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BETTER PAY, FAIRER PENSIONS: Reforming Teacher Compensation

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Executive Summary

States across the nation have recently turned considerable attention to reforming retirement programs for public school teachers. Such efforts have been spurred by the widely recognized need to address the crisis of unfunded liabilities and the escalating annual payments that states must make to their teacher pension systems. But there is another compelling reason to consider reforming these systems: They work poorly for many teachers, particularly those who remain in the profession for less than the 30 years that is often required to become eligible for the maximum payout.

From our analysis of compensation in the nation's 10 largest school districts, we find that two simple reforms—neither of which would increase spending—would allow school districts to:

- Raise teacher salaries, in some cases substantially;
- Give teachers more retirement security than they now have;
- Make teaching a more attractive option for people who are unsure that they will work for decades in the same school district; and
- Offer teachers more control over when they stop working.

What changes would allow schools to make teaching more attractive in these ways?

First, districts should jettison their current approach to retirement benefits, in which teachers accrue relatively meager benefits through much of their careers, and then abruptly become eligible for much more as they near retirement age. In its place, districts should adopt retirement systems where benefits accrue smoothly, year after year, without sudden, arbitrary jumps late in a teacher's working life. This would allow talented people to teach for part of their career, or teach in more than one district, without harming their retirement security. It would also end an unfair practice that places the majority of teachers on an insecure retirement savings path in order to support more generous pensions for the minority who work a full career in one system.

Second, districts should increase the amount of teacher compensation that is paid directly as salary, and reduce the amount of compensation that is devoted to retirement benefits in order to match the norm for similarly situated workers in the private sector. This reform would substantially increase teacher take-home pay in some school systems, while having only a marginal effect in others.

Our paper models the effects these reforms would have on teacher compensation in the nation's 10 largest school districts. We conclude that these compensation changes would help districts offer a more attractive compensation package to most teachers likely having a positive effect on teacher quality and student achievement, without the need for higher taxes or reduced services.

About the Authors

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Better Pay, Fairer Pensions: Reforming Teacher Compensation

Josh McGee and Marcus A. Winters

INTRODUCTION

Once a topic that induced glazed stares, reform of retirement programs for public school teachers has gained the attention of policymakers across the country. The primary driver for the increased interest in teacher pensions has thus far been financial: The unfunded liabilities and annual payments tied to teacher pensions have reached such high levels that they now threaten the fiscal health of and provision of essential services in several jurisdictions. Such difficult fiscal realities have led several states and school systems to either enact or actively pursue meaningful pension reform. But there is another compelling reason to consider reforming the pension system: The current system is bad for many (particularly young) teachers.

The compensation structure for most public school teachers differs from the typical private-sector compensation structure in ways that have serious implications for a teacher's take-home salary, lifetime earnings, and overall wealth. If we make the assumption that teachers' preferences are similar to those of other workers, policymakers could make the teaching profession more attractive by allocating a larger portion of teacher compensation to salary and offering a more flexible, portable retirement benefit.[1 2] This would help attract people to the profession by eliminating the bias of the current system toward the interests of teachers who have stayed in one school system over decades. Additional portability would permit teachers to move to another school across state or district lines—or decide after a few years to give up teaching entirely—without sacrificing retirement security. It would also allow them to match their retirement date more closely to their preference for work, potentially leading to a significantly more

productive workforce.[3] Such changes are not exotic or experimental. In fact, they would align the teacher compensation system with what is commonly offered in the private sector.

In this paper, we examine these two cost-neutral changes in retirement benefits—moving more compensation into salary and offering more flexible retirement benefits packages—by modeling the effects they would have on teacher compensation for the 10 largest public school districts in the United States.

The first reform we consider is a change in the pension system. Specifically, we propose a change in the way retirement wealth is accrued, so that these benefits are earned evenly with every passing year, rather than being "backloaded" toward the end of a teacher's career. The second compensation reform we model reduces the share of total compensation devoted to retirement savings to match private sector norms, and moves the difference into salary.

Under the traditional defined benefit (DB) pension system that currently covers 89 percent of public-school teachers nationwide,[4] teachers accrue very little retirement wealth through the early and middle portions of their careers. Then, toward the end of their working lives, they receive steep increases in retirement wealth as they near the system's retirement eligibility thresholds. Teachers who change systems or leave the profession before these late-career increases are left with relatively little retirement wealth. For the minority of teachers who stay in place and thus qualify for full benefits, DB pension systems offer relatively high maximum retirement earnings. But they do this by relying on significant teacher turnover, which lets these plans leverage contributions made on behalf of the majority of teachers to subsidize the retirements of a select few.[5]

According to our calculations, based on figures reported by the Institute for Educational Sciences, only about 28 percent of American public school teachers remain in the profession for even 20 years. The overwhelming majority separate from service well before reaching the retirement thresholds in any public retirement system. And only about 63 percent of teachers who remain in their school system for 10 years will remain in the profession for at least 20 years.[6] Those teachers who leave before reaching the system's retirement eligibility thresholds often are left with a benefit that is less valuable than total contributions made on their behalf plus interest, harming their retirement security.

Nothing requires school districts to backload retirement compensation so heavily. There are viable retirement plan designs that provide employees with smooth accrual throughout their careers.[7] Well-designed defined contribution (DC) systems, which are common in higher education and the private sector, provide smooth wealth accrual. So do "cash balance" (smooth accrual) plans—which provide additional investment protection and require less employee decision making than a DC.

In this study, for each of the nation's 10 largest school districts, we model the effect of moving new teachers to a smooth accrual system, with similar investment and longevity protections as those in their existing DB plans. As we have described, we also model the effect on teacher take-home pay of reallocating total compensation dollars from retirement benefits to salary, to match the average compensation allocation offered to similarly skilled workers in the private sector.[8]

Using information from district and state pension plans for each of the 10 districts, we consider a teacher's total cumulative compensation (the sum of salary and retirement benefits earned by a teacher up to that point in the teacher's career) and take-home salary under the current system, and compare that to the teacher's earnings under a new system with a smoothed retirement accrual and a ratio of take-home pay to benefits that mimics the average for private sector managers and professionals.

We find that some districts could significantly improve teacher salaries across the board by adopting these changes, while in other systems the effect on salaries would be minimal. In most districts, however, we demonstrate that movement toward a smoothed retirement system would lead to substantially higher

total compensation early in a teacher's career, with often only small to moderate losses in later career compensation and maximum retirement amount. This suggests that the retirement security of early- and mid-career teachers could be significantly improved with relatively minor impairment for those who would achieve the maximum.

The remainder of this report follows in five sections. First, we set the stage for our analysis by describing in more detail teacher compensation under the current system, with particular emphasis on the structure of the retirement system. We then describe potential changes to the current system and our strategy for calculating teacher compensation under a reformed approach. We then summarize our findings. In an additional section, we report separately the results for each of the nation's 10 largest public school districts. A technical appendix provides detailed calculations and information about the current and revised system for each district.

I. TEACHER COMPENSATION

Teacher compensation is made up of several components including: (1) current wages, (2) current health benefits, (3) deferred retirement compensation, and (4) deferred retirement health benefits. In this paper we closely examine parts 1 and 3. The sections below will discuss current wages and retirement compensation for public school teachers generally.

I.1 Current Wages

Teacher salaries in nearly all public school systems are dictated by district salary schedules that increase with years of service and educational attainment or credentials. Teacher salaries commonly increase steeply early in a teacher's career and then reach a maximum after 10 to 20 years of service.

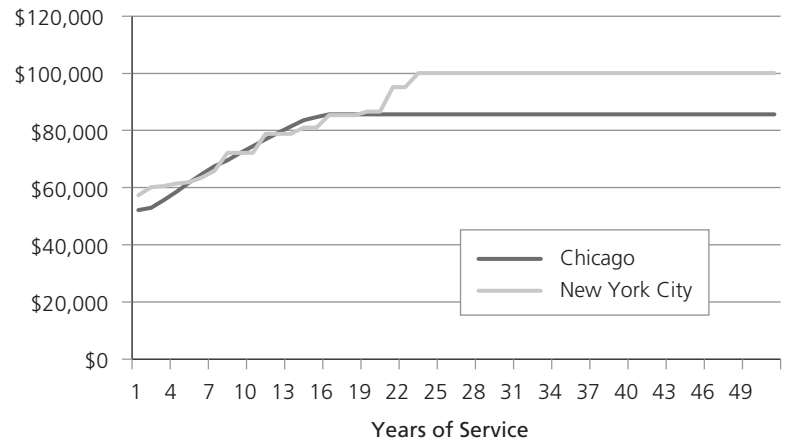
Figure 1 below shows the typical salary path for public school teacher with a master's degree working in Chicago and New York City. In Chicago the maximum salary is reached after 15 years of service while in New York City the maximum occurs after 22 years of service. The maximum salary in New York is also roughly $15,000 greater than the maximum in Chicago.

In this paper, we do not assume any change in the structure of the pay-scale for public school teachers. Our analysis assumes continuation of the salary ladder based on years of experience and credentials earned. We simply calculate the effect of reform at each year in each system's pay-scale.

