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UNDERSTANDING CUTS TO PUBLIC PENSIONS

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In the past several years, fears that underfunded public pensions are a growing burden on taxpayers have led to calls to cut employer-provided pension benefits through increased employee contributions, increased retirement ages, reduced cost-of-living adjustments (COLAs), or other changes. But too often news reports on proposed or enacted pension cuts either overplay the rationale behind them, or minimize the impacts on affected workers. The latter is especially true with changes that do not decrease take-home pay but reduce future retirement benefits and thus may be harder to quantify.

This primer is intended to help organizations understand both the rationales behind and the details of proposed cuts to public pensions. It provides tools for assessing and understanding the true underlying health of public pension plans, the history behind any actuarial shortfalls, and the impacts on workers and taxpayers of proposed or enacted legislation that reduces pension benefits. The primer is organized as a series of 10 steps, although all may not be relevant in every situation. While it ends with a specific example of the percentage change in lifetime benefits, measured in real terms, received by a prototypical worker under four different pension plan changes, it provides guidance on using alternative measures as well.

1. Gather background knowledge and data from available sources

Unions representing affected workers may have materials describing the current pension and proposed changes that can introduce you to the relevant issues in your state or city. The National Education Association book, *Characteristics of Large Public Education Pension Plans* (NEA 2010), provides a good overview of many public education pensions, including survey data on specific plans. In addition to the NEA survey, there are other surveys that can provide useful information about particular state, county, or municipal pensions and how they compare with others around the country. These include the Public Plans Database, a joint effort by the Center for State and Local Government Excellence (CSLGE) and the Center for Retirement Research (CRR) at Boston

College (CSLGE and CRR n.d.); the National Association of State Retirement Administrators' Public Fund Survey (NASRA n.d.); and the Wisconsin state legislature's Comparative Study of Major Public Employee Retirement Systems (Wisconsin Legislative Council various years). The U.S. Census Bureau also conducts an annual survey of public pensions, which is summarized in an annual report (U.S. Census Bureau 2013). The main disadvantage of surveys is that the information is often a year or more out of date.

News articles can sometimes be a useful source for a broad overview of issues, though the topic is unfortunately too often framed as a "crisis" when it is not, or is presented as a political dogfight instead of a substantive policy issue. In our experience, too many reporters reflexively accept the narrative that public pensions are imposing unsustainable long-run costs on state and local government budgets, and therefore portray cuts to pensions as courageous "reforms" even when cuts include benefits that workers themselves have helped pay for. Because reporters widely accept the "public pensions are unsustainable" frame, knowledgeable sources such as pension fund actuaries or union representatives are often treated as simply self-interested. Reporters for specialized outlets such as *Pensions & Investments* or *Bond Buyer* have more expertise on the subject and less tendency to glorify those arguing for pension cuts, but they do cover the news from a business, not worker, perspective.

Actuarial valuations (sometimes called actuarial reports) prepared annually by a pension fund's outside actuaries are usually the most important source of financial information about specific plans. Comprehensive annual financial reports (CAFRs) provide some of the same information and can provide a bird's-eye view when there are separate actuarial valuations for different groups of workers. Most reports have glossaries that explain unfamiliar terms.

Though CAFRs and other reports usually contain information on current benefits, it is often convenient to look in the Public Plans Database, the NASRA survey, or the NEA survey, since this allows comparisons with other plans. Note that pension benefits vary not only across types of workers (e.g., public safety workers and teachers), but also across "tiers" of workers hired at different times. It is usually easiest to focus on the largest groups of workers and the latest (usually least-generous) tier.

2. Determine who is affected

When analyzing how legislation affects pension benefits, you need to begin by understanding which workers and pension funds are affected—that is, whether they are municipal or state employees, whether they participate in local or statewide plans, and whether the legislation affects all or only some workers in the plan. This can be confusing, since it is common for large statewide pension funds to cover workers employed by local government entities, such as school districts. The largest groups of rank-and-file workers are typically teachers, public safety workers (police and firefighters), and general or administrative employees. Different groups of workers may be in different plans and may or may not be affected by proposed cuts, since would-be reformers often attempt a divide-and-conquer strategy.

For simplicity, it is easiest to focus on the largest groups of affected workers. It also helps to put a face on statistics—teachers, cops, and firefighters rather than anonymous civil servants. If the goal is to analyze the effects of proposed or enacted cuts on rank-and-file workers, then it is safe to ignore small, privileged groups such as judges and legislators who are typically too few in number to have a substantial impact on state and local government finances, though it is worth noting if they are exempt from the cuts. As you perform your analysis, keep in mind that it is often—though not always—nonunion employees who are responsible for the kinds of pension abuses that are a staple of negative news stories.

This primer will focus on the effects of proposed cuts on a prototypical long-career worker (a hypothetical 30-year

worker retiring at age 62), which typically depends on that worker's salary at retirement as well as his or her years of service. However, it is also useful to know the average salary of active workers and the average pension received by current retirees; these are typically lower than salaries and pensions cited by pension critics and in the news media because most workers retire with less than 30 years of service. This information can usually be found in actuarial valuations. The Current Population Survey and other government data sources also include limited information about public-sector worker pay and retiree incomes (see Appendix Table A: Average state and local government employee pay and retiree pensions by state).

Another key piece of information is whether workers are covered by Social Security. One in four state and local government workers are not. Workers lacking Social Security coverage are the most vulnerable to benefit cuts, especially if a proposed move to a defined-contribution or hybrid system strips away disability and survivor benefits. They may also appear to receive outsize benefits if the lack of Social Security coverage is not taken into account. Information on Social Security coverage can be found in Congressional Research Service reports, the Public Plans Database (CSLGR and CRR n.d.), the NEA survey (NEA 2010), and other resources. Note that some groups of workers in a state may be covered by Social Security and some not.

3. Understand how the pension is funded

Unlike their private-sector counterparts, public-sector workers typically contribute toward their defined-benefit pensions, though these contributions are sometimes waived. According to a NASRA analysis of public pension funding over 30 years, employee contributions amounted to one-third of total contributions to public pension funds. Specifically, fund revenues (including sources besides contributions) included investment earnings (61 percent), employer contributions (26 percent), and employee contributions (13 percent) (NASRA 2014a). The general public is often unaware that public pensions are funded in part—sometimes in large part—through worker contributions, so when pushing back against retroactive cuts to pensions it is important to emphasize that workers themselves helped pay for the pensions. In any case, many economists believe that employee benefits are always indirectly paid for through lower wages.

Typically, employee contributions are structured as a fixed share of the normal cost (expressed as a share of salary),[1] whereas employer contributions include the employer share of the normal cost plus or minus an amount necessary to gradually amortize any unfunded liability or surplus. However, in at least seven states (Arizona, California, Iowa, Kansas, Nevada, Pennsylvania, and Utah), some or all public-sector workers contribute a variable amount.[2] Even in the majority of states where employee contributions are supposedly fixed as a share of salary, employee contributions may be variable in practice because unions and employers negotiate higher or lower employee contributions in lean or flush times. In the wake of the recent downturn, for example, employee contributions increased in New Mexico, Virginia, Wisconsin, and Wyoming (NASRA 2014a).

