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Peaks, Cliffs and Valleys: The Peculiar Incentives in Teacher Retirement Systems and their Consequences for School Staffing

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Abstract

This paper examines the pattern of incentives for work versus retirement in six state teacher pension systems. We do this by examining the annual accrual of pension wealth from an additional year of work over a teacher's career. Accrual of wealth is highly non-linear and heavily loaded at arbitrary years that would normally be considered mid-career. One typical pattern exhibits low accrual in early years, accelerating in mid-to-late fifties, followed by dramatic decline, or even negative returns in years that are relatively young for retirement. Key factors in the defined benefit formulas that drive such patterns are identified along with likely consequences for employee behavior. The authors examine efficiency and equity consequences of these systems, as well as options for reform.

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Introduction

Pensions have long been an important part of compensation for teachers in public schools. Traditionally, it has been argued, salaries have been relatively low, but pension benefits have been relatively high for teachers and others who spend their career in public service. This mix of current versus deferred income was rationalized by the contention that the public good was best served by the longevity of service that would be induced by these pension plans.[1] In recent decades, however, evidence has grown that many of these plans, both in the private and public sector, may actually have *shortened* rather than lengthened professional careers, by encouraging early retirements.[2]

This highlights the growing disconnect between state teacher pension systems and the larger public discussion of pension and Social Security solvency in an era of longer life spans and the impending bulge of retirees.[3] Nearly all proposed remedies for fixing Social Security involve raising retirement ages as part of the menu. By contrast, there is little discussion of the incentives to retire even earlier in teaching; indeed, early retirement plans are commonplace in teaching, even as traditional pension plans are disappearing entirely in much of the private sector.

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[1] NEA, 1995, p. 3. As the NEA report points out, however, this purpose has "been lost for many in the mists of time," and "many pension administrators would be hard-pressed to give an account of why their systems are structured as is except to say that 'the Legislature did it' or 'It is a result of bargaining.'"

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

[3] See, for example, and Diamond and Orszag, 2003; Kotlikoff and Burns, 2004; Munnell and Sass, 2008.

The cost side of employee benefits also affects labor markets by driving a wedge between the amount paid by employers and the take-home pay received by teachers. The sharp rise in that wedge due to employee health insurance costs is well documented. However, less well known are the growing costs and large unfunded liabilities for some teacher pension plans and virtually all retiree health insurance plans. In Ohio, for example, the combined contributions of teachers and school districts for retirement benefits have risen steadily from 10 percent, in 1945, to 24 percent today. But even this large "tax wedge" falls short of what is needed and pension officials are recommending a phased increase to 29 percent, to shore up funding for pensions and retiree health benefits. At this level, retiree benefits for teachers and other professionals would be consuming well over $1,000 of the annual per student expenditures. The costs of school retiree benefits (including "legacy" costs from unfunded benefits for previous retirees) consume a sizeable share of K-12 spending, similar to the benefit overhang of GM, Chrysler and Ford, which finally forced them to overhaul their retiree benefits.[4]

[4] The focus of this paper is on the incentive structure of teacher retirement benefits and not their overall level. However, two researchers at the Economic Policy Institute (Mishel and Rothstein, 2007), using BLS data from the National Compensation Survey (NCS), claim that employer contributions for teacher retirement benefits are no greater than those of professionals in private sector employment. Unfortunately, data limitations in the NCS do not permit exact calculation of the retirement benefit rates for public school teachers. In addition, there are several errors in the authors' analyses of these NCS data. Using the BLS table for private industry, NCS data show an employer contribution rate of 4.9 percent of earnings for retirement benefits for "management, professional and related" (calculated from U.S. Department of Labor, 2006, Table 5). For public school teachers, we can compute the employer contribution rates directly by using data from NASRA (2008) supplemented with annual financial reports where necessary. Since all of the private sector professionals and managers are covered by Social Security (SS), we first compute the weighted average employer contribution for teachers covered by SS (roughly 61 percent of teachers). This rate is 9.0 percent, which exceeds the 4.9 percent figure above, for private sector professionals and managers. Alternately, we can compute a weighted average SS+employer contribution for all public teachers, including both covered by SS and non-covered, and compare that to the SS + employer contributions for private sector professionals and managers. That comparison is 13.6 percent for public teachers versus 10.5 percent, for private sector professionals and managers. Thus, the employer contribution rates for retirement benefits are significantly higher for teachers, whether or not we take account of teacher SS coverage. Details of these calculations are available in a separate appendix.

As the costs of teacher retiree benefit systems receive more attention from policy-makers, it is also important to begin asking what effect these systems have on recruitment, retention, and workforce quality, and whether these are efficient expenditures. A substantial literature in labor economics demonstrates that the incentives in pension systems matter, not only for the timing of retirement, but for labor turnover and workforce quality (Friedberg and Webb, 2005; Asch, Haider, and Zissimopoulos, 2005; Ippolito, 1997; Stock and Wise, 1990). Unfortunately, little of this literature pertains to teacher pensions. While there have been many studies of the effect of current compensation on teacher turnover (e.g., Murnane and Olsen, 1990; Stinebrickner, 2001; Hanushek, Kain, and Rivkin, 2004; Podgursky, Monroe, and Watson, 2004), the econometric literature on teacher pensions is very slender. The only published econometric study to date is Ferguson, et. al. (2006), who find that Pennsylvania teachers responded to pension incentives.[5]

In this article, we analyze the incentives embedded in teacher pension systems by examining the pattern of pension wealth accumulation over a teacher's career. As we shall see, these systems feature dramatic peaks, cliffs and valleys in pension wealth accumulation that can distort career decisions – or penalize teachers for not adapting their plans to the system's benefit structure. In many states, teachers will accumulate little pension wealth until their early 50s, at which point they can suddenly reap large increases. But if they stay much beyond such a pension "peak", they can suffer declines in pension wealth – incurring a tax-like financial penalty for staying too long. This is one simple pattern, with no compelling rationale, but systems can also exhibit even more

[5] See also Brown (2008) for a study of teacher retirements in the LA Unified school district.

peculiar accumulation patterns, which reward or penalize teachers at seemingly arbitrarily chosen points in their career.

Our main contribution in this paper is to illustrate graphically the peaks and valleys in pension wealth accumulation that operate over the course of a teacher's career in an illustrative set of six state systems. They are in contrast with the much smoother path of pension wealth accumulation under alternative professional pension plans, increasingly common in other sectors, that tie benefits more closely to contributions, and which, as a result, provide more neutral incentives for career decisions.

How Teacher Pensions Work

Public school teachers are almost universally covered by traditional defined benefit (DB) pension systems. We say "traditional" because these are the types of plans that were the norm in both the public and private sector until recent decades. However, this is no longer the case in the private sector where employers have shifted dramatically to 401(k)-type defined contribution (DC) systems and restructured their DB systems as well (more on this below).[6] In a traditional DB system, the employer has an obligation to provide a regular retirement check to employees upon their retirement.

Typically, a DB teacher pension plan requires that both teachers and employers make a contribution each year to a pension trust fund. On average, these contributions are smaller for the 61 percent of teachers who are part of the Social Security system and larger for those who are not covered. We estimate that in the systems covered by Social Security, employees contribute an average of 4.5 percent and employers contribute 9.0

[6] Data collected by the U.S. Department of Labor show that DC plans now predominate in the private sector (Hansen, 2008).

percent, for a total of 13.5 percent. This is in addition to the 12.4 percent combined employer and employee contribution to the Social Security system. By contrast, in non-covered systems, employees contribute an average of 7.9 percent and employers contribute 11.2 percent, for a total of 19.1 percent.

In a fully funded system, these contributions and the investment returns they earn should cover the benefits these teachers are accruing for their future retirement. However, in many states the teacher pension systems have accrued large unfunded liabilities.[7] These have arisen for several reasons, including the fact that most systems were originally pay-as-you-go (i.e. no pre-funding), and also benefits have been added over time (including early retirement benefits) without commensurate funding. As a result, employer and teacher contributions must not only cover the currently accruing liabilities (known as "normal costs"), but also the amortization of previously accrued unfunded liabilities -- the so-called "legacy costs."[8]

Once a teacher is vested (usually 5 or 10 years), she becomes eligible to receive a pension upon reaching a certain age and/or length of service. Different versions of these eligibility rules are discussed below, but they typically allow a teacher to draw a pension well before age 65, especially if she has been working since her mid-20s.

Benefits at retirement are usually determined by a formula of the following sort:

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[7] The unfunded liabilities and funding ratios for pension funds in the six states included in this study, as of 2007, are: AR ($1.8b, 85.3%), CA ($19.6b, 87.0% [2006]), MA ($9.7b, 69.3% [including Boston]), MO ($5.3b, 83.5%), OH ($14.5b, 82.2%), TX ($12.5b, 89.2%). (Source: state pension fund Comprehensive Annual Financial Reports).