I.2 Retirement Compensation

Nearly all public school teachers in the United States earn retirement wealth through a traditional final average salary defined benefit system. Under a DB plan, at the time of retirement the teacher is provided with

Figure I: Salary Schedules in New York City and Chicago



a fixed payment for life (often adjusted for inflation over time) based on a formula that includes years of service and final average salary. A teacher's starting annuity is given by equation (1):

(1) $B=YOS*M*(1-E)*FAS$

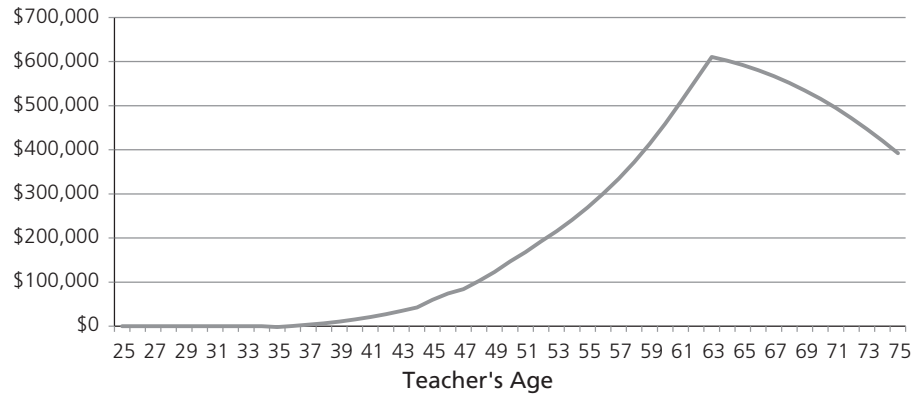
Where *B* is the starting annuity (i.e. the lifetime regular payment to the retiree each year), *M* is a percentage (usually about 2 percent) of the employee's salary to be paid in retirement for each year of service (*YOS*), *E* is the percent reduction as a penalty for early retirement (which equals 0 if the employee retires after the plan's normal retirement eligibility thresholds), and *FAS* is the employee's final average salary, which is usually calculated as the average salary for the employee during the final three to five years of employment.

A teacher gains legal right to an annuity from the retirement system after vesting but cannot begin receiving that annuity until reaching the early or normal retirement eligibility thresholds. These thresholds are generally set using a combination of age and years of service, and have eligibility rules that are often quite complicated.

Because the DB system provides annual payments to a retired teacher for life, the total amount of money that a teacher receives in retirement depends not only on the annuity amount calculated in Equation 1, but also on the individual's life-span after retirement. In an account-based retirement system, an employee's retirement wealth is a number that can be easily understood, but in a DB system the value of an individual teacher's total pension is not intuitively clear. Considering a teacher's pension wealth at any given point in that teacher's career requires making an actuarial calculation for the market value of an annuity under the given rules of the system. In order to provide comparisons across time and across plans, we did not calculate a lifetime pension payment, but rather the present value of a hypothetical teacher's annuity or the lump-sum amount that an individual should be indifferent to receiving (for the concept of indifference, see Appendix B on page 31).

Because the DB system promises a benefit that can only be accessed at certain points in time, the design of teacher pension programs is such that the value of a teacher's retirement wealth (present value of the lifetime annuity) can change suddenly at various points across a career. The annuity's value increases linearly as a teacher earns more service, but it also increases in big jumps at particular points in time, as a teacher approaches the retirement thresholds. Conversely, a teacher's annuity generally loses value each year after reaching the plan's normal retirement eligibility threshold, because with each additional year of work that teacher is forgoing a year of retirement in which a payment would have been received.

Figure 2: Pension Wealth–25 Year-Old Entrant, New York City



To illustrate, Figure 2 shows the accumulation of pension wealth across the career of a 25 year-old entrant into the New York City teaching workforce.[9] The line represents the present value of the teacher's accumulated employer-provided pension wealth at any given age.[10]

In New York as in other systems, teachers earn very little employer provided retirement wealth in the early and middle portions of their careers, followed by steep accrual each year of service in late career, and negative accrual each year after reaching the system's normal retirement age. The net present value of pension wealth for the 25-year-old entrant in New York City hits its maximum of $610,250 at the age of 63.

Figure 2 illustrates the extent to which teachers receive relatively few dollars toward retirement early in their careers, and much higher retirement compensation per-year for later years of service. It takes our hypothetical New York City teacher nearly 20 years of work to accumulate more than $50,000 in employer-provided retirement wealth, but in the subsequent 20 years more than an additional $550,000 accumulates. Retiring at age 61, prior to the system's normal retirement age, would leave our teacher with employer-provided pension wealth worth $101,667 less than if he or she had remained in the classroom until age 63. In contrast, our teacher would earn only an additional $13,671 in employer-provided pension wealth by adding the same two years of service by leaving the school system at age 43 rather than age 41. As previously mentioned, those who choose to remain employed after the system's normal retirement age actually lose pension value each year because the additional retirement wealth gained for an additional year of service is not large enough to counter the loss of pension payments for that year.

2. EFFECTS OF AN ALTERNATIVE SYSTEM

We now consider the effect of the two reforms we have described. We first calculate retirement wealth at each point in a teacher's career under a retirement plan with smooth accrual, and compare it to retirement wealth in each period under the current system. We then compare the teacher's total cumulative compensation at each period under the two systems. Finally, we report changes to public school teacher pay ladders under a system in which the ratio of salary to benefits is similar to what is offered in the private workforce.

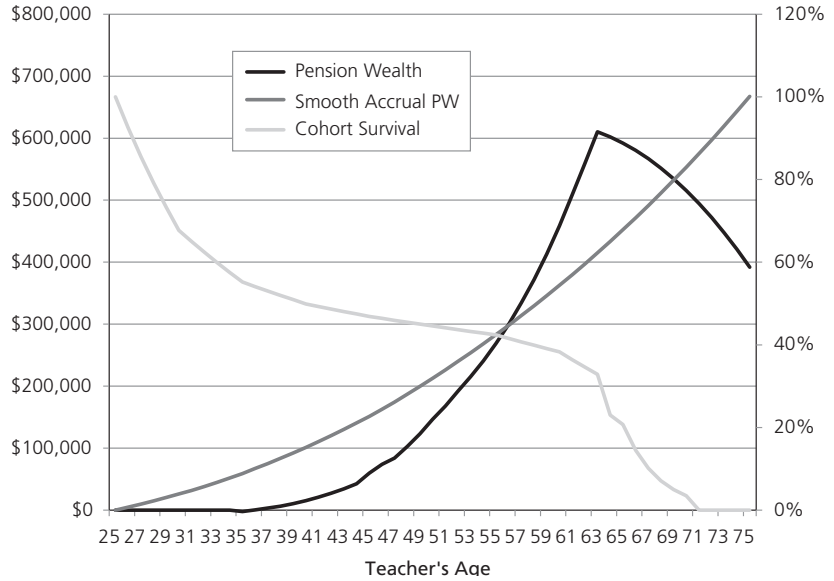
We illustrate each of the calculations using data from New York City's teacher compensation stucture. The final section of the paper produces results following a similar format for each of the nation's 10 largest school districts.

2.1 Retirement Wealth and Total Cumulative Compensation Under a Smooth Accrual Retirement System

We compare retirement wealth at each point in our hypothetical teacher's career under the current system to one that more evenly distributes the teacher's retirement wealth throughout his career. To do so, we follow the method developed in Costrell and Podgusky (2010) to calculate a cost-equivalent smooth accrual curve. This curve represents, for each period in the teacher's career, the wealth earned under a smooth-accrual plan that costs his employer exactly what the current retirement plan costs. Appendix B details the calculations used to develop the smoothed distribution of teacher retirement wealth under this revised system.

Figure 3 presents this comparison for new 25 year-old teachers in New York City, showing that teachers would earn significantly more retirement wealth early in their careers under the smooth accrual system than they do under the current DB system. For example, a teacher who exits the district at age 45 with 20 years in the classroom receives the equivalent of $59,572 in employer-provided retirement wealth under the current DB system, but would leave with $151,120 under a smooth accrual system. Our hypothetical smooth accrual retirement benefit system has the effect of moving a considerable portion of the employee's total career compensation earlier in her career, and thereby providing 15- to 20-year teachers with a much more secure retirement savings path.

Figure 3: Retirement Wealth Over Time Under Alternate Systems
New York, NY



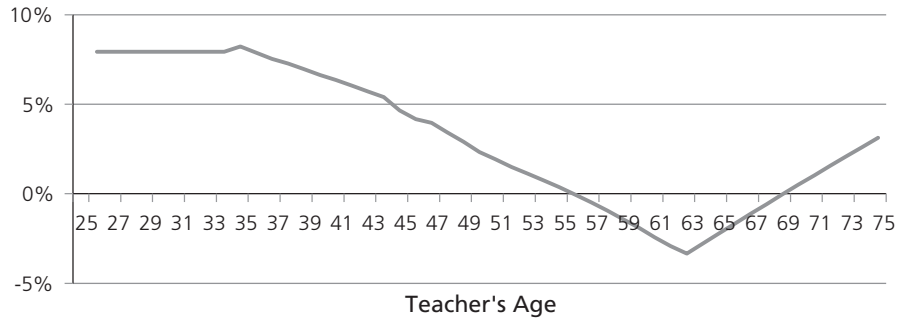
On the other hand, the graph shows that those who remain employed by the New York City school system until the plan's normal retirement eligibility threshold will do better under the current DB system. The city's plan reaches its maximum value at age 63, the normal retirement age under the New York City plan. A teacher who retires at that maximum would have earned the equivalent of $610,250 in employer-provided retirement wealth under the DB, but would have earned $415,107 under the smooth accrual plan. A new teacher who stays until the Social Security retirement age of 67 would earn $567,022 under the DB versus $491,230 under the smooth accrual system, a difference of 13.4 percent.

