	\$4.08	11.36	\$2.43	7.28
Retirement and legally required	\$4.99	13.89	\$4.34	12.99
Total benefits	\$9.07	25.25	\$6.77	20.27
March 2009				
	\$/hr	%	\$/hr	%
Salary	\$39.75	100.00	\$40.30	100.00
Insurance	\$5.77	14.52	\$3.18	7.89
Retirement and legally required	\$6.89	17.33	\$5.32	13.20
Total benefits	\$12.66	31.85	\$8.50	21.09

Source: U.S. Department of Labor. Bureau of Labor Statistics. 2009, 2004.

then, legally required contributions are lower. However, because they are not covered by Social Security their public pension plans are more generous (more on this below). For this reason we have combined legally required and employer retirement contributions. The key point is that in 2004, the fringe benefit rate for public school teachers was five percentage points higher for public school teachers, and by 2009 the gap had widened to 10%. Thus, fringe benefits as a percent of salary are larger for teachers, and this gap has not been stationary, but widening, at least since 2004.<sup>15</sup>

#### 4.1 Public–private teacher compensation

In areas other than K–12, public sector personnel managers often use private pay and benefits as a benchmark in setting government pay. In public administration, it is commonplace to undertake surveys comparing government and private sector pay. Indeed, one important function of compensation data collected by the Bureau of Labor Statistics is to provide private-sector as well as state and local benchmark data for Federal

<sup>15</sup> As noted above, the OECD now routinely reports international relative salary data for teachers, typically normed by GDP per capita (e.g., OECD (2009)). The U.S. ranks low in comparison to other developed countries by these measures, although spending per student ranks high. In part this reflects the low staffing ratios in the U.S. However, it should also be kept in mind that the fringe benefits for U.S. teachers compare very favorably to private sector employees. Other developed nations have national health insurance schemes, while the U.S. does not. This makes teacher health benefits relatively attractive. As noted in the text, the retirement benefits in relation to salary on average are also much higher for teachers.

wage-setting. Since 12% of teachers are employed in private schools, one might expect private sector compensation data to play a larger role in policy discussions concerning the adequacy of public school teacher pay. The two sectors compete for teachers, and mobility between the two is extensive. Data from the 1999–2000 School and Staffing Survey (SASS), national surveys of schools and teachers undertaken at regular intervals by the U.S. Department of Education's National Center for Education Statistics (NCES), show that 36% of full-time private and 13% of full-time public school teachers report some teaching experience in the other sector (Podgursky (2003)).

This cross-sector experience is hardly surprising since there are very few occupations or professions in which employment is entirely segmented in one or the other sector. It is not uncommon for many professionals to move from public to private sector employment over a work career, or from for-profit to nonprofit firms within the private sector. However, in spite of this mobility, comparisons of pay and benefits between public and private schools play little role in education policy discussions. There are legitimate objections to gross public–private teacher pay comparisons. First, many private schools have a religious orientation and are staffed by teachers of the same religious denomination. To the extent that such schools are advancing a religious mission, they and their teachers are not comparable to public K–12 schools. Second, private schools are generally more selective in admissions than public schools and, on average, have students with higher socio-economic status. To the extent that this results in better-behaved and more academically-motivated students in private school classrooms, it makes for a more attractive teaching environment. However, when religious-oriented and special emphasis (e.g., Montessori, special education) schools are eliminated from the private school sample, and public school teachers are limited to those in suburban low poverty districts, average private school pay is still well below that of the public schools at every level of experience. Benefit levels for private school teachers are lower as well (Podgursky (2003)). In spite of the lower pay and benefits, academic measures of teacher quality as well as principal evaluations are higher in private schools (Ballou and Podgursky (1998)).

## 5. TEACHER PAY AND STUDENT ACHIEVEMENT

An important strand of research on teacher compensation concerns the relationship between teacher pay and student performance. Surveys of the early education production function literature found little evidence of a strong positive effect of teacher pay on student achievement. Of 118 estimates reported in the literature, 73% were statistically insignificant, 20% were positive and significant, and 7% were negative and significant (Hanushek and Rivkin (2004)). A subset of “value-added,” single state studies had 17 estimates of earnings. Of these, 82% were statistically insignificant and 18% were positive and significant. Two recent econometric studies of teacher effects cast further doubt on a positive wage effect. Jacob and Lefgren (2004) find no relationship between teacher pay and teacher performance in

a large urban school district, and Hanushek, Kain, O'Brien, and Rivkin (2005) report no relationship between teacher productivity and changes in teacher pay for teachers who left a Texas school district. Contrary evidence is found in Loeb and Page (2000), who examine data from multiple Census years aggregated to the state level. They estimate the effect of changes in teacher relative pay on changes in dropout rates and college attendance and find significant effects. They estimate similar difference-in-difference models for California school districts and get comparable results.<sup>16</sup>

Ballou and Podgursky (1997) explore evidence concerning changes in teacher salaries and teacher quality during the 1980s. This period brackets the watershed year of 1983 in which President Ronald Reagan's National Commission on Excellence in Education issued its provocative report, *A Nation at Risk*. The furor in the wake of that report set in motion many efforts at education reform, along with substantial increases in spending per student and in relative teacher pay. However, there was wide variation across states with regard to pay increases. While nearly all measures of teacher quality rose over this period, these authors find no evidence that states with above average increases in teacher pay had above average increases in teacher quality, however measured. They identify a variety of structural factors in teacher labor markets such as tenure and single salary schedules, which dampen a quality response. Ballou (1996) finds no evidence that teachers with stronger academic credentials such as in-field majors or graduation from a selective college are favored in employer hiring decisions.<sup>17</sup> Ballou and Podgursky (1995, 1997) show that this weak return to quality, combined with other structural rigidities in the market for public school teachers, may actually discourage candidates from entering job queues in response to across-the-board pay increases.<sup>18</sup> Simulations over a wide range of parameters suggests that the quality elasticity of across-the-board pay increases, given such poor screening by employers, will be very low and possibly even negative.

## 6. STRUCTURE OF TEACHER COMPENSATION

### 6.1 Institutional framework: Single salary schedule

Salary schedules for teachers are a nearly universal feature of public school districts. Pay for teachers in public school districts is largely determined by these schedules. In large school districts the pay of thousands of teachers in hundreds of schools—from

<sup>16</sup> In general, aggregated studies have tended to find more positive effects of "inputs" on student achievement outputs than disaggregated student-level panel studies. For a discussion of this point see Hanushek, Rivkin, and Taylor (1996).

<sup>17</sup> Ballou finds that graduates from more selective institutions (conditional on certification) file as many applications as nonselective applicants, but are no more likely to be hired. Nor does he find evidence that "choosiness" by the former in applications is the explanation. Education majors are favored over academic majors as well.

<sup>18</sup> If all types of teachers of all quality types enter the labor market in response to an increase in relative pay, and schools are indiscriminating in either their hiring or firing, then the probability of getting a "good" teaching job for a high quality teacher may actually fall. This can act to lower the high quality share of the applicant labor pool, and hence average teacher quality.

kindergarten up to secondary teachers in math and science—is set by a single district schedule. The nearly universal use of salary schedules in public school districts is seen in data from the 1999–00 SASS. Ninety-six percent of public school districts accounting for nearly 100% of teachers report use of a salary schedule (Podgursky (2007)).

Table 5.2 provides an example of a salary schedule, in this case for Columbus, Ohio public school teachers. The rows and columns refer to years of experience and levels of teacher education, respectively. The pay increases associated with higher levels of education may be for training not associated with a teacher's actual classroom assignments. For example, it is not uncommon for teachers to earn remuneration for graduate credits and degrees in education administration while they are still employed full time as classroom teachers.

These teacher salary schedules are sometimes referred to as “single salary schedules,” a term reflecting their historical development. Kershaw and McKean (1962) note that there were three phases in the historical development of teacher pay regimes. The first phase, which lasted roughly until the beginning of the twentieth century, saw teacher pay negotiated between an individual teacher and a local school board. As school

**Table 5.2** 2007–08 salary schedule for Columbus, Ohio public school teachers

Years Experience	Pre-License Bachelor's Degree	Bachelor's Degree	150 Hours and Bachelor's Degree	Master's Degree	Master' Degree Plus 30 Semester Hours
0	29,313	36,779	37,844	40,788	44,220
1	30,490	38,251	39,353	42,406	43,252
2	31,703	39,795	40,935	44,098	44,981
3	32,991	41,376	42,553	45,863	46,746
4	34,278	43,031	44,282	47,702	48,622
5	35,676	44,760	46,047	49,615	50,571
6		46,525	47,886	51,601	52,594
7		48,401	49,799	53,661	54,727
8		50,350	51,785	55,794	56,897
9		52,337	53,844	58,037	59,177
10		54,433	56,014	60,354	61,531
11		56,640	58,258	62,782	63,995
12		58,883	60,575	65,283	66,570
13		61,237	63,002	67,894	69,218
14		63,701	65,540	70,616	72,013

Source: Columbus Education Association.

districts consolidated and grew in size, this type of salary determination became increasingly unpopular with teachers. With consolidation and growth, the monopoly power of school districts in the labor market increased, and charges of favoritism were common. In response to these concerns, there was gradual movement toward the use of salary schedules that differed by grade level and position. “Typically the salaries differed from grade to grade, and high school salaries would inevitably be higher than those at the elementary level.” (Kershaw and McKean (1962, p. 22)).