Note that all of these estimates discount future liabilities at rates of 8 percent or higher. Most financial economists believe that these future liabilities should be discounted at a lower (and low risk) rate, which is required accounting practice for private-sector pension funds. Were that practice followed for these public teacher funds, the funding ratios would be much lower. (Waring, 2008)

[8] It is important to note that these contributions do not include future costs for retiree health insurance -- an issue that is now beginning to appear on education finance radar screens, as discussed below.

(1) *Annual Benefit = r(YOS,Age)·YOS·FAS.*

In this expression, *YOS* denotes years of service, the final average salary *(FAS)* is an average of the last few years of salary (typically three) and *r* is a percentage that we will call the "replacement factor" that may be constant, but is often a function of service and age .[9] In Missouri, for example, teachers at normal retirement earn 2.5 percent for each year of teaching service. Thus, a teacher with 30 years of service would earn 75% of the final average salary. So if the final average salary were $60,000 she would receive:

Annual Benefit = .025 x 30 x $60,000 = $45,000,

payable for life. If the teacher were to separate from service prior to being eligible to receive the pension, the first draw would be deferred and the amount of the pension would be frozen until that time. Once the pension draw begins, there is typically some form of inflation adjustment, although the nature of it varies from state to state.

Table 1 summarizes some of the key parameters of DB pension plans in six states. While not randomly chosen (we inhabit two of these states), they are broadly representative of the universe of teacher pension plans.[10] More complete such tables are published by the NEA and others, showing similar variation in these pension parameters across states.[11]

The complexity of the formula varies from state to state. Arkansas, for example, has a relatively simple formula. Once one reaches age 60 or 28 years of service, one can draw a pension equal to the final average salary times 2.15% times years of service (plus

[9] States will often specify a replacement factor for "normal" retirement, but also have various "early" retirement provisions that can be expressed as age-or-service-based reductions in the "normal" replacement factor.

[10] These six states account for 29 percent of total Fall 2004 employment of public school teachers.(U.S. Department of Education, 2008, Table 63).

[11] NEA (2004), Loeb and Miller (2006).

$900 per year). One can start drawing the pension earlier, after 25, 26, or 27 years of service, but with an adjustment of 85%, 90% or 95%, respectively. The formulas of other states are more complicated, as we shall see below.

The composite effect of these systems -- whether they are simple or complex -- is hard to discern from the system's parameters. To appreciate the powerful incentive effects of these systems, and thus make informative comparisons among states, we use the parameters to examine the way in which teachers accumulate pension wealth with each year of employment.

Pension Wealth and Earnings Wealth

The parameters of teacher pension plans can be used to estimate the magnitude of pension benefits using the concept of present value. When an individual retires under a DB plan he or she is entitled to a stream of payments that has a lump sum value that can be readily determined, using standard actuarial methods. By the same token, the stream of earnings over one's worklife can also be converted to a lump sum for the purpose of comparison. It is simply the cumulative earnings over time, with interest accrued. Hence, the two streams of income – earnings during one's worklife and pension benefits during retirement – can be placed on a common footing.

Formally, consider an individual's pension wealth, *P*, at some potential age of separation, A_s. The stream of expected payments may begin immediately, or may (perhaps must) be deferred until some later retirement age. The present value of those payments is:

$$(2) \qquad P(A_s) = \sum_{A \geq A_s} (1+r)^{(A_s - A)} f(A \mid A_s) \cdot B(A \mid A_s),$$

where $B(A \mid A_s)$ is the defined benefit one will receive at age A, given that one has separated at age A_s, and $f(A \mid A_s)$ is the conditional probability of survival to that age.

The benefit stream may itself be a choice among alternative streams open to the individual, based upon the choice of when to begin receiving payments. Often, the best choice is simply to receive benefits as soon after separation as possible, but not always, since there may be an age reduction in benefits for receipt prior to "normal" retirement age. In modeling pension wealth below, we assume that individuals separating at age A_s will choose the stream of payments that maximize present value.[12]

In principle, $P(A_s)$ represents the market value of the annuity. If, instead of providing a promise to pay annual benefits, the employer were to provide a lump sum of this magnitude upon separation, the employee could buy the same annuity on the market. The teacher's pension wealth, $P(A_s)$, is the size of the 401(k) that would be required to generate the same stream of payments she would be owed upon separation at age A_s.

Figure 1 depicts the pension wealth, in inflation-adjusted dollars, for a 25-year-old entrant to the Ohio teaching force who works continuously until leaving service at various ages of separation.[13] The salary schedule assumed is that of the state capital (Columbus, Ohio), under which teachers receive annual step increases and also lane increases as they move from a B.A. to a master's degree. The entire salary grid is

[12] This is not as strong an assumption as might appear at first sight. We are *not* assuming that teachers choose their age of separation to maximize present value -- that is the major decision, and obviously there are many other factors that affect it, as discussed below. We are *only* assuming here that for any *given* age of separation, where the individual has to choose whether to collect the pension immediately (if eligible) or to defer, and for how long, that *this* decision (a relatively minor one) is based on maximizing present value. In cases where it pays to defer, teachers may well receive advice to that effect from the pension professionals in the state retirement office. In many cases the formula is such that discretionary deferrals are actuarially similar to one another, so that the precise choice made is not that important. For all these reasons, the assumption made in the text is not particularly strong.

[13] Similar diagrams can be drawn for individuals entering service at different ages. See below.

assumed to increase at 2.5% inflation.[14] We assume a 5% interest rate,[15] and use the most current female mortality tables (2004) from the CDC.[16]

The accumulation of pension wealth is not smooth and steady, but rises with fits and starts after age 49, due to rules of eligibility for early retirement and the like (discussed in more detail below). During her first 24 years in the classroom, this teacher accumulates about $309,000 in pension wealth. However, over the next six years she accumulates more than $100,000 <u>*per year*</u>, approaching the million dollar mark by age 55. Pension wealth reaches a peak by her early sixties and then starts to decline.

For purposes of comparison, it is useful to define one's earnings wealth analogously to that of pension wealth:

$$(3) \qquad E(A_s) = \sum_{A<A_s} (1+r)^{(A_s-A-1)} W(A),$$

where $W(A)$ is one's annual wage at age A. Thus $E(A_s)$ is simply cumulative earnings with accrued interest. It can be thought of as the lump sum that would have been sufficient to fund the stream of earnings, as evaluated at the age of separation. Since pension wealth is the present value of a stream of payments going forward and earnings

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[14] Typically a three-year contract will include three grids, each of which is an increase over the preceding one, and subsequent contracts will have grids that are similarly higher. So, for example, if a teacher's first step increase is 4%, she will receive that increase plus the effect of moving to the next year's grid, assumed here to be 2.5% higher, for a total increase of 6.6% (1.04×1.025 - 1). If the teacher also shifts "lanes" by acquiring a master's degree (assumed here to occur after 6 years), there is an additional increase. Most grids have a top step (14 in Columbus), after which the only increases are due to shifts in the grid, except for "longevity" increases that may also be included, e.g. at years 19, 23, 27, and 30 in Columbus' contract.

[15] As mentioned in note 7, there is a dispute between financial economists and actuaries regarding the prudent assumption for the rate of return. The 5% figure here is closer to the economists' recommendation than that of the actuaries, who typically use about 8%. The higher discount rate will affect the dollar amount for Figure 1 (e.g. the pension wealth for a teacher separating at age 56 drops from $997,000 to $724,000), but will not have much effect on the spikes and valleys in the other diagrams, which are the main focus of this paper.

[16] Most teachers are female. For males, the pension wealth is a bit lower, due to shorter life expectancies, but the curves have very similar shapes.

wealth is the present value of a stream of payments going backwards, both evaluated at the same point in time (at age A_s), they are comparable measures, capitalizing these two components of compensation.

Figure 2 depicts pension wealth as a percentage of cumulative earnings, $P(A_s)/E(A_s)$. This measure has a fairly intuitive interpretation. If one nets out the employee contribution (10 percent in the case of Ohio) it expresses deferred compensation as a percent add-on to compensation during one's working life. Thus, an individual separating at age 55 receives pension benefits worth 38% of cumulative earnings, for a net fringe benefit rate of 28%. Conversely, an individual separating at age 30 would receive pension benefits worth only 7% of cumulative earnings, which is negative, net of employee contribution, so this individual (and others up to age 35) would be better off withdrawing her contributions, even though she is vested.