If a teacher chooses to work past the age of 63, the current DB structure results in a penalty, but this penalty for postponing retirement vanishes under the smooth accrual system. Since retirement wealth continues to accrue smoothly as long as the person is employed, there is no maximum value. Under the smooth accrual system, a teacher who chooses to stay in the profession until age 70 (or later) would receive greater retirement wealth than in the DB system.

It is important to note the narrow range in which the DB structure produces more pension wealth for a teacher. The lines representing wealth accumulation under the two plans cross at age 56, at which point the current DB plan would deliver greater retirement wealth than the smooth accrual system, until age 70, when the smooth-accrual method would once again generate greater wealth. So our 25 year-old entrant to the New York City public school system would earn more retirement wealth under a DB system if and only if she chooses to leave the classroom between the ages of 56 and 70. As we have noted, this does not represent the experience of most teachers.

In fact, a majority of teachers do not remain in the system long enough to benefit from the higher potential payoff of the DB system. The line in Figure 3 illustrates at each age the percentage of an entering cohort of 25 year-old teachers whom the pension plan assumes will remain in the system.[11] While the line graphs the plan's assumption for teacher turnover, not actual teacher exits, these assumptions are, of course, based on historical data reflecting plan experience. In fact, if actual exits were significantly slower than the plan assumptions, then the current plan would cost a great deal more than expected. (This means, of course, that under the current pension system, a district that is successful at improving teacher retention—a goal

Figure 4: Percent Difference in Cumulative Total Compensation
New York, NY



held by many districts—will increase its pension costs dramatically.)

Accepting the plan's assumptions, then, we should expect that only 42 percent of an entering 25 year-old cohort would still be teaching in the same district at age 56, and thus make it to the crossover point. Further, the plan assumes that only a third (33 percent) of teachers from the cohort would remain in the classroom long enough to receive the maximum pension payout at age 63. As shown in similar figures reported at the end of the paper, New York's assumed turnover rates are often far lower, and thus more conservative, than those used by other pension plans.[12]

Figure 4 illustrates changes in the teacher's total cumulative compensation each year of employment under a smooth accrual system relative to the current DB system.[13] In New York City, for example, shifting to a smooth accrual system would increase total teacher compensation by between 5 and 8 percent in each of the first 20 years of employment. This shifting of total compensation is paid for by a decrease in total compensation of between 0.04 and 3.4 percent in each employment year between 33 and 42 years of service.

2.2 Changes in Teacher Salaries

As we have noted, teacher compensation differs from the compensation of professionals in the private sector both in the design of retirement benefits and also by the proportion of compensation taken home in the form of salary. We now consider the effect of our other proposed reform: allocating a greater share of teacher compensation to current salary versus deferred retirement benefits.

Table I: Effect of Policy Change*

District	Estimated Employer Cost for DB Plan for 25 Year-Old Entrant (percent of salary)	Participates in Social Security	Total Employer Cost for Retirement (percent of salary)	Percent Increase in Annual Salary due to Policy Change
Chicago	9.56%	No	9.56%	0.00%
Dade	10.05%	Yes	16.25%	5.11%
Broward	10.55%	Yes	16.75%	5.56%
Hillsborough	9.30%	Yes	15.50%	4.43%
Clark	11.77%	No	11.77%	1.06%
Hawaii	5.09%	Yes	11.29%	0.62%
Houston	6.95%	No	6.95%	0.00%
Los Angeles	18.51%	No	18.51%	7.15%
Philadelphia	5.37%	Yes	11.57%	0.88%
New York City	8.43%	Yes	14.63%	3.64%

The percent increase in annual salary was calculated using the equation $Percent\ Increase = \frac{(1+ERC)}{(1+ERC^*)}$, where ERC is total employer retirement cost under the current system as a percentage of pay and ERC is the target total employer retirement cost.

According to the Bureau of Labor Statistics' latest update of the National Compensation Survey, the average private sector manager and professional earns 10.6 percent of total earnings in the form of deferred retirement savings.[14]

Table 1 (previous page) demonstrates that the effect of such a policy change differs considerably across school systems. For instance, such a change would have no real effect on the take-home salaries of teachers in Chicago (primarily because in Illinois teachers are not covered by Social Security), but would lead to an across-the-board salary increase of more than 7 percent in Los Angeles and more than 5 percent in Dade and Broward counties. The variation in Social Security coverage across our study districts is a significant driver of the results presented in Table 1.[15]

For the purposes of this paper, we do not make adjustments to the structure of the salary ladder itself. We apply the potential salary increase equally to each point of the employee's career. In the case of New York City, the alternative system could produce an across-the-board salary increase of 3.64 percent at each point of the teacher's career.

CONCLUSION

This paper examined the effect of cost-neutral changes to the structure of teacher compensation that, compared to current practices, would both increase teacher take-home salaries and offer a more secure retirement savings path for the majority of teachers.

Those who support the traditional DB pension systems that predominate across U.S. public schools correctly argue that such systems offer teachers a higher potential maximum retirement wealth than can be achieved under a cost equivalent smooth accrual system. However, our analysis makes clear that the higher maximum offered by the current system comes at a cost to a large share—often the heavy majority—of the teaching workforce: those who do not remain in their school systems for some three decades to become eligible for the maximum payout. In fact, these plans are explicitly designed to pay higher retirement benefits to long-career employees by reallocating wealth from teachers who exit the system earlier in their careers. As the detailed results for each of the 10 largest school systems provided in the final section of this paper demonstrate, in many systems these plans anticipate that the vast majority of teachers will not remain employed long enough to benefit from the traditional DB. Some long-serving teachers do well, but overall, this policy harms teachers' retirement security.

This paper has also demonstrated the effect on teacher salaries of rebalancing the proportions of compensation that go to current salary versus retirement benefits. Our results demonstrate that such a reform would substantially improve teacher take-home salaries in some major school systems (though not in others). Of course, teachers require adequate retirement wealth; however, the heavy investment in retirement—only acquired by those teachers who remain in the classroom until the plan's arbitrary normal retirement eligibility threshold—has artificially reduced teacher salaries in many school systems. If offered the opportunity, many teachers would likely prefer a system in which they took home a larger portion of their compensation than they do today.

An important caveat for our results is that we have only focused on the effects of changes to the teacher pension system. In many school systems the ratio of total compensation devoted to health care is similarly bloated, relative to what is offered in the private sector. In these cases, it would likely be possible to further increase teacher salaries by adopting compensation ratios similar to those offered in the private sector.

School systems across the nation have made recruiting and retaining a high quality teaching workforce an important goal. Most agree that for teaching to be an attractive profession, school systems must offer compensation packages that are competitive with those offered in other professions. The results provided in this paper demonstrate how simple, cost-neutral reforms—altering the structure of teacher compensation to align with that of the private workforce—could allow school systems across the nation to offer more attractive compensation packages without raising taxes or cutting other services.

TABLE 2: Results by District

Table 2 provides descriptive information for the pension systems for each of the nation's largest 10 school districts. Each of the calculations reported in this paper rely on the information reported in the table.