The third and current phase began in the 1920s and accelerated in WWII and the immediate post-war period. This is characterized by what is termed the “single salary schedule”—the current norm. An education commentator writing in the 1950s noted that “the distinguishing characteristic of the single salary schedule is that the salary class to which the classroom teacher is assigned depends on the professional qualifications of the teacher rather than the school level or assignment.” Kershaw and McKean write, “The single salary schedule was regarded as bringing a feeling of contentment and *professionalism*. A teacher would no longer be an *elementary* teacher, but a *teacher*, a member on equal footing of the profession that included all teachers.” By 1951, 98% of urban school districts employed the single salary schedule (Kershaw and McKean (1962, pp. 23, 25); see also Lieberman (1956, pp. 391–393)).

Since elementary school teachers were nearly all women whereas high school teachers were largely male, early struggles for a single salary schedule were seen by some commentators as an important part of feminist struggles for pay equity (Murphy (1990)). Eventually, the unification of schedules for elementary and secondary school teachers was embraced by the National Education Association as well as the American Federation of Teachers and embedded in collective bargaining agreements and, in some cases, state legislation.

These salary schedules for teachers contrast with the situation in most other professions. In medicine, pay of doctors and nurses varies by specialty. Even within the same hospital or HMO, pay will differ by specialty field. In higher education there are large differences in pay between faculty by teaching fields. Faculty pay structures in most higher education institutions are flexible. Starting pay is usually market-driven, and institutions will often match counter-offers for more senior faculty whom they wish to retain. Merit or performance-based pay is commonplace. Ballou and Podgursky (1997) and Ballou (2001) report generally similar findings for private K-12 education. Even when private schools report that they use a salary schedule for teacher pay, payments “off schedule” seem commonplace.<sup>19</sup>

<sup>19</sup> These salary schedules remain the primary determinant of U.S. teacher pay. As we will note below, some districts have begun to experiment with performance or market-based adjustments. This has been encouraged by several federal initiatives discussed below. Ballou (2001) finds that even when public schools report the use of performance bonuses, their effect on pay for recipients is very small. This is also seen in direct examination of performance pay plans actually enacted by districts (Podgursky and Springer (2007)).

Rigid salary schedules might have some efficiency rationale if the factors rewarded, teacher experience and graduate education, were strong predictors of teacher productivity. However, surveys of the education production literature find no support for a positive effect of teacher graduate degrees. [Hanushek \(2003\)](#) reports that, of 41 “value-added” estimates of the effect of education levels on teacher effectiveness (primarily Master’s degrees), not a single study found a statistically significant positive effect. In fact, 10 of the studies found negative effects. Furthermore, teacher experience has little effect beyond the first few years ([Hanushek and Rivkin \(2004\)](#)).

If wages are not allowed to clear the labor market, then the market will clear in other ways (“You can’t repeal the law of supply and demand.”) We now consider some consequences of teacher salary schedules. First, the single salary schedule suppresses pay differentials by field. All teachers in a district with the same experience or education level earn the same base pay. Thus, a 2nd grade teacher will earn the same pay as a high school chemistry teacher. Given the major differences in human capital investments by teaching field (e.g., elementary education versus secondary physical science) it is almost certainly the case that nonteaching opportunity earnings differ greatly as well.

National data on teacher recruiting in [Table 5.3](#) bear this out. These data are from the 1999–00 and 2003–04 SASS. These are assessments of market conditions by administrators who have recently recruited teachers in these fields. Respondents were asked to rate how difficult or easy it was to fill a vacancy in the field. In 2003–04, 75% of school administrators reported that it was “easy” to fill vacancies in elementary education, with fewer than 4% reporting it “very difficult” or that they could not fill the position. The situation changes dramatically when we turn to math, science, and special education, where a large share of districts reported it was “very difficult” or they were unable to fill a vacancy. Data in [Table 5.4](#) show that this pattern also prevailed even in high poverty schools. While low poverty schools reported greater ease in recruiting, nonetheless 63% of high poverty schools reported it easy to fill vacancies in elementary education.<sup>20</sup>

In a market with flexible wages, earnings of elementary teachers would fall relative to science, math, and special education teachers. However, district salary schedules do not permit this relative wage adjustment to occur. Thus, the market “clears” in terms of quality rather than price. Numerous reports have documented the extent of “teaching out of field,” or teachers practicing with substandard licenses in the fields of science, math, and special education, while over 95% of elementary school teachers are fully licensed in elementary education ([U.S. Department of Education \(2004b\)](#)).

<sup>20</sup> Further evidence on this point may be found in [Goldhaber and Player \(2005\)](#), who analyze the nonteaching earnings of former teachers by broad teaching field. Elementary school teachers on average earned less than secondary school teachers, and among former secondary teachers, those who taught in technical fields earned more than those in nontechnical fields.



**Table 5.3** Recruitment difficulties by teaching field

1999–00	How easy was it to fill the vacancy?			
	Easy	Somewhat difficult	Very difficult	Could not fill
Elementary	67.6%	26.2%	5.5%	.7%
Social studies	70.0	24.7	4.7	.6
ELA	56.5	33.2	9.5	.8
Math	29.0	34.8	33.3	2.8
Biological science	34.0	38.5	26.2	1.3
Phys. science	31.7	35.7	30.2	2.4
Spec. ed.	25.5	35.8	32.8	5.8
2003–04				
Elementary	75.1	21.1	3.3	.5
Social studies	71.5	24.4	3.6	.4
ELA	59.0	32.9	7.1	1.1
Math	33.3	37.8	25.5	3.4
Biological science	34.9	44.2	19.0	1.9
Phys. science	34.6	37.7	25.3	2.4
Spec. ed.	29.1	41.8	25.7	3.5

Source: Schools and Staffing Surveys, various years.

**Table 5.4** Recruitment difficulties by teaching field in high- and low-poverty schools

2003–04	Easy	Somewhat difficult	Very difficult	Could not fill
Elementary				
Low poverty (bottom 25%)	85.4%	13.0%	1.4%	.2%
High poverty (top 25%)	62.7	29.0	6.9	1.4
Math				
Low poverty (bottom 25%)	37.4	40.1	21.6	1.4
High poverty (top 25%)	31.1	29.4	32.5	7.1

Source: 2003–04 Schools and Staffing Surveys.

Policy makers and researchers tend to treat K–12 teachers as a single occupation. From a labor market perspective, this is probably not a very useful aggregation. The training, working conditions, and nonteaching opportunities of a 2nd grade teacher

are very different from those of a high school chemistry teacher. Yet, for purposes of policy and in many research studies they are grouped into a single occupation: teachers. This is abetted in part by the collective bargaining process, which puts all teachers in a school district, regardless of the level of school or teaching field, into a single “bargaining unit.” However, single salary schedules are the norm even in nonbargaining states.

A second problem with the single salary schedule is that it suppresses differentials by schools within districts. In larger urban districts dozens or even hundreds of schools are covered by the same salary schedule. The working environments for teachers often vary greatly between these schools. Some may even be dangerous places to work, whereas other schools are more pleasant and attractive worksites. Often teachers in the less desirable schools will be able to use their seniority to transfer to a more pleasant school, or they may simply quit at a higher rate. In either case, the result is that students in high poverty schools will on average have less experienced (and less educated) teachers. Because the salary schedule assigns lower pay to teachers with less experience within a school district, an unintended consequence of a district-wide salary schedule is lower spending per student in high-poverty schools (Roza and Hill, 2004; Roza, et al. (2007); Iaterola and Stiefel (2003)). High poverty schools will also have relatively more novice or inexperienced teachers. One fairly consistent finding in the “teacher effects” literature is that students taught by novice or inexperienced teachers have lower achievement gains than students with more experienced teachers (e.g., Hanushek, Kain, O’Brien, and Rivkin (2005); Aaronson, Barrow, and Sander (2007); Boyd, et al. (2006)). Lankford, Loeb, and Wyckoff (2002) examine the allocation of teachers in New York City and find that children in high poverty schools are more likely to be exposed to novice teachers. Again, this is an intra-NYC allocation problem—one that is clearly exacerbated by a uniform salary schedule across all schools. Podgursky (2009) examines an administrative data set with the universe of public elementary schools in Missouri. He finds that children in high poverty schools are more likely to be exposed to novice teachers, but this is entirely due to the intra-district allocation of teachers. To return to our market-clearing thesis, if the attractiveness of working conditions varies among schools within a district, then equalizing teacher pay disequalizes teacher quality. In order to equalize teacher quality, one needs to disequalize teacher pay.