The pension wealth measure $P(A_s)/E(A_s)$ also has a more concrete interpretation, from the funding side. It represents the percentage of earnings that must be set aside each year (from employer and/or employee) in order to fully fund the pension benefits, for any given age of separation.[17] Clearly, those individuals who retire in their mid-to-late 50s receive significantly more in benefits than has been contributed to the system on their behalf, while those who separate from service earlier in their career do not. Figure 2 therefore illustrates the uneven distribution of benefits that is built into the system. Subtracting out the Ohio teachers' contribution of 10 percent of earnings, one sees the net benefits are even more unequally distributed than the gross benefits.

[17] This does not include the portion of contributions to amortize unfunded liabilities from previous cohorts.

This is true of other states as well. Comparable diagrams typically show a single peak in pension wealth, as a percent of cumulative earnings, but there is significant variation due to the specifics of each state's benefit formula.[18]

Finally, note that a state's pension wealth curve often has distinct segments, with markedly different slopes, as in Figure 1. The important implication of this is that the annual increments to pension wealth at different ages can vary quite dramatically, as we shall presently show.

Annual Change in Pension Wealth, as a Measure of Deferred Compensation

The evolution of a teacher's pension wealth over her career captures the incentives embedded in the pension system. Properly calculated, the change in pension wealth is a measure of deferred compensation, which can be compared with current compensation. Specifically, one must distinguish between changes in wealth due to a change in the stream of payments (evaluated at the same point in time) and a change in wealth due solely to the passage of time. The latter piece is simply the interest on the previous year's wealth – it is the return to capital, not labor. It is the former piece – the change in wealth due to a change in the stream of payments – that is the proper measure of labor income, either in current or deferred compensation. Finally, we must also net out the employee's contribution to the pension fund, since that cannot be considered part of labor income.

Recall that pension wealth is the size of the 401(k) that would be required to purchase the stream of pension benefits. Thus, the growth of that notional 401(k), net of

[18] See Costrell and Podgursky (2007a) for these other diagrams.

interest and net of employee contributions is conceptually identical to the 401(k) contributions made by the employer. That is, our measure of deferred income is equivalent to the employer's annual contribution to the corresponding 401(k) plan.

Formally, the change in pension wealth net of interest is:[19]

(4) $$p(A_s) \equiv \Delta P(A_s) - r \cdot P(A_s - 1).$$

This can be expressed more explicitly as:

(5)

$$p(A_s) = \sum_{A \geq A_s} (1+r)^{(A_s - A)} \left[f(A \mid A_s) B(A \mid A_s) - f(A \mid A_s - 1) B(A \mid A_s - 1) \right] - (1+r) B(A_s - 1 \mid A_s - 1)$$

As stated earlier, this is the effect on wealth of deferring separation due to changes in the expected stream of pension payments.

Let us examine (5) in more detail. The first term represents the increase in expected pension payments from A_s forward. We see from the bracketed expression, which is positive, that this is due to the rise in benefits from the pension formula $(B(A \mid A_s) > B(A \mid A_s-1))$, as well as the higher probability of surviving to receive each benefit payment ($f(A \mid A_s) > f(A \mid A_s-1)$).

Note that if A_s is at an age or service level where the formula allows one to accelerate the first pension draw (e.g. age 50 in Ohio, as shown in Figure 1 and discussed further below), then one or more of the $B(A \mid A_s-1)$ terms are zero while the corresponding $B(A \mid A_s)$ terms are positive. Thus, at such an age the annual income from deferred compensation includes the sudden addition of one or more years of pension payments, frontloaded. Conversely, if one was already eligible to receive a pension the

[19] Analogously, it can be easily shown that the change in earnings wealth, net of interest on the prior year's earnings wealth is simply the annual earnings income: $e(A_s) \equiv \Delta E(A_s) - r \cdot E(A_s-1) = |W(A_s-1)$.

previous year, at age A_s-1, then deferring separation forgoes that benefit payment, as shown in the last term in (5).

In sum, the income from deferred compensation in any given year has several conceptual pieces: (i) the rise in expected benefit payments due to the formula (more years of service, higher final average salary, and, in some states, a higher replacement factor); (ii) at certain break points in the formula, additional years of pension eligibility; and (iii) later in one's career, the loss of a year of benefits from deferring separation.

Pension Spikes

The next set of charts (Figures 3-9) is the most important for an analysis of labor market behavior. Here we show the change in net pension wealth arising from an additional year of work, expressed as a percent of salary for Ohio and five other states. Behind each of these charts is a pension wealth accrual chart such as that in Figure 1. Each of these charts answers the question posed above: how much does a teacher's net pension wealth change if she works an additional year? Specifically, we consider *deferred* income (net of interest on prior pension wealth and net of employee contributions), expressed as a percent of the teacher's salary.[20]

Ohio

Consider Ohio, depicted in Figure 3. A teacher who enters service at age 25 accrues pension wealth upon vesting, starting at roughly ten percent of annual earnings.

[20] It is important to note that the pension accrual concept used here is different from the actuarial concept. The actuarial concept is based on the assumption that the individual will work to a given "normal" retirement age, independent of the age at which the accrual is being evaluated. It is calculated to guide the employer in providing prudent reserves, and it results in smooth curves. The economist's concept, depicted here, considers each year as the individual's year of separation; it is calculated to depict the incentives for individual decisions about separation. As has been previously established in the economics literature (e.g. Kotlikoff and Wise, 1987, Friedberg and Webb, 2005), these curves have sharp kinks, leading to strong incentives to stay or leave at various ages.

This is offset by her contribution to the fund, so her net addition to wealth is zero -- this is her deferred income that year. Her deferred income gradually rises to 23 percent of her salary in her 24th year (age 49). Throughout this period, her deferred income reflects the credit she is accruing to a higher pension, collectable at age 60.

After her 25th year (age 50), the eligibility rules allow her to collect starting five years earlier, deferring the first pension draw to age 55 instead of 60. This yields a large sudden increase in pension wealth. In that year her net pension wealth jumps by 164 percent of her annual earnings. Each of the next five years also yields deferred income that approaches or exceeds her current income. Here, the reason is not additional years of pension eligibility. Rather, annual deferred income is high because the increase in the annual pension accrued is rapid, as the early retirement reduction gets phased out upon reaching 30 years of service, when she qualifies for "normal" retirement.

The growth of pension wealth drops off sharply over the next few years -- it actually goes negative for ages 56-59. Her annual pension continues to rise with each additional year of service (albeit more slowly). But this is entirely offset by the fact that she has now reached the point where she collects her pension immediately upon separation, so each additional year of work means forgoing a year of pension payments.

This is followed by yet another sharp spike at age 60 (35 years experience), equal to 132% of her salary that year. That is because Ohio has an incentive for delayed retirement, adding 9% to the total replacement rate after 35 years (as indicated in Table 1), beyond the 2.9% given by the formula.

Beyond age 60, pension wealth shrinks once again (net of interest), and at an accelerating rate. At age 61, her pension contribution and reduction in pension wealth constitute an implicit 33% tax on her earnings (over and above her state and Federal income tax). By age 65 the pension system is imposing a tax of 92%, so, together with her income tax she is effectively paying for the privilege of teaching.

Table 2 gives more detail on what is going on in Figure 3. Each cell gives the annual pension, as a percent of FAS for the corresponding YOS and age. The blank region indicates no pension eligibility. The region with bolded figures (Age = 65 or YOS ≥ 30) is the region of "normal" retirement, and the bonus year YOS=35 is indicated by bold italic figures. The region with unbolded italic figures is the region of "early" retirement, where the pension is reduced by various adjustment factors. The table's shaded cells denote the wealth-maximizing choice of first pension draw for a 25-year-old entrant, after separation at any given YOS.

As the table shows, age 60 is the earliest she can collect up through her 24th year of service, and that does in fact maximize pension wealth, even though further deferral (e.g. to the "normal" retirement age of 65) would raise her annual pension. Upon her 25th year, she maximizes pension wealth by taking the five extra years of pension eligibility (jumping from the shaded cell at (24, 60) to the one at (25, 55)), despite the fact that the pension is reduced from 44.9 percent of FAS to 41.3 percent. The draw at age 55 continues to be her optimal choice until she reaches age 55, at 30 years of service. For service beyond that point, her first draw is immediate upon separation, so the shaded cells move diagonally to the southeast. Note the particularly large jump in the annual pension, from 76.6 percent of FAS to 88.5 percent, at YOS=35, the bonus that generates Figure 3's third spike.

