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The teacher weekly wage penalty hit 21.4 percent in 2018, a record high

Trends in the teacher wage and compensation penalties through 2018

Report • By Sylvia Allegretto and Lawrence Mishel • April 24, 2019

SECTIONS

In 2018, teacher strikes in West Virginia, Oklahoma, Arizona, North Carolina, Kentucky, and Colorado raised the profile of deteriorating teacher pay as a critical public policy issue. Teacher protests have continued in many states into 2019, and there have been several prominent strikes in major cities including Los Angeles, Oakland, and Denver. Teacher protests gained sufficient national attention to merit a *Time* magazine cover story in September 2018 (Reilly 2018).

Teachers, students, parents, and community supporters protested cutbacks in public education spending and a squeeze on teacher pay that have persisted well into the economic recovery from the Great Recession. Spending reductions affect resources available to schools, which influence numerous decisions such as whether the school has adequate support personnel, reasonable class sizes, and competitive compensation for both teachers and nonteacher staff. Spending cuts over the recovery were not the result of weak state economies. Rather, many state legislatures and governors cut spending in order to finance tax cuts for the wealthy and corporations. This report underscores the crisis in teacher pay by updating our data series on the teacher wage and compensation penalty—the percent by which public school teachers are paid less in wages and compensation than other college-educated workers—and by providing new regression-based estimates of the teacher weekly wage penalty in each state.

Providing teachers with a decent middle-class living commensurate with other professionals with similar education is not simply a matter of fairness. Effective teachers are the most important school-based determinant of student educational performance.[1] To promote children's success in school, schools must retain credentialed teachers and ensure that teaching remains an attractive career option for college-bound students. Pay is an important component of retention and recruitment.

The deepening teacher wage and compensation penalty over the recovery parallels a growing shortage of teachers. Every state headed into the 2017–2018 school year facing a teacher shortage (Strauss 2017). New research by García and Weiss (2019) indicates the persistence and magnitude of the teacher shortage nationwide:

> The teacher shortage is real, large and growing, and worse than we thought. When indicators of teacher quality (certification, relevant training, experience, etc.) are taken into account, the shortage is even more acute than currently estimated, with high-poverty schools suffering the most from the shortage of credentialed teachers. (1)

García and Weiss explain why the teacher shortage matters:

> A shortage of teachers harms students, teachers, and the public education system as a whole. Lack of sufficient, qualified teachers and staff instability threaten students' ability to learn and reduce teachers' effectiveness, and high teacher turnover consumes economic resources that could be better deployed elsewhere. The teacher shortage makes it more difficult to build a solid reputation for teaching and to professionalize it, which further contributes to perpetuating the shortage. In addition, the fact that the shortage is distributed so unevenly among students of different socioeconomic backgrounds challenges the U.S. education system's goal of providing a sound education equitably to all children. (1)

In their study of the teacher shortage in California, Darling-Hammond et al. point to a number of factors limiting the supply of teachers, from layoffs that "left a mark on the public psyche" to frozen salaries, declining working conditions, and increased class sizes. "One sign of the impact is that only 5 percent of the students in a recent survey of college-bound students were interested in pursuing a career in education, a decrease of 16 percent between 2010 and 2014," the authors noted (Darling-Hammond et al. 2016, iii).

To address teacher shortages, it is necessary to focus on both recruiting and retaining teachers who have the qualifications associated with being an effective teacher. There are an array of policies needed to accomplish this goal, but providing appropriate compensation is a necessary, major tool in addressing constant shortages.

> Even if teachers may be more motivated by altruism than some other workers, teaching must compete with other occupations for talented college and university graduates.... Teachers are more likely to quit when they work in districts with lower wages and when their salaries are low relative to alternative wage opportunities, especially in high-demand fields like math and science. (Darling-Hammond et al. 2016, 18)

As we have shown in our more than a decade and a half of work on the topic, *relative* teacher wages, as well as total compensation—compared with the wages and total compensation of other college graduates—has been eroding for over a half a century. These trends influence the career choices of college students, biasing them against the teaching profession, and also make it difficult to keep current teachers in the classroom. In *How Does Teacher Pay Compare* (Allegretto, Corcoran, and Mishel 2004), we studied the long-term trends in teacher pay. We followed this up with *The Teaching Penalty*, published in 2008, and updated our findings in other reports (Allegretto, Corcoran, and Mishel 2011; Allegretto and Tojerow 2014; Allegretto and Mishel 2016, 2018). As noted, this body of work has documented the relative erosion of teacher pay. For instance, women teachers enjoyed a wage premium in 1960, meaning they were paid more than comparably

educated and experienced women workers in other fields. By the early 1980s, the wage premium for women teachers had transformed into a wage penalty. The total compensation penalty (how much less teachers receive in combined wages and benefits relative to comparable workers) has also increased.

Here we extend our analysis through 2018 and provide estimates of the teacher weekly wage penalty by state using regression-adjusted analysis of state-specific samples of college graduates. Our examination of the teacher wage penalty begins in 1979.[2] Our examination of the teacher compensation penalty (combining wage and benefit data) begins in 1993. With this update, we continue to sound the alarm regarding the long-run growth in the teacher wage and compensation penalty. We also provide new estimates of teacher weekly wage penalties by state. Following is a summary and our key findings.

Key findings

The mid-1990s marks the start of a period of sharply eroding teacher weekly wages and an escalating teacher weekly wage penalty

- Average weekly wages of public school teachers (adjusted for inflation) *decreased* $21 from 1996 to 2018, from $1,216 to $1,195 (in 2018 dollars). In contrast, weekly wages of other college graduates rose by $323, from $1,454 to $1,777, over this period.
- For all public-sector teachers, the relative wage penalty (controlling for education, experience, and other factors known to affect earnings) has grown substantially since the mid-1990s. The teacher weekly wage penalty was 5.3 percent in 1993, grew to 12.0 percent in 2004, and reached a record 21.4 percent in 2018.

Wage penalties have grown significantly for both men and women teachers

- The wage premium that women teachers enjoyed in the 1960s and 1970s has long been erased, replaced by a growing wage penalty. Our previous research found that in 1960 women teachers earned 14.7 percent more in weekly wages than comparable women workers. This report finds that the teacher weekly wage premium for women teachers had fallen to 6.9 percent in 1979. And the wage premium for women teachers gradually faded over the 1980s and 1990s, until it was eventually replaced by a large and growing wage *penalty* in the 2000s and 2010s. In 2018, women public school teachers were making 15.1 percent *less* in wages than comparable women workers.
- The wage penalty for men teachers is much larger. The weekly wage penalty for men teachers was 17.8 percent in 1979; it improved to 14.2 percent in 1993 but worsened in the late 1990s and into the early 2000s. In 2018, men teaching public school were making 31.5 percent less in wages than comparable men in other professions.

Improvements in benefits relative to professionals have not been enough to offset the growing teacher wage penalty

- While relative teacher wage penalties have worsened over time, some of the difference may be attributable to a trade-off between wages and benefits. In other words, school districts may not be giving teachers raises but are instead offering stable or slightly better benefits such that benefits make up a larger share of the overall compensation package for teachers than for other professionals. In 2018, nonwage benefits made up a greater share of total compensation for teachers (29.1 percent) than for professionals (21.5 percent).
- As a result of their growing benefit share of compensation, teachers are enjoying a "benefits advantage" over other professionals that has grown from 1993 to 2018, rising from 2.4 percent to 8.4 percent.
- However, this benefits advantage has not been enough to offset the growing wage penalty. The total teacher compensation penalty was 13.1 percent in 2018 (composed of a 21.4 percent wage penalty offset by an 8.4 percent benefits advantage), just slightly less than the record high 13.3 percent compensation penalty in 2017. The bottom line is that the teacher compensation penalty grew by 10.2 percentage points from 1993 to 2018.
- This growing compensation penalty is a key part of the story of changing teacher pay but shouldn't obscure the importance of the wage penalty alone—only wages can be saved or spent on housing and food and other critical expenses.

Teacher wage and compensation penalties grew over the recovery since 2010

- The public school teacher weekly wage penalty grew from 13.5 percent to 21.4 percent between 2010 and 2018.
- Teacher benefits improved relative to benefits for other professionals from 2010 to 2018, boosting the teacher benefits advantage from 4.8 percent to 8.4 percent. Despite this improvement, the total compensation (wage and benefit) penalty for public school teachers grew from 8.7 percent in 2010 to 13.1 percent in 2018.

The Great Recession can't be blamed for the erosion in teacher pay

- The erosion of teacher weekly wages relative to weekly wages of other college graduates in the last couple of years—and in fact since 2008—reflects state policy decisions rather than the result of revenue challenges brought on by the Great Recession. A recent study (AFT 2018) found that most of the 25 states that were still spending less for K–12 education in 2016 than before the recession had also enacted tax cuts between 2008 and 2016.
- In fact, eight of the 10 states with the largest reductions in education funding since 2008 were states that had reduced their overall "tax effort"—meaning through tax cuts or other measures they were collecting less in taxes relative to their capacity to

generate tax revenue. These eight states were Alabama, Arizona, Florida, Georgia, Idaho, Kansas, Oklahoma, and Virginia.

- In 2016, 24 states still had total state/local per-student funding below pre-recession levels. Among the eight states with the deepest cuts were three featuring teacher protests in 2018: Oklahoma, North Carolina, and Arizona (tied with Florida for the biggest cuts, at 23 percent).

Teacher weekly wage penalties vary across the states

- We report teacher weekly wage penalties for each state for the period 2014–2018. State wage penalties are based on regression-adjusted analyses using a sample of college graduates in each state. Teacher penalties range from 0.2 percent to 32.6 percent.
- Four of the seven states with the largest teacher wage penalties—Arizona, North Carolina, Oklahoma, and Colorado—were, unsurprisingly, ground zero for the 2018 teacher protests, helping to draw national attention to the erosion of teacher pay. In these states, teachers earned at least 26 percent less than comparable college graduates.
- In 21 states and D.C., the teacher wage penalties are greater than 20 percent.

Data sources and key methodological issues

There are two sources of data used in this analysis. For our wage analysis, we use data from the Current Population Survey (CPS), and for our benefits analysis, we use the Employer Costs for Employee Compensation survey (ECEC). Both sets of data are from the Bureau of Labor Statistics (BLS). Below we discuss our sources and how we address some of the key methodological issues pertinent to understanding teacher wage trends. Appendix A includes a comprehensive discussion of the data and methodologies that produce our teacher weekly wage and total compensation penalties.

There are several measurement and data issues regarding the CPS that require some further discussion, and this discussion is included in the subsections below. First, as in our earlier work, we explain our decision to compare weekly, as opposed to annual or hourly, earnings. Second, we discuss the method and data we use in our benefits calculation.

Data and weekly wages

For our wage analysis we use CPS data on individual workers from 1979 through 2018. The CPS is a monthly survey of more than 60,000 households conducted by the U.S. Census Bureau for the BLS. We specifically employ the "Outgoing Rotation Group" sample, or CPS-ORG. The CPS-ORG is one of the data sources most widely used by economists to study wages and employment. The CPS-ORG data are particularly useful due to their large

sample size and information on weekly wages. We pool monthly data into a series of annual data with over 150,000 workers for each year.

As in our previous analyses, this research restricts the sample to all full-time workers ages 18 to 64 (defining "full-time" as working at least 35 hours per week). Teachers are identified using detailed occupation codes, and the sample includes only elementary, middle, and secondary teachers; excluded are prekindergarten and kindergarten teachers, adult educators, and special education teachers. We also focus on the wages of public school teachers only, excluding private school teachers—who, on average, earn less than public school teachers—from our wage penalty estimates.[3] We also continue to restrict our analysis to data reported by survey respondents; thus, we do not include imputed data (i.e., we do not use the substitute values provided by the Census Bureau).

In this report, we have made several changes from our previous work in our approach to sample construction and our regression specification. Thus, our estimates of relative teacher weekly wages reported here *will not match* those from previous reports—as they did in all prior reports released from 2008 through 2018. Appendix A details these changes, our reasons for adopting them, and how they affect historical analyses. Here is a brief accounting: Our sample is now restricted to workers with at least a college degree (meaning a four-year bachelor's degree)—as teachers today are required to have at least a bachelor's degree. We also adjust weekly wages truncated at the Census-assigned top codes. (To preserve anonymity, the Census Bureau does not provide wage data for those earning more than the assigned top-code value for weekly wages, which has been set at $2,884.61 since 1998. All survey respondents earning more than $2,884.61 per week are recorded in the data as earning exactly $2,884.61 per week.[4]) Lastly, our regression specifications now include geographic controls at the state level and are weighted with the CPS-ORG weights.