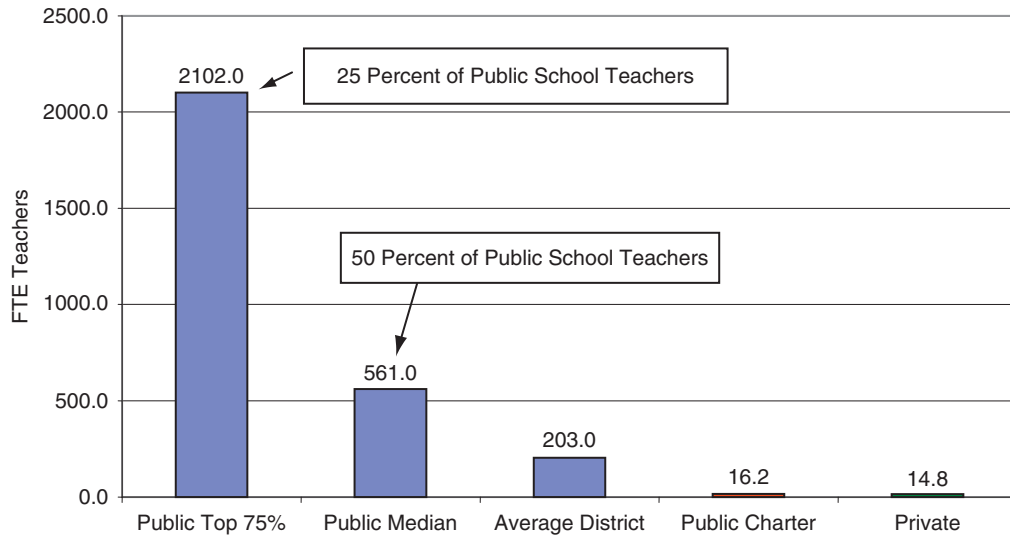
A final consequence of single salary schedules is the equalization of pay regardless of teacher effectiveness. A consistent finding in the teacher value-added literature is that there is a very large variation in teacher effectiveness (e.g., Rivkin, Hanushek, and Kain (2005); Aaronson, Barrow, and Sander (2007)). Even within the same school building, some 4th grade teachers are much more effective at raising student achievement than other 4th grade teachers. Some teachers are harder working and elicit greater effort from students than others. Some teachers may be “burnt out” and simply putting in time until retirement (more on pension system incentives below). The single salary schedule suppresses differences between more effective and less effective teachers (however defined). Rewarding more effective teachers on the basis of performance would have two important consequences. The first is a motivation effect. Incumbent

teachers would have an incentive to work harder to raise whatever performance measure is rewarded. In addition, over the longer term, performance pay would have a selection effect. It would draw teachers into the workforce who are relatively more effective at meeting the performance targets and would help retain such teachers as well (Podgursky and Springer (2007)). Equalizing teacher pay among teachers of different effectiveness lowers the overall quality and performance of the teaching workforce.

## 6.2 Confounding factors: Tenure and size of wage-setting units

The costs associated with teacher salary schedules are exacerbated by two other features of K-12 human resource policy: tenure and the size of wage-setting units (i.e., districts). Consider first the effect of teacher tenure. Even if experience *per se* does not raise a teacher's effectiveness, in principle a seniority-based wage structure might be efficient if less effective teachers are weeded out over time through contract nonrenewal. However, personnel policies in traditional public schools are not likely to produce such an effect. Teachers in traditional public school districts receive automatic contract renewal (tenure) after two to five years on the job. After receiving tenure, it is very difficult to dismiss a teacher for poor job performance, a finding that has been widely documented (Bridges (1992); Hess and West (2006)). Thus, the presence of teacher tenure laws and collective bargaining language, which further hampers dismissal of low-performing teachers, makes the economic costs associated with single salary schedules even greater.

Another factor that increases the cost of rigid district salary schedules is the size of wage-setting units. Other things equal, the larger the size of the unit, the greater the economic cost of rigid salary schedules. The wage-setting unit in private and charter schools is typically the school, whereas in traditional public schools wage-setting is at the district level. In fact, most personnel policy concerning teachers—the level and structure of teacher pay, benefits, and recruiting—is centralized at the district level in traditional public schools. This policy has two effects. First, it makes the market for teachers less flexible and less competitive. Rather than 10 “districts” each setting pay for 10 schools, a single employer sets pay for 100 schools. At least the 10 smaller districts could compete with one another and adjust their schedules to meet their own internal circumstances. A second consequence of large wage setting units is that the wage-setting process becomes more bureaucratic and less amenable to merit or market adjustments (Podgursky (2007)). Figure 5.2 illustrates the dramatic differences in the size of the wage and personnel units in traditional public and private schools. There are approximately 15,000 public school districts in the U.S. However, the size distribution of these districts in terms of teacher employment is very highly skewed. As a consequence, most teachers are employed in large school districts. One quarter of teachers in traditional public schools are employed in districts with at least 2100 full-time equivalent (FTE) teachers, and half of traditional public school teachers are in districts with at least 561 FTE teachers. Thus, the typical teacher finds herself in a large organization with standardized, bureaucratic wage-setting.



**Figure 5.2** Size of wage-setting units in traditional public, charter, and private schools. *Source:* Podgursky (2007).

By contrast, the average charter school—an independent employer—employs just 16 FTE teachers, barely larger than the average private school (15 FTEs).

In principle, public school districts need not be so bureaucratic. They could adopt more decentralized systems of personnel policy, give school principals more control over teacher recruitment and pay, and adopt more of a team model. The fact that one observes wage-setting in private schools, including Catholic dioceses, following a more decentralized model suggests that there are few efficiency gains to be had from centralization of compensation. However, this highlights an important difference between traditional public and charter or private schools. The percent of teachers covered by collective bargaining agreements in charter schools is far lower than in traditional public schools; for private schools, it is virtually nil. Tabulations from the 1999–00 Schools and Staffing Surveys find that 70% of public school districts, employing 73% of teachers, have collective bargaining agreements covering their teachers. This contrasts with just 14% of charter schools (employing 18% of charter school teachers).<sup>21</sup> The absence of a binding collective bargaining agreement is an important source of personnel flexibility in private and charter schools. Teacher unions in general have been opposed to more flexible market or performance-based pay systems, although there are exceptions such as the widely-publicized

<sup>21</sup> The Schools and Staffing Surveys does not ask a collective bargaining question of private schools. However, we are aware of no private schools organized by the major teaching unions. Some Catholic dioceses negotiate agreements with Catholic teacher associations. However, these agreements are far less restrictive than anything negotiated in public schools, and Catholic school teachers do not have tenure.

Denver performance pay plan. However, even in Denver, the plan is district-wide and not school-based (Podgursky and Springer (2007)). Collective bargaining laws, by defining the district as the “appropriate bargaining unit,” have tended to push personnel policy and wage-setting to the district level and lock them there.

These types of salary schedules seem to be the norm in most OECD countries. However, some differences are apparent. It is not uncommon for secondary teachers to be on separate and higher salary schedules than primary teachers (Sclafani and Tucker (2006)). Another interesting effect arises as a consequence of the importance of rigorous high-stakes exams for college and high school placement. Some Asian countries have seen the development of a private, after-school market in test preparation. The most widely discussed is Japan, which has a private system of “juku” schools. Hagwon schools in South Korea are a similar phenomenon. While we are unaware of any systematic data on this, anecdotal evidence suggests that these schools are heavily staffed by moonlighting public school teachers. We do know that parents spend a good deal of money on them. Thus, while the public system has wages set bureaucratically, the private test-prep market is competitive and will likely tend to reward the most effective teachers in the key tested areas. Public school teachers and college students, contemplating their teaching and nonteaching options, will presumably take account of potential remuneration in these after-school markets as part of their teaching compensation package.<sup>22</sup>

