Investment-Based Transition Costs Associated with Closing a Public Defined Benefit Pension Plan

Andrew G. Biggs

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Abstract

Defined benefit retirement plans for state and local government employees are underfunded in most jurisdictions. Policymakers and analysts have proposed closing these traditional pensions and enrolling public-sector workers in defined contribution plans similar to 401(k) retirement plans. One objection to such a change is that once a pension plan is closed to new entrants it must adopt a more conservative, lower-yielding investment portfolio that will require higher taxpayer contributions. These higher contributions are referred to as transition costs and increase the cost of pension reforms. I analyze optimal investment portfolios for open and closed pension plans, showing that portfolio allocations differ only slightly and that these differences appear only over long periods. Thus, the actual transition costs associated with pension reforms are likely to be far smaller than has been claimed.

Author Affiliation and Contact Information

Andrew G. Biggs
Resident Scholar
American Enterprise Institute
andrew.biggs@aei.org

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Public employee retirement systems remain a topic of concern for policymakers and a topic of controversy for pension stakeholders and the public. Most state and local government employees participate in so-called final earnings defined benefit (DB) pension plans. In such plans, a benefit is commonly calculated as a percentage of final earnings multiplied by the employee's number of years of service. Benefits, as calculated, are independent of the performance of the plan's underlying investments; are intended to be guaranteed; and, in many jurisdictions, are guaranteed by law. Employee retirement systems fund benefits by using a mix of investments that generally contain bonds, US and foreign equities, and, increasingly, so-called alternative investments such as real estate, private equity, and hedge funds.

By contrast, most private-sector workers have been shifted over time to defined contribution (DC) pension plans. At present, 60 percent of private-sector employees are offered a DC plan, with only 19 percent offered a DB pension.[1] A DC plan, of which the most typical is the 401(k), is based on employer and employee contributions to a retirement savings account. The employee receives earnings on those contributions and is subject to market risk.

Some workers in both the public and private sectors participate in cash balance (CB) plans. A CB plan is a DB plan that resembles a DC plan: that is, employees have a notional account to which contributions and interest are credited each year. When the employee retires, the account is converted into a monthly annuity benefit for life. However, a CB account is

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[1] Bureau of Labor Statistics, "Employee Benefits in the United States: March 2014," table 2, news release, July 25, 2014, http://www.bls.gov/news.release/pdf/ebs2.pdf.

credited with principal and interest based on a formula, whereas actual contributions to fund benefits may differ, and interest rates depend on realized returns on those investments.

In addition, a number of jurisdictions considering reform of public employee pensions have explored so-called hybrid pensions, which contain elements of both DB and DC structures. For instance, federal government employees have a loose hybrid of a DB pension (the Federal Employees Retirement System) and a DC pension (the Thrift Savings Plan). Utah now offers newly hired employees a choice between a DC pension and a DB plan in which employer contributions are capped; in conventional public DB plans, the employer's potential contribution level is unlimited. In Pennsylvania, lawmakers have proposed a hybrid plan in which a base of earnings is subject to a DB plan, but earnings above a given level trigger contributions to a DC pension.

In states and cities around the nation, efforts are underway to address the rising cost of such plans.[2] In most cases, these efforts are restricted to simple changes such as increases in employer and employee contributions, which leave the benefit formula unchanged. In other cases, benefit changes such as reductions to postretirement cost-of-living adjustments have been implemented. In still other cases, fundamental reforms have been proposed that would shift public employees to an entirely new pension plan. For instance, the cities of San Diego and San Jose, California, voted via referenda to shift new employees to DC pensions. Detroit, as it navigates bankruptcy proceedings, has proposed shifting all active employees and newly hired workers to a hybrid pension plan.

There are many pros and cons to structural changes in public plans. However, one recent prominent objection to converting public DB plans into DC, CB, or hybrid structures concerns

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[2] The National Conference of State Legislatures tracks public-sector pension reforms. See the organization's website at http://www.ncsl.org.

so-called transition costs. Transition costs would temporarily raise the cost of supporting public plans so that savings from reform would be delayed for a number of years. Higher costs in the interim may be seen as problematic because the rising costs for current DB plans are a primary motivation for pension reforms.

However, clarifying from the outset what is meant by transition costs in the public plan context is important. The phrase *transition costs* gained prominence in the debate about Social Security personal accounts, which would allow workers to divert a portion of their payroll taxes to DC retirement accounts. Social Security is a pay-as-you-go program, meaning that current tax revenues are used to fund current benefit payments. As a result, the diversion of current workers' payroll taxes to personal accounts would deprive the program of a portion of its revenues, thereby raising costs for the program until current workers with accounts began to retire. The higher costs during this period are often referred to as transition costs.[3]

At first glance, this issue should not arise with public-sector pensions, which are, or are intended to be, fully funded. A fully funded public plan has sufficient assets on hand to pay for all accumulated obligations. If future contributions are directed instead to an alternative pension plan, this would have no effect on the ability of the DB program to pay what it owes: neither its assets nor its liabilities have changed. If plan sponsors opt to shift from a DB to a DC plan structure, liabilities from the previous DB plan still exist and legally must be honored. But those liabilities are due to the DB plan itself and are not increased by virtue of shifting new employees or new contributions to a DC plan.

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[3] See, for instance, John Genakoplos, Olivia S. Mitchell, and Stephen P. Zeldes, "Would a Privatized Social Security System Really Pay a Higher Rate of Return?" (Working Paper W6713, National Bureau of Economic Research, Cambridge, MA, 2000).

The issue of transition costs arises in the public sector for various reasons. First, some groups, including public plans themselves, argue that accounting rules 25/27 promulgated by the Governmental Accounting Standards Board (GASB) require that a closed DB plan more quickly pay off, or amortize, its unfunded liabilities. Under current practice, plans may amortize unfunded liabilities over a period of up to 30 years. Faster amortization would mean higher payments, thereby raising plan costs over a period of time.