For our analysis of the relative wages of teachers, we rely on comparisons of weekly earnings and not on annual or hourly earnings, as some researchers do. As discussed in our prior research with Sean Corcoran on teacher pay (Allegretto, Corcoran, and Mishel 2004, 2008), we elect to use weekly wages to avoid measurement issues that arise in many studies of teacher pay that use annual wages or hourly wages.[5] Annual earnings of teachers cannot be directly compared with annual earnings of nonteachers given that teachers are typically contracted to work only a nine-month year. And there is no settled way to adjust for teachers' traditional "summers off" because researchers do not agree on exactly how much time teachers devote to their position outside of their nine contracted months of teaching—or on how to adjust for the fact that teachers are afforded little time off during the teaching year compared with other professionals. Teachers also spend some of their summer months in class preparation, professional development, or other activities expected of a professional teacher. Similarly, attempts to compare the hourly wages of teachers and other professionals have generated considerable controversy by setting off an unproductive debate about the number of hours teachers work compared with other professionals.[6] It is noteworthy that a survey by Scholastic and the Bill & Melinda Gates Foundation (Scholastic 2012) found that teachers work very long hours:

> Few would assume that teachers' work days begin and end when the bell rings, but

> the degree to which teachers are investing time before and after school may be surprising: prior to taking on any extracurricular activities, teachers work an average of 10 hours and 40 minutes a day, three hours and 20 minutes beyond the average required work day in public schools nationwide. (13)

Importantly, decisions regarding wages interval (weekly, annual, or hourly) become mostly irrelevant when considering changes in relative wages over time. Changes in relative wages over time can be expected to be similar as long as the relative work time (between teachers and comparable professionals) remains constant: That is, a constant bias is consistent with having an accurate trend.[7]

Benefits

Our analysis examines the relative wages of teachers but also examines relative compensation—specifically accounting for how differences in benefits affect total compensation. We use the ECEC survey from the BLS to analyze the benefits received by primary, secondary, and special education teachers in state and local government compared with the benefits received by civilian professionals. The ECEC is a quarterly survey that reports employers' average hourly costs for total compensation and for its components—wages and benefits—in dollar amounts and as percentages of compensation. Data are reported separately for broad benefit categories such as paid leave, supplemental pay, insurance, retirement and savings, paid holidays, health insurance, defined-benefit pensions, and workers' compensation.

The ECEC reports compensation statistics for public- and private-sector workers and also provides data by occupation, including "primary, secondary and special education" teachers specifically. This allows us to focus on public (state and local) school teachers (as we do with our wage analysis) and to account for the benefits advantage that teachers have compared with other professionals (in the broadest group possible, including all state and local and private-sector professionals, to correspond as best as possible to our control group—all nonteacher college graduates). The ECEC data allow us to compute the benefits share of total compensation for public school teachers and professionals and to assess for a given wage penalty what is the corresponding compensation penalty. That is, we net out the wage penalty and the benefits advantage to compute the total compensation (wages and benefits) penalty facing public school K–12 teachers. Appendix A provides greater detail on the computation of the benefits advantage over the 1993–2018 period.

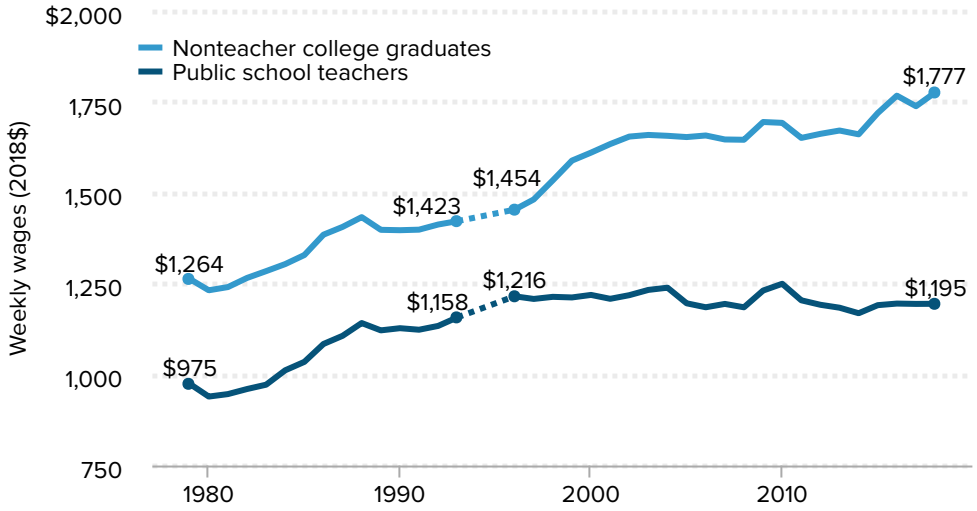
Recent trends in teachers' relative weekly wages

Our discussion of the teacher weekly wage penalty begins with trends in weekly wages but then focuses on regression-adjusted wage penalties—penalties that remain after controlling for education, experience, state, and other factors known to affect wage levels.

Figure A

Teacher weekly wages have not grown since 1996

Average weekly wages of public school teachers and other college graduates, 1979–2018



Notes: Figure shows weekly wages (2018$) of public school teachers (elementary, middle, and secondary). Nonimputed data are incomplete or not available for 1994 and 1995; data points for these years are represented by dotted lines (see Appendix A for more detail).

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data

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Generally, we express the teacher wage penalty as a percent disadvantage—how much less, in percentage terms, the average teacher earns relative to a similar college graduate in another profession. The exception is for a period in the 1960s when teachers earned more than other college-educated workers—for this period (referenced in this report but calculated in our earlier research) the penalty is referred to as a "premium" or "advantage."

Weekly wage trends: The unadjusted gap

Figure A presents average weekly wages of public school teachers and of other college graduates from 1979 to 2018, adjusted only for inflation. As noted in Appendix A, nonimputed data are incomplete or not available for 1994 and 1995; data points for these years are represented by dotted lines in the figure. We refer to level differences in weekly wages between teachers and other college graduates as "gaps," reserving the term "penalty" for when we provide regression-adjusted data.

In 1979, teachers earned $975 per week, or 22.9 percent less than other college graduates, who earned $1,264. The wage difference between teachers and other college graduates narrowed into the mid-1990s, falling to 16.4 percent in 1996, but then widened considerably during the tight labor markets of the late 1990s and early 2000s. There was a 12.4 percent ($181) jump in weekly wages for nonteacher college graduates from 1996 to 2001 during an unusual time of exceptional wage growth among low-, middle-, and high-

wage earners. But inflation-adjusted wages of teachers did not grow at all during this period because teacher wages are set by long-term contracts and therefore public-sector wages are not as volatile (do not rise and fall as much) as private-sector wages.

In fact, teacher weekly wages actually fell by $7, or 0.6 percent, from 1996 to 2001. Combined with the simultaneous rise in weekly wages for nonteacher college graduates, this resulted in a 26.1 percent weekly wage gap for teachers in 2001. The gap remained fairly consistent throughout the 2000s and into 2010–2011; between 2004 (the peak teacher weekly wage year in the 2000s) and 2018, weekly wages of other college graduates grew $119 (7.2 percent), while teacher weekly wages dropped $44 (3.6 percent). In 2018, the $1,195 teacher weekly wage was $582, or 32.7 percent, less than the $1,777 earned by other college graduates. The teacher weekly wage difference of 32.7 percent in 2018, unadjusted to account for demographic shifts or other factors, was roughly double that of the 16.4 percent disadvantage in 1996.

Regression-adjusted weekly wage penalties

The previous section concerned levels of weekly wages; we now move to differences based on regression methodology. Regression-adjusted estimates of relative teacher weekly wages account for any differences in and changes over time in the composition (by age, education, race/ethnicity) of our sample of teachers and other college graduates. We employ a typical wage model where the dependent variable is (log) weekly wage with indicator controls for public school teacher, private school teacher, gender, and marital status; along with indicator sets on education (B.A., M.A., professional degree, and Ph.D.), and race/ethnicity (white, black, Hispanic, other); we also control for age (as a quartic) and state of residence. As is standard, we have left out of the regression specification one indicator for each dummy variable set.[8] We also run regressions separately by gender to examine relative teacher wage trends for women and men.

As mentioned, results reported here differ from those in our previous research because of changes to our sample and methodological approach—as detailed in Appendix A. The newly adopted changes produce mixed results depending on each modification—some increase and some decrease our original penalties. The net effect of all changes, however, is to find a larger penalty; for instance, we reported an 18.7 percent penalty for 2017 (Allegretto and Mishel 2018), but our current approach instead yields a 20.7 percent penalty for 2017. The new estimates for past years are higher than previous estimates primarily because of the use of a top-coding adjustment that raises the wages of nonteacher college-educated workers more than it raises teacher wages (very few teachers have very high wages). The discussion in Appendix A assesses the impact of each specification or sample change on our estimates of the teacher weekly wage penalty since 1979.

Overall results

Trends in public school teacher wages relative to wages of workers with comparable education, experience, and other characteristics are presented in **Figure B** (estimates for

each year are listed in **Appendix Table B1**). The estimates for 1979–1993 are benchmarked to the 1996 level to account for the probable underreporting of teacher wages in the earlier period compared with wages measured after the 1994 redesign of the CPS.[9] The teacher wage *penalty*—how much less teachers make than comparable workers—grew from 7.3 percent in 1979 to a record 21.4 percent in 2018 for all teachers. The wage penalty was fairly stable from 1979 to the mid-1990s but then grew into the early 2000s—confirming what we present in Figure A. After some variability in the mid-2000s, the increasing teacher wage penalty continued to grow from 2010 through 2018, rising from 13.5 to 21.4 percent—driven by a particularly large increase in the wage penalty for women teachers (rising from 5.9 to 15.1 percent). It is noteworthy that the wage penalty shrank in the early portion of the Great Recession, as private-sector wages fared worse than those in the public sector, reflecting the greater short-run stability of teacher wages due to long-term contracts. This trend was more than reversed in the recovery beyond 2010 as state and local spending cuts sapped teacher wage growth while private-sector wage growth accelerated.

The estimated 21.4 percent teacher weekly wage penalty in 2018 means that, on average, teachers earned just 78.6 cents on the dollar compared with what other college graduates earned—and much less than the relative 93.7 cents on the dollar that teachers earned in 1996.

Results by gender

As illustrated in Figure B, teacher weekly wage differentials vary greatly by gender. The teacher weekly wage penalty currently stands at 15.1 percent for women. The teaching profession was relatively good for women in 1979, when they made 6.9 percent *more* than comparably educated women workers. Our earlier work examining prior decades also found a 14.7 percent weekly wage premium for women teachers in 1960 that fell to 10.4 percent in 1970 and to 2.9 percent in 1980 (Allegretto, Corcoran, and Mishel 2008, 7).

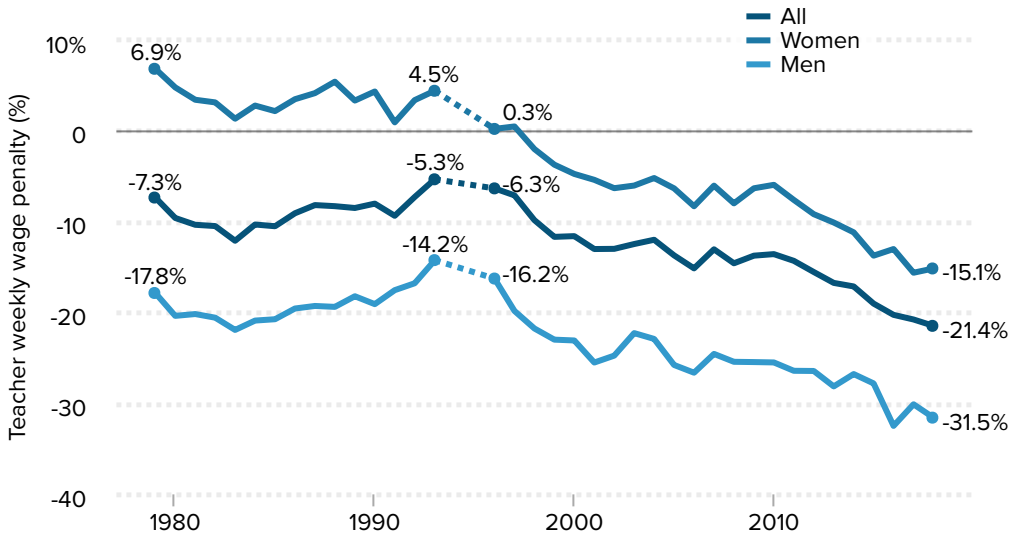
This earlier work combined with the results in Figure B demonstrates a very long negative trend in teacher weekly wages—as women teachers moved from having a substantial weekly wage premium to a large weekly wage penalty relative to other women workers. More recently the women teacher wage penalty has substantially widened. Referring to Figure B, women teachers earned weekly wages somewhat higher than the weekly wages of other comparable women college graduates in the early to mid-1990s. By 2001, however, women teachers were earning 5.4 percent less than comparable women college graduates and, before the start of the recession in 2007, were still earning 6.0 percent less. Weekly wages for women teachers fared somewhat better in the early part of the recession, but beginning in 2010 the teacher weekly wage penalty for women increased annually until it reached its largest deficit, of 15.1 percent, in 2018—a nearly 30 percentage-point decline from the 14.7 percent weekly wage premium in 1960.