Arkansas

The case of Ohio is a bit more convoluted than most -- its system of incentives for early retirement *and* for delayed retirement results in multiple spikes. But most of the state systems we have examined also display sharp pension spikes. In Arkansas, a particularly sharp spike occurs at age 50 (25th year of service for 25-year-old entrant), as depicted in Figure 4. In that year, our teacher would earn an increase in pension wealth worth almost five times her salary. In other words, a teacher with a $50,000 salary would earn total compensation of nearly $300,000 for that year of teaching, before dropping off precipitously the next year. The reason is that she is eligible for ten extra years of pension payments, since she qualifies for early retirement immediately after 25 YOS, instead of having to defer to age 60. Upon reaching 28 YOS, she qualifies for normal retirement, and beyond that point -- age 53 for a 25-year-old entrant -- her deferred income turns negative each year. This is because the rise in annual pension does not outweigh the loss of a year's pension payment.

Missouri

Missouri's formula is a bit more complicated. It allows one to draw a "normal" pension at Age ≥ 60 or YOS ≥ 30, but also has a "rule of 80," under which one is eligible once Age + YOS reaches 80. In Table 3, "normal" retirement is represented by the region with bold figures, and the "rule of 80" is represented by the serrated border of that region. Alternatively, one can take "early" retirement at ages 55-59, with downward adjustment factors, or with YOS from 25 to 29 ("25-and-out"), but with lower replacement factors (2.20% - 2.40%, instead of the normal 2.50%).[21] These options are represented by the two wedge-shaped regions in Table 3, with italicized figures.

This formula, like that in Ohio, gives rise to multiple spikes, depicted in Figure 5. A 25-year-old entrant considering separation during her first 20 years would do best to defer her first pension draw to normal retirement at age 60. Her 21st year of service (at age 46) allows her to bring the first pension draw forward a year, to age 59, under the rule of 80 -- she starts moving down the serrated border of the normal retirement region in Table 3. This extra year of pension eligibility gives a bump to her pension wealth accrual that year, seen in Figure 5. This recurs for each of the next three years. If she were to stay on through her 25th year (age 50), she qualifies for the attractive "25-and-out" option, under which she would collect immediately. This means six extra years of pension eligibility, as she jumps from the shaded cell (24, 56) in Table 3 to (25, 50). This generates her biggest pension spike in Figure 5, worth almost four times her salary. If she stays two more years, she should avail herself again of the rule of 80, and at age 53 (28 YOS), she would qualify for normal retirement immediately upon separation -- her second spike. A third bump occurs at age 56, due to an increase in the replacement factor at 31 YOS. Beyond that point, deferred income turns negative.

Other states and general comments

The pension systems in California, and Massachusetts also generate spikes for our representative teacher in her early to mid-50's (Figures 6-7), as did the system in Texas, prior to recent changes (Figure 8). The details of what generates each spike vary from state to state, but there are a few general points.

[21] This "25-and-out" provision has been a "temporary" feature of Missouri code since 1996. Originally set to expire in 1998, it was enhanced and extended to 2000, and then again to 2003, 2008 and 2013.

Since both the teacher and employer are making the same contributions year after year, one might imagine that pension wealth accrual would be fairly smooth and consistent. However, contribution rates do not drive wealth accrual in these pension plans. Pension wealth is only loosely tied to contributions. The primary drivers in pension wealth accrual are changes in the annual annuity payment (determined by equation (1)) and the number of years the teacher can expect to collect it. As we have seen, it is the latter that is often the wild card in these systems. In other cases, spikes are created by enhancements to the benefit formula at specified ages or YOS.

As mentioned above, pension accrual spikes have been documented by previous researchers in other sectors, notably by Kotlikoff and Wise, 1987, in their exhaustive analysis of thousands of private sector plans. However, the magnitude of the spikes we have found in teacher systems dwarf those found by Kotlikoff and Wise, typically by an order of magnitude.[22] One important reason for this appears to be a difference in early retirement provisions between many teacher systems today and the private DB systems of the 1980s. Those private systems tended to reduce early retirement pensions based on age, rather than service; the reductions were often less than actuarially warranted -- hence the spikes -- but age was at least the actuarially relevant variable. By contrast, teacher systems often condition early retirement on YOS thresholds, which are unrelated to the present value of future benefits.[23] This accentuates the disjunction between benefits and contributions, playing a significant role in generating the very large spikes we have seen.

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[22] For example, among the 513 plans that set early retirement at age 55 and normal retirement at age 65, the median accrual rate at age 55 (where the main spike generally occurs for these plans) was found to be 10 percent. That accrual rate was 21 percent for the plan at the largest fifth percentile by average accrual, and 41 percent for the plan with the maximum accrual ratios. (Kotlikoff and Wise, 2007, Table 10.3)

[23] YOS is related to contributions, and this is crudely represented in the basic benefit formula, $r \cdot YOS \cdot FAS$, but the YOS-eligibility rules for teachers lead to large discontinuities, as we have seen. The calculations in

Once teachers get past the spike (or spikes), pension wealth accrual turns negative. For all these states this occurs by the early sixties, and in some states it does so much earlier. This is not because the annual pension annuity falls. In fact, it is rising (although eventually teachers hit a pension cap typically set at 100 percent of earnings). Rather pension wealth falls because the teacher collects the pension for one fewer years and the annual payment is not enhanced sufficiently to offset this loss.

Finally, these charts also illustrate how legislatures alter these incentive structures periodically (even if the public policy impact may not always have been fully understood at the time). In the cases of California and Massachusetts (see Figures 6 and 7), these spikes were created by benefit enhancements enacted when pension funds were flush, following the bull market of the 1990s.[24] Ohio's multiple-spiked system also reflects benefit enhancements enacted over the years – it used to have a single spike at age 60.[25] By contrast, recent changes in Texas' formula eliminated its spikes, in an explicit cost-cutting measure. Since Texas' action was not a benefit enhancement, however, the

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Kotlikoff and Wise ignore service requirements for early retirement, but the minimal nature of those requirements leads them to conclude this is unlikely to significantly affect their results (see their Note 2).

[24] Prior to these changes, California and Massachusetts did not have notable spikes, because their formulas were driven by replacement factors that rose gently with age, more so than by discontinuities in the eligibility criteria. California's benefit enhancements since 1999 added 0.2% to the replacement factor at YOS=30, creating a spike at that point. In addition, the maximum replacement factor was raised from 2.0%, at age 60, to 2.4% at age 63, which pushed out the age of negative accrual. Another enhancement was to allow the highest single year of salary to serve as the FAS after 25 years, as opposed to the three-year average, a rather unusual feature that accounts for the minor spike at 25 YOS.

In the case of Massachusetts, the enhancement in 2001 added 2% × (YOS-24) to the replacement rate, for YOS ≥30, which created the spike at 30 YOS. This also reduced the age of negative accrual, by accelerating the date at which one reaches the 80% cap on the replacement rate. (By way of disclosure, one of us (Costrell) served in the Massachusetts administration at the time of this change and, along with other staff, recommended a gubernatorial veto (which was overridden by the legislature). An account of that episode can be found in Costrell and Podgursky (2007a), along with further discussion of the effect on these diagrams of variations in state formulas.)

[25] See Costrell and Podgursky (2007b), Figure 7 and Appendix A: "History of Ohio's Pension Formula Since 1965." More generally, this report contains more detail on the Ohio system.

change only applied to new hires -- the vast majority of current teachers still face the incentives given by the double-peaked curve in Figure 8.[26]

Pension Accrual Patterns at Different Entry Ages

Figures 1-8 assumed entry at age 25. This entry age is representative – we have estimated from a national sample of new retirees that their median entry age was 25-26.[27] However, it is important to consider variation in this pattern, especially with the rise of alternative paths into teaching, as well as the traditional career interruptions of teachers.

At first blush, it might seem that the spikes would simply be displaced to the left or right depending on the entry age of the teacher. Things are not that simple, however, since the spikes depend in part on the interaction of age and YOS. For example, if a teacher is eligible for regular retirement at age 60 or YOS = 30, then the magnitude of the spike when YOS hits 30 will depend on the difference between a teacher's age at that point and age 60 -- the number of extra years of pension which 30 YOS obtains.

We illustrate some of these complexities by analyzing the Ohio pension formula. Figure 9 shows the pattern of deferred income over the careers of three entrant groups. The solid curve is the three-peaked pattern of the 25-year-old entrant depicted previously, in Figure 3. The dotted curve represents a 22-year-old entrant – an entry age that is actually a bit more common than age 25. It, too, has three peaks, but they are moved three years to the left, appearing at ages 47, 52, and 57. The peak at age 52 is particularly

[26] Specifically, Texas, like Missouri, had a rule of 80, but effective with new hires after September 2007, eligibility was restricted to those reaching age 60. In addition, Texas eliminated another feature that had allowed one to receive close to the full pension, if one was close to fulfilling the rule of 80, once Age = 55 and YOS=20. These two features had accounted for the two spikes in Figure 8's pre-2006 accrual curve.