Second, some analysts argue that a closed DB plan must invest in a safer, more liquid portfolio as its participant population ages. Because safety and liquidity are accompanied by lower expected returns and public plan contributions are based on the expected return on plan investments, this approach would increase the funding cost of the current DB plan until the last DB participant passed through the system.

Both arguments for public plan transition costs have intuitive appeal. But both are based on misunderstandings of public plan accounting and investment practices that, once resolved, show transition costs not to be a first-order impediment to public plan reforms. Advocates for current DB plans might oppose such reforms for other reasons, but transition costs would not stand in the way of shifting public pension provisions toward DC, CB, or hybrid structures.

Yet transition cost issues are important in the policy debate over pension reforms. As Robert Costrell shows, claims of transition costs have been successfully cited in a number of states as a reason not to enact comprehensive public pension reforms.[4] For instance, Minnesota's three statewide plans published a study that claims that pension reform could generate transition costs of $2.8 billion over 10 years. Laurie Hacking, executive director of the Teachers Retirement Association in Minnesota, called transition costs the most important point with

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[4] Robert M. Costrell, "'GASB Won't Let Me': A False Objection to Public Pension Reform" (LJAF Policy Perspective, Laura and John Arnold Foundation, Houston, TX, May 2012).

regard to pension reforms.[5] Similarly, the National Institute on Retirement Security—an organization representing many public plan stakeholders, such as public employee unions, actuarial firms, investment advisers, and the plans themselves—issued talking points to members that state, "closing a DB pension can incur unfunded liability growth and large transition costs."[6]

In California, local governments wishing to pull out of the California Public Employees' Retirement System (CalPERS) are required to participate in a terminated agency pool, which invests far more conservatively than the CalPERS fund for open plans. A terminated plan is required by CalPERS to hold a mostly bond portfolio with an expected yield of 3.8 percent, versus a 7.75 percent assumed return on the main CalPERS fund.[7] This lower assumed yield imposes a large penalty on local governments hoping to pull out of CalPERS and has effectively prevented a number of jurisdictions from doing so.[8]

Thus, arguments regarding transition costs are not merely academic abstractions. Rather, they have had and continue to have a concrete effect on policy initiatives in states and cities around the country. For successful pension reforms to be enacted, policymakers must understand what transition costs do and do not mean for plan sponsors.

Accounting-Based Transition Costs

Until recently, the most common claim of transition costs for public pension reform was based on the idea that a closed public plan must, because of accounting requirements, pay down (amortize) its unfunded liabilities more rapidly than a plan that remained open to new entrants.

[5] Mary Jo Webster, "Public Pensions: Minnesota Commission to Review Options," *St. Paul Pioneer Press*, November 5, 2013.

[6] Diane Oakley, "Retirement Issues 2013," National Institute for Retirement Security, presentation at the National Press Foundation, Washington, DC, April 8, 2013.

[7] See California Public Employees' Retirement System, "FAQs: Discount Rate for Terminated Agencies," March 23, 2012, http://www.calpers.ca.gov/index.jsp?bc=/employer/faqs/benefits/discount-rate-term.xml&pat=STER.

[8] Tim Reid, "California City Looks to Quit CalPERS, Fears It Can't Afford to," *Reuters*, August 27, 2014.

To pay down unfunded liabilities more quickly, a plan sponsor must increase its payments.[9] A more rapid amortization schedule raises required contributions over a transition period.

This claim was based on now-superseded GASB Statement No. 25 (GASB 25), which requires that a plan sponsor calculate an annual required contribution. The contribution consists of the normal cost, which is designed to finance new benefits accruing to employees in that year, and an amortization payment to retire unfunded liabilities from prior years. Most plans amortize unfunded liabilities on a level payroll basis, which means that payments are scheduled to rise each year with the employee wage base. In GASB 25, however, the level percentage of payroll option is available only for open plans for which new entrants cause the payroll base to grow. When a plan is closed, the number of participants and the payroll base shrink over time. Thus, pension stakeholders have interpreted GASB 25 as requiring that closed plans amortize unfunded liabilities on a more demanding level dollar basis, which implies higher amortization payments for roughly the first 10 years and lower payments thereafter.

However, as Costrell points out, GASB sets standards for disclosure. GASB statements do not dictate funding requirements, and GASB does not have (and makes no pretense of having) the power to enforce how governments choose to fund their plans.[10] This fact should be obvious, given the large number of plan sponsors in recent years that have with impunity failed to make their supposedly required contributions, which include amortization costs. Jurisdictions such as Alaska have reformed their pensions while maintaining their prior amortization schedules. They are free to make precisely the same amortization payments as under the prior benefit plan. As Costrell shows, plan officials and public plan actuaries acknowledge this fact, albeit seemingly reluctantly.

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[9] This analysis omits the possibility of cutting accrued benefits, which is effectively a default on plan liabilities rather than the funding of them.

[10] Costrell, "'GASB Won't Let Me.'"

Moreover, GASB's 2013 updates to pension accounting standards—termed Statements

No. 67 and No. 68—make clear that the organization's standards are for disclosure only. In a

document called "GASB's New Pension Standards: Setting the Record Straight," GASB

addresses the question, "Do the new GASB Statements establish requirements for how

governments should fund their pensions?" GASB answers as follows:

> No. In the past, the accounting and financial reporting standards were closely associated
> with the approach that many governments take to funding their benefits—that is, toward
> contributing sufficient resources to a defined benefit pension plan to finance benefit
> payments when they come due. Consequently, many governments have established
> funding policies based on the GASB's standards. However, after reexamining the prior
> standards for pensions, the GASB concluded that approaches to funding are not
> necessarily the best approach to accounting for and reporting pension benefits. Therefore,
> the new Statements mark a definitive separation of accounting and financial reporting
> from funding.[11]

GASB goes on to reiterate the following:

> The new pension Statements relate only to accounting and financial reporting, or how
> pension costs and obligations are measured and reported in external financial reports.
> How much governments actually contribute each year to a pension plan is a policy issue.
> Governments will likely report pension expense more quickly than under the prior
> standards; however, how or whether this information is used in assessing the amounts
> that governments will contribute to their pension plans is a public policy decision made
> by government officials.[12]

Simply put, despite claims that GASB requires higher amortization payments from closed DB

plans, the opposite is the case: GASB standards do not make any funding requirements. Funding

is a policy decision. Proponents of the accounting-based transition costs argument make no

policy argument about why amortization payments should increase.