The teacher weekly wage penalty has always been largest for men in the teaching profession—the men's penalty was 17.8 percent in 1979 and grew to 31.5 percent by 2018. The larger teacher weekly wage penalty for men reflects that teaching has been a predominantly female profession. Because of gender discrimination that historically limited

Figure B

Teachers earn 21.4% less than comparable college graduates

Teacher weekly wage penalty for all teachers and by gender, 1979–2018



Notes: Figure shows regression-adjusted weekly wage penalties (or premiums) for public school teachers (elementary, middle, and secondary) relative to other college graduates. (The figure shows a wage premium for women teachers from 1979–1997.) Dependent variable is (log) weekly wages with indicator controls on public school teacher, private school teacher, gender, and married, along with indicator sets on education (M.A., professional degree, Ph.D.) and race/ethnicity (black, Hispanic, other); also included are age (as a quartic) and state fixed effects. Estimates are omitted for 1994 and 1995, as imputation flags are incomplete or not available; data points for these years are represented by dotted lines (see Appendix A for more detail).

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data

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occupational options for educated women, these women became a captive labor pool with less leverage to secure higher wages. Thus, weekly wages for teachers have been less than weekly wages in male-dominated professions. Men in predominantly female professions will thus earn substantially less than men in male-dominated professions.

The difference between teacher weekly wages for men and weekly wages of comparable college graduate men shrank from 1990 to 1996 but increased quickly during the late 1990s, when wages of college graduates increased considerably and teacher wages stagnated. The large wage penalty that men face in the teaching profession goes a long way toward explaining why the gender makeup of the profession has not changed much over the past few decades (roughly three-fourths of teachers are women). Those arguing that teachers are overpaid have a hard time explaining why, if this is so, men have not swarmed to teaching. In fact, tabulations of the CPS-ORG data show that men's share of public school teachers (in grades 1–12) has fallen from 32.2 percent in 1979 to just 24.9 percent in 2018, a trend consistent with a male teacher wage penalty that is extraordinarily high and rising.

Tax and spending cuts limit teacher wages in the recovery

The erosion of teacher wages is not simply a reflection of a loss of government revenue available for education spending due to the recession and slow recovery (i.e., a shrinking tax base due to falling incomes and property values). Rather it is the result of revenue declines states brought on themselves by cutting tax rates. This is evident in data on the extent of tax cuts and reduced "tax effort" across the states, especially in states where teacher wages were constrained. (Tax effort is a measure of how much governments are collecting in taxes relative to their capacity to generate tax revenue and is computed by dividing total state and local tax revenue by total taxable resources.) A recent study by the American Federation of Teachers examined spending and tax efforts for each state and found:

> In 2016 (the latest data at the time of the study), 25 states were still providing less funding for K–12 schools than before the recession, after adjusting for inflation. While all states faced real revenue challenges immediately following the recession, most of the states that were still spending less on schools in 2016 had also enacted tax cuts between 2008 and 2016. Eighteen of the 25 states that provided less funding for K–12 education reduced their tax effort between 2008 and 2015. The 10 worst states for per-pupil funding in 2016 either reduced their overall tax effort or took action that had a net negative impact on revenue after 2008. Eight of the 10 states with the largest reductions in education funding compared with 2008—Alabama, Arizona, Florida, Georgia, Idaho, Kansas, Oklahoma and Virginia—reduced their overall tax effort. (AFT 2018, 4)

Recent research by Leachman and Figueroa (2019) compared state K–12 school formula funding between fiscal years 2008 and 2019 and found that

> [m]ost of the teacher-protest states had cut their formula funding so deeply over the last decade that even last year's sizeable funding boosts weren't enough to restore funding to pre-recession levels. For example, in Oklahoma, per-student formula funding remains 15 percent below 2008 levels, including inflation adjustments. And per-student formula funding in Arizona, North Carolina, and West Virginia, as well, is still well below pre-recession levels. While combined state and local funding in 2016 was nearly back to pre-recession levels nationally, state funding was down $167 per student while local funding was up $161. (4)

Leachman and Figueroa also examined *total* state and local funding for schools up through 2016 (the latest data available). Their data (Figure 5) show that:

- In 2016, 24 states still had total state/local per-student funding below pre-recession levels.
- Among the eight states with the deepest cuts were three featuring teacher protests in 2018—Oklahoma, North Carolina, and Arizona (the latter was tied with Florida for the

biggest cuts, at 23 percent below pre-recession funding levels).

Reduced spending for K–12 schools and the corresponding cutbacks in teacher salaries were conscious policy choices and were frequently done to accommodate tax cuts for corporations and the rich as well as an ideological commitment to smaller government.

State teacher wage penalties

To this point our analysis has focused on average teacher wage penalties for the United States. But how do teacher wage penalties differ across states? In this report we improve on earlier reports by providing teacher weekly wage penalties based on regression-adjusted estimates for each state. Our previous state wage comparisons were based on an analysis of the raw data without regression controls. For this report, we pool five years of CPS-ORG data from 2014 to 2018 to provide regression-adjusted weekly wage penalties for each state based on samples of college graduates. We present these estimates in **Appendix Table C1** along with standard errors, t-statistics, sample size, and the low and high estimates associated with a 95 percent confidence interval.

The methodological shift to regression-adjusted state wage penalty estimates in this study yields smaller penalties for all but eight states compared with what we reported in 2018. In that report, our U.S. wage penalty was 23.8 percent, using descriptive analysis and pooled data for 2013–2017. Thus, that wage penalty was roughly four percentage points more negative than our 19.8 percent results using regression analysis and 2014–2018 pooled data (shown in **Figure C**). As one would expect, this 19.8 percent teacher weekly wage penalty estimated from five years of pooled data (2014–2018) roughly matches the average of the five annual estimates reported in Figure B for 2014–2018 (19.7 percent).

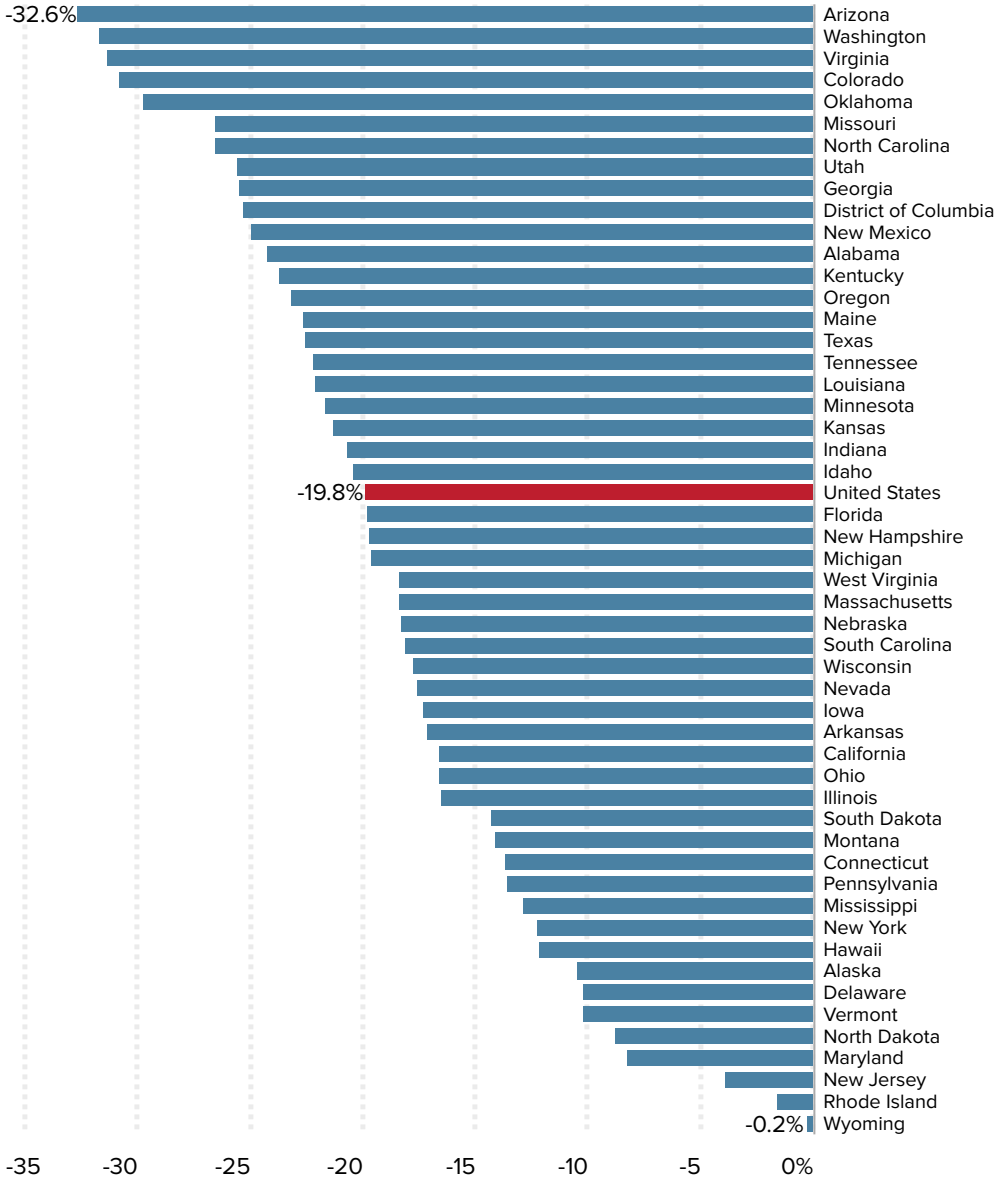
We display the weekly wage penalty by state in Figure C ranked from the largest wage penalty to the smallest. Teacher weekly wage penalties in 21 states and D.C. are greater than 20 percent. Perhaps not surprisingly, several of the states where teacher protests occurred in 2018 are those with some of the largest teacher wage disadvantages. Of the seven states with the largest wage penalties, four (*italicized*) were where massive walkouts took place last year: *Arizona* (32.6 percent) had the largest penalty followed by Washington (31.6 percent), Virginia (31.3 percent), *Colorado* (30.7 percent), *Oklahoma* (29.7 percent), Missouri (26.5 percent), and *North Carolina* (26.5 percent). Teacher wage penalties also exceeded 25 percent in Utah (25.5 percent), Georgia (25.4 percent), and the District of Columbia (25.2 percent).

There is no state where teacher wages are better than those of other college graduates. Wyoming, Rhode Island, and New Jersey have the most modest weekly wage penalties—at 0.2, 1.5, and 3.8 percent, respectively—and the estimates for these states are not statistically different from zero.

Figure C

The teacher weekly wage penalty is greater than 20% in 21 states and D.C.

Teacher weekly wage penalty, by state, pooled data from 2014–2018



Notes: Figure reports state-specific regression-adjusted teacher weekly wage penalties of public school teachers (elementary, middle, and secondary) relative to other college graduates within each state. Dependent variable is (log) weekly wages with indicator controls on public school teacher, private school teacher, gender, and married, along with indicator sets on education (M.A., professional degree, Ph.D.) and race/ethnicity (black, Hispanic, other); also included are age as a quartic and state fixed effects (see Appendices A and C for more detail).

Source: Authors' analysis of pooled 2014–2018 Current Population Survey Outgoing Rotation Group data

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Adding benefits to the picture

Our analysis of relative teacher pay thus far has focused entirely on teachers' weekly wages relative to those of other comparable college graduates. Yet benefits such as pensions and health insurance are an increasingly important component of the total compensation package. Teachers do enjoy more attractive benefits packages than other professionals; thus, our measure of relative teacher *wages* overstates the teacher disadvantage in *total compensation*.

This section examines how we adjust our estimates of relative teacher wages to reflect differences in total compensation; that is, it measures the size of the advantage teachers have in benefits, relative to professionals, and adjusts the teacher wage penalty to derive a relative compensation comparison. We draw heavily on our prior work analyzing the "benefits bias"—which we now label the "benefits advantage" (Allegretto, Corcoran, and Mishel 2004, 2008)—and update our calculations to 2018.

While the total compensation penalty rounds out our understanding of how teachers are faring compared with other professionals, the growing wage penalty is still important and critical to keep in mind given the different natures of wages and benefits—only wages can be spent or saved!

Basic facts on nonwage benefits and the teacher 'benefits advantage'

Table 1 provides the basic information necessary to compare benefits packages of primary, secondary, and special education public school teachers with benefits packages of comparable workers (specifically, workers in professional occupations).[10] This table draws on the BLS Employer Costs for Employee Compensation series to estimate the benefits advantage not taken into consideration in the wage-only comparisons presented earlier. This section presents estimates of the benefits advantage for 1993–2018 to enable estimates of the overall teacher compensation (wages and benefits) penalty for 1993–2018.