District	Broward, FL	Clark, NV (employee contributory plan)	Chicago, IL	Dade, FL	Hawaii (hybrid)
Benefit Factor	2.00%	2.50%	2.20%	2.00%	1.75%
Normal Retirement Thresholds	Age ≥ 65 YOS ≥ 33	Age ≥ 65 and YOS ≥ 5 Age ≥ 62 and YOS ≥ 10 YOS ≥ 30	Age ≥ 67	Age ≥ 65 YOS ≥ 33	Age ≥ 65 Age ≥ 60 and YOS ≥ 30
Early Retirement Thresholds	Age≥ 65-20 (45)		Age ≥ 62	Age≥ 65-20 (45)	Age ≥ 55 and YOS ≥ 20
Early Retirement Reduction	5% per year of age under 65	6% per year under normal retirement age thresholds	6% per year under age 67	5% per year of age under 65	5% per year of age under 65
Final Average Salary	8 years	3 years	8 years	8 years	5 years
Employee Contribution	3.00%	11.25%	9.00%	3.00%	8.00%
Employer Pickup of Employee Contribution	None	None	7.00%	None	None
Vesting	8 years	5 years	10 years	8 years	10 years
COLA	None	2% for years 4-6 3% for years 7-9 3.5% for years 10-11 4% for years 12+	3% or one-half of the CPI whichever is lower.	None	1.5%
COLA Compound or Simple	None	Compound	Simple	None	Simple
COLA Cap	None	None	None	None	None
Maximum Initial Benefit	None	75% of FAS	75% of FAS or $1,500 per month whichever is greater.	None	None
FAS Cap	None	None	FAS capped at $106,800 in 2011, increases by 3% or one-half of the increase in CPI whichever is lower.	None	None
Social Security	Yes	No	No	Yes	Yes
Plan Nominal Interest Rate	7.80%	8.00%	8.00%	7.80%	7.75%
Annual Inflation	3.0%	3.5%	3.0%	3.0%	3.0%
Interest Earned on Contributions	0%	0%	0%	0%	2.00%
Withdraw Provisions	EEC	EEC	EEC	EEC	Non-Vested—EEC + Interest Vested—(EEC + Interest)*120%

District	Hillsborough, FL	Houston, TX	Los Angeles, CA	New York City, NY	Philadelphia, PA (T-E)
Benefit Factor	2.00%	2.30%	Varies by Age: 55-1.16%, 56-1.28%, 57-1.40%, 58-1.52%, 59-1.64%, 60-1.76%, 61-1.88%, 62-2.00%, 63-2.133%, 64-2.267%, 65-2.40%	Varies by YOS: YOS ≥ 19-1.67%, YOS ≥ 20-1.75% for the first 20 YOS and 2% for any YOS>20	2.00%
Normal Retirement Thresholds	Age ≥ 65 YOS ≥ 33	Age ≥ 65 Age+YOS ≥ 80 and Age ≥ 62	Age ≥ 55	Age ≥ 63	Age ≥ 65 and YOS ≥ 3 Age+YOS ≥ 92 and YOS ≥ 35
Early Retirement Thresholds	Age ≥ 65-20 (45)	Age ≥ 55 YOS ≥ 30 Age+YOS ≥ 80	None	Age ≥ 55	Age ≥ 55 and YOS ≥ 25 YOS ≥ 10
Early Retirement Reduction	5% per year of age under 65	For Age ≥ 55: 55-47%, 56-51%, 57-55%, 58-59%, 59-63%, 60-67%, 61-73%, 62-80%, 63-87%, 64-93%, For YOS ≥ 30 and Age+YOS ≥80: 5% per year of age under 62	None	6.5% per year of age under 63	For 55/25 - 3.0% per year under normal retirement thresholds For YOS ≥ 10—actuarially equivalent reduction
Final Average Salary	8 years	5 years	3 years	5 years	3 years
Employee Contribution	3.00%	7.70%	8.00%	Varies by salary: up to $45k-3%, $45k to $55k-3.5%, $55k to $75k-4.5%, $75k to $100k-5.75%, $100k or more-6%	7.50%
Employer Pickup of Employee Contribution	None	None	8.00%	None	None
Vesting	8 years	5 years	5 years	10 years	10 years
COLA	None	None	2.0%	1.25%	None
COLA Compound or Simple	None	None	Simple	Compound	None
COLA Cap	None	None	None	COLA only applies to the first $18,000 of the initial benefit	None
Maximum Initial Benefit	None	None	None	None	100% of FAS
FAS Cap	None	None	120% of the 2013 SS wage base, $136,440 for 2013. Increases w/ CPI.	Governor's salary (currently $179,000). Assumed to increase at rate of inflation.	None
Social Security	Yes	No	No	Yes	Yes
Plan Nominal Interest Rate	7.80%	8.00%	7.50%	7.50%	7.50%
Annual Inflation	3.0%	3.0%	3.0%	2.5%	3.0%
Interest Earned on Contributions	0%	5.0%	0.5%	5.0%	4.0%
Withdraw Provisions	EEC	EEC + Interest	EEC + Interest	EEC + Interest	EEC + Interest

Appendix A: Results from the 10 Largest School Districts in the U.S.

1. New York, New York– 995,336 Total Students; 68,458 Total Teachers[16]

Figure 5 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in New York City at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 56 and 69. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 56, the plan assumes that 42 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $567,022 under the DB versus $491,230 under the smooth accrual system, a difference of 13.4 percent. The maximum pension accrual is $610,250 if the teacher leaves the system at age 63. The teacher would have earned $415,107 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 32.0 percent. The plan assumes that 33 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 63.

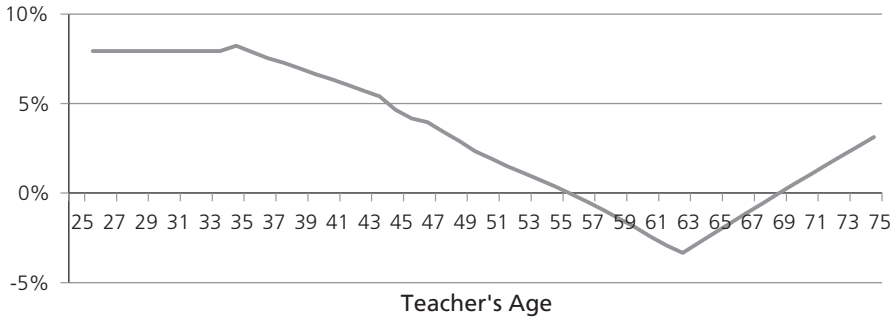
Figure 6 illustrates the percentage difference in total cumulative compensation for the 25 year-old

Figure 5: Retirement Wealth Over Time Under Alternate Systems
New York, NY

entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 8 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 56 through 69, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 3.34 percent at age 63.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, New York could offer teachers an across-the-board salary increase of 3.64 percent at no additional cost to the taxpayer.

Figure 6: Difference in Cumulative Total Compensation
New York, NY



2. Los Angeles, California—667,273 Total Students; 31,092 Total Teachers

Figure 7 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Los Angles in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 59 and 69. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 59, the plan assumes that 39 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $730,445 under the DB versus $666,673 under the smooth accrual system, a difference of 8.7 percent. The maximum pension accrual is $734,785 if the teacher leaves the system at age 65. The teacher would have earned $616,843 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 16.1 percent. The plan assumes that 6 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 65.

Figure 7: Retirement Wealth Over Time Under Alternate Systems
Los Angeles, CA

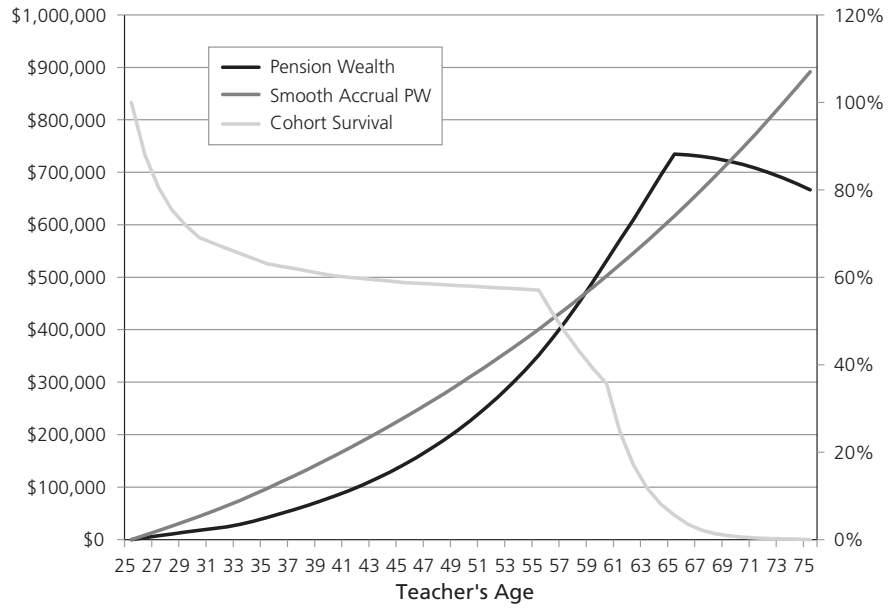
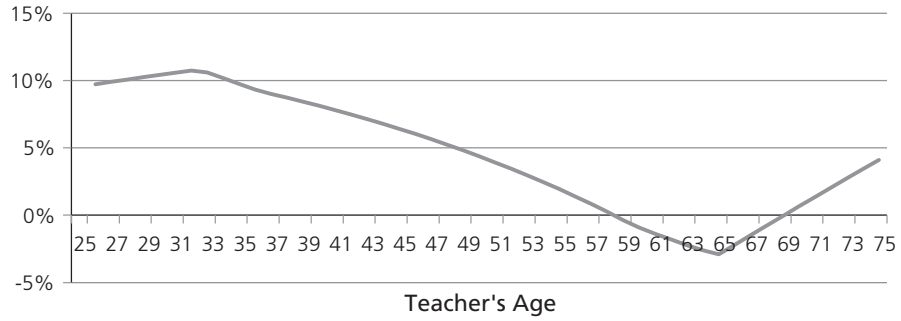


Figure 8 illustrates the percentage difference in total cumulative compensation for the 25 year-old entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 10.74 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 59 through 69, teachers would earn more total compensation each year under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 2.9 percent at age 65.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Los Angeles could offer teachers an across-the-board salary increase of 7.15 percent at no additional cost to the taxpayer.