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[11] "GASB's New Pension Standards: Setting the Record Straight," Governmental Accounting Standards Board,
accessed February 4, 2015, http://www.gasb.org/cs/ContentServer?c=Page&pagename=GASB%2FPage%2FGASB
SectionPage&cid=1176160432178.
[12] Ibid.

Investment-Based Arguments

There is a more recent and more sophisticated claim regarding pension transition costs that has

nothing to do with accounting rules or amortization of unfunded liabilities. Rather, the claim is

based on how a closed DB plan might change its investment strategy and how such changes

would affect the cost of the plan. The investment-based transition costs argument states that a

closed plan with an older participant population must shift to a less risky and more liquid

portfolio of investments to ensure that it has sufficient funds on hand to make benefit payments

when they are due. An open-ended plan, it is argued, can rely on a more aggressive portfolio and

thus reap the rewards of higher expected investment returns. Shifting to a lower-returning

portfolio would increase the plan's liabilities because, under GASB's (controversial) accounting

standards, liabilities are calculated using the interest rate that is assumed for plan investments.

Higher liabilities would increase the plan's unfunded liabilities and thereby raise the

amortization payments needed to restore the plan's finances to balance.

It is worth highlighting how common this new investment-based transition costs

argument has become. For instance, a study by CalPERS states the following:

> As a closed DB plan ages, fewer contributions due to fewer active members, relative to
> retiree benefit payments, increases the need for more liquid assets. This creates a need to
> shift assets to investments that have a more predictable cash flow such as bonds. This
> generally has a negative impact on the fund and results in lower investment income. This
> lost investment income needs to be covered by additional contributions. These
> contributions may come from the employer, the employee or a combination of both.[13]

Similarly, the actuarial firm Milliman argues that a closed plan should alter its investments and,

based on GASB accounting rules, the discount rate it applies to its liabilities. In a letter to the

Pennsylvania Public Employee Retirement Commission, the firm's actuaries state the following:

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[13] California Public Employees' Retirement System (CalPERS), "The Impact of Closing the Defined Benefit Plan at
CalPERS," March 2011, 4.

Once active membership in [the State Employees' Retirement System] and [the Public School Employees' Retirement System] has significantly declined and retired members are the majority of each System's total membership, the Systems' should consider revising their investment policy. Each system may be inclined to invest assets in a more conservative manner resulting in a lower discount rate than current levels. This revision would result in a lower valuation interest rate, which would result in higher actuarial accrued liabilities.[14]

Also in Pennsylvania, the actuarial firm Buck Consulting issued to the Pennsylvania State

Employees' Retirement System an actuarial report on reform legislation sponsored by Rep.

Mike Tobash:

It is possible that, under House Bill No. 1353, liquidity considerations may arise due to the shift in liability towards retirees. At such time, the Board may change the asset allocation policy to reduce the risk of the portfolio and reflect the need to hold a growing portion of its assets in more liquid, less volatile asset classes. In general, lowering the riskiness of the portfolio may result in a lower expected return. . . . This would increase the accrued liabilities and contribution requirements of the System.[15]

In a study about the Florida Retirement System, the public pension actuarial firm Milliman

similarly argues the following with regard to reform proposals in Florida:

Over time, the State Board of Administration may lose the ability to invest with a long-term perspective as annual cash flow becomes more and more negative. Under a closed plan, as the active population shrinks and the retired population continues to grow, benefit payments will exceed the contributions made to the plan by continually increasing amounts. This will possibly necessitate future changes in asset allocation in order to provide sufficient sources of cash for benefit payments, which in turn could impact the rates of return earned by the Fund's assets . . . thereby putting upward pressure on costs.[16]

The three Minnesota statewide retirement plans published a joint analysis of a potential

conversion to DC plans:

Relative to an open ongoing DB plan, a closed DB requires higher cash outflow, meaning benefit payouts are high relative to contribution revenue. As a result, plan assets will be

[14] "Letter from Timothy J. Nugent and Katherine A Warren, Milliman Company, to James L. McAneny Transmitting an Actuarial Note on Senate Bill 566," August 30, 2010.
[15] David L. Driscoll, Buck Consultants, letter and attachments to Jeffrey B. Clay, Pennsylvania Public School Employees' Retirement System, May 2, 2014, table 2.
[16] Milliman, "Study Reflecting the Impact of Closing the Florida Retirement System Defined Benefit Plan to New Members Effective January 1, 2014," February 15, 2013, 7. View online here: http://static-lobbytools.s3.amazonaws .com/press/53183_florida_s_pension_plan_requested_by_speaker_will_weatherford.pdf.

spent down and thus, must be invested in a lower risk investment allocation. The financial impact of these investment allocation changes would be significant and are not included in the cost estimates. Mercer estimates that if the investment earnings and interest assumption for the closed DB were lowered from 8.5 percent to 6 percent to reflect a more conservative asset allocation, the actuarial accrued liabilities would increase by approximately 30 to 40 percent and the unfunded actuarial accrued liabilities would more than double.[17]

Such research is distributed increasingly widely, and pension stakeholders are more commonly making such arguments.