### 6.3 Deferred compensation: Teacher pension incentives

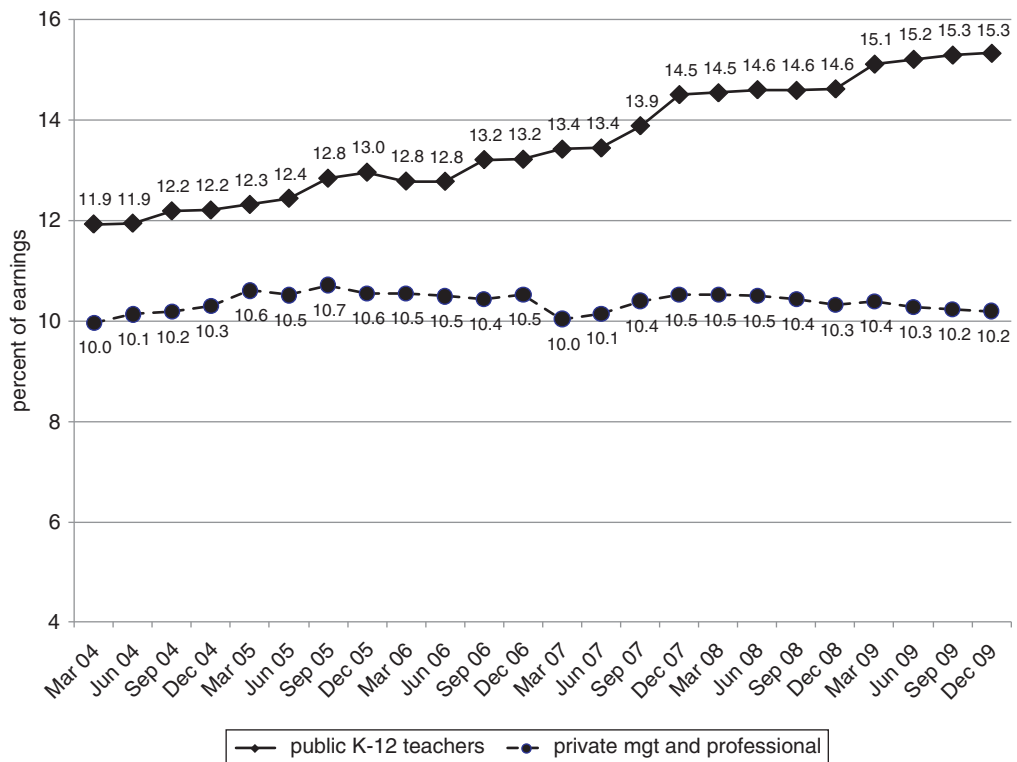
Pensions have long been an important part of compensation for teachers in public schools. Traditionally, it has been argued, salaries have been relatively low, while pension benefits have been relatively high for teachers and others who spend their career in public service. This mix of current versus deferred income was rationalized by the contention that the public good was best served by the longevity of service that would be induced by these pension plans.<sup>23</sup> In recent decades, however, evidence has grown that many of these plans, both in the private and public sector, may actually have *shortened* rather than lengthened professional careers by encouraging early retirements.<sup>24</sup>

<sup>22</sup> The U.S. as well has a growing private and test preparation market, with national franchises such as Sylvan Learning Centers, Princeton Review, Kaplan, and Kumon, along with independent local firms. Unfortunately, the U.S. Department of Education does not collect data on these firms or their staff. Anecdotal evidence suggests that these firms do hire moonlighting and retired teachers as well as regular full-time staff.

<sup>23</sup> National Education Association (1995, p. 3). As this report points out, however, this purpose has “been lost for many in the mists of time,” and “many pension administrators would be hard-pressed to give an account of why their systems are structured as is except to say that ‘the Legislature did it’ or ‘It is a result of bargaining.’”

<sup>24</sup> Kodlikoff and Wise (1987) showed the incentives for early retirement in private defined benefit pension plans and argued that their spread in the post-war period contributed to declining labor force participation of older workers up to that time. More recently, Friedberg and Webb (2005) showed that the private sector shift toward defined contribution plans contributed to the rise of retirement ages since the 1980s. With regard to teachers, Harris and Adams (2007) find considerably higher rates of labor force exit at ages 56–64 than in comparable professions, as well as evidence that this is due to their pension coverage.

The cost side of teacher retirement benefits affects labor markets by driving a wedge between the amount paid by employers and the take-home pay received by teachers. In Ohio, for example, the combined contributions of teachers and school districts for retirement benefits have risen steadily from 10% in 1945 to 24% today. But even this large wedge falls well short of what is needed, and pension officials are recommending a phased increase to 29% to shore up funding for pensions and retiree health benefits. At this level, retiree benefits for teachers and other professionals would be consuming well over \$1000 of the annual per student expenditures (Costrell and Podgursky (2007)). The costs of school retiree benefits (including “legacy” costs from unfunded benefits for previous retirees) consume a growing share of K-12 spending. Figure 5.3 reports employer costs for retirement and Social Security for teachers and private sector managers and professionals based on BLS benefit data discussed earlier. The gap in retirement benefit costs as a percent of salaries widened from 1.9% to 5.1% of earnings between 2004 and 2009. However, this understates the actual gap since the BLS data



**Figure 5.3** Employer contribution to public teacher and private professional retirement and Social Security as a percent of salary. Source: Costrell and Podgursky (2009c), updated.

do not include employer contributions for retiree health insurance, which are substantial in some states and districts, but have all but disappeared in the private sector.<sup>25</sup>

An important research question is the effect of these retirement benefits systems on the teaching workforce. [Costrell and Podgursky \(2009a\)](#) show that the pattern of pension wealth accrual in teacher defined benefit (DB) systems creates strong incentives to pull teachers to a given age and then push them out of the workforce afterward, with the push encouraging teachers to retire at relatively early ages by economy-wide standards. [Figure 5.4](#) illustrates this point for a hypothetical female teacher who enters the profession at age 25 and teaches continuously in California.<sup>26</sup> The employer contribution rate is 12.77%, yet for most of a teacher's career, her annual accrual of pension wealth is below that. However, in certain years, the accrual of pension wealth has very sharp spikes. These are usually associated with earlier eligibility for regular benefits. For example, in the case of California, during her first 29 years on the job (up to age 54), on separation she would be unable to collect her pension until age 57. However, upon completion of her 30th year on the job (age 55) she can begin collecting the pension immediately. Thus, the spike in



**Figure 5.4** Deferred income per year as a percent of salary: California public school teachers (addition to pension wealth from an additional year of teaching) Age at separation (entry age = 25). Source: [Costrell and Podgursky \(2009a\)](#).

<sup>25</sup> [Clark \(2009\)](#). Since retiree health insurance is largely funded pay-as-you-go by districts and states, the BLS does not treat it as a benefit for *current* active teachers.

<sup>26</sup> The teacher's earnings rise along a typical California salary schedule (Sacramento). For other details, see [Costrell and Podgursky \(2009b\)](#).

pension wealth largely reflects the discounted value of two additional years of pension annuities. There is nothing unique about California. [Costrell and Podgursky \(2009b\)](#) show that these spikes exist in other teacher DB plans.

These pension systems also impose very large costs on mobile teachers. [Costrell and Podgursky \(2009a\)](#) consider the mobility costs of teacher pension systems in six state teacher pension systems. They show that teachers who work a full career in teaching but who transfer between systems (“movers”) suffer huge losses of pension wealth as compared to “stayers.” In their simulations, teachers who split a 30-year career evenly between two otherwise identical pension systems typically lose one half or more of their pension wealth as compared to an otherwise identical 30-year stayer.

It is difficult to discern an efficiency rationale for these spikes in pension wealth accrual. The fairly massive backloading of benefits might be justified if there were evidence of large returns to experience and important job specific human capital investments. However, the majority of value-added econometric studies of teacher effectiveness find that novice teachers (e.g., teachers with less than three years of experience) on average are less effective than more senior teachers, but thereafter the returns to experience level off quickly. There is little evidence that a teacher with 20 years experience is any more effective in the classroom than a teacher with 10 years experience. Ironically, the current pension system, by pushing many teachers into retirement at relatively young ages, actually raises the steady-state share of novice teachers in the workforce and thus lowers overall teacher effectiveness.

Do these pension incentives and penalties affect teacher behavior? A substantial literature in labor economics demonstrates that the incentives in pension systems matter, not only for the timing of retirement, but for labor turnover and workforce quality ([Friedberg and Webb \(2005\)](#); [Asch, Haider, and Zissimopoulos \(2005\)](#); [Ippolito \(1997\)](#); [Stock and Wise \(1990\)](#)). Unfortunately, little of this literature pertains to teachers. While there have been many studies of the effect of current compensation on teacher turnover (e.g., [Murnane and Olsen \(1990\)](#); [Stinebrickner \(2001\)](#); [Hanushek, Kain, and Rivkin \(2004\)](#); [Podgursky, Monroe, and Watson \(2004\)](#)), the econometric literature on teacher pensions is slender but expanding. Several papers find that the structure of teacher pension wealth accrual affects the timing of teacher retirement behavior ([Furgeson, et al. \(2006\)](#), [Brown \(2009\)](#); [Costrell and McGee \(2009\)](#)). [Costrell and McGee \(2009\)](#) use their model to explore what effect a smoother pension wealth accrual system (such as a defined contribution or cash balance plan) would have on teacher retirement. They find that smoother accrual would delay teacher retirement.

## 7. TRENDS IN MARKET-BASED PAY

Given the efficiency costs of rigid salary schedules described above and growing pressure on schools to raise performance, it is not surprising that interest in market and performance-based pay is growing. Several states and districts have implemented



incentives to encourage experienced educators to teach in low-performing schools (Prince (2002)). Florida, Minnesota, and Texas have implemented state programs to encourage schools and districts to implement performance based pay systems for teachers. Congress has also provided an impetus through its Teacher Incentive Fund (TIF), a two-year, \$200 million program to encourage states to set up pilot programs of teacher performance incentives (Podgursky and Springer (2007)). The administration has proposed another \$200 million expansion in TIF in its current budget. Perhaps more importantly, implementation of performance pay is encouraged in “Race to the Top” state applications, wherein states compete for \$4 billion in total awards for broad-based school reform initiatives (U.S. Department of Education (2010)).