4. Find out whether the plan is underfunded, and why

Calls for benefit cuts are usually framed as a necessary response to pension shortfalls. To counter this often misleading frame, it is useful to understand whether the plan is severely underfunded, and if so, why. A pension plan's funded (or funding) ratio is the ratio of actuarial assets to actuarial liabilities.[3] The unfunded actuarial accrued liability (UAAL) is the difference between assets and liabilities in dollar terms. A plan's funded status fluctuates for a number of reasons, most notably due to financial market fluctuations. This is normal, and shortfalls should not automatically lead to benefit cuts any more than

surpluses should automatically lead to benefit improvements. Except under extraordinary circumstances, shortfalls and surpluses can be gradually eliminated through adjustments in contributions.

In practice, a funded ratio of 80 percent is often considered adequately funded, though the American Academy of Actuaries (AAA) recently critiqued what it calls the 80 percent "myth," saying that "pension plans should have a strategy in place to attain or maintain a funded status of 100% or greater over a reasonable period of time" (AAA 2012). Also, critics often argue that funded ratios are inflated by assuming a high rate of return on plan assets, though most pension funds have met or exceeded assumed rates of return over long periods. According to an analysis by Callan Associates published by NASRA, the 20- and 25-year median return on public pension assets was 8.1 percent and 9.0 percent, respectively, for the period ending December 31, 2013, exceeding the average assumption of 7.7 percent (NASRA 2014b).

In most cases where there is a genuine problem with the actuarial health of a public pension plan, the problem has nothing to do with accounting assumptions but is instead driven by the employer's failure to make required contributions in full. Most pension funds that remain close to the 80 percent threshold in the wake of the 2008 market downturn are probably in decent shape and were responsibly funded prior to the downturn, though there are some exceptions. In the rare cases where overoptimistic assumptions played a role, the problem was compounded by an unusually low worker-to-retiree ratio. Under normal circumstances, a shortfall caused by unrealistic assumptions will be amortized over a predetermined number of years by increases in employer contributions. The shortfall will also result in changes to assumptions. Employer contributions are automatically adjusted each year, whereas assumptions are usually changed after actuaries conduct periodic experience studies, typically every five years.

Pension fund critics often ignore the fact that contributions and assumptions are adjusted in response to changing economic conditions. For example, a report by Josh McGee of the Laura and John Arnold Foundation claims that the California Public Employees' Retirement System, with $237.5 billion in assets, will have a $300 billion shortfall if it misses its 7.75 percent investment target by half a percentage point and a $540 billion shortfall if it misses its investment target by a full percentage point (McGee 2011).[4] However, this assumes contributions are not adjusted to amortize the shortfall or as a result of a lower rate-of-return assumption.[5] In other words, McGee's estimate appears based on a naïve or deliberately misleading idea of how pension funds actually operate.

Though it is not necessary to research the history behind severe underfunding to determine the impact of proposed cuts going forward, it is often helpful to do so simply to assess whether the proposed solution is actually addressing the root cause of a shortfall. Often, however, such research shows that the problem lies not with the structure of the pension itself (rosy accounting or lavish benefits) but instead with politicians who have wanted to spend more and tax less (and thus cut contributions to the pension, the bill that is easiest to shirk). Unfortunately, this history can be hard to unearth because the causes of underfunding often go back many years and pensions in the early years often functioned more on a pay-as-you-go rather than advance-funded basis.

As mentioned, critics often accuse pension funds of inflating funded ratios through rosy rate-of-return assumptions. This is sometimes done by critiquing any assumed rate of return (typically 7.5 percent or 8 percent) that is higher than the yield on long-term Treasury bonds (less than 4 percent in recent years), which economists often refer to as the "risk-free rate" (see Morrissey 2011; Baker 2011a). Similarly, critics frequently compare recent pension fund returns, including the 2008–2009 downturn, with the assumed rate, even though most pension

funds have met or exceeded assumed rates over longer periods, such as the past 25 years. Pension fund actuaries periodically conduct experience studies to see if they need to change actuarial assumptions. These studies, usually done every five years, can save time by providing multiple years of rate-of-return data.

Public pension critics often selectively critique assumptions that have not been met in recent years, such as the assumed nominal rate of return, when they should be taking a longer view, as pension fund actuaries do. In addition to taking a longer view, it is important that any analysis of pension fund finances highlights assumptions that have proven "pessimistic" from an actuarial perspective. In particular, assumptions of inflation rates and wage growth are likely to be much higher than recent experience, which would tend to inflate projected liabilities. Whereas plans typically assume 3 percent price inflation, according to the NASRA Public Fund Survey, inflation was 2.5 percent over the most recent 25-year period (author's analysis of Bureau of Labor Statistics CPI-URS data for March 1989–March 2014).[6] Likewise, 75 of 93 plans in the NEA survey have a salary growth assumption of 4 percent or higher even though state and local government wage and salary growth has declined sharply since the Great Recession (author's analysis of NEA 2010 and the BLS Employment Cost Index using all available years). Therefore, a comprehensive analysis is likely to show that pension funds use reasonable—even somewhat conservative—actuarial assumptions.[7]

5. Document past pay or pension cuts

According to pollster Guy Molyneux, the public is generally not interested in, or is confused about, who is to blame for pension underfunding and believes in "shared sacrifice" to address the problem, no matter who is at fault (Molyneux 2012). However, the public is generally sympathetic to teachers, firefighters, police, etc. For this reason, even those focusing single-mindedly on pension cuts often make a point of expressing concern for workers' retirement security. Documenting how much workers have already accepted in wage and benefit cuts is thus very important, though it can be complicated if the cuts are introduced gradually. It is often simplest to focus on prototypical workers before and after all the cuts have taken effect, ignoring grandfather provisions.

A 2013 CRR analysis of 32 plans in 15 states found that in most cases cuts that have already been enacted will fully offset or more than offset the impact of the 2008 financial crisis on the sponsors' required contributions (Munnell et al. 2013a).[8] The analysis took into account benefit cuts and increased employee contributions that reduced employer costs, as well as changes in actuarial assumptions that increased employer costs. The report found that employer normal costs (the cost of current benefits) will be almost halved once reforms are fully phased in.

As noted earlier, pension shortfalls caused by market downturns should not automatically lead to benefit cuts, especially since such shortfalls, like surpluses in boom years, often prove temporary. Instead, both shortfalls and surpluses should normally be eliminated through adjustments in contributions designed to gradually amortize shortfalls or surpluses over time. However, not only did workers appear to bear the full brunt of the 2008 crisis, but the authors of the CRR report noted that in 40 percent of the cases examined, employer normal costs were actually reduced below pre-crisis levels.