These claims understandably make policymakers reticent to consider reforms that would close existing DB plans. For instance, a Pennsylvania newspaper reports that "in failing to take up [Governor Tom] Corbett's previous proposal, lawmakers cited concerns about . . . the transition costs of a new system for new hires."[18]

Public Pensions' Investment Philosophy

Investment-based transition costs arguments come from a philosophical standpoint that public pensions essentially need not account for the risk of their investments. Public plan disclosures promulgated by GASB disregard investment risk entirely, suggesting that a higher-risk portfolio, which would have a higher expected annual return, instantly makes a plan better funded. Similarly, most plans provide little quantitative information or sensitivity analysis regarding the risks they are taking. Moreover, there is a broad view among pension stakeholders that public plans' long time horizons allow them to effectively ignore investment risk.[19] But once investment risk is accounted for—as it must be in any rigorous analysis of the economic costs of different policy approaches—the supposed costs of a lower-risk financing strategy disappear.

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[17] Minnesota Statewide Retirement Systems, "Retirement Plan Design Study," June 1, 2011, 3.
[18] "Pa. Gov. Corbett Revisits Pension Reform," *Lancaster New Era*, March 3, 2014.
[19] For references, see Andrew G. Biggs, "The Public Pension Quadrilemma: The Intersection of Investment Risk and Contribution Risk," *Journal of Retirement* 2, no.1 (2014): 115–27.

These points can be illustrated by making a distinction between what might be termed *actuarial full funding* and *true full funding*. Actuarial full funding is satisfied when a plan has a best guess that its assets will be sufficient to pay its liabilities. For instance, if a plan assumes an 8 percent return on its investments, it will be fully funded if the current value of its assets equals the present value of its liabilities discounted at that 8 percent expected return.

True full funding, conversely, acknowledges that the expected return on a mixed portfolio of stocks and bonds is uncertain while the liabilities the plan is obligated to pay are intended to be guaranteed. Although a plan's investments may have an expected return of 8 percent, the true return on a portfolio of risky assets may be well above or well below that expected rate. In this view, actuarial full funding represents a roughly 50 percent chance of being able to pay a benefit that is intended to be payable 100 percent of the time. This uncertainty regarding investment returns, coupled with the obligation to pay full benefits regardless, imposes contingent liabilities (or, if investment returns are above expectations, contingent assets) on future generations of taxpayers.

The costs of guaranteeing against investment risk can be illustrated using financial products known as options. A put option is a financial product that acts as insurance against low returns on some other investment. For instance, a put option might guarantee that a portfolio of stocks can be sold for no less than some specified strike price at some named time in the future. A public plan might purchase a put option that would make up any difference between the actual earnings on its investment and the amount it needs to pay full promised benefits. If it doesn't make such a purchase—and actual public plans do not—then the cost is borne by the taxpayer through an implicit put option. That is, if investment returns are below expectations, then additional costs are imposed on taxpayers. This is a contingent liability on future generations that

does not exist with DC pension plans in which participants bear the risk of their investment choices. The purchase of such a put option would make a DB plan truly fully funded, meaning that it could guarantee the benefits owed to public employees without any recourse to the taxpayer for additional funds.[20]

If the cost of this put option protecting against investments falling short of expectations were added—minus the sale of an offsetting call option that would give away any future surpluses—the total cost of a plan being truly fully funded is simply the value of the future benefit payments discounted at the interest rate on market investments (such as bonds) with a similar level of risk. This result is due to a principle known as put-call parity.

The cost of a put option depends on the risk of the investment it is insuring. Not surprisingly, insuring a risky investment is more costly than insuring a safe one. So although a pension plan may appear able to lower its cost by taking more investment risk, the higher expected returns on a risky portfolio are offset by the higher costs of the implicit put option that future taxpayers are unwittingly forced to provide. The plan's investment strategy—a small contribution in riskier, higher-returning assets or larger contributions in safer, lower-returning assets—is just that: a strategy that decides how costs are divided between current generations of taxpayers making cash contributions and future generations of taxpayers bearing implicit liabilities, but it does not alter the overall cost of the plan's obligations.

Thus, although a closed plan might choose to hold safe, lower-returning assets, the cost of the implicit put option imposed on future taxpayers decreases significantly. Given the

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[20] For more details, see Andrew G. Biggs, "Proposed GASB Rules Show Why Only Market Valuation Fully Captures Public Pension Liabilities," *Financial Analysts Journal* 67, no. 2 (March/April 2011): 18–22; and Andrew G. Biggs, "An Options Pricing Method for Calculating the Market Price of Public Sector Pension Liabilities," *Public Budgeting and Finance* (Fall 2011): 94–118. Also see American Academy of Actuaries, "Measuring Pension Obligations: Discount Rates Serve Various Purposes," Issue Brief, November 2013, footnote 7.

principle of put-call parity, financial theory says that the value of these contingent pension liabilities decreases by enough to fully compensate taxpayers for the lower expected return on the pension's investments. However, as the following section discusses, this is not how most public plan stakeholders view their investment decisions.

Public Plan Investment Practices

A common rule of thumb for individual investors is to allocate a percentage of their investment portfolio to stocks equal to 100 minus their age. For instance, a 20-year-old investor would hold 80 percent of his or her assets in stocks, a 40-year-old investor would hold 60 percent in stocks, and a 60-year-old would hold 40 percent in stocks. Although more sophisticated investment strategies exist, this rule is not out of line with common practice. For instance, so-called life cycle or target date funds, which are increasingly common investment options offered under DC pensions, follow patterns of reducing allocations to risky assets as the participant ages.