Figure 8: Pecent Difference in Cumulative Total Compensation
Los Angeles, CA



3. Chicago, Illinois– 405,644 Total Students; 23,146 Total Teachers

Figure 9 illustrates the pension wealth, net of contributions, each year for an employee who begins teaching in Chicago in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[17]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 58 and 67. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 58, the plan assumes that 35 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $521,871 under the DB versus $517,185 under the smooth accrual system, a difference of 0.9 percent. The maximum pension accrual is $580,272 if the teacher leaves the system at age 65. The teacher would have earned $477,434 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 17.7 percent. The plan assumes that 4 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 65.

Figure 9: Retirement Wealth Over Time Under Alternate Systems
Chicago, IL

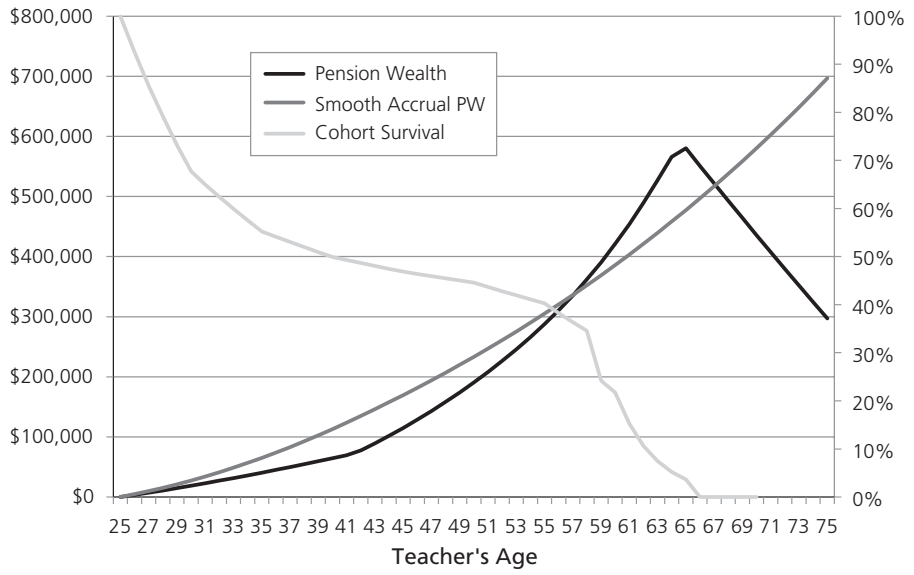
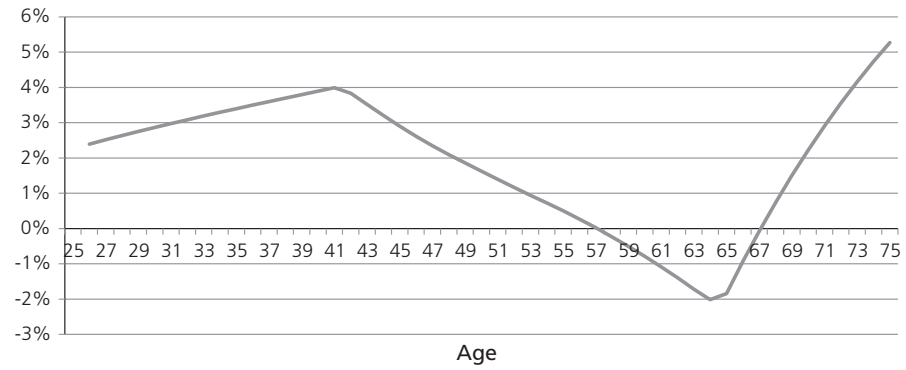


Figure 10 illustrates the percentage difference in total cumulative compensation for the 25 year-old entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 4 percent higher in the first several years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 58 through 67, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 2 percent at age 64.

If applied equally to all parts of the current salary ladder, the alternative system would not allow for an across-the-board salary increase.

Figure I0: Percent Difference in Cumulative Total Compensation
Chicago, IL



4. Dade County, Florida—347,366 Total Students; 27,195 Total Teachers

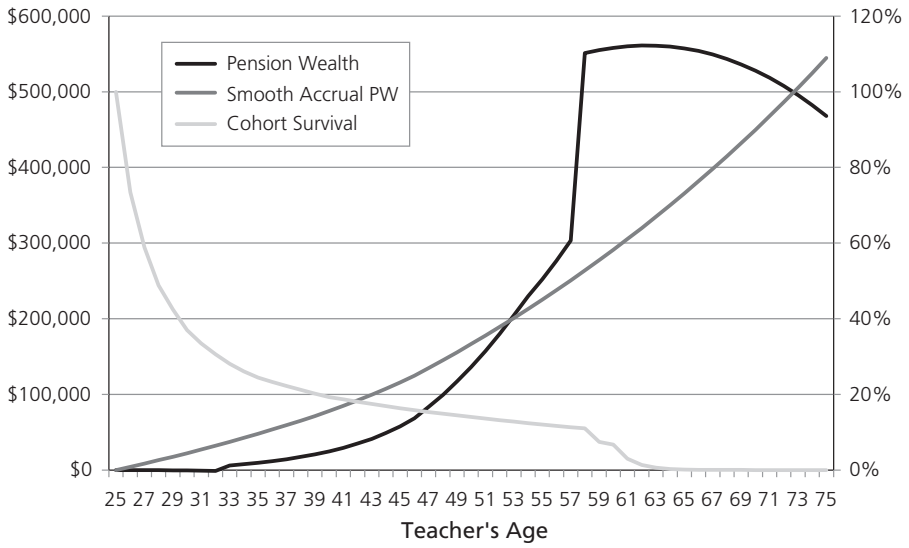
Figure 11 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Dade County in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year. [18]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 53 and 72. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 53, the plan assumes that 13 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $549,207 under the DB versus $398,104 under the smooth accrual system, a difference of 27.5 percent. The maximum pension accrual is $561,085 if the teacher leaves the system at age 62. The teacher would have earned $319,913 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 43.0 percent. The plan assumes that 1 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 62.

Figure 12 illustrates the percentage difference in total cumulative compensation for the 25 year-old

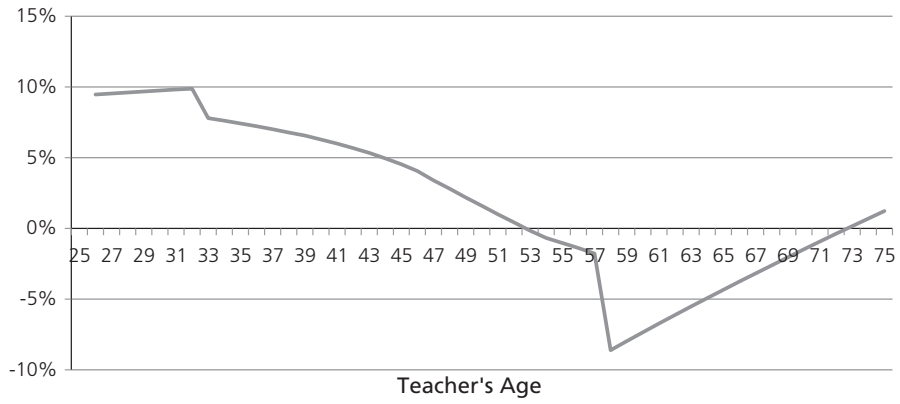
Figure 11: Retirement Wealth Over Time Under Alternate Systems
Dade County, FL



entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 9.88 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 53 through 72, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. The largest difference in total compensation is 8.6 percent at age 58.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Dade could offer teachers an across-the-board salary increase of 5.11 percent at no additional cost to the taxpayer.

Figure I2: Percent Difference in Cumulative Total Compensation
Dade County, FL



5. Broward County, Florida—256,472 Total Students; 15,573 Total Teachers

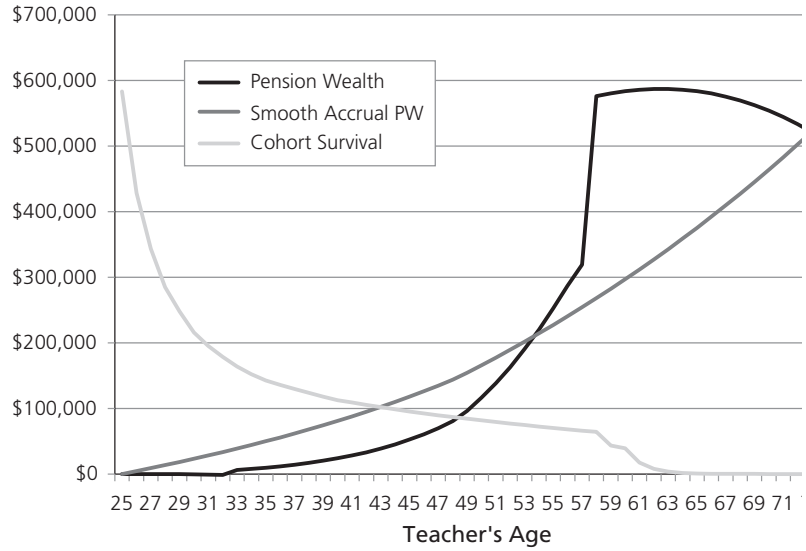
Figure 13 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Broward County in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[19]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 54 and 72. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 54, the plan assumes that 12 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $575,426 under the DB versus $409,434 under the smooth accrual system, a difference of 28.8 percent. The maximum pension accrual is $586,995 if the teacher leaves the system at age 63. The teacher would have earned $342,762 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 41.6 percent. The plan assumes that 1 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 63.