An additional resource that covers cuts to pension benefits in 45 states since 2009, though not in as much depth as the CRR report and associated fact sheets, is a CSLGE and NASRA report on the effects of pension plan changes on workers' retirement security (CSLGE and NASRA 2014).[9] The report quantifies changes to pension formulas in the form of reduced benefit multipliers and increases in the final salary averaging period, as will also be discussed in this primer. As the report shows, increases in employee contribution rates, com-

bined with increases in the normal retirement age, mean plan participants have to work more years to attain a retirement income similar to what they would have otherwise received (assuming any take-home pay forgone due to higher contributions would otherwise have gone toward retirement savings). Thus, the report estimates those worker-borne costs of increased contribution rates in the form of additional work years. In contrast, this primer will show how to estimate the dollar cost to workers of increases in the retirement age and does not attempt any additional analysis of increases in employee contribution rates beyond the increased share of pay going toward the pension. It is a simple matter to note that an increase in employee contributions, say, from 5 percent to 6 percent of pay, based on a total normal pension cost of 15 percent of pay, is equivalent to a 10 percent cut in the employer-provided benefit since the employer contribution to the pension declines from 10 percent to 9 percent.

6. Read between the lines of existing actuarial valuations and reports

The first step in analyzing pension cuts is gathering information that is already available. An analysis of proposed or enacted changes may be part of the annual actuarial valuation, though the valuation may not provide much detail. In addition, special reports may have been commissioned by legislators, unions, or the pension funds. If nothing else, comparing "before" and "after" pension costs can be informative if legislation has already been enacted, since actuarial valuations usually present information in a way that isolates the effects of changes to the plan.

However, be aware that the impact of benefit changes may be obscured by changes in actuarial assumptions or the length of the amortization period.[10] Also, layoffs and pay cuts will tend to inflate pension costs as a percent of payroll, giving the misleading impression that pension costs are a growing burden on taxpayers. Thus, it is also advisable to look at costs in nominal or inflation-adjusted dollar terms, and, if possible, as a share of projected state, county, or city revenues or GDP. The Center for Retirement Research and the Center for Economic and Policy Research have both done research along these lines (e.g. Baker 2011b; Munnell et al. 2013a; Munnell et al. 2013b).

7. Understand different ways of measuring benefit cuts

There are different ways of measuring the effect of benefit cuts on workers and taxpayers, and the appropriate method may depend on the context. It is also important to keep in mind that not all workers (or taxpayers) will be affected equally. In particular, proposed changes may have different impacts on workers depending on how long they work and what age they retire. To keep things manageable, it is best to pick a limited number of illustrative examples, including at least one full-career (30+ year) worker. It is also necessary to decide on a retirement age. It is conventional to assume retirement at age 65 or the plan's normal retirement age, though it may also be helpful to show, as an extreme example, a worker who would be most affected by the proposed cuts, such as a 40-year worker retiring at 62.[11]

Though the main focus of this primer is on workers, the effect of benefit cuts on taxpayers may also be of interest. Be aware that losses to workers may be larger or smaller than the cost savings to the plan—and by extension to public employers and taxpayers. There are several reasons for this. First, cost savings to the plan are normally expressed as the present value of reductions in future benefits, which may not be the best way to measure the impact on workers. Second, cost savings may be larger or smaller in percentage terms than the effect on a prototypical worker if some workers are "grandfathered," if benefit cuts affect some workers more than others, and if attrition due to mortality is taken into account. Third,

if a new type of plan is being introduced, transition costs may fully or partially offset any cost savings in the short run. Fourth, switching to new type of plan may reduce the net return on investments, so the average benefit loss will be larger than any cost savings even in the long run. Finally, cost savings may *appear* to be larger or smaller than they really are if accompanied by changes in actuarial assumptions or changes in the amortization period. Some of these points will be explained at greater length below.

The value of a stream of pension benefits can be measured as the sum of the nominal dollar value, the real (inflation-adjusted) value, or the present (discounted) value of annual benefits. Assume, for example, that annual inflation is 3 percent and the rate of return on plan assets is 8 percent. In this case, $100 in benefits this year is equivalent to $103 in benefits next year in real terms and $108 in benefits next year in discounted terms, assuming benefits are discounted by the rate of return on plan assets. Though discounting future benefits is an appropriate way to measure the impact of changes on a plan's finances, it is not a good measure of the impact on workers unless they are investors and happen to have the same rate of return as the pension fund. Thus, it is often preferable to use real values to show the loss to workers. In general, an analysis of benefit cuts that have the same proportional impact on benefits received early and late in retirement will not be affected by the choice of measure. However, the choice of measure makes a difference when analyzing an increase in the retirement age or a change to the cost-of-living adjustment. In general, changes that reduce early benefits and/or disproportionately affect younger retirees will loom larger in discounted terms, whereas those that disproportionately affect later retirees will appear smaller in discounted terms.

In addition, because the retiree pool shrinks as beneficiaries die, a benefit cut that disproportionately affects older retirees, such as a COLA cut, provides less cost savings to a plan than one that affects younger retirees more or affects all retirees equally. However, from the workers' perspective, cuts at older ages may be more damaging because older retirees have less savings and higher out-of-pocket health costs. Unfortunately, taking attrition into account is challenging for nonactuaries. Therefore, for most purposes it is easiest to ignore how benefit cuts affect retirees at different ages and instead focus on how benefit cuts affect a prototypical worker with an average life expectancy.

8. Estimate the value of benefits

The examples used in this primer are based on a typical "final average pay" pension, where benefits are calculated as a share of preretirement earnings based on years of service. Thus, for example, the benefit may be equal to 1.5 percent multiplied by years of service multiplied by final average salary, where 1.5 percent is the multiplier (a.k.a., the "accrual rate" or "factor") and the "final average salary" is based on the highest three years of pay. Thus, if the typical worker's final average salary is $50,000, he or she will receive a benefit equal to $15,000 after 20 years, which is 30 percent of $50,000.[12] After 30 years, a retiree will receive a benefit equal to $22,500, or 45 percent of $50,000. The share of earnings replaced by a pension—in this case 30 percent or 45 percent—is referred to as the replacement rate.

It can also be useful to calculate the total replacement rate, including Social Security, for the three-fourths of state and local government workers covered by Social Security. Social Security benefits are based on the highest 35 years of earnings indexed to the average wage each year. For simplicity, we can assume that a worker's final average salary and average indexed earnings are the same—that is, that a worker who earned the median wage in his or her three years before retirement also earned the median wage throughout his or her career, for example.[13] Social Security benefits are based on a progressive formula whose factors are adjusted each year with the average wage index. The monthly benefit for some-

one retiring in 2014 at the full retirement age of 66 will equal 90 percent of the first $816 in monthly earnings, plus 32 percent of monthly earnings above $816 and through $4,917, plus 15 percent of monthly earnings above $4,917 and below $9,475.[14] For someone earning $4,167 per month ($50,000 per year), this "primary insurance amount" will be $1,806 per month (see SSA 2014 for the current benefit formula).