There is no particular reason a DB pension, public or private, would follow a very different approach. A plan has participants of different ages, each of whom is accruing future benefits and on whose behalf the plan is making investments to fund those benefits. In theory, the benefit accruals and investments for each cohort of participants is separable, and one would expect that plans would follow a similar age-based rule for each cohort of active employees or retirees participating in the plan. And research shows that private-sector DB plans in the United States follow this logic, as do public employee plans in other countries. Andonov, Bauer, and Cremers find that for US corporate pensions and for public employee pensions in other countries, as the plan's participant population ages, the plan portfolio shifts toward safer investments such as

bonds.[21] Specifically, for funds other than US public plans, a 10 percent increase in the percentage of retired members is associated with a 1.2 percentage point reduction in the plan's portfolio allocation to risky assets.[22] US public plans, conversely, appear to work from a different economic logic: they have been taking *more* investment risk as they age. For US public pensions, a 10 percent increase in the percentage of retired members is associated with a 2.1 percentage point *increase* in the allocation to risky assets. The authors attribute this difference to the unique accounting standards for US public plans. In the US private sector and for public employee plans in other countries, benefit liabilities must be valued (or discounted) using a low interest rate to reflect that these benefits are guaranteed. The discount rate used to value these liabilities usually is derived from government bonds or investment-grade corporate bonds. What is important to note here is that the discount rate applied to a liability has nothing to do with the actual investment portfolio the plan holds: a private plan or overseas public plan does not alter how it values its liabilities when it changes its investments. Thus, these plans have the incentive to adopt the investment portfolio that best suits their needs, not a portfolio based on accounting rules.

Plan advocates counter that public pensions, as governmental institutions, have essentially infinite time horizons and that they can effectively ignore investment risk. A quantitative analysis of how investment risk interacts with the volatility of annual employer pension contributions shows that, despite these supposedly long time horizons and the use of actuarial smoothing methods to take advantage of them, risky pension investment portfolios result in actuarially required employer contributions that can vary significantly from year to year.[23]

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[21] See Aleksandar Andonov, Rob Bauer, and Martijn Cremers, "Pension Fund Asset Allocation and Liability Discount Rates: Camouflage and Reckless Risk Taking by U.S. Public Plans?," presentation at the Federal Reserve Bank of Cleveland Public Pension Conference, Cleveland, November 2013.
[22] Ibid.
[23] Biggs, "Public Pension Quadrilemma."

A more plausible argument is that, because public employees' earnings are less variable

and their employment more stable, they (or plans investing on their behalf) rationally should

invest more in risky assets. Doing so creates a broad portfolio combining financial assets and

future earnings capacity that is no more risky than that of a private-sector worker, who may take

on less investment risk but has greater volatility of earnings. In contrast, public employees have

less ability to alter their hours of work and, under DB pensions, often are severely penalized for

retiring either before or after some plan-specific optimal age.[24] This lack of labor-supply

flexibility would point toward less investment in stocks or other risky assets. A private-sector

worker with more leeway to delay retirement can more easily absorb the risks of holding stocks

in his or her retirement savings. Thus, these factors, although useful to note, do not point toward

the large differences in portfolio allocations seen between public-sector pensions and individuals

saving for retirement on their own.

The degree to which public plans have embraced risky investments far out of proportion

to the choices made by individual investors can be illustrated using CalPERS, which, in making

the case for investment-based transition costs, describes how closing a plan might alter the

appropriate investment portfolio:

> The newly adopted asset allocation of the Public Employees' Retirement Fund (PERF)
> calls for 15.9 percent of the assets to be invested in fixed income. Once all members are
> retired, it is reasonable for a closed DB plan to invest a much higher portion of its assets
> in fixed income. For example, the pension plan may shift the asset allocation to 60
> percent in fixed income once all members have retired. For CalPERS, most of the current
> active members will likely retire in about 30 years. At that point, more assets would be
> allocated to fixed income. If the asset allocation were to gradually shift each year over the

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[24] See Zvi Bodie, Robert C. Merton, and William F. Samuelson, "Labor Supply Flexibility and Portfolio Choice in a Life-Cycle Model," *Journal of Economic Dynamics and Control* 16 (1992): 427–49. On retirement age penalties, see Robert M. Costrell and Michael Podgursky, "Peaks, Cliffs, and Valleys: The Peculiar Incentives in Teacher Retirement Systems and Their Consequences for School Staffing," *Education* 4, no. 2 (2009): 175–211.

next 30 years toward more fixed income assets to achieve a 60 percent fixed income goal, the expected investment income for the entire portfolio would be lower.[25]

CalPERS estimates that such a shift would have a present value cost of $30 billion to $40 billion.

But before accepting that conclusion, one should do some basic math. CalPERS states that its total portfolio funding all liabilities is currently 16 percent bonds and 84 percent risky assets. (For simplicity's sake these risky assets will be called stocks, though the risky investment pool also includes real estate, private equity, hedge funds, and other investments.) CalPERS also states that a reasonable portfolio for an all-retired population would be 60 percent bonds and 40 percent stocks. In addition, CalPERS's actuarial valuation notes that the plan's liabilities are roughly equally divided between active employees and inactive or retired participants. This information allows one to calculate the effective stock share of the CalPERS portfolio dedicated to funding liabilities for active employees. The effective stock share of CalPERS' investments funding benefit liabilities for current employees is 125 percent, with a negative 25 percent bond share (table 1).[26] The average age of active participants in CalPERS is around 45, which, under a simple 100-minus-age rule, would point toward an equity allocation of around 55 percent. Thus, the CalPERS portfolio to fund liabilities for active employees is more than twice as stock heavy as investment advisers would recommend for an individual saving for retirement on his or her own.

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[25] CalPERS, "Impact of Closing the Defined Benefit Plan," 4–5.

[26] In isolation, a plan could achieve such a portfolio by purchasing stocks on margin, which means borrowing money so the stock share of the portfolio could exceed 100 percent. In practice, this is achieved by having a merged investment portfolio that covers both active and retiree employee obligations. Specifically, the implicit portfolio for retired participants would hold more stocks than the 40 percent CalPERS states is appropriate for a retiree-only population. This allows the portfolio for active participants to effectively hold more than 100 percent stocks.

Table 1. Calculating CalPERS Effective Portfolio Allocations for Active and Retirement Employee Liabilities

Employees	Allocation (%)		Share of total liabilities (%)
	Stocks	Bonds	
Total	84	16	100
Retired	40	60	50
Working	125	−25	50

Source: Author's calculations based on California Public Employees' Retirement System (CalPERS), "The Impact of Closing the Defined Benefit Plan at CalPERS," March 2011.