"Benefits" in our analysis refers to the employer costs for health and life insurance, retirement plans, and payroll taxes (i.e., Social Security, unemployment insurance, and workers' compensation). The remaining components of compensation are "W-2 wages," a wage measure that corresponds to the wages captured in the CPS-ORG data used above; W-2 wages are the wages reported to employees and to the Internal Revenue Service. W-2 wages include "direct wages," defined by the BLS as "regular payments from the employer to the employee as compensation for straight-time hourly work, or for any salaried work performed" and other wage items including "supplemental pay." Supplemental pay includes premium pay for overtime, bonus pay, profit-sharing, and "paid leave." Appendix A provides detailed information on the computation of the fringe benefits advantage over the 1993–2018 period and illustrates the computation with 2018 data.

Table 1

The teacher compensation penalty was 13.1% in 2018

Trends in the teacher compensation penalty and its components, 1979–2018

	W-2 wage share of compensation		Public school teachers*		
Year(s)	Professionals	Public school teachers*	Wage penalty	Benefits advantage**	Compensation penalty
1979	n.a.	n.a.	-7.3%	n.a.	n.a.
1993	n.a.	n.a.	-5.3%	2.4%	-2.9%
2004	81.3%	79.3%	-12.0%	2.2%	-9.8%
2007	80.7%	77.2%	-13.0%	3.9%	-9.1%
2010	79.8%	75.6%	-13.5%	4.8%	-8.7%
2017	78.1%	71.4%	-20.7%	7.4%	-13.3%
2018	78.5%	70.9%	-21.4%	8.4%	-13.1%
Percentage point change					
1979–1993	n.a.	n.a.	2.0	n.a.	n.a.
1993–2007	n.a.	n.a.	-7.7	1.5	-6.2
1994–2007	-0.6	-2.1	n.a.	n.a.	n.a.
2007–2018	-2.2	-6.3	-8.4	4.4	-4.0
2010–2018	-1.3	-4.6	-7.9	3.6	-4.3
2017–2018	0.4	-0.4	-0.7	0.9	0.2
1993–2018	n.a.	n.a.	-16.1	6.0	-10.2

* Teachers are elementary, middle, and secondary public school teachers (compensation data do not include kindergarten teachers).
** The benefits advantage is the degree to which higher benefits offset the teacher wage penalty. See Appendix A for more detail.

Note: Numbers may not sum to totals due to rounding.

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data and Bureau of Labor Statistics Employer Costs for Employee Compensation data

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The first pair of columns in Table 1 present the share of W-2 wages in total compensation, for professionals and for state and local K–12 public school teachers. The W-2 wage share of compensation and the benefits share of compensation sum to one. These W-2 shares allow us to examine how important wages are relative to benefits in the total compensation package. For example, we see that in 2018, teacher W-2 wages made up 70.9 percent of their total compensation. Professionals have weaker benefits per dollar of compensation, with 78.5 cents going to wages for every dollar of compensation (implying that 21.5 cents go to benefits). So, for every dollar of W-2 wages, public school teachers do receive more in benefits. One reason health and pension costs are higher for teachers is that teacher health benefits are provided for a full year, while teacher salaries are for less than a full year.

The next set of columns in Table 1 provide our estimate of the teacher wage penalty from Figure B, followed by the "benefits advantage." These two estimates can then be combined to estimate the teacher compensation penalty, shown in the last column. In other words, the "benefits advantage" estimate tells us to what extent an estimated relative wage disadvantage will be offset by a relative benefits advantage.

The benefits advantage for teachers in 2018 was 8.4 percent, significantly higher than the 3.9 percent and 2.4 percent teacher benefits advantage in, respectively, 2007 and 1993. This means that primary and secondary public school teachers currently have a benefits advantage that partially offsets the wage disadvantages they face.

Adding together the wage penalty column and the benefits advantage column gives the overall compensation penalty. The *growth* in the benefits advantage means that the relatively better benefits for teachers have somewhat offset the worsening wage picture for teachers. The total teacher compensation penalty was 13.1 percent in 2018 (composed of the 21.4 percent wage penalty partially offset by the 8.4 percent benefits advantage). The 13.1 percent total compensation penalty for teachers in 2018 is just slightly lower than the 13.3 percent compensation penalty estimated for 2017. The 2017 and 2018 compensation penalties are both higher than the penalties in any other year covered by our studies, going back to 1960.[11]

We estimate that in 1993 there was a small compensation penalty for teachers of 2.9 percent, as the 5.3 percent wage penalty was partially offset by a 2.4 percent benefits advantage. The wage penalty grew substantially since 1993, as noted above, rising 16.1 percentage points by 2018. However, the 6.0 percentage-point increase in the benefits advantage partially offset the wage trends so that the overall compensation penalty grew by 10.2 percentage points between 1993 and 2018.[12]

The compensation penalty actually subsided a bit in the early part of the Great Recession and recovery, from 2007 to 2010, as the slight 0.5 percentage-point increase in the wage penalty was accompanied by a 0.9 percentage-point increase in the benefits advantage. Between 2010 and 2018, however, the 7.9 percentage-point spike in the wage penalty was offset by a 3.6 percentage-point growth in the benefits advantage. The result was the corresponding 4.3 percentage-point growth in the compensation penalty over the 2010–2018 period, a time of recovery but one during which states cut education spending, in part to accommodate tax cuts for the rich and for corporations (as noted earlier in the "Tax and spending cuts limit teacher wages in the recovery" section of this report).

These trends in wages and benefits are probably related. Recent years have seen extreme pressure on school district budgets to curtail hiring and costs. It may be the case that teachers and school districts have sought to preserve benefits by restraining wage costs. If this were the case relative to the employers of professionals, we would observe a greater teacher wage penalty with a partially offsetting increased benefits advantage. The bottom line is that since 1993 the teacher compensation penalty has increased by 10.2 percentage points.

Conclusion

The recent surge in teacher strikes across the country have brought to the public's attention many issues affecting public education, including too-large class sizes, crumbling buildings, outdated textbooks, the spread of publicly funded charter schools, low teacher compensation, teacher shortages, and inadequate staffing of nurses, librarians, and other critical positions. The research presented here underscores the critical importance of addressing the issue of low teacher wages and compensation as they continue to fall further and further behind the earnings of other college graduates.

We have been sounding the alarm about the relative erosion of teacher compensation for 15 years. The opportunity cost of choosing a career in teaching is rising as relative teacher wages and compensation falls further behind that of other professions—and we must remedy that if we are to keep experienced teachers in the classroom.

The large wage penalty for male teachers is likely a key reason why the gender mix of teachers has not changed much over time. And women, once a somewhat captive labor pool for the teaching profession, now have many more opportunities outside the profession today than in the past (Corcoran, Evans, and Schwab 2004)—meaning that growing wage and compensation penalties are making it all the more difficult to recruit and retain teachers, period. Moreover, the ever-increasing costs of higher education and burdensome student loans are also a barrier to the teaching profession in light of a widening compensation penalty.

The recent trends we document in this report with CPS-ORG data represent only a small part of a much larger long-run decline in the relative wages and compensation of teachers. To track that longer decline, we turn from CPS-ORG to U.S. decennial census data. U.S. decennial census data show that the wage penalty between women public school teachers and comparably educated women—for whom the labor market dramatically changed from 1960 to 2000—grew by nearly 20 percentage points, from a relative wage *advantage* of 14.7 percent in 1960 to a disadvantage of 4.7 percent in 2000. Among all public school teachers (both men and women), the relative wage disadvantage grew almost 13 percentage points from 1960 to 2000 (Allegretto, Corcoran, and Mishel 2008, 7). Our results in this report show that the teacher wage penalty grew an additional 9.8 and 10.4 percentage points, respectively, for all teachers and for women teachers from 2000 to 2018.

Improvements in the nonwage benefits of primary and secondary school teachers have partially offset the worsening wage disparities. The weekly total compensation (wages plus benefits) penalty for teachers in 2018 was 13.1 percent, or 8.4 percentage points less than the 21.4 percent weekly teacher wage penalty estimated for that year. It is good news that teachers are able to bargain for a total compensation package—though it seems they may have forgone wage increases for benefits recently: As we've documented, teacher wages have been stagnant since the mid-1990s; public school teacher weekly wages have not grown in the 22-year period from 1996 to 2018! This makes the wage penalty, on its own, critically important, as it is only wages that families can put toward making ends

meet—only wages can pay for expenses such as rent, food, and student loan payments.

Raising the level of teacher compensation, including wages, is critical to recruiting and retaining teachers who have the qualifications associated with teacher effectiveness in the classroom. Policies that focus solely on changing the composition of current compensation (e.g., merit or pay-for-performance schemes) without actually increasing compensation levels are unlikely to be effective. Simply put, improving public education in this country—by preventing teacher turnover, strengthening retention of credentialed teachers, and attracting young people to the teaching profession—requires eliminating the teacher weekly wage and compensation penalty.

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Appendix A: Data and methodological issues

In this appendix, we discuss the data and methods used in the estimation of the teacher pay penalty—both the weekly wage estimates and the analysis of benefits to compute the adjustments required to estimate the compensation penalty. We highlight and assess the improvements in sample selection and regression specification in the results reported in this study. This appendix draws on and updates the documentation found in *The Teaching Penalty* by Allegretto, Corcoran, and Mishel (2008).

There are two measurement issues whenever there is discussion of teacher pay. One is that teachers have the "summers off," so annual earnings are an inappropriate guide for wage comparisons. Two, teachers have good health and pension benefits that must be taken into account. We directly address these issues, the first by examining the weekly earnings of teachers compared with other college graduates and the second by adjusting our estimates of the weekly wage penalty for differences in benefits. This appendix provides details on our choice to use weekly wages as our metric of wages and on our methods for measuring benefit differences and adjusting the wage penalty to reflect a total compensation penalty.

Many other issues are covered as well. We discuss all matters related to our use of the Current Population Survey, including the choice of sample; the inconsistencies created by the 1994 redesign and by 1992 changes in how education level is measured; our exclusion of observations with imputed wage data; and adjustments made to top-coded data in response to significant growth in the number of observations with top-coded weekly wages. We detail and explain the improvements in sample selection and regression specification and assess the impact of these choices on the level and trend of the estimated teacher weekly wage penalty. We also describe the regression specification and method for estimating a teacher weekly wage penalty for each state. Last, we provide the details on the measurement of benefits and our method of computing the teacher "benefits advantage" that we use to adjust the weekly wage penalty and identify the teacher compensation (wage and benefits) penalty.

Current Population Survey sample

As noted in the body of the report, we use individual microdata from the Current Population Survey (CPS) from the Bureau of Labor Statistics (BLS), specifically the "Outgoing Rotation Group" (ORG) sample, or CPS-ORG, for our wage analysis. The CPS is the monthly survey administered by the BLS to more than 60,000 households to measure and report on unemployment. The CPS-ORG data used here are based on reports from roughly 150,000 workers each year. These data are among the most widely used by economists to study an array of labor market topics including wages, employment, and unemployment. The CPS-ORG data are particularly useful due to their large sample and

the inclusion of information on weekly wages. Since 1994, the CPS-ORG survey has asked respondents to report their wages on a weekly, biweekly, monthly, or annual basis (whichever a respondent finds most appropriate), from which the BLS then derives the weekly wage.

Our analysis restricts the sample to all full-time college graduates between the ages of 18 and 64 (defining "full-time" as working at least 35 hours per week). Teachers are identified using detailed census occupation codes, and the sample includes only elementary, middle, and secondary teachers (prekindergarten and kindergarten teachers, adult educators, and special education teachers are excluded). This analysis also focuses only on public school teachers (private school teachers—who, on average, earn less than public school teachers—are excluded). In earlier work, our regressions were estimated using a sample that included workers of all education levels rather than being restricted to college graduates: We explain our reasoning and assess the impact in the section on changes to sample selection and regression specification.

Addressing inconsistencies in the CPS historical series and 'benchmarking to 1996'

There are two inconsistencies in the historical CPS data that affect our estimates. The first is that the coding scheme for education changed in 1992. Prior to 1992 the survey asked for the "highest grade of school attended," and in 1992 the question was changed to "highest level of school completed or the highest degree received." Thus, the data in years prior to 1992 provide a measure of the number of years in school of each worker, while the data starting in 1992 provide the level of the highest degree attained. EPI's *Methodology for Measuring Wages and Benefits* (EPI 2019) describes how this inconsistency is handled by adjusting the pre-1992 data:

> The challenge of making a consistent wage series by education level is to either make the new data consistent with the past or to make the old "years of schooling" data consistent with the new educational attainment measures. To that end, we assume that completing 12 years of schooling equates with a high school diploma, 16 years with a college degree, and 18 or more years with an advanced degree. Anything between and including 13 and 15 are coded as "some college." We redistribute the "17s" to the "16 years" category (presumably a four-year degree).

The second inconsistency is due to the major CPS redesign in 1994. For the purposes of our study, the most significant change is that, starting in 1994, respondents may choose whether to report their earnings on an hourly, weekly, biweekly, monthly, or annual basis—whichever earnings interval is easiest for them to report. In pre-redesign years, respondents were specifically asked to report their weekly wages from the last week.