The primary insurance amount is reduced by 25 percent, 20 percent, 13⅓ percent, and 6⅔ percent, for early retirement at ages 62, 63, 64, and 65, respectively (SSA n.d.). If we assume the prototypical worker will retire at the plan's normal retirement age of 62, which is also Social Security's earliest eligibility age, the primary insurance amount will be multiplied by 75 percent, and our prototypical worker will receive a Social Security benefit equal to $1,355 per month that replaces about 33 percent of preretirement earnings. The total replacement rate at age 62, with pension and Social Security benefits, will be about 63 percent if the worker has worked 20 years and about 78 percent if he or she has worked 30 years.[15] Thus, even a long-career worker will see a drop in income at retirement. Whether or not he or she will also see a decline in living standards depends on how expenses such as taxes and out-of-pocket health costs are affected by retirement and aging.

To estimate the lifetime value of pension benefits, it is necessary to estimate how long the average or prototypical worker is likely to receive benefits. "Intermediate" life expectancies published annually with the Social Security Trustees report are a good source for the general population (SSA 2013). For more detailed information about attrition, the Social Security Administration also publishes life or mortality tables every few years (SSA 2005; SSA 2009), as does the Society of Actuaries (SOA 2014). Averaging the Social Security male and female life expectancies and rounding, we can assume an average life expectancy of around 20 years at age 65, or 23 years at age 62.[16]

For our example, we will also assume that the early retirement age is 55 with 10 years of service and the normal or full retirement age is 62 with five years of service. The five-year requirement, also known as a vesting period, means that workers receive no benefits regardless of age if they work fewer than five years.[17] At age 62, vested workers are eligible for full benefits according to the benefit formula outlined earlier in this section. Alternatively, workers with 10 years of service can retire before age 62 (though not before age 55), but their annual benefits will be permanently reduced by 6 percent for each year they retire before age 62 (that is, they receive 58 percent of the normal benefit at 55). This is roughly equal to the Social Security reduction factor, which is intended to be actuarially fair based on Social Security life expectancy and long-run yields on Treasuries. An actuarially fair reduction factor means that lifetime benefits are the same for a worker who retires early as for one who retires at the normal age, taking into account both the reduced pension and the additional years of benefits. In some plans, the benefit formula specifies "actuarial reduction" rather than a fixed rate. In other plans, the reduction factor is lower than actuarially fair (often 3 percent) to encourage early retirement.[18]

In the examples that follow, we will assume that the COLA is tied to a consumer price index (CPI), though it is not uncommon for COLAs to be fixed (e.g., 3 percent each year), ad hoc (e.g., approved each year by the state legislature), or capped (e.g., "CPI up to 3 percent annually" or "CPI up to $25,000"). In our examples, we will also assume that expected annual consumer price inflation is 3 percent, expected annual wage growth is 4 percent, and the expected annual return on pension fund assets is 8 percent (these are fairly typical actuarial assumptions).

9. Analyze the impact of pension cuts on a prototypical worker

This section will give step-by-step instructions for calculating the impact of four kinds of pension cuts: a reduction in the benefit multiplier, an increase in the salary averaging period, an increase in the normal retirement age, and a COLA cut. The focus will be on the percentage change in lifetime benefits, measured in real terms, received by a prototypical worker, with alternative measures discussed in the following section.

Though the effect of each type of cut will be shown on its own, there are interaction effects when more than one kind of cut is implemented. For example, if a reduction in the multiplier and an increase in the retirement age each reduce real benefits by 10 percent, the combined effect will be somewhat less than 20 percent because the worker will receive fewer years of a smaller benefit. In this case, the combined effect will be a 19 percent reduction, because 90 percent times 90 percent equals 81 percent. In general, it is necessary to estimate the lifetime value of benefits before and after all cuts have been implemented before calculating the combined effect of cuts.

Reducing the multiplier. A reduction in the multiplier is one of the easiest cuts to understand because the effect is usually proportional for all workers, regardless of retirement age, life expectancy, etc. If the multiplier is reduced from 1.5 percent to 1 percent, this simply amounts to a one-third (33 percent) reduction in benefits (-0.5/1.5 = .33). The situation is somewhat more complicated when the benefit formula has different multipliers for different years of service (e.g., 1.5 percent for the first 10 years and 2 percent for years 11 onward). In this case, the impact of a proposed cut, such as reducing the second multiplier to 1.5 percent, depends on the number of years of service.

Increasing the salary averaging period. Like a reduction in the multiplier, this is relatively easy to analyze, once we know how wages increase in nominal terms, since the effect is proportional for all workers, assuming wage growth is equal across the board.[19] In our example, an increase in the final average salary period from three to five years is approximately equal to a 3.9 percent cut in benefits if wages are assumed to grow by 4 percent per year. Perhaps the easiest way to calculate this is to index the salary at age 57 to 100 and use the 4 percent wage growth assumption to index wages over a worker's last five years (100, 104, 108.16, ~112.49, ~116.99). The average of all these numbers is ~108.33, whereas the average of the last three numbers is ~112.54, which is ~3.9 percent higher. This makes intuitive sense because the average of the last three years is approximately equal to the salary in the second-to-last year, the average of the last five years is approximately equal to the salary in the third-to-last year, and salaries are assumed to grow by 4 percent per year.

Raising the normal retirement age. Workers with shorter life expectancies and those who plan to retire as soon as they are eligible are more affected by increases in the retirement age. Measuring the impact on a prototypical worker with an average life expectancy at age 62 of 23 years, an increase in the normal retirement age from 62 to 65 amounts to a ~13 percent cut in real terms if the worker had planned to retire at 62 (a worker who already planned to retire at age 65 would not be affected). This is the sum of the benefits the participant would have received from age 62 to 64 divided by the sum of the benefits he or she would have received from age 62 to 81. Since benefits with a CPI-based COLA are the same each year in inflation-adjusted terms, this simply amounts to a loss of three years of benefits out of a total 23 (3/23≈13 percent). Note that the benefit calculation does not take into account additional years of service by the worker because the worker is now forced to delay retirement, nor does it account for the additional salary the worker earns by working from 62 through 64, because it assumes the additional pay and service credits are compensation for additional work performed. In other words, this methodology holds all else equal—work, salary, and service cred-

its—in order to isolate the effect of raising the retirement age.