Figure 14 illustrates the percentage difference in total cumulative compensation for the 25 year-old entrant each year under the current and alternative

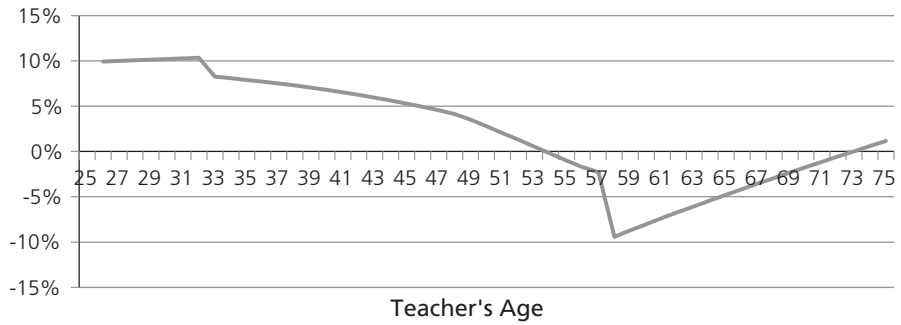
Figure 13: Retirement Wealth Over Time Under Alternate Systems
Broward County, FL



systems. Early career compensation is much higher under the alternative system—as much as 10.36 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 54 through 72, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. The largest difference in total compensation is 9.41 percent at age 58.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Broward could offer teachers an across-the-board salary increase of 5.56 percent at no additional cost to the taxpayer.

Figure I4: Percent Difference in Cumulative Total Compensation
Broward County, FL



6. Clark County, NV—314,059 Total Students; 15,269 Total Teachers

Figure 15 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Clark County in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[20]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 55 and 61. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 55, the plan assumes that 20 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $158,554 under the DB versus $412,527 under the smooth accrual system, an increase of 160 percent. The maximum pension accrual is $549,804 if the teacher leaves the system at age 55. The teacher would have earned $247,598 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 55 percent. The plan assumes that 20 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 55.

Figure 15: Retirement Wealth Over Time Under Alternate Systems
Clark County, NV

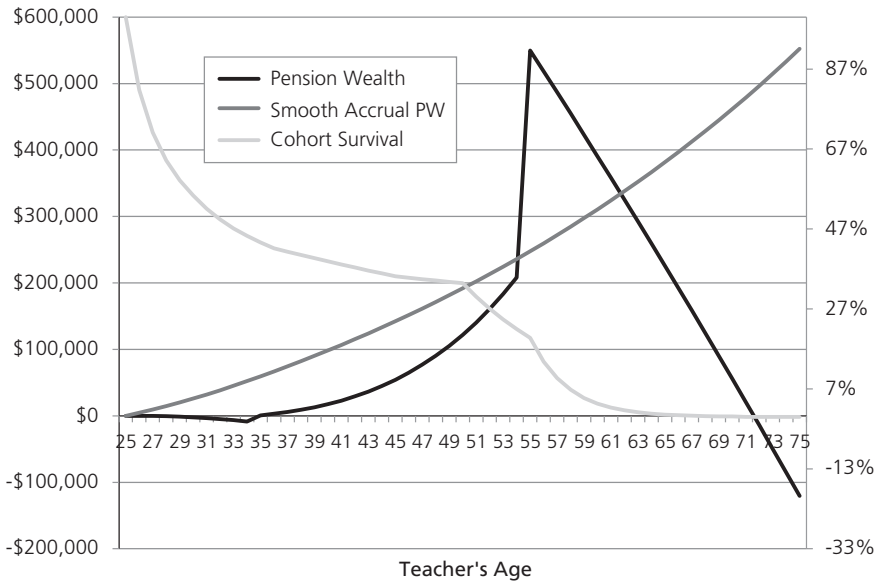
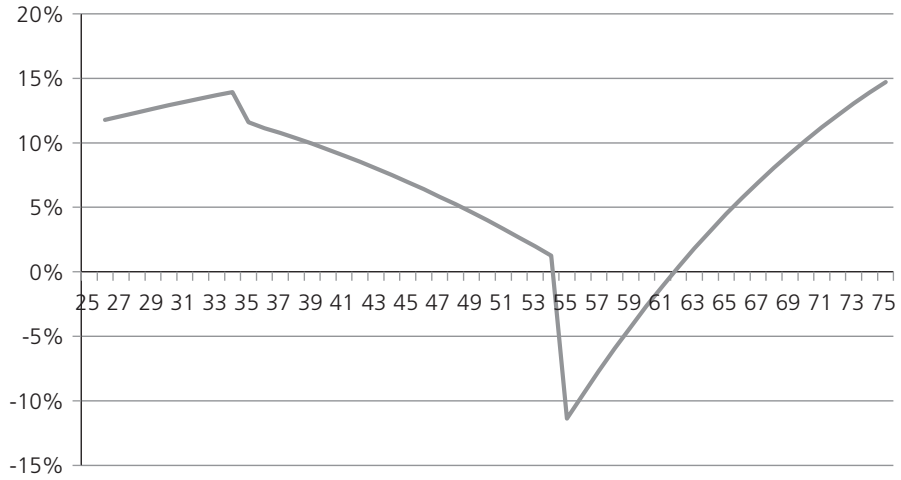


Figure 16 illustrates the percentage difference in total cumulative compensation for the 25 year-old entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 13.93 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 55 through 61, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 11.39 percent at age 55.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Clark could offer teachers an across-the-board salary increase of 1.06 percent at no additional cost to the taxpayer.

Figure 16: Percent Difference in Cumulative Total Compensation
Clark County, NV



7. Hillsborough County, FL—194,525 Total Students; 13,470 Total Teachers

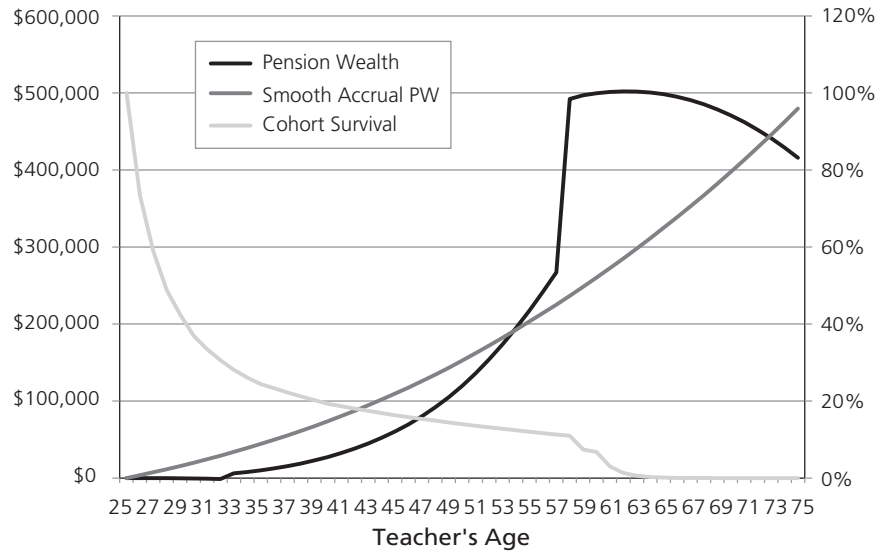
Figure 17 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Hillsborough County at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[21]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 54 and 72. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 54, the plan assumes that 12 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $490,582 under the DB versus $352,798 under the smooth accrual system, a difference of 28.1 percent. The maximum pension accrual is $502,041 if the teacher leaves the system at age 62. The teacher would have earned $285,121 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 43.2 percent. The plan assumes that 1 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 62.

Figure 18 illustrates the percentage difference in total cumulative compensation for the 25 year-old

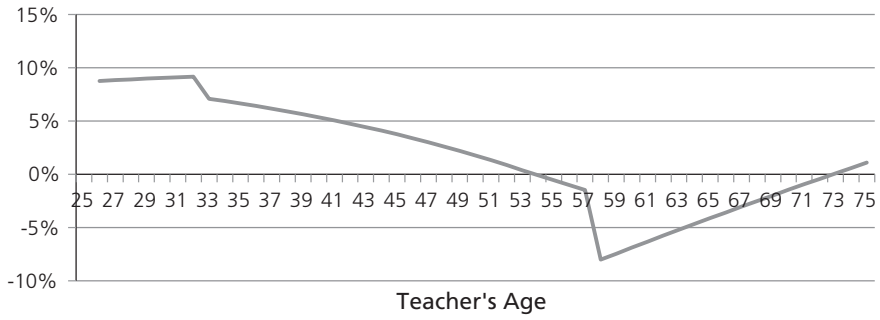
Figure 17: Retirement Wealth Over Time Under Alternate Systems
Hillsborough County, FL



entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 9.17 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 54 through 72, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 8 percent at age 58.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Hillsborough could offer teachers an across-the-board salary increase of 4.43 percent at no additional cost to the taxpayer.