[27] We tabulated the ages of first year teachers from the 2003-04 Schools and Staffing Surveys.

pronounced: a 22-year-old entrant will, in her 30th YOS, raise her pension wealth by the equivalent of almost four times her salary. This is a bigger spike than for the 25-year-old entrant because her 30th YOS now qualifies her for three extra years of pension payments (starting at age 52 instead of 55).[28] Finally, the dashed curve represents the 30-year-old entrant. For her, the first two peaks collapse into one at age 55, and the final peak occurs 10 years later, upon her 35th YOS.

Our analysis of Ohio and other states suggests that the curves for 25-year-old entrants are, in fact, indicative of the patterns for entry at the most common entry ages. The accrual patterns for older entrants, such as age 30, are not quite as striking, but those for younger entrants, such as age 22, are even more dramatic, and more strongly tilted toward early retirement.

Incentive Effects of Pension Spikes

There are two key incentives created by the spikes in pension wealth accrual – a pull and a push as it were. First, teachers have a strong incentive to stay on the job – a pull – until they reap the benefit of the spikes. Even if a teacher is no longer suited to the job, it may well be worth "putting in one's time" for a few more years if it means collecting several hundred thousands of dollars in pension wealth.[29]

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[28] For the 25-year-old entrant, the 30th YOS did not qualify her for any extra years of pension: her 25th YOS qualified her for pension at age 55, but by time she reached her 30th year, she was already 55. However, her 30th year did qualify her for the full phase-out of the penalty for early retirement.

[29] A recent survey conducted by Education Sector sheds light on this point. Seventy-six percent of teachers agreed ("somewhat" or "strongly") with this statement: "Too many veteran teachers who are burned out stay because they do not want to walk away from the benefits and service time they have accrued." Duffett, et. al., 2008.

Second, once a teacher is beyond the spike and into the region of negative deferred compensation, the pension system creates a disincentive to stay on – a push out the door – even if one excels at the job. At this point, the pension system serves as a two-fold tax on earnings, first by the required employee contribution and second by the negative wealth accrual; together, these can easily offset much or even all of one's salary. That is, the reduction in pension wealth from working an additional year and forgoing that year's pension payment can approach or exceed the teacher's take-home pay, in which case her total compensation is little or nothing.

There is ample evidence that such incentives affect behavior. Anecdotal evidence is commonplace of teachers (and others) timing their retirement decisions, at least in part, to features of the benefit formula. Pension systems routinely provide on-line pension calculators and retirement counseling to help their members do so. Labor economists have developed more systematic evidence of the behavioral impact of defined benefit pensions in other fields, particularly in the private sector (e.g., Friedberg and Webb, 2005). There has been much less research on teacher pensions, but that which is available indicates strong incentive effects (Ferguson, Strauss, Vogt, 2006; Brown, 2008; Podgursky, Ni, and Ehlert, 2008).

A careful econometric analysis of the effect of these incentives (and changes in the plan parameters) for our set of states is beyond the scope of this paper. However, the overall effect of these incentives is seen in even simple tabulations of state retirement data. Consider the case of Arkansas. For most Arkansas teachers, the critical variable for pension benefits is YOS. As we saw in Figure 4, there is typically a large spike in pension wealth accrual at 25 YOS, upon eligibility for early retirement, and accrual turns negative after eligibility for normal retirement, at 28 YOS. Figure 10 gives the distribution of teacher retirements in Arkansas by YOS, for the period since these eligibility rules were set, in 1997.[30] This figure provides clear evidence that teachers do indeed respond to the incentives embedded in the pension system. There is a spike in retirements at 25 YOS, consistent with the system's "pull" on those teachers who are approaching 25 YOS. And there is a particularly pronounced spike at 28 YOS, followed by a sharp drop in retirements at 29 YOS and beyond, consistent with the system's "push" to retire once pension wealth accrual turns negative.

This is not to say that the pension system is the sole determinant of teacher retirement decisions. As Figure 10 indicates, 12% of retirees were willing to incur negative pension wealth accrual, teaching beyond 28 YOS, but not many were willing to stay on for long -- only 3% stayed on after 30 YOS.[31] Also, 45% of retirees had fewer than 25 YOS. This figure includes late-starting teachers, or teachers with interrupted spells of employment, who taught until age qualified them for retirement, instead of service. But it also includes many teachers who stopped teaching for any number of non-pension reasons before meeting either age or service requirements, and thus deferring first pension draw until reaching the minimum age. Still, it is evident from Figure 10 that the distribution of YOS cannot be understood without reference to the pension parameters.

[30] This set of teachers excludes participants in Arkansas' T-DROP system, discussed below. It is also restricted to those in Arkansas' contributory system. Since 1999, all new full-time teachers were contributory, but prior to then, teachers could choose instead to participate in a non-contributory system, with lower benefits. About one-third of recent non-T-DROP teacher retirees were non-contributory.

[31] As stated in the previous note, this excludes participants in T-DROP, a program discussed below that allows teachers to continue teaching beyond the 28-year mark while attenuating the negative accrual.

Moreover, teachers surely respond to *changes* in pension parameters. Figure 11 depicts Arkansas' distribution of retirees under the previous set of parameters, 1984-1996, when the YOS requirement for normal retirement was 30. As one would expect, the major spike was at 30 YOS, instead of 28.[32]

<u>Unintended Consequences: Employment After "Retirement"</u>

We have seen that teacher pension systems often have strong incentives built into them to encourage teachers to retire at relatively young ages. Clearly, many teachers, even if they nominally "retire" in their 50s, will continue with labor market work of some sort for many years. Given concerns about "teacher shortages" and pressures from the No Child Left Behind Act to make sure that all classrooms are staffed with qualified teachers, it may be educationally problematic for districts to nudge qualified and effective teachers out the door at such early ages. Not surprisingly, all of these teacher pension systems have provisions allowing educators to continue to teach and collect their pension (a practice called "double dipping"). In many states, these provisions have been expanding. Here are some examples.[33]

1. Part time employment. All of the pension systems considered here allow teachers who have retired to continue to work in covered employment on a part time basis (without accruing additional benefits).

2. Employment in shortage areas. Many states permit retired educators to teach full time for a specified period of time in "shortage" fields.

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[32] There remains a spike at 25 YOS, consistent with the fact that the early retirement YOS was unchanged. The vesting requirement, however, was reduced from 10 years to 5 in 1997, and this is reflected in the difference between 5-9 YOS retirements in Figures 10 and 11.

[33] See also Bragg (2003).

3. Break in employment. Some states allow teachers to return to full-time employment and collect their pension after a specified break in service. In California the required break is 12 months. In Ohio, a retired teacher can return to work the next day, but must wait two months before receiving pension benefits.

4. DROP plans. Many states have implemented Deferred Retirement Option Plans (DROP's). These permit teachers to continue working full time for a specified period of time (one to ten years), during which some portion of their pension check goes into what amounts to an individual retirement account. This prevents or attenuates negative pension wealth accrual, providing an incentive for teachers to "retire" and return to work.

Figure 12 illustrates the incentives under the Arkansas T-DROP plan. Under this plan, a teacher with 28 or more YOS can keep working after "retirement" for up to ten years, with 60-70% of her pension check going into a retirement account and accumulating interest until she actually leaves teaching. Figure 12 assumes a teacher who entered at age 25 exercises this option after 28-30 years of service (at ages 53-55). Under these simulations, the T-DROP eliminates most of the pension penalty for continuing to teach beyond 28 years. (The curves are higher for entering T-DROP at 30 vs. 29 vs. 28 YOS because the deposit rates are 70%, 65% and 60% respectively.)

As would be expected, T-DROP participants work more years than non-T-DROP participants. We saw in Figure 10 that only 12% of recent non-T-DROP retirees had more than 28 YOS. However, T-DROP entrants require a minimum of 28 YOS[34] and they put in an average of 4-5 years of additional teaching while in T-DROP. Taken

[34] From the program's inception in 1995 until 1999, the minimum was 30 YOS.

together, the median T-DROP teacher works for 32-33 years. Adding those retirees from 1998-2008 who were in T-DROP to those who were not gives us Figure 13. This figure gives the distribution of YOS, plus, for T-DROP participants, years in T-DROP, since these are also teaching years (but not credited as YOS for pension benefits).