Eliminating the COLA. Indexing the initial benefit at age 62 to 100 and assuming 3 percent inflation, the COLA provides a stream of benefits over 23 years equal to 100, 103, and so on until age 84, when the benefit will be approximately 192. Thus, if the COLA is eliminated so that the nominal benefit stays at 100 rather than increasing with inflation, the benefit at age 84 for the prototypical retiree will be approximately 48 percent lower than with the COLA in nominal terms, because (192–100)/192 ≈ .48. At age 84 (or any given year), the percentage change is the same in real terms, because the inflation-adjusted value of the benefit declines from 100 at age 62 to ~52 at age 84 (22 years later) because $100/(1+3\%)^{22} \approx 52$. Summing over ages 62 to 84, the real value of total benefits received by this prototypical retiree will be ~26 percent lower and the nominal value will be ~29 percent lower (see Appendix Table B: Measuring the effect of a COLA cut).

10. Consider mortality

The above estimates are based on changes in the real value of lifetime benefits for a prototypical participant with an average life expectancy. However, benefit cuts may affect workers differently depending on when they retire and how long they live (though we will only consider the second of these variables; we will continue to assume that all workers retire at the normal retirement age). An increase in the normal retirement age, for example, will have a bigger impact on workers with shorter lifespans. Conversely, a COLA cut will have a bigger impact on retirees who live longer.

Taking mortality into account is not simply an issue of identifying which participants are most affected by specific changes. It is also the most precise way to measure the effect on retirees as a group, though, as we shall see, the measured impact on a prototypical retiree with an average lifespan is usually close enough.

To illustrate how mortality affects different measures, we will use a Social Security cohort life table for the 1950 birth cohort (SSA 2005), assuming for simplicity an equal number of male and female retirees at age 62 and indexing the initial number in both groups to 100,000, as shown in Appendix B.[20] As explained earlier, the real value of total benefits received by a prototypical retiree between age 62 and 84 will be about 26 percent lower without a COLA, assuming 3 percent inflation. If we instead look at the real value of total benefits received by surviving retirees from age 62 to 116, total benefits will be about 24 percent lower without a COLA, which is quite close to our earlier estimate. On the one hand, the more precise measure takes into account the large impact the COLA cut will have on the oldest retirees; on the other hand, it also takes into account the fact that there are more younger retirees than older retirees, and the two effects almost cancel each other out in this case.

Another measure to consider is the present (discounted) value of costs to the pension plan—and by extension to taxpayers—taking mortality into account. By this measure, changes that affect earlier benefits, such as an increase in the retirement age, have a greater impact on plan finances than changes that affect all benefits equally or that disproportionately affect benefits for older retirees. This is both because benefits in the out years are more discounted and because there are fewer older beneficiaries.

As shown in Appendix B, using the present value (PV) measure and taking mortality into account, the cost savings from eliminating the COLA is only 20 percent. Thus, eliminating the COLA is an inefficient and inequitable way to reduce costs because it disproportionately affects older retirees, who have often exhausted their savings and usually have higher medical and other expenses, without as large a cost savings to taxpayers.

About the author

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APPENDIX TABLE A

Average state and local government employee pay and retiree pensions by state

	Average state and local government employee pay	Average pension benefit, FY2011		
	2011–2013	State and local plans	State plans	Local plans
United States	$43,525	$25,135	$24,139	$30,810
Alabama	$39,884	$21,921	$21,748	$25,499
Alaska	$45,261	$23,795	$23,463	$42,182
Arizona	$41,400	$21,494	$21,489	$21,553
Arkansas	$36,095	$18,910	$18,730	$27,123
California	$49,258	$32,537	$30,886	$38,121
Colorado	$46,131	$31,544	$33,235	$17,064
Connecticut	$49,304	$35,079	$37,954	$24,839
Delaware	$43,383	$18,924	$18,627	$22,259
District of Columbia	$46,764	$23,933	n.a.	$23,933
Florida	$45,057	$21,304	$19,941	$29,455
Georgia	$38,885	$28,064	$28,366	$26,039
Hawaii	$42,024	$23,457	$23,457	n.a.
Idaho	$35,482	$17,015	$17,002	$23,521
Illinois	$43,259	$29,620	$27,762	$34,654
Indiana	$40,104	$16,679	$16,408	$29,024
Iowa	$42,056	$15,656	$15,656	$15,412
Kansas	$38,675	$15,704	$15,238	$28,220
Kentucky	$36,512	$22,068	$21,954	$31,439
Louisiana	$39,082	$21,666	$22,115	$15,780
Maine	$38,881	$19,562	$19,562	n.a.
Maryland	$47,849	$22,173	$21,277	$25,366
Massachusetts	$51,718	$29,067	$32,273	$22,981
Michigan	$40,251	$21,145	$20,195	$24,989
Minnesota	$40,873	$20,813	$20,224	$30,070
Mississippi	$38,368	$20,891	$20,891	n.a.
Missouri	$36,888	$21,994	$22,835	$17,574
Montana	$35,360	$15,258	$15,258	n.a.

APPENDIX TABLE A (CONTINUED)

	Average state and local government employee pay	Average pension benefit, FY2011		
	2011–2013	State and local plans	State plans	Local plans
Nebraska	$36,354	$22,333	$20,375	$26,791
Nevada	$46,573	$30,274	$30,274	n.a.
New Hampshire	$43,425	$19,174	$19,293	$14,712
New Jersey	$55,141	$29,425	$29,432	$25,192
New Mexico	$37,794	$22,006	$22,006	n.a.
New York	$51,825	$30,871	$26,867	$38,299
North Carolina	$41,016	$18,571	$18,513	$35,706
North Dakota	$39,213	$14,553	$14,331	$18,867
Ohio	$37,686	$26,864	$26,701	$42,134
Oklahoma	$35,535	$18,558	$18,647	$16,454
Oregon	$42,045	$28,333	$28,043	$38,491
Pennsylvania	$48,008	$24,360	$26,148	$18,817
Rhode Island	$50,424	$31,548	$31,263	$32,982
South Carolina	$39,872	$19,423	$19,424	$18,776
South Dakota	$35,461	$16,436	$16,159	$26,189
Tennessee	$39,369	$16,626	$15,322	$22,753
Texas	$39,878	$22,004	$21,103	$31,175
Utah	$39,439	$22,150	$22,140	$23,641
Vermont	$40,751	$15,802	$15,760	$16,953
Virginia	$40,600	$20,892	$20,900	$20,857
Washington	$46,124	$21,591	$21,702	$19,988
West Virginia	$36,182	$16,414	$16,193	$22,478
Wisconsin	$39,135	$24,546	$24,878	$21,850
Wyoming	$38,785	$15,539	$15,539	n.a.

Sources: For average state and local government employee pay, author's analysis of U.S. Census Bureau Current Population Survey data, 2011–2013 (Ruggles et al. 2013); for average pension benefit, author's analysis of U.S. Census Bureau Annual Survey of Public Pensions data, FY2011 (for fiscal years ending between July 1, 2010 and June 30, 2011).