Figure 18: Percent Difference in Cumulative Total Compensation
Hillsborough County, FL



8. Hawaii—179,601 Total Students; 11,396 Total Teachers

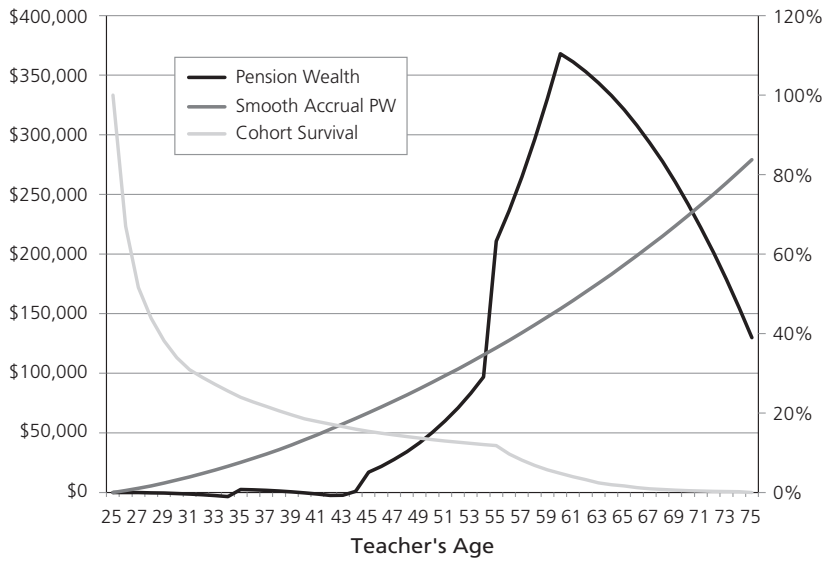
Figure 19 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Hawaii in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[22]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 55 and 70. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 55, the plan assumes that 12 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system

A new teacher who stays until the Social Security retirement age of 67 would earn $293,317 under the DB versus $206,799 under the smooth accrual system, a difference of 29.5 percent. The maximum pension accrual is $367,996 if the teacher leaves the system at age 60. The teacher would have earned $154,020 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 58.1 percent. The plan assumes that 5 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 60.

Figure 20 illustrates the percentage difference in total cumulative compensation for the 25 year-old

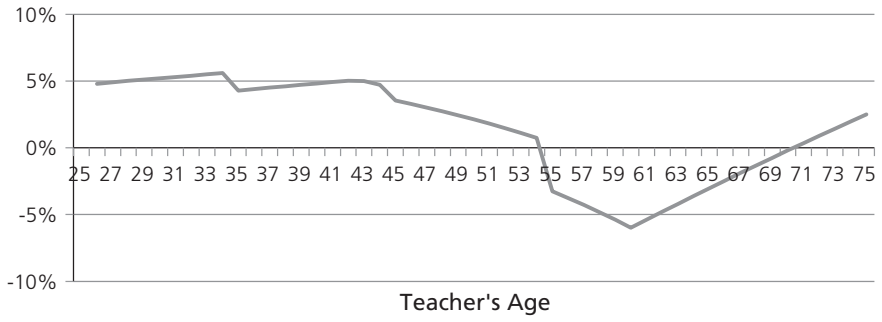
Figure 19: Retirement Wealth Over Time Under Alternate Systems
Hawaii



entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 5.6 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 55 through 70, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 6 percent at age 60.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Hawaii could offer teachers an across-the-board salary increase of 0.62 percent at no additional cost to the taxpayer.

Figure 20: Percent Difference in Cumulative Total Compensation
Hawaii



9. Houston, Texas—204,245 Total Students; 11,811 Total Teachers

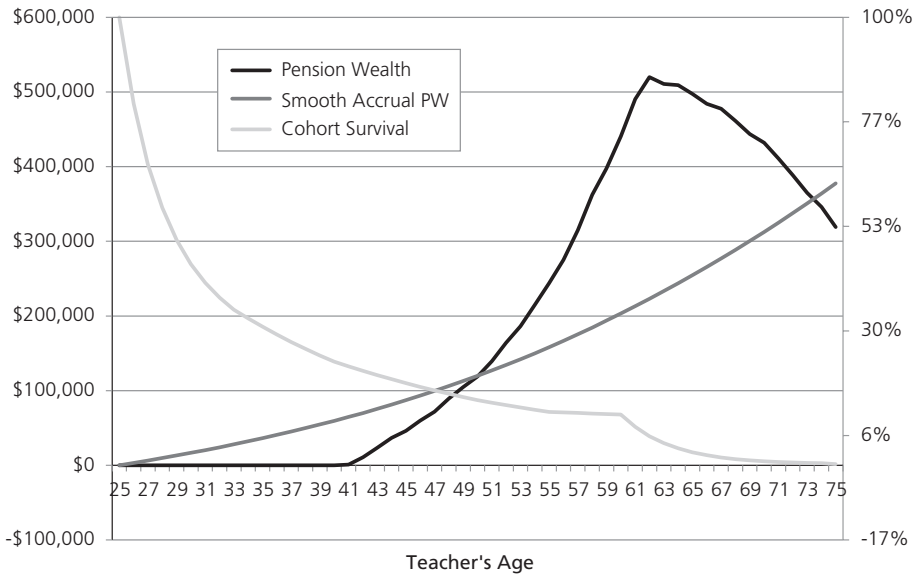
Figure 21 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Houston in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[23]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 48 and 73. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 51, the plan assumes that 14 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $477,697 under the DB versus $276,928 under the smooth accrual system, a difference of 42.0 percent. The maximum pension accrual is $519,776 if the teacher leaves the system at age 62. The teacher would have earned $223,103 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 57.1 percent. The plan assumes that 3 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 62.

Figure 22 illustrates the percentage difference in total cumulative compensation for the 25 year-old

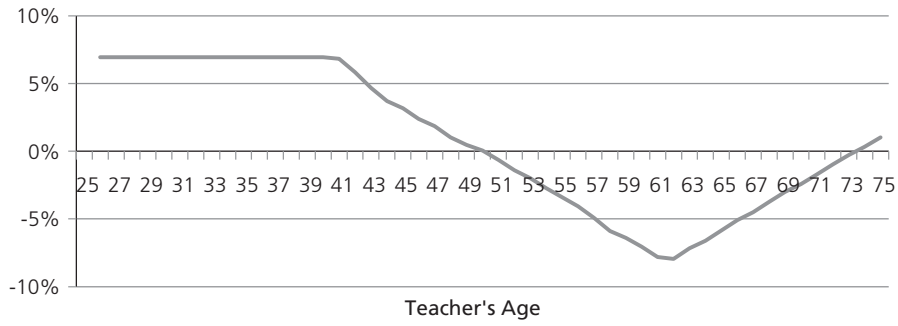
Figure 21: Retirement Wealth Over Time Under Alternate Systems
Houston, TX



entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 6.95 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 51 through 73, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 7.96 percent at age 60.

If applied equally to all parts of the current salary ladder, the alternative system would not allow for an across-the-board salary increase.

Figure 22: Percent Difference in Cumulative Total Compensation
Houston, TX



10. Philadelphia, PA—166,233 Total Students; 10,451 Total Teachers

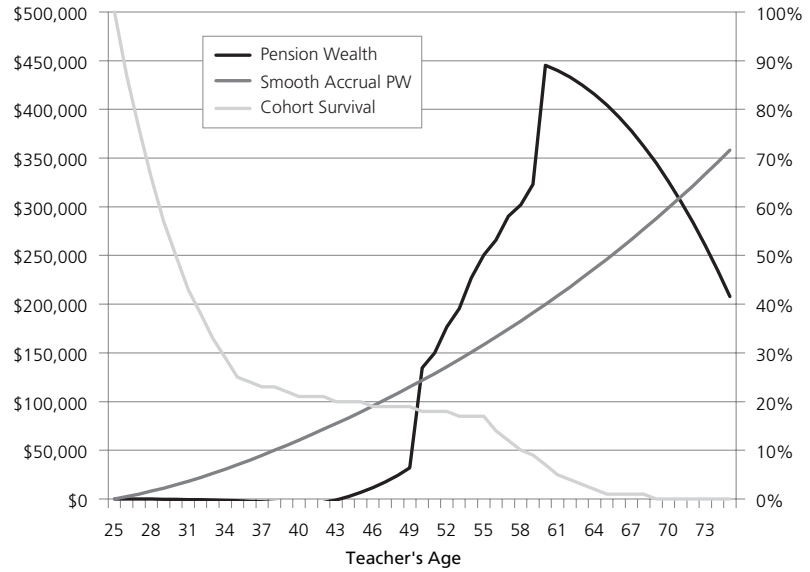
Figure 23 illustrates the pension wealth, net of employee contributions, each year for an employee who begins teaching in Philadelphia in at age 25. The black line represents pension wealth each year under the current DB system, and the dark grey line represents retirement wealth under a smooth accrual system. The ligh grey line, which is linked to the scale on the right of the figure, illustrates the percentage of teachers who began with the cohort who are assumed by the pension plan to still be employed by the system—and thus earn at least the respective retirement wealth that period—each year.[24]

Teachers would earn higher pension wealth under the current DB system if they left the retirement system between the ages of 50 and 70. Teachers who leave the system outside of those age parameters would exit with greater pension wealth under the smooth accrual system. At the point at which the lines cross and individuals would begin earning higher pension wealth under the DB plan at age 50, the plan assumes that 18 percent of those who entered this particular teaching cohort at the age of 25 would still be employed by the system.