As reported by Allegretto, Corcoran, and Mishel (2008),

> The change in the CPS survey question on earnings appears to have resulted in a significantly higher weekly wage among teachers, as teacher wages rose 10.2

> percent between 1993 and 1994 (the year the redesigned survey was first used)—far faster than the 2.2 percent increase among nonteacher college graduates. The additional 8 percent wage growth among teachers appears to represent the effects of a correction for the underlying bias in the pre-1994 survey. Consequently, our estimates incorporate the pre-1994 data in a way that does not allow this bias to be built into our results. (47)

To avoid the bias in the pre-1994 data, we benchmark our historical weekly wage penalty series to 1996 levels, using 1996 since it is the first year for which we have data following the redesign. This takes two steps. The first is to link 1996 estimates to 1993, the last year pre-redesign. The challenge is that we do not have data for 1994 and 1995, and there is a 1993–1994 inconsistency. Our method is to use the changes in the estimated teacher weekly wage penalty series in the March CPS to link 1993 and 1996, using the estimates presented in Allegretto, Corcoran and Mishel 2008, Table 3: The teacher weekly wage penalty changed by -1.0, -4.2, and -2.0 percentage points for all teachers, for women teachers, and for men teachers, respectively. This provides an estimate of the teacher wage penalty in 1993 benchmarked to 1996 levels. The second step is to use the changes in the estimated teacher weekly wage penalty for the years 1979 to 1993 to backcast from the 1993 estimate to each prior year. That is, we use our estimates for 1992 and 1993 to compute the percentage point change and add that to the benchmarked 1993 level to obtain a benchmarked estimate for 1992. The same process yields benchmarked estimates for the entire 1979–1993 period. For more information on CPS coding schemes and the 1994 redesign, see Cohany, Polivka, and Rothgeb 1994.

Imputations

The CPS-ORG data used in this analysis are nonimputed data—we have used only nonimputed since the inception of this series in 2004. When a survey respondent fails to report any earnings, the BLS imputes their earnings—also referred to as allocated earnings. The imputation procedure is based on a Census Bureau "hot deck" methodology that finds a respondent or "donor" in the survey who closely matches the nonrespondent in characteristics such as location, age, race, and education. The problem is that the CPS-ORG does not match on detailed teacher occupations; it instead matches on a broad set of occupational categories. Thus, more often than not nonresponding teachers are assigned the average earnings of college graduates in higher-paid nonteacher occupations. Thus, imputed teacher earnings are systemically overstated, which creates a systemic bias in the comparison of teacher earnings with that of other professionals—which effectively attenuates the teacher disadvantage.[13]

In addition, the share of CPS-ORG earnings data that are imputed has grown markedly over time; hence, the bias is exacerbated. In 1979, for our original sample, which included workers with less than a bachelor's degree, imputed earnings data in the CPS-ORG made up 17 percent of the sample; by 2000, imputations accounted for 33 percent of the sample; and in 2018, they made up 41 percent of the original sample. As mentioned, the implications for our analysis of the teacher weekly wage penalty are significant. In the early years, 1979 through 1993, the differential between the teacher weekly wage penalty

found using all the data available (without regard for imputations) and the teacher weekly wage penalty found by analyzing only nonimputed observations was *at most* a 2 percentage-point difference—meaning that the inclusion of imputed data *lessened* the teacher weekly wage penalty by 2 percentage points or less. But post-1996, the differential steadily grew, and in 2015 the differential was larger than ever. For all teachers, the teacher weekly wage penalty of 19.0 percent for 2015 reported in Figure B (estimated without imputed data) would be mitigated to a 10.0 percent penalty had imputations been included—thereby reducing the penalty by nearly half.

As mentioned above, our current methodology restricts the sample to workers with at least a bachelor's degree. Compared with the above, shares of imputed data on our new sample of teachers and other college graduates are qualitatively similar. Over the more consistent data period, from 1996 to 2018, allocated data increased from 18 percent to 30 percent for teachers, while it increased from 24 percent for the sample of other college graduates to 39 percent. Whether we analyze our previous, larger sample of workers or our new sample of workers—only those with at least a bachelor's degree—the problem of imputed data has substantially worsened over time.

BLS allocation flags are not available for 1994 and are available for only the last four months of 1995. Because we cannot limit our analysis to nonimputed data for 1994 and 1995, we therefore do not report results for those years. In the past we have extrapolated results for these two years by comparing estimates using all data available with estimates using nonimputed data only. We then compared the two sets of estimates for the years just prior to and just after 1994 and 1995. The results gave us a rough expectation of what the teacher weekly wage penalties would be if nonimputed data were available for 1994 and 1995. However, in this update we no longer make these two guesstimates. When the time frame of our analysis was much shorter, we felt it was important to try to provide informed guesses for these two years—but we no longer think it is important to do so. Generally, comparisons of the time periods pre-1994 and post-1995 are at best suggestive, as the 1994 CPS redesign was substantial and other variables such as imputation flags and educational attainment coding are not consistent between the two time periods.

Weekly wage

Our analysis of the relative wage of teachers relies on comparisons of weekly earnings, rather than annual earnings, the approach taken by some authors (e.g., Hanushek and Rivkin 1997; Temin 2002, 2003; Greene and Winters 2007; Podgursky and Tongrut 2006), or hourly earnings. As discussed in our prior work, we elect to use weekly wages rather than annual earnings to avoid measurement issues re how to handle annual weeks worked (to, for example, account for teachers' traditional "summers off"). We elect weekly wages rather than hourly earnings to avoid controversies over the number of hours teachers work per week. We note that a Scholastic–Melinda & Bill Gates Foundation survey found that "teachers work an average of 10 hours and 40 minutes a day, three hours and 20 minutes beyond the average required work day in public schools nationwide" (Scholastic 2012).

It is often noted that the annual earnings of teachers cannot be directly compared with those of nonteachers given that teachers are typically only contracted to work a nine-month year. But differences arise over exactly how much time teachers devote to their position outside of their nine contracted months of teaching. Teachers spend some of their summer months in class preparation, professional development, or other activities expected of a professional teacher. Teachers who may wish to earn additional income during the summer months can often do so but are unlikely to be able to earn at the same wage rate as in their teaching role (so having a nine-month salary is a disadvantage in attaining an annual salary target). Similarly, attempts to compare the hourly wages of teachers and other professionals have resulted in considerable controversy by setting off an unproductive debate about the number of hours teachers work at home versus other professionals.[14]

As we note in this report, such decisions regarding wages interval (weekly, annual, or hourly) become mostly irrelevant when considering *changes in relative wages over time* since a constant bias is consistent with identifying an accurate trend. For instance, a measure can be biased in terms of levels (a thermometer, say, may be off by two degrees) but could still provide accurate information on trends (how much the temperature rose may be accurately discerned with either a precise or a consistently biased thermometer). Similarly, changes in relative wages are expected to be similar as long as the relative work time (between teachers and other college graduates) remains constant. For example, if the ratio of weekly hours worked by teachers relative to those worked by comparable workers remains constant over time, then estimates of changes in relative hourly wages will be the same as for relative weekly wages. Similarly, estimated changes in relative annual earnings will parallel those for weekly earnings as long as the annual weeks worked by teachers have not changed relative to those of other college graduates.

Some researchers (e.g., Podgursky and Tongrut 2006) have contended that the use of the CPS-ORG weekly wage data downwardly biases teacher earnings: They claim that teachers report a weekly wage that is actually an annual salary divided over a full year rather than the partial year they actually work, which exaggerates the teacher weekly wage penalty relative to other comparable workers. This issue is particularly relevant to CPS data prior to the 1994 CPS redesign. In Allegretto, Corcoran, and Mishel 2008, we benchmarked the CPS-ORG wage data to annual data from the Annual Social and Economic Supplement (ASEC) of the CPS, the "March CPS." This extensive benchmarking exercise provided validation that the CPS-ORG wage data are consistent with the annual March data, which Hanushek and Rivkin (1997, 2004), Temin (2002, 2003), and Podgursky and Tongrut (2006) have used in their analyses of teacher wage trends. As expected, the annual wage penalty is just the weekly wage penalty multiplied by the ratio of teacher and nonteacher annual weeks worked. We are even more confident in the post-redesign CPS data because the redesigned questions allow respondents to provide wage data for a variety of reporting periods—hourly, weekly, biweekly, monthly, annual. The BLS uses the reported wage data to compute weekly wages based on information on weeks worked provided by respondents. Therefore, the potential problem of teachers reporting weekly wages earned in nine months but received over the full year was lessened by the redesign.

Our 1979 through 1993 benchmarking exercise leaves little doubt that there has been deterioration in the relative earnings of teachers over time. Moreover, our use of weekly wage comparisons in all of our work on teacher pay allows us to avoid unproductive discussions of work years, summers off, and so on. Allegretto, Corcoran, and Mishel 2008 also show in chapter 2 that the long-term trends in the March CPS, decennial census, and CPS-ORG data all yield similar findings regarding the relative erosion of teacher wages.

Adjusting observations with BLS top-coded weekly wages

To protect the confidentiality of respondents, public-use CPS data have assigned top codes for each source of income that respondents' report and for the wage data in the ORG files. In our prior analyses, we did not make any adjustments to weekly wages to account for top-coding. Failure to account for this has generated a growing understatement of college graduate wages as more and more observations have become top-coded in the last 20 years. We therefore make adjustments to the top-coded data in the analyses reported here; below, we provide an assessment of the impact of this decision on our estimates of the level and trend of the teacher weekly wage penalty.

For the time period of this study, 1979 through 2018, the BLS top code was increased only twice: the assigned amount rose abruptly in 1989 from $999 to $1,923 per week, and again in 1998 to $2,884.61.

The share of observations that hit the top code grew considerably over the long periods between updates. During the first period, from 1979 through 1988, when the top-code value was $999, the share of top-coded data for all wage and salary workers ages 18–64 increased from 0.6 percent to 4.6 percent. Over this same period, the share of public school teachers with top-coded weekly wages increased from 0.1 percent to 3.7 percent. Importantly, over the same time, the shares for other college graduates increased much more, from 2.6 percent to 16.7 percent, reflecting the growth in wages at the top of the distribution along with the few changes in the BLS-assigned amount. As expected, when the assigned top-code value was increased from $999 to $1,923 in 1989, the top-code share of observations plummeted—falling to 0.5 percent, 0.0 percent, and 2.4 percent for the whole sample, for teachers, and for other college graduates, respectively.

The shares then increased to 1.7 percent, 1.0 percent, and 6.5 percent in 1997, the final year weekly wages were top-coded at $1,923. In 1998, the top-code value was increased to $2,884.61, where it stands today. Over the last 21 years, the top-code share has increased from 0.6 percent to 4.2 percent for the overall sample, from 0.3 percent to 1.3 percent for teachers and from 2.3 percent to 12.1 percent for other college graduates.

The dynamic of the BLS-assigned top code essentially truncates the wage distribution at the top and creates a downward bias in the mean weekly wages measured; the issue becomes more pronounced as the share of observations with top-coded weekly wages increase. To ignore the issue of top codes is to artificially attenuate the teacher disadvantage because far fewer teacher observations are top-coded than observations

among other college graduates.

For this report, we replace original BLS-assigned top-code values with a Pareto-distribution implied mean for the upper tail of the weekly earnings distribution. The method is further described in EPI's *Methodology for Measuring Wages and Benefits* (EPI 2019).

Improvements in sample selection and specification

We have been tracking trends in teacher pay and estimating relative teacher wage and compensation penalties since 2004 when we released our first book on the subject, *How Does Teacher Pay Compare?* We made two substantive changes in our approach in our second book, *The Teaching Penalty*, released in 2008. For this current study, we have introduced seven significant modifications to the sample, data, and regression specifications. This section details these changes and their impact on the level and trend of the teacher weekly wage penalty.

The effects of the two methodological changes made for *The Teaching Penalty* are documented in Appendix A of that book. First, we excluded private-sector teachers from our estimated teacher weekly wage penalties so that the estimates were restricted to public school teachers. Teacher wages in the private sector are, on average, substantially less than in the public sector, as documented by Allegretto and Tojerow (2014). Thus, we added a control in our regression model to separate out weekly wage penalties of public-sector teachers from those of teachers in the private sector. This change resulted in a smaller, otherwise less negative (public-sector only) teacher weekly wage penalty than originally estimated in our 2004 book.

A second improvement was to include a finer set of controls on educational attainment in the regression model, adding separate controls for B.A. and M.A. degrees rather than simply controlling for having a college degree. This change was made because a much larger share of teachers hold a master's degree or higher compared with other college graduates. This change in the specification of education increased the relative teacher weekly wage penalty (making it more negative). The two changes together *decreased* the original teacher disadvantage slightly (the penalty became less negative). For example, in the 2008 book, we concluded that the original 2004 teacher weekly wage penalty of 16.3 percent became 15.1 percent with the simultaneous implementation of the two changes. For all teacher pay studies we published from 2008 through 2018, we made no changes to our research design or sample construction.

For this report, we have revised our sample strategy and regression specification to improve the estimates. We explain our reasoning for each decision and assess the impact on our estimates of the teacher weekly wage penalty. **Appendix Table A1** provides a summary of the changes we have incorporated into our new approach compared with our other analyses since the publication of *The Teaching Penalty* in 2008.