APPENDIX TABLE B

Measuring the effect of a COLA cut, by age and gender

Age	Retirees		Benefit with COLA (C)			Benefit without COLA (D)			Total cost with COLA (A+B) x C			Total cost without COLA (A+B) x D		
	Male (A)	Female (B)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)
	(62=100,000)	(62=100,000)												
62	100,000	100,000	100	100	100.0	100	100.0	100.0	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000	20,000,000
63	98,717	99,120	103	100	95.4	100	97.1	92.6	20,377,202	19,783,691	18,867,780	19,783,691	19,207,467	18,318,233
64	97,337	98,165	106	100	91.0	100	94.3	85.7	20,740,808	19,550,201	17,781,900	19,550,201	18,427,939	16,761,146
65	95,850	97,130	109	100	86.7	100	91.5	79.4	21,087,523	19,298,071	16,739,956	19,298,071	17,660,469	15,319,431
66	94,250	96,007	113	100	82.7	100	88.8	73.5	21,413,639	19,025,741	15,739,664	19,025,741	16,904,124	13,984,487
67	92,530	94,790	116	100	78.9	100	86.3	68.1	21,715,527	18,732,005	14,779,223	18,732,005	16,158,392	12,748,688
68	90,690	93,477	119	100	75.2	100	83.7	63.0	21,990,561	18,416,749	13,857,784	18,416,749	15,423,737	11,605,676
69	88,730	92,071	123	100	71.8	100	81.3	58.3	22,236,227	18,080,087	12,974,625	18,080,087	14,700,765	10,549,557
70	86,653	90,567	127	100	68.4	100	78.9	54.0	22,449,754	17,722,043	12,128,904	17,722,043	13,989,945	9,574,669
71	84,445	88,957	130	100	65.3	100	76.6	50.0	22,625,037	17,340,207	11,318,151	17,340,207	13,289,825	8,674,420
72	82,102	87,230	134	100	62.2	100	74.4	46.3	22,756,728	16,933,143	10,540,768	16,933,143	12,599,849	7,843,322
73	79,630	85,389	138	100	59.4	100	72.2	42.9	22,842,579	16,501,965	9,796,791	16,501,965	11,921,371	7,077,410
74	77,050	83,443	143	100	56.6	100	70.1	39.7	22,882,566	16,049,372	9,086,982	16,049,372	11,256,706	6,373,426
75	74,363	81,389	147	100	54.0	100	68.1	36.8	22,872,624	15,575,144	8,410,216	15,575,144	10,605,915	5,726,948
76	71,557	79,209	151	100	51.5	100	66.1	34.0	22,804,617	15,076,539	7,764,084	15,076,539	9,967,368	5,132,974
77	68,616	76,887	156	100	49.1	100	64.2	31.5	22,668,906	14,550,308	7,146,185	14,550,308	9,339,289	4,586,864
78	65,541	74,426	160	100	46.8	100	62.3	29.2	22,460,585	13,996,694	6,556,031	13,996,694	8,722,277	4,085,502
79	62,342	71,830	165	100	44.7	100	60.5	27.0	22,176,529	13,417,165	5,993,627	13,417,165	8,117,606	3,626,243
80	59,019	69,097	170	100	42.6	100	58.7	25.0	21,810,902	12,811,606	5,458,157	12,811,606	7,525,468	3,206,092
81	55,581	66,217	175	100	40.6	100	57.0	23.2	21,357,253	12,179,743	4,948,733	12,179,743	6,945,937	2,822,193
82	52,019	63,172	181	100	38.7	100	55.4	21.5	20,804,790	11,519,108	4,463,630	11,519,108	6,377,851	2,471,404
83	48,327	59,943	186	100	37.0	100	53.8	19.9	20,141,375	10,826,981	4,001,200	10,826,981	5,820,036	2,150,842
84	44,493	56,516	192	100	35.2	100	52.2	18.4	19,354,295	10,100,862	3,560,039	10,100,862	5,271,564	1,857,958
85	40,539	52,886	197	100	33.6	100	50.7	17.0	18,438,106	9,342,436	3,140,291	9,342,436	4,733,735	1,591,160

APPENDIX TABLE B (CONTINUED)

Age	Retirees		Benefit with COLA (C)			Benefit without COLA (D)			Total cost with COLA (A+B) x C			Total cost without COLA (A+B) x D		
	Male (A)	Female (B)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)
	(62=100,000)	(62=100,000)												
86	36,506	49,067	203	100	32.1	100	49.2	15.8	17,395,360	8,557,364	2,743,237	8,557,364	4,209,656	1,349,491
87	32,464	45,090	209	100	30.6	100	47.8	14.6	16,238,187	7,755,448	2,371,066	7,755,448	3,704,045	1,132,434
88	28,482	41,002	216	100	29.2	100	46.4	13.5	14,984,999	6,948,465	2,025,998	6,948,465	3,221,966	939,445
89	24,636	36,859	222	100	27.8	100	45.0	12.5	13,659,786	6,149,486	1,710,025	6,149,486	2,768,431	769,835
90	20,989	32,721	229	100	26.5	100	43.7	11.6	12,288,276	5,370,920	1,424,380	5,370,920	2,347,504	622,563
91	17,595	28,653	236	100	25.3	100	42.4	10.7	10,898,762	4,624,850	1,169,737	4,624,850	1,962,538	496,374
92	14,499	24,720	243	100	24.1	100	41.2	9.9	9,519,436	3,921,882	946,016	3,921,882	1,615,763	389,746
93	11,727	20,983	250	100	23.0	100	40.0	9.2	8,177,734	3,270,989	752,483	3,270,989	1,308,353	300,983
94	9,295	17,497	258	100	21.9	100	38.8	8.5	6,899,145	2,679,193	587,807	2,679,193	1,040,430	228,267
95	7,207	14,310	265	100	20.9	100	37.7	7.9	5,707,044	2,151,705	450,223	2,151,705	811,249	169,746
96	5,468	11,475	273	100	20.0	100	36.6	7.3	4,628,658	1,694,297	338,102	1,694,297	620,189	123,760
97	4,059	9,021	281	100	19.0	100	35.5	6.8	3,680,365	1,307,941	248,920	1,307,941	464,820	88,462
98	2,950	6,954	290	100	18.2	100	34.5	6.3	2,870,517	990,421	179,765	990,421	341,727	62,025
99	2,103	5,262	299	100	17.3	100	33.5	5.8	2,198,462	736,447	127,479	736,447	246,697	42,703
100	1,472	3,913	307	100	16.5	100	32.5	5.4	1,655,773	538,501	88,899	538,501	175,135	28,912
101	1,012	2,855	317	100	15.7	100	31.6	5.0	1,224,434	386,619	60,871	386,619	122,076	19,220
102	681	2,042	326	100	15.0	100	30.7	4.6	888,250	272,299	40,887	272,299	83,475	12,534
103	448	1,428	336	100	14.3	100	29.8	4.3	630,581	187,678	26,876	187,678	55,858	7,999
104	288	976	346	100	13.7	100	28.9	3.9	437,550	126,434	17,268	126,434	36,534	4,990
105	181	651	356	100	13.0	100	28.1	3.7	296,263	83,115	10,826	83,115	23,317	3,037
106	111	422	367	100	12.4	100	27.2	3.4	195,821	53,336	6,625	53,336	14,527	1,805
107	66	266	378	100	11.8	100	26.4	3.1	125,495	33,186	3,931	33,186	8,776	1,040
108	38	162	390	100	11.3	100	25.7	2.9	77,770	19,966	2,256	19,966	5,126	579
109	21	95	401	100	10.8	100	24.9	2.7	46,819	11,670	1,257	11,670	2,909	313
110	11	54	413	100	10.3	100	24.2	2.5	26,980	6,529	671	6,529	1,580	162
111	6	29	426	100	9.8	100	23.5	2.3	14,896	3,500	343	3,500	822	81