In comparing Figures 10 and 13, one should be cautious in causally attributing all of the longer employment spans to the T-DROP program; no doubt T-DROP participants self-select from among those who would work longer anyway. In this respect, Figure 10 overstated the effect of the pension formula's incentives for early retirement, by omitting the T-DROP participants. Figure 13, however, does not have that problem, and it still shows a behavioral response to the system's incentives, with unmistakable spikes at 25 and 28 YOS. As for the effect of T-DROP itself, the comparison of Figures 13 and 10 is at least consistent with the intent of T-DROP, to blunt some of the system's incentives toward early retirement.

In addition to these various re-employment provisions, there is no obstacle to retirees resuming employment in other fields, or even in teaching itself, by crossing a state line or a district boundary to work in a different pension system. For example, Missouri teachers in the state pension system can retire and work full time in the St. Louis or Kansas City systems, or a KC, Missouri teacher can cross the border and work in KC, Kansas.

The net result of all of these practices is that the decision to “retire” (i.e., collect a retirement check) is not necessarily the same as a decision to quit teaching in public schools. Unfortunately, we are aware of no comprehensive national data on this topic. Limited data from a national survey conducted by the U.S. Department of Education suggest that at least five percent of the public school teaching workforce is also collecting a teacher pension. A longitudinal study of Missouri teachers found that 12 percent of teachers worked at least one year part- or full-time following retirement (Podgursky and Ehlert, 2007).

The significance of these practices has not been fully explored. They have no parallel in the private sector, since early retirement incentives there are always part of a downsizing effort, not one that offers re-employment. In teaching, by contrast, early retirement incentives have a completely different origin, namely legislatively enacted benefit enhancements, typically under heavy union lobbying. Re-employment provisions are often a response to the unintended (if often predictable) problems created by these incentives. In other words, these provisions are *ad hoc* fixes to some of the perverse incentives created by enhanced pension spikes.[35]

Post-retirement employment blurs the distinction between current and deferred compensation. At the very least, this calls into question the meaning of published data on teacher compensation. In addition, as re-employment becomes easier, the incentive to "retire" at or near a pension spike becomes more pronounced – there is no downside if employment can continue. It might also be in the district's interest, if the pension costs are borne by the state, since new teachers cost the district less than older ones.[36] One

[35] In higher education, where DC plans (overwhelmingly TIAA-CREF) predominate, some colleges have encouraged "phased retirement," wherein professors move to half-time employment status with a commensurate reduction in pay, but the college continues to maintain contributions to the retirement plan based on full time equivalent earnings. In general, partial retirement is easier to implement in a DC type system. Also, as discussed below, in contrast to the typical teacher pension system, pension wealth never falls in a DC (or cash balance) system. Thus there is no work penalty or tax to offset. The costs and benefits of phased retirement are far more transparent (Clark, 2004).

[36] The logic of cost-shifting also contributes to the phenomenon of "buyouts," under which a district will offer additional financial incentives for teachers to retire. A consulting sector has developed to advise school districts on how to do this. See http://www.epcinternet.com/, and especially the K-12 client list.

might expect, therefore, that "retirements" would become further concentrated around the spikes, maximizing the total cost to taxpayers. [37]

More Unintended Consequences: Health Insurance

Another consequence of early teacher retirement is a linked demand for retiree health insurance coverage.   Since Medicare eligibility does not begin until age 65, teachers who retire in their fifties have a gap of many years in coverage. In light of this, many school districts and states have extended health insurance coverage to retirees. Most retiree health insurance benefits have been paid by school districts out of current revenues (i.e., no trust fund was created to pay for these future liabilities, as was also the case originally with most pensions). Under new government accounting rules (GASB 43 and 45) benefit plans and employers must begin providing estimates of these liabilities in their annual financial statements. First hints at the figures are staggering. LA Unified, which provides complete health insurance coverage for all retirees, initially estimated a five billion dollar unfunded liability, as of July 2004. The following year it was increased to ten billion dollars.[38] A recent report by the Cato Institute estimates these unfunded liabilities of state and local governments could total $1.5 trillion.[39]

The consequences of early teacher retirements for publicly-funded health liabilities have not been studied. However, to the extent that early retirement increases

[37] For example, 63.9% of recent contributory Arkansas retirees, including T-DROP participants, clustered at 25-30 YOS.

[38] The factors that contributed to that increase were, in descending order of importance: (i) a change in the discount rate applied; (ii) change in actuarial cost methods; (iii) health care cost increases; (iv) increased life expectancy and changes in retirement and turnover assumptions; and (v) one year of interest on the previous liability and additional benefits paid. Los Angeles Unified School District (2006).

[39] Edwards and Gokhale (2006).   See also Deloitte Research (2006).

the total number of individuals – active and retired – relying on the school system for health insurance, the cost to taxpayers is increased.

<u>Options for Reform: Cash Balance or Defined Contribution Plans</u>

The underlying problem with traditional DB systems is their distortion of retirement incentives, stemming from the broken link between benefits and contributions. DC systems and cash balance (CB) plans restore that link. Many large corporations have switched to DC and CB plans over the last twenty years. Some public entities, including a few teacher pension systems (Ohio and Florida), have also started to offer DC or CB-type options in their plans.[40]

CB plans are very similar to DC plans, in that both systems tie benefits closely to contributions. Under a CB plan, employees and employers contribute a certain percentage of earnings to an individual retirement account, the same as under DC. The main difference is that in a CB plan, the return is guaranteed by the employer (typically at a rate comparable to risk-free Treasury bonds), so the market risk is not borne by the employee. Often the debate over DB vs. DC plans focuses on the shift of market risk from employer to employee, rather than retirement incentives. Since our subject here is the incentives, we focus first on CB plans, where employers continue to bear the market risk, so no market risk-shifting occurs.

The incentive-neutrality of CB plans with regard to age of separation can be simply depicted. In the net pension wealth accrual graphs (Figures 3 – 9), the irregular curves would simply be replaced with flat lines, at a percentage given by the employer

[40] One difficulty in evaluating these plans is that the DC option may not be on a level playing field with the traditional DB plan. For example, in Ohio the DB plan offers subsidized retiree health insurance, but the DC plan does not.

contribution (e.g. at 14 percent, in Figure 3). There are no spikes, inducing teachers to stay to their mid-fifties and then to leave. Pension wealth never declines: if a teacher wants to work another year, the account grows by the contributions, plus the investment return. This can then be converted to an annuity (many CB plans do this automatically). If a teacher works another year, the starting annuity is increased in an actuarially fair manner, since there is one less year of retirement to cover.

Such a retirement-neutral plan leaves the employee much more latitude to decide when to retire or switch careers, based on individual preferences. It also makes it easier for schools to retain effective teachers, who might otherwise be driven by the pull-push incentives of pension spikes, created by the heavy-handed traditional DB formulas. It is also fiscally more stable, since benefits are tied closely to contributions. Unfunded liabilities do not arise so readily, and legislatures have less opportunity to enhance benefits by shifting costs to future generations of taxpayers and teachers.

Some of these features of CB also characterize DC plans, since they, too, tie benefits to contributions. In fact, DC plans are totally immune to unfunded liabilities, since there is no employer obligation beyond the contribution. On the other hand, the employee bears the risk of any investment decisions and also forgoes the benefit of institutional investment expertise. Also, since employee contributions are typically voluntary under DC plans, there is concern that employees will not save sufficiently for a secure retirement.[41] Finally, there is also the concern that DC plan participants will tend not to annuitize their retirement balances, thereby incurring risk of outliving one's assets. These concerns have led some to argue that DC plans might best be introduced as part of

[41] This was reportedly the case for many teachers in West Virginia's shift from DB to DC. See "Wild West Virginia" (2008).

a "hybrid" plan, which still includes a DB component. Note also that many of these drawbacks can be avoided under CB, which is why many private employers switched to CB from the traditional type of DB plan.

A particularly relevant model for K-12 retirement reform may be found in higher education. Established in 1918, TIAA-CREF represents a popular and effective system that provides lifetime annuities and retirement security, as well as transparency and complete mobility of retirement benefits to several million faculty, staff, and others in roughly 15,000 non-profit institutions. Some private K-12 school teachers participate as well. While nominally a DC plan, TIAA-CREF has avoided many problems associated with such plans. Fees are very low, members have relatively few investment choices, and annuity payout options are the norm. By providing a guaranteed annual return combined with an annuity payout, TIAA more closely resembles a cash balance DB plan, in that downside market risk continues to be borne by the plan (Greenough, 1990).

In comparing traditional DB plans with contribution-based plans such as DC or CB, the issue of equity is also quite important. Traditional DB plans create wide variations in pension wealth between those who retire at or near the pension spikes and those who leave service early in their career. As we saw in Figure 2, the former will receive a windfall of pension wealth that far exceeds the joint contributions, while the latter will not. Indeed, this feature creates a huge element of risk, since an entering teacher often does not know in advance whether she will be a short-timer, leaving the system with little pension wealth, or a career teacher receiving benefits that far outweigh the contributions. In this respect, CB and DC plans are *less* risky than traditional DB plans, since one will receive benefits commensurate with contributions, regardless of length of career.