CalPERS is not alone in making heavy allocations to equities and other risky investments. Although a number of plans have reduced the returns they assume for their investment portfolios, such that the average today is closer to 7.75 percent than the previous 8.0 percent, these changes have not matched the decline in riskless returns that should form the foundation of projecting yields on a mixed allocation of investments.[27] Plans could be overstating the expected returns on investment, as some evidence seems to indicate.[28] Similarly, public plans have taken on additional investment risk over time,[29] which would help maintain expected rates of return in the face of falling riskless rates, at the cost of higher volatility of employer contributions in future years.[30]

What these trends may indicate is that US public employee pensions are not accounting for the age structure of participants and the duration of liabilities in setting current investment policies. Thus, in assessing how changing portfolio allocations for a closed DB plan may

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[27] Society of Actuaries, Blue Ribbon Panel on Public Pension Plan Funding, "Report of the Blue Ribbon Panel on Public Pension Plan Funding," February 24, 2014.

[28] See James J. Rizzo and Piotr Krekora, "The Goldilocks Principle & Investment Return Assumptions," Presentation at the Florida Government Finance Officers Association, Annual Business Meeting, Boca Raton, June 25, 2013.

[29] See Andrew G. Biggs, "The Multiplying Risks of Public Employee Pensions to State and Local Government Budgets," American Enterprise Institute, Economic Perspectives, December 2013.

[30] Biggs, "Public Pension Quadrilemma."

generate investment-based transition costs, one cannot simply compare the investment allocations currently made by open DB plans with allocations that might be appropriate for a closed plan. Instead, one must analyze appropriate investment portfolios for both open and closed plans using the same criteria of evaluation. Investment-based transition costs are generated by the difference in yield between these two portfolios.

Applying the Lucas-Zeldes Model to Public Plans

In this section, a pension portfolio–allocation method designed by Massachusetts Institute of Technology economist Deborah Lucas and Columbia University economist Stephen Zeldes is used to illustrate appropriate investment policies for open and closed public plans. There are alternative approaches to pension investment policy, including those espoused by William Sharpe and Fischer Black, but these often focus on issues—such as protections offered to corporate pensions by the Pension Benefit Guaranty Corporation or the tax implications of pension investment choices—that are of secondary importance in this context.[31] The Lucas–Zeldes model is useful here because it focuses on whether the long time horizons available to an open public plan point toward heavy investments in risky assets.

It is commonly argued that the liabilities of public-sector pension plans should be discounted using the yield on low-risk bonds because the benefits offered by such plans are guaranteed. Recent events in the city of Detroit, in which bankruptcy proceedings resulted in only modest reductions to pension benefits while holders of explicit government debt lost far more, strengthen this perception. For instance, in a 2011 study I value pension liabilities using the yield

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[31] William F. Sharpe, "Corporate Pension Funding Policy," *Journal of Financial Economics* 3, no. 3 (1976): 183–93; Fischer Black, "The Tax Consequences of Long-Run Pension Policy," *Financial Analysts Journal* 36, no. 4 (1980): 21–28.

on long-term US treasury securities; Robert Novy-Marx and Joshua Rauh use Treasury Inflation-Protected Securities yields plus an expected inflation premium to account for the fact that benefits are at least partially inflation indexed; the CBO uses a long-term rate assumed for treasury securities; and the Bureau of Economic Analysis calculates state and local pension liabilities for the national income and product accounts using a corporate bond yield for consistency with its calculations for private-sector DB pensions, as does the bond rating agency Moody's.[32]

This view is not unique to a small number of economists specializing in pension issues. Economists are practically unanimous in agreeing that the use of the expected return on plan investments—generally around 8 percent—is incorrect because of the difference in risk between these investments and the guaranteed benefit liabilities they are used to finance. In October 2012, the Initiative on Global Markets Forum at the University of Chicago's Booth School of Business surveyed 39 professional economists with regard to public pension discount rates. This group of respected economists represents differing areas of expertise and a wide variety of outlooks on the role of government. The economists were asked to express their agreement or disagreement with the following statement: "By discounting pension liabilities at high interest rates under government accounting standards, many U.S. state and local governments understate their pension liabilities and the costs of providing pensions to public-sector workers." Thirty-eight of the 39 economists surveyed agreed, with half agreeing "strongly." None of the economists surveyed disagreed.[33]

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[32] See Andrew G. Biggs, "An Options Pricing Method for Calculating the Market Price of Public Sector Pension Liabilities," *Public Budgeting and Finance* 31, no. 3 (Fall 2011); Robert Novy-Marx and Joshua Rauh, "Public Pension Promises: How Big Are They and What Are They Worth?," *Journal of Finance* 66, no. 4 (2011), 1207–45; Congressional Budget Office, "The Underfunding of State and Local Pension Plans," May 2011; Marshall B. Reinsdorf and David G. Lenze, "Defined Benefit Pensions and Household Income and Wealth," Bureau of Economic Analysis, Research Spotlight, August 2009; and Moody's Investor Services, "Adjustments to US State and Local Government Reported Pension Data," Request for Comment, July 2012.

[33] For details, see http://www.igmchicago.org/igm-economic-experts-panel/poll-results?SurveyID=SV_87 dlrlXQvZkFB1r.

Given a risk-adjusted discount rate, liabilities for public plans are roughly double the levels reported under accounting disclosures promulgated by GASB. True funding ratios are roughly half those reported using GASB standards, and unfunded liabilities rise from a reported level of around $1 trillion to more than $4 trillion.[34]

As a simplification, the use of a risk-adjusted discount rate is fine: public plan benefits are taken to be practically immune to default risk, meaning that they will be paid under nearly all circumstances. However, a more precise way of determining the proper discount rate for public plans is to construct a so-called matching portfolio, whose investments can reproduce the cash flows involved with a public plan.