APPENDIX TABLE B (CONTINUED)

Age	Retirees		Benefit with COLA (C)			Benefit without COLA (D)			Total cost with COLA (A+B) x C			Total cost without COLA (A+B) x D		
	Male (A)	Female (B)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)	Nominal ($)	Real ($)	PV ($)
	(62=100,000)	(62=100,000)												
112	3	15	438	100	9.3	100	22.8	2.1	7,646	1,744	163	1,744	398	37
113	1	7	452	100	8.9	100	22.1	2.0	3,679	815	73	815	180	16
114		3	465	100	8.5	100	21.5	1.8	1,601	344	29	344	74	6
115		1	479	100	8.1				550	115	9			
116		1	493	100	7.7				566	115	9			
Sum all ages:			13,607	5,500	2,001	5,300	2,717	1,327	652,789,540	434,715,236	260,390,952	434,715,006	310,161,796	202,885,211
Percent change without COLA:						-61%	-51%	-34%				-33%	-29%	-22%
Sum ages 62–84:			3,245	2,300	1,434	2,300	1,694	1,120	499,570,030	367,487,425	241,914,429	367,487,425	280,233,900	194,497,485
Percent change without COLA:						-29%	-26%	-22%				-26%	-24%	-20%

Note: PV stands for present value.

Source: Author's calculations based on Social Security cohort life table for the 1950 birth cohort (SSA 2005). See text for underlying assumptions.

Endnotes

1. The normal cost is the estimated cost of pension credits accrued this year expressed as a share of payroll.

2. In Utah, new hires contribute the full cost of the benefit above 10 percent of pay.

3. The actuarial value of assets may differ from the market value due to smoothing of investment returns. Actuarial liabilities are not liabilities in the legal sense because they incorporate projections of the future value of accrued benefits—accrued service credits multiplied by a projected final average salary, for example.

4. McGee acknowledges that the assumption accurately reflects CalPERS' 20-year returns, but prefers to focus on the fund's lower returns in recent years.

5. $237.5 billion x $(1.0775)^{30} \approx$ $2,229 billion; $237.5 billion x $(1.0725)^{30} \approx$ $1,939 billion; $237.5 billion x $(1.0675)^{30} \approx$ $1,685 billion.

6. Inflation in recent years has averaged closer to 2 percent.

7. Ideally, rate-of-return assumptions should not just rely on historical returns, but should take other factors into account—notably the stock market's price-to-earnings ratio and economic growth projections. However, Dean Baker of the Center for Economic and Policy Research has defended a 7.75 percent assumed rate of return using a more forward-looking methodology (Baker 2013).

8. The sample includes large plans in California, Florida, Georgia, Illinois, Massachusetts, Michigan, New Jersey, North Carolina, Ohio, Connecticut, Texas, Virginia, and New Mexico. Fact sheets on these states are available at http://crr.bc.edu/special-projects/state-local-pension-plans/.

9. The CSLGE/NASRA report also analyzes new hybrid (defined-benefit plus defined-contribution) plans. Though this topic is outside the scope of this paper, it is worth noting that the methodology used is favorable to defined-contribution and hybrid plans because it assumes a high (6.5 percent) annuity interest rate and does not take into account the erosion in the replacement rate caused by inflation in the absence of a COLA.

10. For example, in Rhode Island, the plan's funded ratio fell as a result of changes in the rate-of-return and other actuarial assumptions, paving the way for major changes in the system, including the introduction of a hybrid plan that provided less secure benefits without any cost savings. The fact that the hybrid plan did not provide cost savings was obscured by extending the amortization period, which reduced the amount employers had to contribute annually to pay down the unfunded liability (Morrissey 2013a; Morrissey 2013b; Hiltonsmith 2013).

11. Some people interpret a relatively low retirement age as a sign of a privileged workforce or union clout, even if the benefit is otherwise meager (a low multiplier) or it reflects management priorities (the need to ease out workers in stressful or physically demanding jobs, for example). The best single measure of the relative generosity of a plan is the normal cost, but casual readers are more likely to focus on the retirement age.

12. It is a good idea to use realistic, but rounded, salary assumptions in calculations. For example, if the average salary for all covered workers is $46,355, we may assume a final average salary of $50,000, noting that this is slightly higher than the average salary though not necessarily higher than the average *final* salary, which may not be reported in actuarial reports.

13. This will overstate the Social Security replacement rate somewhat because the wage-indexed earnings of full-time workers tend to increase over the course of a career.

14. Amounts are rounded down to the nearest dollar. The cap on taxable earnings, which is not binding in our example, was $113,700 per year or $9,475 per month in 2013.

15. The reduction in benefits for retirement at age 62 will be greater for workers born after 1954 as the full retirement age gradually increases to 67. Details are available from the Social Security Administration (SSE 2010).

16. In 2013, Social Security's "intermediate" cohort life expectancy at age 65 is 19.2 years for men and 21.5 years for women, or ~ 20 years on a unisex basis.

17. Alternatively, some plans base eligibility on a "rule of 85" or similar provision (where 85 is the sum of age and years of

service). A few plans base eligibility for full (unreduced) benefits only on years of service (such as 30).

18. Though critics often zero in on eligibility provisions, early retirement may be encouraged by employers for a number of reasons. This may not be as costly as it appears because older workers also tend to have high salaries. Though it is impossible to tell from eligibility requirements alone whether pension benefits are generous, a plan that provides a meager benefit at a low retirement age may attract more negative attention than one providing a more generous benefit at a higher retirement age. However, people usually understand that there is a good reason why emergency personnel, in particular, retire at relatively young ages.

19. In practice, some groups of workers (e.g., blue-collar workers) may see flatter pay increases at older ages than other groups and therefore may be somewhat less affected by an increase in the averaging period.