From a fiscal viewpoint, it is important to note that the low benefits for short-timers, combined with high teacher contribution rates in some states can help keep the state's average cost down in a traditional DB plan. In Massachusetts, for example, the "normal cost" of teacher pensions (i.e. leaving aside the legacy costs, which amortize unfunded liabilities) is 11.9 percent of payroll, and teacher contributions average 9.7 percent.[42] Assuming (as most actuarial reports do), that all employee contributions go to normal cost, and none to amortize the unfunded liability, this leaves an employer contribution to normal cost of only 2.2% of pay.[43] This is less than the typical employer match on a DC or CB plan. The corresponding figures in our other states are higher: 4.0% in TX, 4.8% in OH, 8.5% in AR, 9.1% in MO, and 10.8% in CA.[44]

In any case, whether the net employer normal cost is low or high, shifting to CB or DC, and eliminating the tilt in benefits against short-timers, will almost certainly reduce benefits for long-termers and may also be more expensive overall, depending on how generous the new program is. The point here is not so much the generosity of current plans, but their idiosyncratic structure, resulting in very uneven distribution of

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[42] For teachers hired after 2000, the contribution is 11%.

[43] The vast majority of the employer's contributions in MA are to amortize the unfunded liabilities. For FY07, these legacy costs totaled 13.4% of payroll. Author calculations, based on Commonwealth Actuarial Valuation Report, January 1, 2007, pp. 8, 11.

[44] Drawn from state CAFR's and actuarial reports. The corresponding figures for employer contributions to amortize the unfunded liabilities are: 2.6% in TX, 8.2% in OH, 5.5% in AR, 3.4% in MO. CA's actuaries calculate the amortization two different ways, at 0.8% and 4.2%. Note that all these calculations are simply a residual from total employer contributions, rather than those that would be required to amortize the liability over some fixed horizon, such as the GASB standard of 30 years.

benefits and strong incentives to time career decisions to arbitrary plan parameters. In our view, that is the most compelling reason for considering pension reform.

Conclusion

Policy discussions about teacher recruitment, retention, and quality often focus on salary. However, pension policy also has important consequences for the teaching workforce. In the recruitment of young teachers, the attraction of pension benefits may seem distant and uncertain, especially since young workers often change jobs. The costs, however, are incurred from the start in contributions to the plan that can exceed 20% between employer and employee. Many young teachers, who are paying off student loans, attempting to start families and buy homes, might prefer more of their compensation up front rather than diverted into a system from which they may well never benefit. They may also be deterred by the fact that, if they leave teaching after five or ten years, they will have accumulated little pension wealth, compared to some of their non-teaching peers in cash balance or 401(k) plans.

With regard to retention, it is difficult to imagine an efficiency rationale for the peculiar retirement incentives we find in these systems. Teachers are pulled to the pension spikes and then pushed out at relatively early ages by negative pension wealth accrual. The labor economics literature has developed the notion that DB pensions in the private sector might be interpreted as part of a mechanism to prevent shirking as one approaches the optimal date of separation (see Lazear, 1979; Gustman, Mitchell, and Steinmeyer, 1994). Under this theory, age-earnings profiles are steeper than the experience-productivity profile, so that workers are effectively "posting a bond," inducing them to exert effort so they will not be fired before reaching late-career levels of compensation. On this view, rapid pension accrual is part of the steep age-earnings profile, and the region of negative accrual serves the same purpose as mandatory retirement, to prevent workers from over-exploiting the gap between late-career compensation and productivity. This theory cannot persuasively apply to public school teaching, since tenure virtually eliminates any fear of firing. Alternatively, the backloading of pension wealth accrual might make sense if research found very strong returns to worker experience. However, the vast majority of education production function studies find little return to experience beyond the first few years (Hanushek and Rivkin, 2006). We are aware of no productivity evidence, for example, that could justify the differences in wealth accrual between a teacher with 15 and one with 25-30 years of experience. We have also noted the (presumably) unintended byproducts of these DB systems in the form of growing retiree health insurance costs and reemployment of retirees ("double-dipping").[45]

In addition, pension policy has powerful effects on K-12 school finance. Teachers who retire in their mid-fifties draw pension benefits for periods of time that are likely to equal or exceed their years of classroom service. A teacher retiring at age 55 with a $50,000 annual pension (indexed) has received an annuity valued at about $1 million. Moreover, she may well receive heavily subsidized retiree health insurance for a

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[45] It is possible that the practice of "double-dipping" is an efficient response to the constraints of the highly regulated personnel environment in which schools operate. Since tenure laws make it prohibitively costly to dismiss more senior teachers, pensioning them off *en masse* and then selectively rehiring the better ones might make sense. (We thank Eric Hanushek for first pointing this out to us.) Indeed, the "burned out" teachers presumably will be less inclined to work after retirement, so this self-selection might also act to raise productivity. Testing this thesis would require reliable teacher value-added estimates as well as pension and rehire data.

good while. Unless these benefits are offset by low benefits for short-timers or high employee contributions, this can squeeze other parts of school budgets.

For all these reasons, we believe that school districts and states would be well-advised to consider systems with smooth wealth accrual such as DC or CB plans. These systems are more transparent, tie benefits more closely to contributions, and do not penalize mobility or job-shopping among young teachers. Given its record in higher education and private K-12, TIAA-CREF might be particularly useful in attracting career changers or young graduates in fields such as science and math, where 401(k) or 403(c) accounts are the norm (and where they are likely to encounter TIAA-CREF employers in future employment).

More generally, education policy-makers should at least consider experiments that provide actuarially fair alternatives to traditional DB plans for new teaching recruits, and evaluate their utility in recruitment and retention of high-quality teachers. Indeed, if new recruits are provided with actuarially fair choices among retirement plans, the incremental costs to states and districts should be modest. Even if most teachers continue to choose the traditional DB option, providing new recruits with a choice may, at the margin, help attract some of the most mobile and academically gifted candidates who have the best non-teaching options.

In addition, such policy experiments could help provide empirical evidence on the labor market effects of pension reforms. Such experimental studies, along with other non-experimental research on existing teacher pension systems (exploiting variation over time and across states), could provide valuable insights into the potential of pension reform for improved teacher recruitment, retention, and quality.

References

Arkansas Teacher Retirement System. 2007. Policies, Rules, and Regulations. http://artrs.gov/index.php?option=com_content&task=view&id=127&Itemid=1

Arkansas Teacher Retirement System. 2008. Comprehensive Annual Financial Report, 2007. http://artrs.gov/Forms/ATRS_10008_07_Annual_Report%202.pdf

Asch, Beth, Steven J. Haider, and Julie Zissimopoulos. 2005. "Financial Incentives and Retirement: Evidence from Federal Civil Service Workers." Journal of Public Economics. Vol. 89 Nos. 2-3, pp. 427-440.

Bragg, Connie. (2003) Summary of Public Pension Plans Incorporating Retention Efforts: A State-By-State Analysis of Retention Efforts Within Public Pension Plans. North Carolina Retirement Systems. (February). http://www.nasra.org/resources/ncretentionstudy.doc

Brown, Kristine. 2008. "The Link Between Pensions and Retirement Timing: Lessons from California Teachers." Department of Labor and Industrial Relations, University of Illinois – Champaign-Urbana.

California State Teachers' Retirement System. 2007. Member Handbook, 2007-08. http://www.calstrs.com/Help/forms_publications/printed/2007MBRHB/MH_Entire.pdf

California State Teachers' Retirement System. 2008. Comprehensive Annual Financial Report, 2007. http://www.calstrs.com/Help/forms_publications/printed/CurrentCAFR/CAFRall.pdf

Clark, Robert. 2004. "Changing Faculty Demographics and the Need for New Policies." Paper presented at TIAA-CREF Institute Conference, New York, April 1-2. http://www.tiaa-crefinstitute.org/research/papers/docs/040104a.pdf

Costrell, Robert and Michael Podgursky. 2007a. "Efficiency and Equity in the Time Pattern of Teacher Pension Benefits: An Analysis of Four State Systems," Washington, D.C. The Urban Institute. Center for Analysis of Longitudinal Data in Education Research (CALDER). Working Paper #6. http://www.caldercenter.org/PDF/1001070_Efficiency_Equity.pdf

Costrell, Robert and Michael Podgursky. 2007b, "Golden Peaks and Perilous Cliffs: Rethinking Ohio's Teacher Pension System," Thomas B. Fordham Institute. http://edexcellence.net/doc/060707_Pensions_Report.pdf

Deloitte Research. 2006. Paying for Tomorrow: Practical Strategies for Tackling the Public Pension Crisis.

http://www.deloitte.com/dtt/cda/doc/content/US_PensionCrisis_Research.pdf

Diamond, Peter A. and Peter R. Orszag. 2003. Saving Social Security. Brookings Institution Press, Washington, D.C.