The website of the National Center for Performance Incentives at Vanderbilt University tracks programs by state. Unfortunately, we do not have much “microeconomic” data on the actual implementation of these programs in schools, and state data systems generally do not capture these program details. Even states that have good data on teacher salaries and their components generally cannot break out teacher performance or incentive bonuses.

The best data currently available on national levels and trends is to be found in various waves of the Schools and Staffing Surveys (SASS). SASS is a large nationally representative sample of roughly 8000 public schools and 43,000 public school teachers.<sup>27</sup> There have been five waves of SASS, associated with five school years: 1987–88, 1990–91, 1994–95, 1999–00, and 2003–04. While SASS covers two decades of public school experience and has included various questions about performance and market-based pay, unfortunately, many of these survey questions have not been comparable over time. Thus, we focus attention on data in the most recent waves of the survey, which contain consistent items.

District administrators were asked whether they provided pay bonuses or other rewards for certain teacher characteristics or behaviors.<sup>28</sup> These are listed in the top rows of Table 5.5. The most common bonus is for professional development. In 2003–04, 36% of teachers were offered such a bonus. The next most common bonus among districts is NBPTS certification. In 2003–04, 18% of districts, accounting for 40% of teachers, offered some sort of bonus for NBPTS certification. This is also the most rapidly growing bonus, with the number of districts offering it growing by 10 percentage points between the 1999–00 and 2003–04 surveys.

Eight percent of districts, accounting for 14% of teachers, reported rewards for excellence in teaching. In 2003–04, 5% of districts (13% of teachers) had bonuses for

<sup>27</sup> SASS includes private schools and teachers as well. However, the focus of this study is on trends in public schools.

<sup>28</sup> “Does the district currently use any pay incentives such as a cash bonuses, salary increase, or different steps on a salary schedule to reward. . .?”

**Table 5.5** Incidence of performance-based teacher compensation

District rewards following:	Teacher weighted (%)		
	1999–00	2003–04	change
NBPTS	22.9	39.8	17.0
Excellence in teaching	13.6	14.0	0.3
In-service professional development	38.8	35.9	–3.0
Teach in less desirable location	11.2	13.1	1.9
Teach in fields of shortage	23.6	25.3	1.7
Number of incentives			
<i>None</i>	39.2	31.1	–8.0
<i>1 incentive</i>	33.1	35.5	2.5
<i>2 incentives</i>	16.0	21.0	5.0
<i>3 incentives</i>	5.9	10.2	4.2
<i>4 incentives</i>	2.0	4.5	2.5
<i>5 incentives</i>	3.9	0.7	–3.2
Based on student achievement, were any schools in the district rewarded in any of the following ways?			
Cash bonus/addl. resources for school-wide activity	—	19.6	—
Cash bonus/addl. resources for teachers	—	15.4	—
Schools given nonmonetary forms of recognition	—	30.4	—

Source: Schools and Staffing Surveys, various years.

teaching in a less desirable location, and 12% of districts (25% of teachers) reported bonuses of some sort for teaching in shortage fields.<sup>29</sup> Table 5.5 also reports the number of incentives provided. Fifty five percent of districts (31% of teachers) provided no incentive rewards. This share has dropped between the 1999–00 and 2003–04 surveys. Two-thirds of teachers are employed in districts that provide one or more such incentives, and 15% of teachers are in districts providing three or more such incentives.

The first block of questions in Table 5.5 focuses on individual teacher bonuses. The next block of questions at the bottom of the table concerns school-wide bonuses. Some states and districts have begun to provide school-wide incentives for staff. Unfortunately,

<sup>29</sup> Interestingly, the rank order of district implementation of these incentives is nearly the opposite of teacher preferences, as reported in a recent study of Washington teachers by Goldhaber, DeArmond, DeBurgomaster (2007). Bonuses for teaching in a less desirable location were the most favored incentive (63%), followed by NBPTS (20%), shortage fields (12%), and performance pay (6%).

these questions were only asked in the 2003–04 survey. Of most interest for our purposes is the question concerning cash payments to teachers. Five percent of districts (15% of teachers) report cash bonuses or additional resources based on student achievement.

While all of the SASS surveys had questions on market and performance-based pay, few of the questions were consistently asked from one administration of the survey to the next. One block of questions that was nearly identical over the years concerned recruitment bonuses by field. This question asked district administrators whether they offered additional rewards in shortage fields, and in which teaching fields they are used. The results are presented in [Table 5.6](#).

First, it is worth noting the sharp increase over the 16-year interval in the incidence of field-based incentives. In the first administration of SASS during the 1987–88 school

**Table 5.6** Recruitment incentives by teaching field\*

**Reward to recruit/retain teachers in fields of shortage**

	1987–88	1990–91	1993–94	1999–00	2003–04	change 1987–88 to 03–04
District provides incentive	11.3%	16.6%	18.7%	23.6%	25.3%	14.0%
Elementary	—	—	—	2.4	2.6	—
Special ed	6.7	11.8	13.4	14.3	20.6	13.9
English/language arts	—	—	—	5.3	4.2	—
Social studies	—	—	—	1.6	2.4	—
Computer sci	1.4	2.9	1.3	3.4	3.4	2.0
Mathematics	5.2	5.8	3.9	8.9	15.7	10.5
Physical sciences	3.6	5.0	3.9	8.4	13.4	9.8
Biological sci	3.8	4.3	3.7	8.4	12.8	8.9
English as second lang.	3.3	7.6	8.1	11.1	15.5	12.2
Foreign lang.	2.4	3.1	2.4	5.3	9.4	7.0
Music or art	—	—	—	4.9	6.4	—
Vocational or technical educ.	—	4.7	3.2	8.0	7.3	—
Other fields	4.2	4.2	1.6	—	—	—

\*“Does this district currently use any pay incentives to recruit or retain teachers to teach in fields of shortage?”Source: Schools and Staffing Surveys, various years. School District surveys.

year, only 7.5% of districts (11.3% of teachers) provided such incentives.<sup>30</sup> That share climbed to 12% of districts employing 25% of teachers by the 2003–04 school year. Consistent with the recruitment difficulty responses seen in Table 3, these recruitment incentives are most commonly used in the areas of special education, math, science, and English as a second language.

While similar quantitative survey data are lacking, available evidence suggests that government experiments in performance pay are growing in other developed nations as well (Sclafani and Tucker (2006); Springer and Balch (2009)).

## 8. TEACHER COLLECTIVE BARGAINING

Public school teachers, like state and local employees, are not generally covered by the National Labor Relations Act (NLRA), the legislation that regulates private sector collective bargaining in the United States. States have the option of permitting bargaining or not and setting the regulatory framework within which it occurs. In general, teacher collective bargaining largely followed the trend of public employee bargaining. In 1962 Wisconsin passed the first NLRA-type bargaining law for public employees (including teachers). Within the next five years, New York and Michigan passed similar laws. By 1974, 37 states had such bargaining laws. In 1974 roughly 22% of public school teachers were covered by collective bargaining agreements. That grew from over 60% by the mid-80s to 67% currently (Farber (2006)).

The institutional landscape changed dramatically as well. Prior to 1960, the National Education Association (NEA) was a professional association dominated by school administrators. Its ranks also included higher education faculty and administrators. It opposed collective bargaining and did not consider itself part of the labor movement (it was not then and has never been affiliated with the AFL-CIO). The American Federation of Teachers (AFT), the other major teacher organization, had a trade-union ideology, was part of the AFL-CIO, and actively sought to advance teacher collective bargaining. The base of strength for the AFT was (and is) in large urban school districts. However, as the AFT rode a wave of labor militancy and strikes during the 1960s to organize more and more schools, the NEA gradually shed its opposition to collective bargaining, as well as its school administrator membership, and effectively began competing with the AFT as a union. Along with teachers, both the NEA and AFT have thousands of K–12 school support personnel in their membership as well.<sup>31</sup>

<sup>30</sup> Note that these recruitment incentives can take the form of cash bonuses, higher pay, or higher initial placement on the salary schedule. The latter is more subtle, and thus less controversial, than explicit bonuses or differentiated pay structures.

<sup>31</sup> The NEA membership is over 2.7 million while the AFT has roughly 1.3 million members. Note that these membership figures include retired members, as well as education support personnel. Both unions have higher education members as well. (Kahlenberg (2006)).