This matching portfolio has several uses. First, it can be used to generate the discount rate by which the pension's liabilities may be valued. Because the matching portfolio generates the same payments at the same time with the same risk as the pension plan, the interest rate that buyers and sellers in financial markets attach to that portfolio is an appropriate discount rate at which the plan's future benefit obligations can be converted into present values that may be compared with the investments the plan has amassed to pay those benefits.

Of course, the pension itself may or may not wish to invest in this matching portfolio. If a plan does so, it can be considered in full compliance with the standard of interperiod or intergenerational equity, in which each generation of taxpayers fully funds the compensation of public employees providing services to the public at the time. Such an approach immunizes future taxpayers from the chance they will be required to bail out the plan.[35] As discussed earlier, to the degree a plan chooses a funding strategy that relies on smaller investments in riskier but

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[34] For instance, see Andrew G. Biggs, "Public Sector Pensions: How Well Funded Are They, Really?," *State Budget Solutions*, July 18, 2012.

[35] For instance, see George Pennacchi and Mahdi Rastad, "Portfolio Allocation for Public Pension Funds," *Journal of Pension Economics and Finance* 10, no. 2 (2011): 221–45.

higher-yielding assets, it is shifting costs to the future and, at least to some degree, violating interperiod equity. To the degree a plan takes on less risk than suggested by the matching portfolio, and thus makes larger contributions, present generations are taking on larger costs and future generations will bear smaller costs. The basic point is simply that valuation of a liability is distinct from the financing strategy used to fund that liability.

Second, the matching portfolio can help policymakers determine the transition costs of closing a DB plan to new entrants. The type of investments chosen for a matching portfolio depend on not only the risk of the plan's benefits, but also the period of time in which those benefits must be paid. In general, fixed income investments with long durations would pay higher interest rates. So as a plan closed and the average duration of the plan's liabilities shortened, the interest rate on a matching portfolio would tend to decline and, relative to a higher interest rate, the cost of servicing those liabilities would increase. In most cases, however, the appropriate portfolio to match guaranteed pension liabilities would be composed of bonds.

But perhaps this is not totally the case. Some economists argue that a pension portfolio will optimally contain some stocks, but not for the simplistic reasons that public plan advocates put forward. Rather, economists Lucas and Zeldes make the following argument:[36]

- First, pension benefits are indexed to wages. In most cases, DB pension benefits are calculated as a percentage of the employee's final earnings multiplied by his or her years of service. As a result, the pension plan does not guarantee a fixed dollar benefit so much as a fixed replacement rate relative to the worker's final earnings.

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[36] Deborah J. Lucas and Stephen P. Zeldes, "Valuing and Hedging Defined Benefit Pension Obligations: The Role of Stocks Revisited" (working paper, Northwestern University and Columbia University, September 2006). Also see Deborah J. Lucas and Stephen P. Zeldes, "How Should Public Pension Plans Invest?," *American Economic Review* 99, no. 2 (2009): 527–32.

- Second, future wage growth is variable, so the benefit amount guaranteed by the plan is variable, too.

- Third, although stock returns and wage growth are not correlated in the short term, over a longer period there exists a theoretical argument and some empirical evidence that stocks and wages rise and fall together.

If so, stocks can act as a hedge against wage-indexed pension liabilities and might form part of a well-designed public plan portfolio.

Because stocks have higher expected returns than bonds, incorporating stocks into a matching portfolio would raise the proper discount rate and lower the measured value of pension liabilities. Doing so would, relative to discounting at a treasury rate, lower unfunded liabilities and raise funding ratios.

Moreover, because the correlation between wage growth and stock returns is believed to exist over long time horizons but not in the short term, a closed pension plan with a shorter duration of liabilities would invest less in stocks and more in bonds. This would lower the return on the plan's matching investment portfolio as the plan closed to new entrants and, at least in theory, raise the cost of funding these liabilities.

This analysis does not suggest that each fund must construct its own matching portfolio to calculate the appropriate discount rate. This task may be beyond the abilities or resources of many plans, especially smaller ones, and the practical task of setting accounting disclosures for public plans may demand something simpler and more straightforward. But considering these issues helps inform the policy debate regarding pension reform, in particular the question of whether closing a public plan incurs significant transition costs that reduce the purported benefits of reform.

To start, such a theory does not open the door to public plans investing two-thirds or more of their portfolios in risky assets, as is common today. Distinguishing between two actuarial measures of pension liabilities helps explain why this is the case. The accrued benefit obligation (ABO) measures benefits earned to date, that is, the benefits the plan would owe if it were terminated today and benefits were calculated on the basis of salaries and work years of employees at the present time. Conversely, the projected benefit obligation (PBO) is a more inclusive measure and takes account of the fact that, particularly in the public sector, plan termination is unlikely. The PBO thus measures benefits based on employees' current number of work years and their projected final salaries.

In the ABO, benefits are certain because both the number of years of job tenure and the salaries of employees are known. Little uncertainty exists regarding these benefits, so they should be hedged using a riskless, or nearly riskless, portfolio. The PBO, by contrast, takes into account future benefit growth, which varies. If this future benefit growth is correlated with stock returns, then stocks can to some degree serve as a hedge and can be incorporated into the portfolio. Because the matching portfolio includes higher-returning stocks, the appropriate discount rate also should be higher.

But the discount rate should not be that much higher. According to Alicia Munnell and her colleagues, the ABO constitutes about 88 percent of state and local pension PBOs measured under current accounting rules.[37] Thus, roughly nine-tenths of pension obligations are bond-like and should be hedged using bonds. The remaining one-tenth is not purely stock-like and thus would be hedged with a mixed portfolio of stocks and bonds. From this, one would not expect

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[37] Alicia H. Munnell et al., "Valuing Liabilities in State and Local Plans" (Issue in Brief 11, Center for Retirement Research at Boston College, 2010).

that stocks would constitute nearly the portion of a properly constructed public pension investment portfolio as they do in existing pension portfolios.