A new teacher who stays until the Social Security retirement age of 67 would earn $377,793 under the DB versus $266,499 under the smooth accrual system, a difference of 29.5 percent. The maximum pension accrual is $445,357 if the teacher leaves the system at age 60. The teacher would have earned $199,651 in pension wealth under the smooth accrual system were she to retire at that time, a decrease of 55.2 percent. The plan assumes that 7 percent of teachers from the cohort will remain employed long enough to receive the maximum pension payout at age 60.

Figure 24 illustrates the percentage difference in total cumulative compensation for the 25 year old

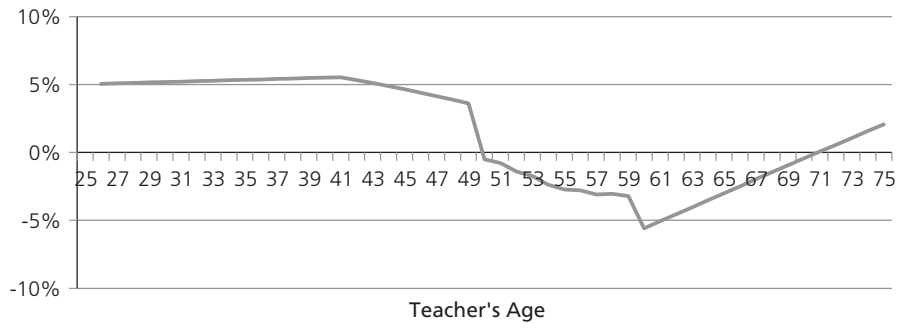
Figure 23: Retirement Wealth Over Time Under Alternate Systems
Philadelphia, PA



entrant each year under the current and alternative systems. Early career compensation is much higher under the alternative system—as much as 5.53 percent higher in the first few years of teaching. The difference in compensation decreases over time, as teachers begin to accrue pension wealth under the current system. From age 50 through 70, teachers would earn more total cumulative compensation under the current system than under the alternative smooth accrual system. However, the largest difference in total compensation is 5.59 percent at age 60.

If the share of total compensation devoted to salary versus retirement savings were changed to match the private sector norm, Philadelphia could offer teachers an across-the-board salary increase of 0.88 percent at no additional cost to the taxpayer.

Figure 24: Percent Difference in Cumulative Total Compensation
Philadelphia, PA



The present value of a teachers retirement benefit can be calculated using standard actuarial techniques.[25] A teacher's pension wealth, *PW*, can be calculated at various ages of separation, A_s. Retirement rules may allow the teacher to begin receiving an annuity immediately or may require that she defer until meeting the retirement eligibility thresholds. The present value of the teacher's retirement wealth at any given age is given by equation 2 below.

$$PW_{As} = \sum_{A \geq A_s} (1+r)^{(A_s - A)} * f(A|A_s) * B(A|A_s) \quad (2)$$

In equation (2), $B(A|A_s)$ is the starting annuity a teacher would receive at age A, given that she has separated at age A_s, $f(A|A_s)$ is the conditional probability of survival to that age, and r is the individual's discount rate. In principle, PW_{As} represents the market value of the annuity the teacher has earned standing at A_s. In other words, a teacher should be indifferent between receiving the lump sum PW_{As} and the annuity $B(A|A_s)$. Present value pension wealth can be calculated as gross pension wealth or net of employee contributions, PW^{net} (i.e., employer provided pension wealth).

This resulting curve provides a measure of benefit generosity or annual retirement compensation for the average entrant of a specified age. Estimating a curve that is cost equivalent to the current retirement system requires us to first calculate the expected value of retirement wealth under the current system standing at the age of entry, *e*. Equation 3 below details this expected value calculation where $g(A_s)$ is the separation probability at age A_s for members of a cohort of teachers who enter the profession at age k.[26]

$$E(PW_k^{net}) = \sum_{A_s=k}^{75} PW_{A_s}^{net} (1+r)^{-(A_s - k - 1)} * g(A_s) \quad (3)$$

To estimate the constant percentage of current wage accrued under a cost equivalent smooth accrual curve, *SA*, we divide expected pension wealth at entry by expected cumulative current wage at entry, CCW_k. Equations 4 and 5 detail this calculation.

$$E(CCW_k) = \sum_{A=k}^{75} W(A) * (1+r)^{-(A-k-1)} * g(A) \quad (4)$$

$$SA = \frac{E(PW_k^{net})}{E(CCW_k)} \quad (5)$$

Endnotes

[1] Warner, John and Saul Pleeter. 2001. "The Personal Discount Rate: Evidence from Military Downsizing Programs." American Economics Review. 19(1): 33-53. Fitzpatrick, Maria. 2013. "How Much Do Public School Teachers Value Their Pension Benefits?" Working Paper.

[2] There is recent evidence that when teachers are given a choice between a traditional DB and a more portable, flexible plan, a significant proportion will actively choose the latter. Chingos, M. R. & West, M. M. (2013). When Teachers Choose Pension Plans: The Florida Story. Working Paper, Fordham Institute. Goldhaber, Dan, & Grout, C. (2013). Which Plan to Choose ? The Determinants of Pension System Choice for Public School Teachers. CEDR Working Paper 2013-1, University of Washington, Seattle, WA.

[3] Friedberg et al provides evidence that DB plans shorten careers by up to 2 years by providing an incentive for otherwise productive workers to leave the workforce. Friedberg, Leora and Webb, Anthony. "The Impact of 401(k) Plans on Retirement." Discussion Paper No. 2000-30, University of California at San Diego.

[4] Bureau of Labor Statistics, "table 2. Retirement Benefits: Access, participation, and take-up rates, State and local government workers, national Compensation Survey" (2009), available at http://www.bls.gov/ncs/ebs/benefits/2009/ownership/govt/table02a.pdf.

[5] Costrell, R., Podgursky M. (2010). The Distribution of Benefits in Teacher Retirement Systems and Their Implications for Mobility. Education Finance and Policy 5 (4), 519-557.

[6] Author calculations using data from, Teacher Attrition and Mobility: Results from the 2008-09 Teacher Follow-up Survey. National Center for Education Statistics, Institute of Education Sciences. 2010-353. This calculation only includes those who leave the profession and ignores those who simply switch between district or state systems.

[7] Smooth accrual loosely defined as a retirement benefit whose value is a constant percentage of cumulative earnings.

[8] In this paper we compare teachers to private sector "Managers and Professionals" as defined by the BLS.

[9] For all present value calculations we use a nominal interest rate of 5 percent and an inflation rate of 2.5 percent. We use the mortality tables dictated for use under ERISA that are compiled and updated by the IRS. Specifically we use the 2013 static mortality table based on the RP-2000 Mortality Tables Report adjusted for mortality improvement using Projection Scale AA. The mortality table can be found at http://www.irs.gov/pub/irs-drop/n-08-85.pdf.

[10] The line in Figure 2 is net of employee contributions representing the retirement compensation provided solely by the employer. We use the concept of net pension wealth through this report.

[11] These cohort survival curves are based on the authors calculations that use the retirement plans' published decrement tables.

[12] New York City's assumed attrition rates are substantially more conservative than the exit probabilities reported in the previously discussed IES study of teachers nationwide. This may reflect a conscious decision by the plan to be more conservative or simply that New York City has less teacher turnover than the average district. The NCES exit probabilities are similar to those reported by school systems that assume much more rapid teacher attrition, such as the Florida or Houston, Texas systems.

[13] It is important to note that Figure 4 presents cumulative total compensation meaning the sum of all salary and retirement compensation up to that point in a teacher's career.

[14] This time series is maintained by Robert Costrell at: http://www.uaedreform.org/wp-content/uploads/2000/01/Employer-contribution-chart-update-June-2013.pdf

[15] The lack of Social Security coverage in some large school districts significantly increases the mobility penalty for teachers potentially making teaching a less attractive job in these districts.

[16] Number of students and teachers for year 2010 reported by National Center for Education Statistics, Digest of Education Statistics 2012, table 102.

[17] The line does not report actual teacher exits. However, actual information about actual exits historically were used to develop the plan assumptions. Further, were actual exits to be significantly different than the plan assumptions, then the plan would be financially instable.

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[25] The methods used here follow Costrell and Podgursky (2009), Costrell and Podgursky (2010), and Costrell and McGee (2010).

[26] We estimate the function g() using the decrement tables provided in the individual plans' reporting documents.

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