Especially in larger school districts, both of these unions negotiate long and complex agreements that specify in detail not only what teachers will be paid, but also how staffing assignments will be made, the length of the work day and year, duty-free lunches, minutes of meetings or professional development time, how vacancies will be filled, maximum class sizes, and many other details about resource allocation in schools.<sup>32</sup> Furthermore, the due process procedures in the contract, combined with state statutes on teacher tenure, often make it very difficult to dismiss poor-performing teachers. Simple observation thus leads many observers to expect teacher collective bargaining to raise school costs and lower school productivity.

On the other hand, some observers note that many school managers are highly inefficient even in the absence of unions. Teacher unions, it is argued, can bring professionalism to a work environment in which it is often lacking. By providing greater worker “voice,” unions may improve teacher productivity (Freeman and Medoff (1984)). Which of these effects dominates is an empirical point.

The episodic and clustered nature of the unionization process poses challenges for assessing its effect on teacher wages and school performance. In the interest of brevity, we will use the term “union teacher” to refer to a teacher whose terms of employment are determined by a union negotiated contract, and a “nonunion teacher,” one who is not. Currently, nonunion teachers are primarily located in states that have not passed collective bargaining laws. The growth of teacher unionization in the U.S. was not smooth and incremental. Rather, it was characterized by episodic jumps in membership associated with state passage of such laws. The structure has stabilized now such that nonbargaining states are primarily located in the south.

Several papers have estimated cross-section models of teacher union effects on pay and student achievement (Baugh and Stone (1982); Eberts and Stone (1984)). Broadly, these studies find that unionization is associated with higher spending per student and teacher pay, and very modest increases in student achievement. However, it is difficult to have much confidence that these cross-section estimates identify causal effects of unions. There are two sources of cross-section variation in the union “treatment”: within and between state variation. In both cases, it is very likely that there are omitted variables associated with teacher unionism and the outcome variables of interest (i.e., spending and student achievement). First, nonunion districts within a bargaining state have some characteristic (unmeasured) that has kept them nonunion—good labor management relations is one obvious candidate. These management skills can readily spill over to teacher quality and student achievement. Moreover, management may act in ways to preempt unionization, perhaps by raising pay. In the labor economics literature this is called a “threat effect” (Rosen (1969)).

<sup>32</sup> The collective bargaining agreement in the LA Unified school district (with appendices and supplements) is 348 single-spaced pages. The website of the National Center on Teacher Quality maintains a searchable database of the collective bargaining for 100 of the largest school districts in the U.S.: [www.nctq.org](http://www.nctq.org). Goldhaber (2006) and Eberts (2007) are recent literatures reviews on the effect of teacher unions and school performance.

Cross-state variation in unionization is also a problem. Most of the cross-section variation in teacher unionization arises from differences in the legislative environment across states. Some states, like Texas, make collective bargaining illegal; others, like Ohio, mandate it. Thus, a cross-section achievement on unionization regression essentially becomes a regression on regions; students in southern states on average have lower achievement and their teachers are less likely to be unionized.

A more ambitious approach to estimating teacher union effects that attempts to address the problems of endogeneity and omitted variables is [Hoxby \(1996\)](#), who examines the effect of teacher collective bargaining on spending, school inputs, and school performance. Hoxby builds a large panel data set of school districts including teacher unionization information from 1972, '82, and '92 Census of Governments along with district data from several other sources. She addresses the endogeneity problem in two ways. First, she estimates difference-in-difference models on the input, spending, and performance variables. Second, she uses an IV for the change in unionism, using the passage of state collective bargaining laws as her instrument. She finds that unionism does, in fact, increase spending per student. Her estimated effect is 9.5%. Most of this increase goes to teacher salaries and a reduction in the student-teacher ratio. However, she also finds that collective bargaining reduces the productivity of these school inputs. The net effect is to lower school performance (as measured by dropout rates). She finds that the effects of teacher unions in raising inputs and lowering performance are more potent in metropolitan markets that are more competitive (with more school districts) than those that are more concentrated, which suggests that consumer residential choice can act as a check on union power.

Unquestionably, [Hoxby \(1996\)](#) has been the most widely cited study on teacher union effects. However, a recent study by [Lovenheim \(2009\)](#) argues that classification error in the measure of collective bargaining may be responsible for Hoxby's findings. Rather than using unionization measures from the Census of Governments, Lovenheim uses "hand collected" union election data from three mid-western states (Indiana, Iowa, Minnesota—chosen because they passed strong teacher collective bargaining laws in the 1970s). His data suggest that there are significant classification errors as compared to Census of Governments data for these three states. Given data on the timing of unionization by districts, he conducts an event history analysis, comparing the pre- and post-trends in the unionized districts. Unlike Hoxby, he finds little evidence that unions raise teacher pay or otherwise increase school spending. He finds no evidence that the teacher unions in his sample lower school productivity. He finds some weak results suggesting a positive union effect on the efficacy of student-teacher ratios.<sup>33</sup> On the whole, he finds little teacher union effect on outcomes or resource use.

<sup>33</sup> A conventional errors-in-variables model would suggest that the Hoxby estimates were biased toward zero. In an appendix to the paper, Lovenheim develops an extension of the classical model with a discrete regressor, drawing on work by Bound, [Brown, Brown, and Mathiowetz \(2001\)](#). He tests and rejects the hypothesis that the classification error is "nondifferential," the discrete analog of classical measurement error.

While the U.S. literature on teacher unions and school performance is slender, we could find almost no literature on this topic for other developed or developing countries. [Kingdon and Teal \(2008\)](#) estimate the effect of teacher union membership on pay and student performance in a sample of secondary schools in India. While the study is cross-section, they make use of the fact that the same student takes multiple tests and estimate a student fixed effect model. By construction, this model identifies a union–nonunion differential by teacher within the same school. They find a positive student effect in three of five subjects. (Whether this results from the fact that better teachers join unions or union membership raises teacher effectiveness cannot be ascertained.) This paper addresses a different issue from the question in the U.S. literature, which focuses on a school-wide union effect.

Some recent studies have examined the effect of teacher unions on the structure of earnings. [Ballou and Podgursky \(2001\)](#) examine the effect of teacher unions on the structure of teacher pay schedules. They find that pay schedules in unionized districts tend to be more backloaded (i.e., higher ratio of peak to starting pay) and more compressed (fewer years to hit peak). They also find evidence that backloading is higher in districts with an older teaching workforce whether or not the workforce is unionized (see also [Babcock and Engberg, 1999](#)). [Goldhaber, et al. \(2005\)](#) examine the effect of teacher unions on district use of various types of performance pay in several waves of the Schools and Staffing Surveys. They distinguish two competing hypotheses about performance pay and teaching. A “nature of teaching” thesis, most closely associated with [Murnane and Cohen \(1986\)](#), holds that performance pay is unsuited to K–12 teaching, whereas a “political cost” thesis, associated with [Ballou \(2001\)](#), holds that there is nothing inherent in teaching that precludes performance pay. The primary impediment is political opposition—largely from teacher unions. The Goldhaber, et al. evidence favors the “political cost” thesis.<sup>34</sup>

[Koski and Hornig \(2007\)](#) is a cross-section study of the effect of union contract language on hiring and transfer on the concentration of low experience or poorly credentialed teachers in high poverty schools. They estimate their model on a sample of schools from California school districts from which they obtained contracts. The hypothesis tested is whether strong contract language facilitates the transfer of teachers away from high poverty schools within a district. They find no evidence that this is the case.

One as yet unexplored area of evidence for teacher union effects is charter schools. The union–nonunion landscape for traditional public schools in the U.S. has been stable for decades. Charter schools are another story. There are currently roughly 5000 charter schools in operation enrolling 1.5 million students.<sup>35</sup> The vast majority of

<sup>34</sup> Similar findings are reported in [West and Mykerezi \(2009\)](#). [Lavy \(2008\)](#) considers and dismisses a different variant of the “nature of teaching” hypothesis. He finds that women (who comprise roughly 80% of teachers) are no less likely to respond to or succeed in a performance pay system.

<sup>35</sup> These are from the website of the Center for Education Reform ([www.edreform.com](http://www.edreform.com)), which tracks charter schools state by state and up-to-date. The most recent data on charters available from the National Center for Education Statistics of the U.S. Department of Education are for school year 2003–04. They report 2179 charter schools with a total enrollment of 627,000 students. The number of charters and total enrollments is growing rapidly.

charter schools begin life nonunion. However, teacher unions have succeeded in organizing some of them. If that trend continues, there may be opportunities for school level studies of union effects.<sup>36</sup>

## 9. CONCLUSION

Human resource (HR) policy—the recruitment, retention, and motivation of employees—is increasingly recognized as a critical variable to the success of an organization. An integrated and coherent compensation policy is the central core of an efficient HR policy. In private and many public organizations, the compensation package is considered as a strategic whole and carefully designed to get the most HR return per dollar of compensation. By contrast, the compensation “system” in public K–12 education is much more fragmented and uncoordinated, with each piece perhaps responding to pressures from a particular constituency or inherited from an earlier collective bargaining agreement, but without systematic consideration of the logic or incentive effects of the whole.