Appendix Table A1

Changes in specification and sample restrictions

Sample restrictions and regression specification	Original sample and model used in previous work	Sample and model used in this paper
Dependent variable log weekly wage	Yes	Yes
Self-employed workers dropped	Yes	Yes
Weekly hours ≥ 35	Yes	Yes
Imputed CPS wage data dropped	Yes	Yes
Age range 18–64	Yes	Yes
Top-code-adjusted data[a]	No	Yes
Education sample restriction	None	B.A. or higher
Education category controls[b]	6	4
Race/ethnic controls: w,b,h,o[c]	Yes	Yes
Married indicator	Yes	Yes
Geographic controls	Region	State
Age quartic controls	Yes	Yes
Gender control (pooled regressions)	Yes	Yes
Private-sector teacher indicator	Yes	Yes
Public-sector teacher indicator	Yes	Yes
Include CPS-ORG weight in regressions	No	Yes

[a] We adjust top codes using Pareto distribution.
[b] Six groups: less than high school, high school diploma, some college or associate degree, bachelor's degree, master's degree, professional degree/Ph.D. (combined). Four groups: bachelor's degree, master's degree, professional degree, Ph.D.
[c] White, black, Hispanic, other. Race/ethnicity categories are mutually exclusive (i.e., white non-Hispanic, black non-Hispanic, other non-Hispanic, and Hispanic any race).

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In this report, we again restrict the sample to all full-time wage and salary workers between the ages of 18 and 64 (defining "full-time" as working at least 35 hours per week), as we have in the past. We also limit the sample to nonimputed earnings data, as discussed above. As usual, teachers are identified using detailed census occupation codes, and the sample includes only elementary, middle, and secondary teachers (prekindergarten and kindergarten teachers, adult educators, and special education teachers are excluded). We continue to separate out public and private teacher outcomes, thereby limiting our reported estimates of the teacher weekly wage penalty to public school teachers. We continue to use log weekly wage as the dependent variable.

We further restrict the sample to include only those workers with at least a bachelor's degree. In some of our earlier work, we estimated wages penalties back to 1960, when

teachers were less likely to have a college degree. But today public school teachers are required to have at least a B.A.; thus, we limit the sample to those workers who have at least a B.A. degree. We also expand the categories of education indicator variables for highest degree attained—to include M.A., professional degree, and Ph.D.—in the regressions. Previously, the only indicator beyond the B.A. level was M.A. These changes allow for a cleaner comparison of teachers with other college graduates.

Additionally, we include finer geographical controls. Regression specifications now include geographic controls at the state (and D.C.) level instead of regional level controls (for four regions). For the first time, we use top-code-adjusted weekly wages that follow a Pareto distribution, as explained above, to avoid the increasing understatement of college graduate wages as more observations are top-coded. We now weight the observations in our regressions using the CPS-ORG weights. This ensures our results are nationally representative and correspond to the descriptive weekly wage data used in Figure A in the main text. In accordance with past work, we continue to include regression controls for race (four categories), marital status (dichotomous indicator), and age as a quartic.

To gain further insight into how these changes affect our estimates, we compare each separately and all simultaneously to our original estimated teacher weekly wage penalties as reported in our earlier work (Allegretto and Mishel 2018)—presented as model (1) in **Appendix Table A2**. We omit any analysis of expanding the education controls because the impact of doing so does not affect the estimated weekly wage penalty by as much as 0.1 percent.

The top panel of Appendix Table A2 reports estimates of the weekly wage penalty for 1979, the beginning of our analysis; for 1993, just before the 1994 redesign and the two-year period in which imputations are incomplete or not available; and then for selected years from 1996 onward. These data allow us to assess the impact of sample and regression specification changes on the levels of the weekly wage penalty in key years. The last four columns report percentage point change in the weekly wage penalty over various time periods to assess the impact of sample and regression specification changes on the trend of the weekly wage penalty. The bottom panel of the table reports differences between the new and original estimates for the selected years and for the trends in particular periods. **Appendix Figure A1** shows the time series of the estimated teacher weekly wage penalty for each year from 1979 to 2018 for every specification choice, except for the years for which we do not have data (1994–1995).

Appendix Table A2

Estimated teacher wage penalty with alternative specifications, 1979–2018

		Level of wage penalty								Percentage point change in penalty			
		1979*	1993*	1996	2002	2007	2010	2017	2018	1979–2018	1996–2018	2007–2018	2010–2018
A. Estimated weekly wage penalty													
1	Original model	-2.5%	-3.3%	-4.3%	-13.5%	-13.0%	-12.1%	-18.7%	-18.7%	-16.2	-14.4	-5.7	-6.6
2	Original & adjust top codes	-3.5%	-4.7%	-5.7%	-14.6%	-14.8%	-14.4%	-22.4%	-22.9%	-19.4	-17.2	-8.1	-8.5
3	Original & replace region with state effects	-1.6%	-1.6%	-2.6%	-11.9%	-11.1%	-10.8%	-16.7%	-16.8%	-15.2	-14.2	-5.7	-6.0
4	Original but exclude noncollege workers	-6.8%	-5.0%	-6.0%	-13.8%	-13.4%	-12.4%	-19.3%	-19.5%	-12.7	-13.5	-6.1	-7.1
5	Original using ORG weights	-3.2%	-3.7%	-4.7%	-13.0%	-12.2%	-11.6%	-17.2%	-17.3%	-14.1	-12.6	-5.2	-5.8
6	All changes described in (2)–(5)	-7.3%	-5.3%	-6.3%	-13.0%	-13.0%	-13.5%	-20.7%	-21.4%	-14.1	-15.1	-8.4	-7.9
B. Difference with original (1)													
1	Original model	–	–	–	–	–	–	–	–	–	–	–	–
2	Original & adjust top codes	-1.0	-1.4	-1.4	-1.0	-1.8	-2.3	-3.7	-4.2	-3.2	-2.8	-2.4	-1.9
3	Original & replace region with state effects	0.9	1.7	1.7	1.6	1.9	1.3	2.0	1.9	1.0	0.2	0.1	0.6
4	Original but exclude noncollege workers	-4.3	-1.7	-1.7	-0.3	-0.4	-0.3	-0.6	-0.8	3.5	0.9	-0.4	-0.5
5	Original using ORG weights	-0.7	-0.4	-0.4	0.5	0.8	0.5	1.5	1.4	2.1	1.7	0.5	0.8
6	All changes described in (2)–(5)	-4.8	-2.0	-2.0	0.6	-0.1	-1.4	-2.0	-2.7	2.1	-0.8	-2.7	-1.3

* Benchmarked estimate: 1993 equals 1996 estimate plus change in wage penalty, 1993–1996, estimated with March CPS data; 1979 equals derived 1993 plus changes in wage penalty, 1979–1993, estimated with ORG data.

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data

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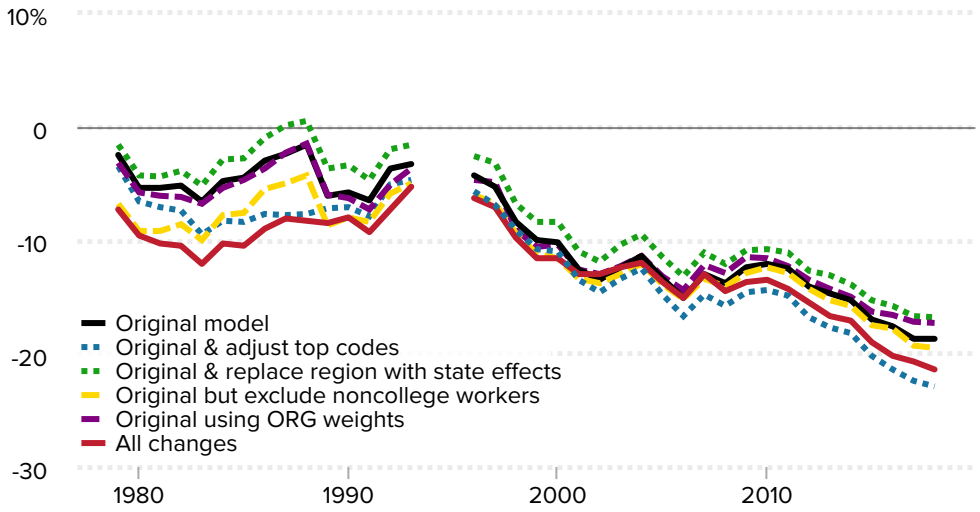
Appendix Figure A1

Estimated teacher weekly wage penalty with alternative specifications, 1979–2018



Notes: Figure shows regression-adjusted teacher weekly wage penalties of public school teachers (elementary, middle, and secondary) relative to other college graduates under alternative models. In all models, the dependent variable is (log) weekly wages. The original model includes indicator controls on public school teacher, private school teacher, gender, and married, along with indicator sets on education (M.A., professional degree, Ph.D.) and race/ethnicity (black, Hispanic, other); also included are age as a quartic and state fixed effects. Each subsequent model builds from the original sample and regression specification. Estimated relative teacher weekly wage penalties reported in this paper are from the final model that incorporates "All changes." Estimates are omitted for 1994 and 1995, as imputation flags for these two years are incomplete or not available.

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data

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Appendix Table A2 and Appendix Figure A1 allow us to assess the impact of four changes: adjusting top codes; replacing region with state controls; excluding non-college-educated workers from the sample; and weighting each observation with the weights provided in the CPS-ORG data.

Appendix Figure A1 provides a visual depiction that compares and contrasts each of the six models over the time period of study. The first thing to notice in the figure is that a comparison of results from each model are much less consistent in the early period compared with the estimated weekly wage penalties after the 1994 redesign. This is due to many issues, but generally we believe that the post-1994 period provides more reliable estimates due to data improvements and consistency (see more below on the redesign)—which is why we benchmark the pre-1994 estimates. Benchmarked estimates effectively reduce the teacher weekly wage disadvantage.

This analysis yields a few general conclusions. Two changes—the use of state rather than regional controls, and the weighting of observations in the period from 1996 to 2018—lower the teacher penalty (move it toward zero). The other changes (top-code adjustments, weighting of observations in the 1979–1993 period, and the exclusion of non-

college-educated workers) increase the estimated teacher weekly wage penalty (making the estimate more negative). Regardless of the model chosen, however, the relative teacher wage penalty deteriorated considerably over time, as Appendix Figure A1 visually confirms. Thus, the worsening trend in teacher relative wages is evident no matter which model is chosen.

The two changes that have had the largest effect in the post-1994 redesign period are estimates from top-code-adjusted weekly wages and the incorporation of state fixed effects into the regression specification. Over time (1996 through 2018), using state fixed effects lowers the teacher penalty on a fairly consistent basis, but the impact of using the top-code adjustment increasingly makes the teacher wage penalty more negative. It is not surprising that the impact of making the top-code adjustment grows over time since the share of the sample with top-coded weekly wages has grown considerably.

The impact of excluding non-college-educated workers is relatively small in recent years but was relatively large in the early period (4.3 percentage points in 1979) and still sizable into the mid-1990s (1.7 percentage points).

In sum, our improved approach with all of the changes (shown as in row (6) in Appendix Table A2) estimates a larger relative teacher disadvantage—even as the estimates increased by differing amounts across the years. A clear deterioration of relative teacher wages is evident, regardless of model. Using model (1) to estimate the teacher weekly wage penalty in 2018 yields a 18.7 percent estimate, while model (6) results in a 21.4 percent penalty.

Estimates of state-specific teacher weekly wage penalties

In this report, we improve our estimates of the teacher weekly wage penalty in the states. In previous work, we relied on descriptive computations of the weekly wages of public school teachers relative to other college graduates, controlling for education levels. Specifically, we used data on the weekly wages of those with educational attainment of a B.A. degree or an M.A. degree for both teachers and other college graduates. We computed a weighted average wage for teachers and for other college graduates using the education composition of teachers as the weights. That is, if half the teachers had an M.A. degree and half had a B.A. degree, then we weighted the wages of other college graduates so that they also had an even split between those with B.A. degrees and those with M.A. degrees.

We report state-specific teacher weekly wage penalties using a regression-adjusted method that corresponds to how the national estimates are obtained and using the same sample of all wage and salary workers, with a bachelor's degree or higher, between the ages of 18 and 64, who report working 35 or more hours a week, and who report hourly wages between $0.50 and $100 (in 1989 dollars). BLS top-coded data are adjusted using the same procedure described above, and the sample only includes observations that have nonimputed wages. To increase the sample size for each state, we pooled five years

of the CPS-ORG data, 2014–2018.

One concern we had about this approach was whether there were sufficient data to obtain state-specific estimates. We initially examined this question using the pooled CPS-ORG data for 2013–2017. We found that D.C. had the smallest sample of public school teachers, 124 observations, and three states (Delaware, Hawaii, and Arizona) had between 133 and 139 observations. All of the remaining states had samples exceeding 150 observations. We assessed that sample sizes were sufficient. Nevertheless, in Appendix C we present the standard error, the 95th-percentile confidence intervals, and the t-statistics for each state's weekly wage penalty estimate so readers can judge the level of precision.