20. See Table 7 — Cohort Life Tables for the Social Security Area by Year of Birth and Sex. For the 1950 birth cohort, there are 79,186 males and 87,156 females still alive at age 62 for every 100,000 males and females born that year. To assume an equal number of male and female retirees at age 62 and index it to 100,000 to construct the table in Appendix B, we divided each number in the male column in the life table by 79,186 and multiplied by 100,000, and divided each number in the female column by 87,156 and multiplied it by 100,000. Note that it does not matter whether we index the numbers to 100 or 100,000, say, as long as the initial male/female proportions are about right. It would be a coincidence if the retiree population reflected the male/female proportions of the general population, and some occupations are heavily male or female. If, for example, the public safety worker population was 85 percent male, then we might index the initial male retiree population to 85 and the initial female retiree population to 15.

References

American Academy of Actuaries (AAA). 2012. *The 80% Pension Funding Standard Myth.* http://www.actuary.org/files/80_Percent_Funding_IB_071912.pdf

Baker, Dean. 2011a. "Returns on Public Pensions: What Rates Should We Assume?" Center for Economic and Policy Research blog, March 6. http://www.cepr.net/index.php/blogs/cepr-blog/returns-on-public-pensions-what-rates-should-we-assume

Baker, Dean. 2011b. *The Origins and Severity of the Public Pension Crisis.* Center for Economic and Policy Research. http://www.cepr.net/documents/publications/pensions-2011-02.pdf

Baker, Dean. 2013. *Testimony on Return Assumptions on New Mexico Pension Plans*. Center for Economic and Policy Research. http://www.cepr.net/index.php/publications/testimony/testimony-on-return-assumptions-on-new-mexico-pension-plans

Bureau of Labor Statistics. Employment Cost Index Original Data Value. Series Id. CIU3020000000000A. Wages and salaries, state and local government, 12-month percent change, all workers, 2001 to 2013.

Center for State and Local Government Excellence (CSLGE) and Center for Retirement Research (CRR) at Boston College. n.d. *Public Plans Database*. http://crr.bc.edu/data/public-plans-database

Center for State and Local Government Excellence (CSLGE) and National Association of State Retirement Administrators (NASRA). 2014. *Effects of Pension Plan Changes on Retirement Security.*

Hiltonsmith, Robert. 2013. *Rhode Island's New Hybrid Pension Plan Will Cost the State More While Reducing Retiree Benefits.* Economic Policy Institute, Issue Brief #366. http://www.epi.org/publication/ib366-rhode-islands-hybrid-pension-plan/

McGee, Josh. 2011. *Creating a New Public Pension System.* Laura and John Arnold Foundation. http://arnoldfoundation.org/img/LJAFSolutionPaper04-5.pdf

Molyneux, Guy. 2012. Discussion at a meeting of the National Public Pension Coalition, National Education Association Chanin Auditorium, July 9.

Morrissey, Monique. 2011. *Discounting Public Pensions: Reports of Trillions in Shortfalls Ignore Expected Returns on Assets.* Economic Policy Institute, Policy Memo #179. http://www.epi.org/publication/pm179/

Morrissey, Monique. 2013a. "Monique Morrissey: R.I.'s Pension Reform Hurts Taxpayers, Workers." *Providence Journal,* June 30. http://www.providencejournal.com/opinion/commentary/20130630-monique-morrissey-r.i.s-pension-reform-hurts-taxpayers-workers.ece

Morrissey, Monique. 2013b. *Truth in Numbers? A Brief History of Cuts to the Employees' Retirement System of Rhode Island.* Economic Policy Institute, Briefing Paper #363. http://www.epi.org/publication/bp363-brief-history-of-cuts-to-the-employees-retirement-system-of-rhode-island/

Munnell, Alicia H., Jean-Pierre Aubry, Anek Belbase, and Joshua Hurwitz. 2013a. *State and Local Pension Costs: Pre-Crisis, Post-Crisis, and Post-Reform.* Center for Retirement Research at Boston College. http://crr.bc.edu/wp-content/uploads/2013/02/slp_30.pdf

Munnell, Alicia H., Jean-Pierre Aubry, Josh Hurwitz, and Mark Cafarelli. 2013b. *Gauging the Burden of Public Pensions on Cities.* Center for Retirement Research at Boston College. http://crr.bc.edu/wp-content/uploads/2013/11/SLP35.pdf

National Association of State Retirement Administrators (NASRA). n.d. *Public Fund Survey.* http://www.publicfundsurvey.org/publicfundsurvey/index.htm

National Association of State Retirement Administrators (NASRA). 2014a. *Employee Contributions to Public Pension Plans.* http://www.nasra.org/files/Issue%20Briefs/NASRAContribBrief.pdf

National Association of State Retirement Administrators (NASRA). 2014b. *Public Pension Plan Investment Return Assumptions.* http://www.nasra.org/files/Issue%20Briefs/NASRAInvReturnAssumptBrief.pdf

National Education Association (NEA). 2010. *Characteristics of Large Public Education Pension Plans.* http://www.nea.org/assets/docs/HE/CharacteristicsLargePubEdPensionPlans2010.pdf

Ruggles, Steven J., Trent Alexander, Katie Genadek, Ronald Goeken, Matthew B. Schroeder, and Matthew Sobek. 2013. *Integrated Public Use Microdata Series: Version 5.0* [machine-readable database]. University of Minnesota.

Social Security Administration (SSA). n.d. "Early or Late Retirement?" Accessed April 16, 2014. http://www.ssa.gov/OACT/quickcalc/early_late.html

Social Security Administration (SSA). 2005. *Life Tables for the United States Social Security Area 1900-2100.* http://www.socialsecurity.gov/OACT/NOTES/pdf_studies/study120.pdf

Social Security Administration (SSA). 2009. "Period Life Table, 2009." http://www.ssa.gov/OACT/STATS/table4c6.html

Social Security Administration (SSA). 2010. "Benefit, as a Percentage of Primary Insurance Amount (PIA), Payable at Ages 62-67 and Age 70" [data table]. August 19. http://www.ssa.gov/OACT/ProgData/ar_drc.html

Social Security Administration (SSA). 2013. "Table V.A4.—Cohort Life Expectancy." http://www.ssa.gov/oact/tr/2013/lr5a4.html

Social Security Administration (SSA). 2014. "Your Retirement Benefit: How It Is Figured." http://www.ssa.gov/pubs/EN-05-10070.pdf

Society of Actuaries (SOA). 2014. *RP-2014 Mortality Tables.* http://www.soa.org/Research/Experience-Study/Pension/research-2014-mort-tables.aspx

U.S. Census Bureau. 2013. *Annual Survey of Public Pensions: State- and Locally-Administered Defined Benefit Data Summary Report: 2011.* http://www2.census.gov/govs/retire/2011summaryreport.pdf

U.S. Census Bureau. Various years. Annual Survey of Public Pensions: State & Local Data [downloadable tables]

Wisconsin Legislative Council. Various years. *Comparative Study of Major Public Employee Retirement Systems. http://www.publicfundsurvey.org/publicfundsurvey/index.htm*