Accountability pressures are forcing school districts to address the inefficiencies in this compensation system and rethink how they are spending roughly \$250 billion annually for compensation of instructional personnel. Federal programs in the U.S. such as the Teacher Incentive Fund are encouraging states to experiment with performance and market-based pay. States such as Minnesota, Florida, and Texas have developed programs to encourage their districts to develop such programs. A number of large urban districts, most notably Denver, have taken important steps in this direction. Performance- and market-based incentives are much more common in charter schools and are expanding with the charter school base. Our examination of various waves of SASS find some evidence of growth in performance and market-based pay reform even among traditional public schools. Much less movement has occurred in the area of teacher pensions, and large unfunded liabilities for pensions and retiree benefits are likely to force reforms in this area as well.

Experience from the private sector and other government employment suggest that much trial and error, hopefully combined with evaluation, will be necessary to arrive at effective and workable systems. However, it is important for education authorities to create “regulatory space” within which these compensation reform experiments can be carried out and studied.

<sup>36</sup> Interesting evidence in this regard is [Abdulkadiroglu, et al. \(2009\)](#). This is a randomized study of Boston area charter and pilot schools (students were admitted to these schools by lottery). Charter schools were not covered by the teacher collective bargaining agreement while the pilot schools were. Although some work rules were relaxed, tenure, salary schedules, and many seniority provisions remained in place. The authors found large positive effects on student achievement in the charter schools but mixed and sometimes negative effects in the pilot schools.



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## REFERENCES

- Aaronson, D., Barrow, L., Sander, W., 2007. Teachers and student achievement in Chicago high schools. *J. Labor Econ.* 25, 95–136.
- Abdulkadiroglu, A., Angrist, J., Cohodes, S., Dynarski, S., Fullerton, J., Kane, T., et al., 2009. Informing the debate: Comparing Boston's charter, pilot, and traditional schools. NBER Working Paper No. 15549.
- Allegretto, S., Corcoran, S., Mishel, L., 2004. How Does Teacher Pay Compare? Economic Policy Institute.
- Asch, B., Haider, S.J., Zissimopoulos, J., 2005. Financial incentives and retirement: Evidence from federal civil service workers. *J. Public Econ.* 89, 427–440.
- Ashenfelter, O., Brown, J., 1986. Testing the efficiency of employment contracts. *J. Polit. Econ.* 94, S40–S87.
- Babcock, L., Engberg, J., 1999. Bargaining unit composition and the returns to education and tenure. *Ind. Labor Relat. Rev.* 12, 163–178.
- Bacolod, M., 2007a. Do alternative opportunities matter? The role of female labor markets in the decline of teacher quality. *Rev. Econ. Stat.* 89, 737–751.
- Bacolod, M., 2007b. Who teaches and where they choose to teach: College graduates of the 1990s. *Educ. Eval. Policy An.* 29, 155–168.
- Ballou, D., 1996. Do public schools hire the best applicants? *Q. J. Econ.* 111, 97–134.
- Ballou, D., 2001. Pay for performance in public and private schools. *Econ. Educ. Rev.* 20, 51–61.
- Ballou, D., Podgursky, M., 1995. Recruiting smarter teachers. *J. Hum. Resour.* 30, 326–338.
- Ballou, D., Podgursky, M., 1997. Teacher Pay and Teacher Quality. W.E. Upjohn Institute for Employment Research.
- Ballou, D., Podgursky, M., 1998. Teacher recruitment and retention in public and private schools. *J. Policy Anal. Manag.* 17, 393–418.
- Ballou, D., Podgursky, M., 2001. Returns to seniority among public school teachers. *J. Hum. Resour.* 37, 892–912.
- Baugh, W.A., Stone, J., 1982. Teachers, unions, and wages in the 1970s: Unionism now pays. *Ind. Labor Relat. Rev.* 35, 368–386.
- Boyd, D., Grossman, P., Lankford, H., Loeb, S., Wyckoff, J., 2006. How changes in entry requirements alter the teacher workforce and affect student achievement. *Educ. Fin. Policy* 1, 176–216.
- Bridges, E., 1992. *The Incompetent Teacher: The Challenge and Response*. Routledge.
- Brown, J., Brown, C., Mathiowetz, N., 2001. Measurement Error in Survey Data. *Handbook of Econometrics*. Vol. 5. North Holland, 3705–3843.
- Brown, K., 2009. *The Link between Pensions and Retirement Timing: Lessons from California Teachers*. Department of Economics, University of Illinois at Urbana–Champaign.
- Chevalier, A., Dolton, P., McIntosh, S., 2007. Recruiting and retaining teachers in the UK: An analysis of graduate occupational choice from the 1960s to the 1990s. *Economica* 74, 69–96.
- Clark, R., 2009. Retiree health plans for public school teachers after GASB 43 and 45. *Educ. Fin. Policy* (forthcoming).
- Corcoran, S., Evans, W., Schwab, R., 2004. Women, the labor market, and the declining relative quality of teachers. *J. Policy Anal. Manag.* 23, 449–470.
- Costrell, R., McGee, J., 2009. *Teacher Pension Incentives, Retirement Behavior, and Potential for Reform in Arkansas*. Vanderbilt University National Center on Performance Incentives.

- Costrell, R., Podgursky, M., 2007. *Golden Peaks and Perilous Cliffs: Rethinking Ohio's Teacher Pension System*. Thomas B. Fordham Institute.
- Costrell, R., Podgursky, M., 2009a. Distribution of Benefits in Teacher Retirement Systems and Their Implications for Mobility. Vanderbilt University National Center on Performance Incentives.
- Costrell, R., Podgursky, M., 2009b. Peaks, cliffs and valleys: The peculiar incentives in teacher retirement systems and their consequences for school staffing. *Educ. Fin. Policy* 4, 175–211.
- Costrell, R., Podgursky, M., 2009c. Teacher Retirement Benefits. *Education Next* 9.
- Dolton, P.J., 2006. Teacher supply. In: Hanushek, E., Welch, F. (Eds.), *Handbook of the Economics of Education*. North-Holland, pp. 1079–1161.
- Eberts, R.W., 2007. Teacher unions and student performance: Help or hindrance? *Future Child* 17, 175–200.
- Eberts, R.W., Stone, J., 1984. *Unions and Public Schools: The Effect of Collective Bargaining on American Education*. DC Heath.
- Ehrenberg, R., Smith, R., 1991. *Modern Labor Economics*, fourth ed. Harper Collins.
- Farber, H., 2006. Public and private sector union membership in the United States. In: Hannaway, J., Rotherham, A. (Eds.), *Collective Bargaining in Education*. Harvard Education Press.
- Flyer, F., Rosen, S., 1997. The new economics of teachers and education. *J. Labor Econ.* 15, S104–S139.
- Freeman, R., Medoff, J., 1984. *What Do Unions Do?* Basic Books.
- Friedberg, L., Webb, A., 2005. Retirement and the evolution of pension structure. *J. Hum. Resour.* 40, 281–308.
- Furgeson, J., Strauss, R., Vogt, W., 2006. The effects of defined benefit pension incentives and working conditions on teacher retirement decisions. *Educ. Fin. Policy* 1, 316–348.
- Goldhaber, D., 2006. Are teacher unions good for children? In: Hannaway, J., Rotherham, A. (Eds.), *Collective Bargaining in Education*. Harvard Education Press.
- Goldhaber, D., Hyung, J., DeArmond, M., Player, D., 2005. Why do so few public school districts use merit pay? *J. Educ. Fin.* 33, 262–289.
- Goldhaber, D., Player, D., 2005. What different benchmarks suggest about how financially attractive it is to teach in public schools. *J. Educ. Fin.* 30, 211–230.
- Hanushek, E.A., 1986. The economics of schooling: Production and efficiency in public schools. *J. Econ. Lit.* 24, 557–577.
- Hanushek, E.A., 2003. The failure of input-based schooling policies. *Econ. J.* 113, F64–F98.
- Hanushek, E.A., Kain, J.F., O'Brien, D.M., Rivkin, S.G., 2005. The market for teacher quality. NBER Working Paper No. 11154.
- Hanushek, E.A., Kain, T., Rivkin, S.G., 2004. Why public schools lose teachers. *J. Hum. Resour.* 39 (2), 326–354.
- Hanushek, E.A., Rivkin, S.G., 1997. Understanding the 20th century growth in U.S. school spending. *J. Hum. Resour.* 32, 35–68.
- Hanushek, E.A., Rivkin, S.G., 2004. How to improve the supply of high quality teachers. In: *Brookings Papers in Education Policy: 2004*. Brookings Institution.
- Hanushek, E.A., Rivkin, S.G., 2006. Teacher Quality. In: Hanushek, E., Welch, F. (Eds.), *Handbook of the Economics of Education*. North-Holland, pp. 1054–1078.
- Hanushek, E.A., Rivkin, S.G., Taylor, L.A., 1996. Aggregation and the estimated effects of school resources. *Rev. Econ. Stat.* 78, 611–627.
- Harris, D., Adams, S., 2007. Understanding the Level and Causes of Teacher Turnover: A Comparison with other Professions. *Econ. Educ. Rev.* 26 (3), 325–337.
- Hess, F., West, M., 2006. *A Better Bargain: Overhauling Teacher Collective Bargaining for the 21st Century*. Kennedy School of Government, Program in Educational Policy and Governance. [www.hks.harvard.edu/pepg/PDF/Papers/BetterBargain.pdf](http://www.hks.harvard.edu/pepg/PDF/Papers/BetterBargain.pdf).
- Hoxby, C., 1996. How teachers' unions affect education production. *Q. J. Econ.* 111, 671–718.
- Hoxby, C., Leigh, A., 2004. Pulled away or pushed out? Explaining the decline in teacher aptitude in the United States. *Am. Econ. Rev.* 94, 236–240.
- Iaterola, P., Steifel, L., 2003. Intradistrict equity and public education resources and reform. *Econ. Educ. Rev.* 22, 60–78.