There are variations across the states in the character of the samples. The share of observations that have imputed wages varies greatly, with imputation rates ranging from 15.9 to 45.6 percent for teachers and from 23.9 to 54.4 percent for other college graduates. Similarly, the share of observations with BLS top-coded weekly wages varies greatly as well. The share of top-coded observations for teachers ranges from zero (in nine states) to 5.5 percent, for an average of 1.0 percent across all states and D.C. Top-code shares for other college graduates range from 3.7 percent to 17.3 percent, for an average of 8.4 percent.

To estimate state-specific teacher weekly wage penalties, we first fit a linear regression of log usual weekly earnings on a complete set of dummy variables for whether the respondent is a public school teacher, interacted with state fixed effects. The state-specific teacher weekly wage penalty is then the sum of the coefficient for being a public school teacher and the coefficient for the interaction with the particular state. Finally, to express the weekly wage penalty in percentage points, we exponentiate the sum and subtract one. In addition to the set of teacher and state interactions, the regression model also includes the same set of control variables employed to estimate the national weekly wage penalty: a gender dummy; a set of dummies for black, Hispanic, and other race; an age quartic; marital status; dummies for M.A., Ph.D., and professional degrees; and state fixed effects. The model also controls separately for a complete set of interactions between the respondent's state and whether the respondent is a private school teacher.

Computing the benefits advantage

This section explains the computations required to assess the benefits advantage in each year. The benefits advantage reflects the advantage of K–12 teachers in benefits relative to those of civilian professionals, assuming the wage penalty is estimated as detailed above. There are no microdata available to researchers for estimating a compensation penalty that requires data on both benefits and wages for teachers and other college graduates. Instead, we rely on a comparison of teachers and professionals in the aggregate to adjust our estimated teacher wage penalties.

The core data for these computations come from the BLS Employer Costs for Employee Compensation (ECEC) Historical Listing based on the National Compensation Survey (BLS 2019). Specifically, we pull data on employer costs per hour worked for detailed categories

of compensation from the section "Primary, secondary, and special education school teachers" in BLS 2019, Table 7 ("State and local government workers"). We compare teacher benefits with those of civilian professionals from BLS 2019, Table 3. The category "civilian professionals"—which includes all private-sector workers and state and local public-sector workers but excludes federal government workers—is the broadest category available that corresponds with all college graduates. State and local government teachers closely correspond to our CPS-ORG sample of public school teachers.

"Benefits" in our analysis refers to the employer costs for health and life insurance, retirement plans, and payroll taxes (i.e., Social Security, unemployment insurance, and workers' compensation). The remaining components of compensation are "W-2 wages," a wage measure that corresponds to the wages captured in the CPS-ORG data used for estimating the wage penalty. W-2 wages are the wages reported to employees and to the Internal Revenue Service, and they include the following ECEC items: "direct wages," defined by the BLS as "regular payments from the employer to the employee as compensation for straight-time hourly work, or for any salaried work performed"; "supplemental pay," which includes premium pay for overtime, bonus pay, profit-sharing; and "paid leave." These data are used to compute the benefits share of compensation presented in Table 1 and the ratio of compensation to W-2 wages used in the calculation of the benefits advantage. It is important to note that the CPS-ORG definition of wages includes supplemental pay items and paid leave, so using the "direct wage" measure of wages from the ECEC would not provide a match to estimates of the wage penalty.

Appendix Table A3 shows the calculations for identifying the benefits advantage. The basic data required, shown in Panel A, are the compensation-to-W-2-wages ratios for K–12 teachers and for professionals, plus the estimated weekly wage penalty for the particular year. The logic is simple. Start with the relative wage disadvantage, or penalty, of teachers—21.4 percent (as reported in Figure B in the main text). Based on this result, we set the wages of professionals to be equal to 100.0 and teacher wages equivalent to 78.6, as shown in Panel B of Appendix Table A3.

The corresponding compensation difference is computed knowing the compensation-to-wage ratio for each occupational group. These compensation differences are then rescaled to set professional compensation equal to 100.0, showing that teacher compensation is 86.9 (indicating a compensation disadvantage of 13.1 percent). The "benefits advantage" calculated when relying solely on the wage data rather than including both benefits and wage data (i.e., compensation data) is thus 8.4 percent, the difference between the relative teacher compensation of 86.9 and the relative wage of 78.6. (Note that the underlying data, not rounded, generate an 8.4 percent benefits advantage, while the rounded-to-one-decimal data indicate an 8.3 percent advantage.)

Historical data issues

Two data discontinuities need to be addressed to develop a historical series. One is the discontinuity introduced by the CPS redesign in 1994. This discontinuity creates two problems: It makes CPS analysis of teacher wage data before and after 1994 inconsistent, and it makes it impossible to identify the observations that do not have imputed wage data

Appendix Table A3

Computing the benefits advantage, 2018

	2018 data
A. Basic data	
Ratio: Compensation to W-2 wages	
K–12 teachers	1.409
Professionals	1.274
Estimated weekly wage penalty	-21.4%
B. Benefits advantage analysis	
W-2 wages	
*K–12 teachers**	78.6
Professionals	100.0
Compensation**	
K–12 teachers	110.7
Professionals	127.4
Rescaled compensation***	
K–12 teachers	86.9
Professionals	100.0
C. Benefits advantage**	8.4%

* 100 less estimated wage penalty
** Wage times compensation-to-wage ratio
*** Divide by professionals' compensation, the benchmark, and multiply by 100
**** Subtract teachers' W-2 wages from teachers' rescaled compensation

Note: Numbers may not sum to totals due to rounding.

Sources: Benefits and wage data from Bureau of Labor Statistics Employer Costs for Employee Compensation data; wage penalty estimated with Current Population Survey Outgoing Rotation Group data

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in 1994 and 1995, preventing us from making estimates for those years consistent with later years. Our method for benchmarking to 1996 levels, described above, allows us to compile a series for the 1979–1993 years that is consistent before and after the 1994 redesign. However, we do not attempt to present estimates for 1994 or 1995.

The second discontinuity is that the ECEC occupational categories changed in 2004. There are consistent data on "professionals" from 2004 to 2018, but the data before 1994 are for "professional and technical workers." Similarly, the ECEC provides data on K–12 teachers (in the state/local sectors) starting in 2004 (see BLS 2019, Table 7), but the data before 2004 are for a category of "elementary and secondary teachers" that are civilians and not limited to the state/local public sector.

Because of the inability to use nonimputed data in 1994–1995, we use 1993 as the key historical year in Table 1 along with 1979 to show the estimated wage penalty trends. These data are benchmarked to the 1996 level of the wage penalty.

There are no benefits data before 1986, so it is not possible to derive a compensation penalty for 1979. This leaves us the challenge of identifying the benefits advantage for 1993. An analysis of the elementary/secondary and professional/technical occupation benefits data from the ECEC for 1993 and 2003 indicates a decline in the benefits advantage from 3.4 percent to 3.2 percent, a decline of 0.2 percentage points. We extend the benefits advantage calculated for 2004, 2.2 percent, to 1993 by adding this 0.2 percentage point trend from the 1993–2003 period to obtain a benefits advantage of 2.4 percent in 1993. This assumes that there was no change in the benefits advantage over the 2003–2004 period and that, over the 1993–2003 period, the teacher–professional advantage experienced percentage-point growth comparable to the growth of the elementary/secondary–professional/technical advantage during this time.

Appendix Table B1

Estimated public school teacher weekly wage penalty, 1979–2018

	Teacher weekly wage penalty		
Year	All	Women	Men
1979	-7.3%	6.9%	-17.8%
1980	-9.6%	4.8%	-20.3%
1981	-10.3%	3.5%	-20.1%
1982	-10.5%	3.2%	-20.5%
1983	-12.1%	1.4%	-21.9%
1984	-10.3%	2.8%	-20.9%
1985	-10.5%	2.2%	-20.7%
1986	-9.0%	3.5%	-19.5%
1987	-8.1%	4.2%	-19.3%
1988	-8.3%	5.5%	-19.3%
1989	-8.5%	3.4%	-18.2%
1990	-8.0%	4.4%	-19.0%
1991	-9.3%	1.0%	-17.5%
1992	-7.3%	3.4%	-16.7%
1993	-5.3%	4.4%	-14.2%
1994	n.a.	n.a.	n.a.
1995	n.a.	n.a.	n.a.
1996	-6.3%	0.2%	-16.2%
1997	-7.1%	0.5%	-19.8%
1998	-9.8%	-2.0%	-21.7%
1999	-11.6%	-3.7%	-23.0%
2000	-11.6%	-4.7%	-23.1%
2001	-13.0%	-5.4%	-25.5%
2002	-13.0%	-6.3%	-24.7%
2003	-12.4%	-6.0%	-22.2%
2004	-12.0%	-5.2%	-22.9%
2005	-13.7%	-6.3%	-25.7%
2006	-15.1%	-8.3%	-26.6%
2007	-13.0%	-6.0%	-24.5%
2008	-14.5%	-8.0%	-25.4%

Appendix Table B1 (cont.)

Year	Teacher weekly wage penalty		
	All	Women	Men
2009	-13.7%	-6.3%	-25.4%
2010	-13.5%	-5.9%	-25.5%
2011	-14.3%	-7.6%	-26.4%
2012	-15.5%	-9.1%	-26.4%
2013	-16.7%	-10.1%	-28.1%
2014	-17.1%	-11.1%	-26.8%
2015	-19.0%	-13.7%	-27.8%
2016	-20.2%	-13.0%	-32.5%
2017	-20.7%	-15.6%	-30.1%
2018	-21.4%	-15.1%	-31.5%

Notes: Table reports regression-adjusted teacher weekly wage penalties (or premiums) for public school teachers (elementary, middle, and secondary) relative to other college graduates. (The figure shows a wage premium for women teachers from 1979–1997.) Dependent variable is (log) weekly wages with indicator controls on public school teacher, private school teacher, gender, and married, along with indicator sets on education (M.A., professional degree, Ph.D.) and race/ethnicity (black, Hispanic, other); also included are age as a quartic and state fixed effects. Estimates are omitted for 1994 and 1995, as imputation flags for these two years are unavailable in 1994 and available only for the last four months of 1995 (see Appendix A for more detail).

Source: Authors' analysis of Current Population Survey Outgoing Rotation Group data

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Appendix Table C1

Teacher weekly wage penalty, 95% confidence interval, sample size by state, pooled data from 2014–2018

State	Estimated weekly wage penalty*	Standard error	t-statistic	95% confidence interval		Sample size
				Low	High	
All U.S. states	-19.8%	0.004	-49.5	-20.5%	-19.1%	155,572
Alabama	-24.2%	0.023	-10.7	-28.6%	-19.8%	1,652
Alaska	-10.4%	0.029	-3.6	-16.0%	-4.8%	1,732
Arizona	-32.6%	0.020	-16.6	-36.5%	-28.8%	2,105
Arkansas	-17.1%	0.023	-7.5	-21.6%	-12.7%	1,718
California	-16.5%	0.012	-13.7	-18.8%	-14.1%	12,805
Colorado	-30.7%	0.022	-13.8	-35.0%	-26.3%	2,956
Connecticut	-13.6%	0.025	-5.5	-18.4%	-8.7%	2,297
Delaware	-10.1%	0.027	-3.8	-15.4%	-4.8%	1,771
District of Columbia	-25.2%	0.026	-9.7	-30.2%	-20.1%	7,472
Florida	-19.7%	0.017	-11.2	-23.1%	-16.2%	5,116
Georgia	-25.4%	0.018	-14.0	-29.0%	-21.9%	3,398
Hawaii	-12.1%	0.025	-4.8	-17.1%	-7.1%	1,783
Idaho	-20.3%	0.026	-7.9	-25.4%	-15.3%	1,956
Illinois	-16.4%	0.019	-8.6	-20.2%	-12.7%	5,174
Indiana	-20.6%	0.023	-8.9	-25.1%	-16.1%	2,283
Iowa	-17.2%	0.025	-6.8	-22.2%	-12.2%	1,892
Kansas	-21.2%	0.030	-7.1	-27.0%	-15.4%	2,324
Kentucky	-23.6%	0.025	-9.3	-28.6%	-18.7%	1,813
Louisiana	-22.0%	0.023	-9.7	-26.4%	-17.6%	2,171
Maine	-22.6%	0.027	-8.4	-27.9%	-17.3%	1,590
Maryland	-8.2%	0.026	-3.2	-13.2%	-3.1%	3,289
Massachusetts	-18.3%	0.026	-7.1	-23.3%	-13.3%	3,958
Michigan	-19.5%	0.025	-7.7	-24.4%	-14.5%	3,045
Minnesota	-21.6%	0.022	-9.7	-26.0%	-17.3%	3,067
Mississippi	-12.8%	0.032	-3.9	-19.1%	-6.4%	1,626
Missouri	-26.5%	0.020	-13.1	-30.5%	-22.6%	2,293
Montana	-14.0%	0.024	-5.7	-18.8%	-9.2%	2,545
Nebraska	-18.2%	0.020	-9.1	-22.2%	-14.3%	2,382
Nevada	-17.5%	0.024	-7.2	-22.3%	-12.7%	1,538
New Hampshire	-19.6%	0.022	-8.8	-23.9%	-15.2%	2,868
New Jersey	-3.8%	0.029	-1.3	-9.4%	1.9%	3,851
New Mexico	-24.9%	0.023	-10.9	-29.3%	-20.4%	1,826
New York	-12.2%	0.019	-6.2	-16.0%	-8.4%	6,556
North Carolina	-26.5%	0.024	-11.2	-31.1%	-21.8%	3,024
North Dakota	-8.7%	0.023	-3.8	-13.2%	-4.2%	2,455
Ohio	-16.5%	0.018	-9.1	-20.0%	-13.0%	4,059
Oklahoma	-29.7%	0.022	-13.7	-33.9%	-25.4%	1,634
Oregon	-23.1%	0.026	-9.0	-28.1%	-18.0%	2,447
Pennsylvania	-13.5%	0.021	-6.5	-17.5%	-9.4%	4,635
Rhode Island	-1.5%	0.034	-0.4	-8.2%	5.2%	1,670
South Carolina	-18.0%	0.021	-8.5	-22.2%	-13.9%	1,951

Appendix Table C1 (cont.)