Duffett, Ann, Steve Farkas, Andrew Rotherham, Elena Silva. 2008. Waiting to Be Won Over: Teachers Speak to the Profession, Unions, and Reform. Washington DC: Education Sector. http://www.educationsector.org/usr_doc/WaitingToBeWonOver.pdf

Edwards, Chris and Jagadeesh Gokhale. 2006. "Unfunded State and Local Health Costs: $1.4 Trillion." Washington, DC: Cato Institute. http://www.cato.org/pubs/tbb/tbb_0925-40.pdf

Employee Benefit Research Institute. 2006. "'Traditional' Pension Assets Lost Dominance a Decade Ago, IRA's and 401(k)'s Have Long Been Dominant." (Feburary). http://www.ebri.org/pdf/publications/facts/fastfacts/fastfact020306.pdf

Furgeson, Joshua, Robert Strauss, and William Vogt. 2006. "The Effects of Defined Benefit Pension Incentives and Working Conditions on Teacher Retirement Decisions." Education Finance and Policy. Vol. 1 No. 3 (Summer), pp. 316-348.

Friedberg, Leora, and Anthony Webb. 2005. "Retirement and the Evolution of Pension Structure." Journal of Human Resources. Vol. 40. No. 2, pp. 281-308.

Greenough, William C. 1990. It's My Retirement Money: Take Good Care of It: The TIAA-CREF Story. Pension Research Council. Wharton School. University of Pennsylvania.

Gustman, Alan L. Olivia S. Mitchell, and Thomas L. Steinmeier. 1994. "The Role of Pensions in the Labor Market: A Survey of the Literature." Industrial and Labor Relations Review. Vol. 47 No. 3 (April), pp. 417-438.

Hansen, Janet. 2008. Teacher Pensions: A Background Paper. Washington DC: Committee for Economic Development. http://www.ced.org/docs/report/report_educ200806pensions.pdf

Hanushek, Eric, Thomas Kain, and Steven Rivkin. 2004. "Why Public Schools Lose Teachers." Journal of Human Resources 39(2), pp. 326-354.

Hanushek, Eric and Steven Rivkin. 2006. "Teacher Quality" in Eric Hanushek and Finis Welch (eds) Handbook of the the Economics of Education. Amsterdam: North-Holland, Vol. 2, pp. 1051-1078.

Harris, Douglas N. and Scott J. Adams. 2007. "Understanding the level and causes of teacher turnover: A comparison with other professions." Economics of Education Review 26, 325-337.

Ippolito, Richard A. 1997. Pension Plans and Employee Performance: Evidence, Analysis, and Policy. Chicago: University of Chicago Press.

Kotlikoff, Laurence J. and David A. Wise. 1987. "The Incentive Effects of Private Pension Plans," in Zvi Bodie, John B. Shoven, and David A. Wise (eds.), Issues in Pension Economics, University of Chicago Press, Chicago, 283-336.

Kotlikoff, Laurence J. and Scott Burns. 2004. The Coming Generational Storm. MIT Press, Cambridge, MA.

Lazear, Edward. 1979. "Why is There Mandatory Retirement?" Journal of Political Economy. Vol. 87 No. 6 (December), pp. 1261-84.

Loeb, Susanna and Luke C. Miller. 2006. "State Teacher Policies: What are They, What Are Their Effects, and What Are Their Implications for School Finance?" Stanford University: Institute for Research on Education Policy and Practice.

Los Angeles Unified School District. 2006. Comprehensive Annual Financial Report: Fiscal Year Ended June 30, 2006. http://notebook.lausd.net/pls/ptl/docs/PAGE/CA_LAUSD/LAUSDNET/OFFICES/CFO_HOME/ADD_HOME/LAUSD_2006_CAFR.PDF

Massachusetts State Teachers' Retirement System. 2006. Your MTRS Benefits: A Guide for Active Members. http://www.mass.gov/mtrs/7pubs/77pdfs/actguids.pdf

Milliman Consultants and Actuaries. 2007. California State Teachers' Retirement System Defined Benefit Program - 2006 Actuarial Valuation. http://www.calstrs.com/Help/forms_publications/printed/2006_DB_Valuation_MillimanReport.pdf

Mishel, Lawrence and Richard Rothstein. 2007. "False Alarm." Phi Delta Kappan. (June), pp. 737-740.

Munnell, Alicia and Steven Sass. 2008. Working Longer: The Solution to the Retirement Income Challenge. Washington DC: Brookings Institution.

Murnane, R. J., & Olsen, R. J. (1990). "The effects of salaries and opportunity costs on length of stay in teaching: Evidence from North Carolina." Journal of Human Resources, 25(Winter), 106–124.

National Association of State Retirement Administrators. 2008. Public Fund Survey. http://www.publicfundsurvey.org/www/publicfundsurvey/actuarialfundinglevels.asp

National Education Association. 1995. Understanding Defined Benefit & Defined Contribution Pension Plans, Washington D.C.

National Education Association. 2004. Characteristics of Large Public Education Pension Plans. Washington DC.

Podgursky, Michael, R. Monroe, D. Watson. 2004. "Teacher Pay, Mobility, and Academic Quality." Economics of Education Review. Vol. 23 (2004), pp. 507-518.

Podgursky, Michael, Shawn Ni, and Mark Ehlert. 2008. "Teacher Pension Incentives and Labor Market Behavior: Evidence from Missouri Administrative Teacher Data." Department of Economics, University of Missouri – Columbia

Podgursky, Michael and Mark Ehlert. 2007. "Teacher Pensions and Labor Market Behavior: A Descriptive Analysis." . The Urban Institute. Center for Analysis of Longitudinal Data in Education Research (CALDER). Working Paper #4. http://www.caldercenter.org/PDF/1001071_Teacher_Pensions.pdf

Public Employee Retirement Administration Commission, Commonwealth of Massachusetts. 2007. Commonwealth Actuarial Valuation Report, 2007. http://www.mass.gov/perac/valuation/2007commonwealth.pdf

Public School and Education Employee Retirement Systems of Missouri. 2007. Comprehensive Annual Financial Report, 2007. http://www.psrs-peers.org/Investments/2007%20Annual%20Report/2007%20CAFR%20Financial%20Section.pdf

Public School Retirement System of Missouri. 2007. Member Handbook, 2007-08. http://www.psrs-peers.org/PSRS/2007-2008PSRSHandbook/Service%20Retirement.pdf

State Teachers Retirement System of Ohio, 2007a. Comprehensive Annual Financial Report, 2007. http://www.strsoh.org/pdfs/CAFR2007/2007_CAFR.pdf

State Teachers Retirement System of Ohio, 2007b. Service Retirement and Plans of Payment. http://www.strsoh.org/pdfs/brochures/15-126.pdf
Stinebrickner, Todd. 2001. A dynamic model of teacher labor supply. Journal of Labor Economics, 19(1), 196–230 (January).

Stock, James H. and David A. Wise. 1990. "Pensions, the Option Value of Work, and Retirement." Econometrica. 1990. Vol. 58 No. 5, pp. 1151-1180.

Teacher Retirement System of Texas. 2007a. Comprehensive Annual Financial Report, 2007. http://www.trs.state.tx.us/about/documents/CAFR.pdf#CAFR

Teacher Retirement System of Texas. 2007b. TRS Benefits Handbook. http://www.trs.state.tx.us/benefits/documents/benefits_handbook.pdf

U.S. Department of Education. National Center for Education Statistics. 2008. Digest of Education Statistics, 2007. Washington DC.
http://www.nces.ed.gov/programs/digest/2007menu_tables.asp

U.S. Department of Labor. Bureau of Labor Statistics. 2006. "Employer Costs for Employee Compensation – June 2006" Washington DC (September 22).

Waring, M. Barton. 2008. "Between Scylla and Charybdis: Improving the Cost Effectiveness of DB Retirement Plans." Paper presented at Pension Research Council Symposium. "The Future of Public Employee Retirement Systems," University of Pennyslvania, Wharton School. May 1-2, 2008.

"Wild West Virginia." Pensions and Investments. (June 9, 2008)
http://www.pionline.com/apps/pbcs.dll/article?AID=/20080609/PRINTSUB/816493577