- Ippolito, R., 1997. *Pension Plans and Employee Performance: Evidence, Analysis, and Policy*. University of Chicago Press.
- Jacob, B.A., Lefgren, L., 2004. The impact of teacher training on student achievement: Quasi-experimental evidence from school reform efforts in Chicago. *J. Hum. Resour.* 39, 50–79.
- Kahlenberg, R., 2006. The History of Collective Bargaining Among Teachers. In: Hannaway, J., Rotherham, A. (Eds.), *Collective Bargaining in Education*. Harvard Education Press.
- Kershaw, J.A., McKean, R.N., 1962. *Teacher Shortages and Salary Schedules*. A RAND Research Memorandum. RAND Corporation.
- Kingdon, G., Teal, F., 2008. Teacher unions, teacher pay and student performance in India: A pupil fixed effects approach. CESifo Group Munich Working Paper No. 2428.
- Koski, W.S., Horng, E.L., 2007. Facilitating the teacher quality gap? Collective bargaining agreements, teacher hiring and transfer rules, and teacher assignment among schools in California. *Educ. Fin. Policy* 2, 262–300.
- Kotlikoff, L.J., Wise, D.A., 1987. The incentive effects of private pension plans. In: Bodie, Z., Shoven, J.B., Wise, D.A. (Eds.), *Issues in Pension Economics*. University of Chicago Press, pp. 283–336.
- Krantz-Kent, R., 2008. Teachers' work patterns: When, where, and how much do U.S. teachers work? *Mon. Labor Rev.* 131 (March), 52–59.
- Lakdawalla, D.N., 2006. The economics of teacher quality. *J. Law Econ.* 49, 285–329.
- Lankford, H., Loeb, S., Wyckoff, J., 2002. Teacher sorting and the plight of urban schools. *Educ. Eval. Policy An.* 24, 37–62.
- Lavy, V., 2008. Gender differences in market competitiveness in a real workplace: Evidence from performance-based pay tournaments among teachers. NBER Working Paper No. 14338.
- Leigh, A., Ryan, C., 2008. How and Why has Teacher Quality Changed in Australia?. *Aust. Econ. Rev.* 41, 141–159.
- Lieberman, M., 1956. *Education as a Profession*. Prentice-Hall.
- Loeb, S., Page, M.E., 2000. Examining the link between teacher wages and student outcomes: The importance of alternative labor market opportunities and non-pecuniary variation. *Rev. Econ. Stat.* 82, 393–408.
- Lovenheim, M., 2009. The effect of teachers' unions on education production: Evidence from union election certifications in three Midwestern states. *J. Labor Econ.* 24, 525–588.
- Moe, T., Chubb, J., 2009. *Liberating Learning: Technology, Politics, and the Future of American Education*. Josey-Bass.
- Murnane, R., Cohen, D., 1986. Merit pay and the evaluation problem: Why most merit pay plans fail and few survive. *Harvard Educ. Rev.* 56, 1–17.
- Murnane, R., Olsen, R., 1990. The effects of salaries and opportunity costs on length of stay in teaching: Evidence from North Carolina. *J. Hum. Resour.* 25, 106–124.
- Murphy, M., 1990. *Blackboard Unions: The AFT and NEA 1900–1980*. Cornell University Press.
- National Education Association, 1995. *Understanding Defined Benefit & Defined Contribution Pension Plans*.
- Nickell, S., Quintini, G., 2002. The consequences of the decline in public sector pay in Britain: A little bit of evidence. *Econ. J.* 112, F107–F118.
- OECD, 2001. *Teachers for Tomorrow's Schools*. Organization for Economic Cooperation and Development.
- OECD, 2009. *Education at a Glance 2009*. Organization for Economic Cooperation and Development. [www.oecd.org/document/24/0,3343,en\\_2649\\_39263238\\_43586328\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/24/0,3343,en_2649_39263238_43586328_1_1_1_1,00.html).
- Pew Center on the States, 2010. *The Trillion Dollar Gap: Underfunded State Retirement Systems and the Roads to Reform*.
- Podgursky, M., 2003. Fringe benefits. *Educ. Next* 3, 73–76.
- Podgursky, M., 2007. Teams versus bureaucracies: Personnel policy, wage-setting, and teacher quality in traditional public, charter, and private schools. In: Berends, M., Springer, M., Walberg, H. (Eds.), *Charter School Outcomes*. Lawrence Erlbaum Associates, Inc., pp. 61–84.

- Podgursky, M., 2009. Market-based pay reform for teachers. In: Springer, M. (Ed.), *Performance Incentives: Their Growing Impact on K-12 Education*. Brookings Institution, pp. 67–86.
- Podgursky, M., Monroe, R., Watson, D., 2004. Academic quality of public school teachers: An analysis of entry and exit behavior. *Econ. Educ. Rev.* 23, 507–518.
- Podgursky, M., Springer, M., 2007. Teacher performance pay: A review. *J. Policy Anal. Manag.* 26, 909–950.
- Podgursky, M., Tongrut, R., 2006. (Mis)–measuring the relative pay of teachers. *Educ. Fin. Policy* 1, 425–440.
- Prince, C., 2002. Higher Pay in Hard-to-Staff Schools: The Case for Financial Incentives. American Association of School Administrators.
- Rivkin, S.G., Hanushek, E.A., Kain, J.F., 2005. Teachers, schools, and academic achievement. *Econometrica* 73, 417–458.
- Rosen, S., 1969. Trade union power, threat effects, and the extent of organization. *Rev. Econ. Stud.* 36, 185–196.
- Roza, M., Guin, K., Gross, B., Deburgomaster, S., 2007. Do districts fund schools fairly? *Education Next* 7, 68–74.
- Roza, M., Hill, P.T., 2004. How within-district spending inequalities help some schools to fail. In: *Brookings Papers on Education Policy 2004*. Brookings Institution.
- Sclafani, S., Tucker, M., 2006. Teacher and Principal Compensation: An International Review. Center for American Progress (October).
- Springer, M., Balch, R., 2009. Design Components of Incentive Pay Programs in the Education Sector. Vanderbilt University, National Center on Performance Incentives. (July).
- Stinebrickner, T.R., 2001. A dynamic model of teacher labor supply. *J. Labor Econ.* 19, 196–230.
- Stinebrickner, T.R., Scafidi, B., Sjodquist, D., 2002. Do Teachers Really Leave for Higher Paying Jobs in Alternative Occupations? Department of Economics, University of Western Ontario.
- Stock, J., Wise, D., 1990. Pensions, the option value of work, and retirement. *Econometrica* 58, 1151–1180.
- Stoddard, C., 2003. Why has the number of teachers per student risen while teacher quality has declined? *J. Urban Econ.* 53, 458–481.
- Taylor, L.L., 2008. Comparing teacher salaries: Insights from the U.S. census. *Econ. Educ. Rev.* 27, 48–57.
- U.S. Department of Education, National Center for Education Statistics, 2004. *Qualifications of the Public School Teaching Force: the Prevalence of Out-of-Field Teaching. 1987–88 to 1999–00*. NCES 2002603 (August).
- U.S. Department of Education, National Center for Education Statistics, 2007. *Digest of Education Statistics*.
- U.S. Department of Education, National Center for Education Statistics, 2009. *Digest of Education Statistics*.
- U.S. Department of Education, 2010. Race to the top fund. [www2.ed.gov/programs/racetothetop/index.html](http://www2.ed.gov/programs/racetothetop/index.html).
- U.S. Department of Labor, Bureau of Labor Statistics, 2000. *Employee benefits in state and local government, 1998*. Bulletin 2531.
- U.S. Department of Labor, Bureau of Labor Statistics, 2008. *National compensation survey: Occupational earnings in the United States, 2007*. Bulletin 2704.
- West, L.K., Mykerezi, E., 2009. *Effects of Teachers' Unions on Qualification-Specific and Incentive-Based Teacher Compensation*. University of Minnesota.