State	Estimated weekly wage penalty*	Standard error	t-statistic	95% confidence interval		Sample size
				Low	High	
South Dakota	-14.2%	0.031	-4.5	-20.3%	-8.1%	1,779
Tennessee	-22.1%	0.021	-10.8	-26.1%	-18.1%	2,324
Texas	-22.5%	0.012	-18.4	-24.9%	-20.1%	8,463
Utah	-25.5%	0.021	-12.4	-29.5%	-21.4%	2,288
Vermont	-10.1%	0.024	-4.2	-14.8%	-5.4%	2,374
Virginia	-31.3%	0.018	-17.5	-34.9%	-27.8%	3,965
Washington	-31.6%	0.016	-19.2	-34.8%	-28.4%	3,415
West Virginia	-18.3%	0.021	-8.7	-22.4%	-14.2%	1,785
Wisconsin	-17.7%	0.019	-9.2	-21.5%	-13.9%	2,735
Wyoming	-0.2%	0.027	-0.1	-5.4%	5.0%	1,717

Notes: State-specific teacher weekly wage penalties fit a linear regression of (log) weekly wage on a complete set of dummy variables for public school teacher interacted with state fixed effects. The state-specific weekly wage penalty is then the sum of the coefficient for being a public school teacher and the coefficient for the interaction with the particular state. To express the penalty in percentage points, we exponentiate the sum and subtract one. Regressions are weighted using CPS-ORG sample weights. BLS top-coded data are adjusted, by gender, assuming the distribution of weekly wages is Pareto. The regression model also includes a dummy for female; dummies for black, Hispanic, and other; age as a quartic; marital status; dummies for M.A., Ph.D., and professional degree; and state fixed effects. The model also controls separately for a complete set of interactions between the respondent's state and whether the respondent is a private school teacher. The sample includes all wage and salary workers with a B.A. degree or higher, ages 18 to 64, who report working 35 or more hours a week, and who report hourly wages between $0.50 and $100 (in 1989 dollars).

Source: Authors' analysis of pooled 2014–2018 Current Population Survey Outgoing Rotation Group data

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Endnotes

1. We often hear that a strong teacher is the single biggest within-school factor influencing learning and student achievement, and both research and common sense affirm this. It is important to keep in mind, however, that teachers operate within a complex ecosystem of fellow teachers, school leadership, curriculum, standards, and a range of resources, including parent and community engagement, all of which have major impacts on teacher effectiveness. Indeed, as Anthony Bryk and his colleagues found in their research on school reforms in Chicago, school improvement—and thus increased achievement—is akin to baking a cake, with five essential ingredients that constantly interact (Bryk et al. 2010). So while it's critically important to design policies to strengthen the teacher corps, that effort must be complemented by larger work to improve school ecosystems as a whole.

2. The year 1979 is the first year for which we have sufficient annual data to track trends in teacher relative wages.

3. To find out more about public versus private school teachers, see an in-depth report on the subject by Allegretto and Tojerow (2014).

4. For further discussion of the practice of top-coding and the implications for data analysis, see Gould 2019 and Ingraham 2019.

5. The earlier work referenced here is Allegretto, Corcoran, and Mishel 2004, 2008.

6. In Allegretto, Corcoran, and Mishel 2008, we compared our results on the relative weekly wages of teachers with our results on the relative hourly wages of teachers using CPS-ORG data on hourly wages and found no qualitative differences.

7. In Appendix A of Allegretto, Corcoran, and Mishel 2008, we benchmarked CPS-ORG weekly wages to annual wages in the March CPS (CPS Annual Social and Economic Supplement) and found the two measures to produce consistent trends.

8. To present weekly wage penalties in percentage terms, we exponentiate the estimated coefficients and subtract 1.

9. For instance, the real weekly wages of teachers grew 5 percent from 1993 to 1996, greater than the 2.2 percent increase for nonteacher college graduates. This likely reflects the change in measurement in the redesign, after which teachers are allowed to report their earnings in any period that is most accessible or easiest. We believe that some teachers in the earlier years reported their weekly wages as their school-year wages spread over the full year, thereby understating their actual weekly wages. This measurement error was removed by the redesign.

10. The ECEC provides compensation data for a narrower category of "primary, secondary, and special education school teachers" and for a broader category of "teachers." We analyze the narrower category, which closely matches the definition of teachers in our ORG data, using data limited to state and local public-sector workers. The inclusion of kindergarten and special education teachers in the benefits analysis does not produce any substantial differences than if they were excluded (as they are in the sample used to estimate the wage penalty). Greater methodological detail is provided in Appendix A.

11. This is true for the data we have going back to 1993 and 1994. In earlier years, back as far as

1960, there was actually a wage premium or a modest wage penalty, so the compensation penalty would have been smaller than in the years since 1993–1994.

12. As reviewed in Allegretto, Corcoran, and Mishel 2008, there are discontinuities in the occupational codes in the ECEC series for both teachers and professionals. The data for teachers in 1993–2003 are for all teachers, not just primary and secondary school teachers, and the definition of professionals in the data before 2004 differs from that used in the data starting in 2004. We use the changes in 1993–2003 to extrapolate backward from 2004. This implicitly assumes no change over 2003–2004. That is, the benefits advantage fell by 0.2 percentage points from 1993 to 2003 for teachers overall (K–12, university, and others). We assume that was the change among primary and secondary school teachers and therefore add 0.2 percent to the benefits advantage in 2004 (calculated using K–12 teacher data) to obtain our estimate of the 1993 benefits advantage.

13. For more on imputations, see Allegretto, Corcoran, and Mishel 2008, 10; Hirsch and Schumacher 2004; and Bollinger and Hirsch 2006.

14. In Allegretto, Corcoran, and Mishel 2008, we estimated regression-adjusted relative hourly wages of teachers using CPS-ORG data and found no qualitative differences in our results.

References

Allegretto, Sylvia A., Sean P. Corcoran, and Lawrence Mishel. 2004. *How Does Teacher Pay Compare? Methodological Challenges and Answers*. Washington, D.C.: Economic Policy Institute.

Allegretto, Sylvia A., Sean P. Corcoran, and Lawrence Mishel. 2008. *The Teaching Penalty: Teacher Pay Losing Ground*. Washington, D.C.: Economic Policy Institute.

Allegretto, Sylvia A., Sean P. Corcoran, and Lawrence Mishel. 2011. *The Teaching Penalty: An Update Through 2010*. Economic Policy Institute Issue Brief no. 298, March 2011.

Allegretto, Sylvia A., and Lawrence Mishel. 2016. *The Teacher Pay Gap Is Wider Than Ever: Teachers' Pay Continues to Fall Further Behind Pay of Comparable Workers*. Economic Policy Institute, August 2016.

Allegretto, Sylvia A., and Lawrence Mishel. 2018. *The Teacher Pay Penalty Has Hit a New High: Trends in the Teacher Wage and Compensation Gaps Through 2017*. Economic Policy Institute, September 2018.

Allegretto, Sylvia A., and Ilan Tojerow. 2014. "Teacher Staffing and Pay Differences: Public and Private Schools." *Monthly Labor Review* (U.S. Department of Labor, Bureau of Labor Statistics), September 2014.

American Federation of Teachers (AFT). 2018. *A Decade of Neglect: Public Education Funding in the Aftermath of the Great Recession*.

Bollinger, Christopher R., and Barry T. Hirsch. 2006. "Match Bias from Earnings Imputation in the CPS: The Case of Imperfect Matching." *Journal of Labor Economics* 24, no. 3: 483–519. https://doi.org/10.1086/504276.

Bryk, Anthony S., Penny Bender Sebring, Elaine Allensworth, Stuart Luppescu, and John Q. Easton. 2010. *Organizing Schools for Improvement: Lessons from Chicago*. Chicago: Univ. of Chicago Press.

Bureau of Labor Statistics (BLS). 2019. *Employer Costs for Employee Compensation Historical Listing: National Compensation Survey, March 2004–December 2018*.

Cohany, Sharon R., Anne E. Polivka, and Jennifer M. Rothgeb. 1994. "Revisions in the Current Population Survey Effective January 1994." *Employment and Earnings*, February 1994.

Corcoran, Sean P., William N. Evans, and Robert M. Schwab. 2004. "Women, the Labor Market, and the Declining Relative Quality of Teachers." *Journal of Policy Analysis and Management* 23, no. 2: 449–470. https://doi.org/10.1002/pam.20021.

Darling-Hammond, Linda, Roberta Furger, Patrick M. Shields, and Leib Sutcher. 2016. *Addressing California's Emerging Teacher Shortage: An Analysis of Sources and Solutions*. Learning Policy Institute, January 2016.

Economic Policy Institute (EPI). 2019. *Methodology for Measuring Wages and Benefits*. Last updated February 21, 2019.

García, Emma, and Elaine Weiss. *The Teacher Shortage Is Real, Large and Growing, and Worse Than We Thought: The First Report in 'The Perfect Storm in the Teacher Labor Market' Series*. Economic Policy Institute, March 2019.

Gould, Elise. 2019. *State of Working America—Wages 2018: Wage Inequality Marches On—and Is Even Threatening Data Reliability*. Economic Policy Institute, February 2019.

Greene, Jay P., and Marcus A. Winters. 2007. *How Much Are Public School Teachers Paid?* Manhattan Institute, January 2007.

Hanushek, Eric A., and Steven G. Rivkin. 1997. "Understanding the Twentieth-Century Growth in U.S. School Spending." *Journal of Human Resources* 32, no. 1: 35–68. https://doi.org/10.2307/146240.

Hanushek, Eric A., and Steven G. Rivkin. 2004. "How to Improve the Supply of High-Quality Teachers." In *Brookings Papers on Education Policy: 2004*, edited by D. Ravitch, 7–44. Washington, D.C.: Brookings Institution Press.

Hirsch, Barry T., and Edward J. Schumacher. 2004. "Match Bias in Wage Gap Estimates Due to Earnings Imputation." *Journal of Labor Economics* 22, no. 3: 689–722. https://doi.org/10.1086/383112.

Ingraham, Christopher. 2019. "Income Inequality Is Rising So Fast Our Data Can't Keep Up." *Washington Post*, February 21, 2019.

Leachman, Michael, and Eric Figueroa. "K–12 School Funding Up in Most 2018 Teacher-Protest States, But Still Well Below Decade Ago." Center on Budget and Policy Priorities, March 2019.

Podgursky, Michael, and Ruttaya Tongrut. 2006. "(Mis-)Measuring the Relative Pay of Public School Teachers." *Education Finance and Policy* 1, no. 4: 425–440. https://doi.org/10.1162/edfp.2006.1.4.425.

Reilly, Katie. "'I Work 3 Jobs And Donate Blood Plasma to Pay the Bills.' This Is What It's Like to Be a Teacher in America." *Time*, September 13, 2018.

Scholastic and the Bill & Melinda Gates Foundation (Scholastic). 2012. *Primary Sources 2012: America's Teachers on the Teaching Profession*.

Strauss, Valerie. 2017. "Teacher Shortages Affecting Every State as 2017–18 School Year Begins." *Washington Post*, August 28, 2017.

Temin, Peter. 2002. “Teacher Quality and the Future of America.” *Eastern Economic Journal* 28, no. 3: 285–300.

Temin, Peter. 2003. “Low Pay, Low Quality.” *Education Next* 3, no. 3: 8–13.

U.S. Census Bureau, Current Population Survey Outgoing Rotation Group microdata (U.S. Census Bureau CPS-ORG). Various years. Survey conducted by the Bureau of the Census for the Bureau of Labor Statistics [machine-readable microdata file]. Data for 2004–2018.