An alternative way to consider these issues is to construct matching portfolios for active employees and for retirees. Active employees have yet to collect their benefits. Because these benefits are based on their future wages, and wage growth over long time horizons is correlated with stock returns, the benefit liabilities for active employees are at least partially stock-like and may be hedged with investments in equities. The younger the employees, the lower their accrued benefits and the more their total benefits will vary with future wage growth, and thus the more stock-like are their liabilities. Inactive employees or current beneficiaries, by contrast, do not represent stock-like obligations. Their benefits are based on their past wages, which are known and obviously do not vary going forward. Thus, liabilities for inactive employees and for current beneficiaries are bond-like, and a matching portfolio hedging these liabilities would be composed almost entirely of bonds. However, liabilities for inactive employees differ. Lucas and Zeldes state, "The liabilities for retired and separated workers are essentially fixed income obligations, and can be valued and hedged as such. In the absence of firm bankruptcy risk, the appropriate discount rate . . . is the riskless rate of interest. . . . The liabilities for retired and separated workers can be hedged with maturity matched bonds, or delta hedged."[38]

Lucas and Zeldes calculate the effects of incorporating long-run equity–wage correlations into the pension plan of a sample corporation, Alcoa. They calculate optimal equity investment shares for employees of different ages based on their salaries, years of job tenure, and probability of remaining in the pension plan through retirement age. This latter variable affects the time at which their pension obligations cease varying with wages, becoming more fixed and bond-like.

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[38] Lucas and Zeldes, "Valuing and Hedging," 7.

For 22-year-old active employees, Lucas and Zeldes conclude that roughly 83 percent of the assets set aside to fund their benefits should be invested in stocks. This is because of the long period before these young workers will collect benefits and the correlation between wages and stock prices over that time. For 62-year-old workers, conversely, only around 14 percent of assets should be held in stocks because most of these employees are on the verge of retirement. The effect of these estimates on the overall pension portfolio will vary on the basis of the number of employees of each age and their salaries. Because pension contributions are generally proportional to the salaries of employees and because older workers have higher average salaries, the overall pension portfolio will be more bond heavy than a simple averaging of equity shares by age would suggest.

Lucas and Zeldes find that the optimal portfolio to fund pension obligations for active employees consists of around 30 percent stocks. But in the Alcoa corporate plan Lucas and Zeldes analyze, total liabilities are heavily weighted toward inactive employees and retirees, with about 84 percent of liabilities falling into these categories. Thus, the appropriate stock weighting for the Alcoa pension portfolio as a whole is only 4.9 percent.

In the public sector, however, optimal stock weightings are likely to be higher. This is not due to the reasons typically floated by pension stakeholders, such as taxing power or the supposedly infinite time horizons of government-sponsored plans, but simply because most public DB plans remain open to new entrants and thus will have a higher ratio of active-to-inactive liabilities. Thus, a public employee pension plan's liabilities are likely to be more stock-like and less bond-like than are most corporate plans.

In contemplating how closing a public DB plan might affect the appropriate investment portfolio, one ought to consider two types of plan closures. In a hard freeze, a plan is closed to

new entrants, and current participants no longer accrue new benefits. Hard freezes are not uncommon in the private sector. In such a case, liabilities for active participants immediately shift from being stock-like—that is, they may vary with future wage growth—to being fixed, bond-like obligations. In this case, plan investments would immediately shift from the mixed stock and bond portfolio that Lucas and Zeldes advocate for open plans to an all-bond portfolio.

A soft freeze, conversely, closes a plan to new participants but allows active employees to continue to accrue benefits. Most proposals to close public DB plans envision a soft freeze. A soft freeze would have a much more gradual effect on the investments chosen by a plan. As remaining plan participants age, the benefit liabilities associated with them become less stock-like and more bond-like, thus producing a change in the appropriate investment portfolio. For instance, if one assumes the baseline portfolio for the open plan is 15.0 percent stocks with an expected return of 3.5 percent, then the equity share of investments would fall to about 13.0 percent 10 years after plan closure, 11.0 percent 20 years after closure, and 7.0 percent 30 years after closure. By the time all current employees had retired—roughly 45 years, assuming the youngest employees are age 20 and all retire by age 65—the plan would be shifted completely to bonds yielding 3.0 percent.

Thus, relative to a scenario in which the plan could maintain a mixed portfolio, a plan closing does increase expected contribution costs. However, the duration of a closed plan's liabilities are gradually reduced precisely because the plan's long-term liabilities are being eliminated. Put another way, the liability-weighted discount rate falls only because liabilities that are assigned higher discount rates are eliminated. For instance, consider a plan whose liabilities range from benefits being paid in the current year to the future benefits payable to a newly employed 20-year-old employee, who is assumed to have a maximum life expectancy of 100 years. The plan's

liabilities extend out 80 years, and the liabilities due in any given year are assigned a discount rate appropriate to their duration. If that plan is closed, then what was an 80-year duration of liabilities this year becomes a 79-year duration next year, a 78-year duration in the following year, and so on. The average discount rate applied to the plan's total liabilities will fall, but it will fall only because the longest-term liabilities that are assigned the highest discount rates are gradually eliminated.

Case Study: Pennsylvania State Employees' Retirement System

The Pennsylvania State Employees' Retirement System (SERS) is used to illustrate these questions. However, the illustration here goes well beyond the policy proposals that have been introduced in that state, which for new employees only would convert SERS from its current all-DB structure to a hybrid pension that combines a base of DB pension benefits on earnings up to $50,000 with a supplemental DC pension plan based principally on any earnings above $50,000.[39] Rather, this case study illustrates the effects of a more far-reaching reform in which the current DB system would be closed to new entrants and all newly hired employees would be enrolled in a DC pension plan.

Several specific pieces of information are necessary to analyze this hypothetical scenario:

(a) Distribution of active participants by age,

(b) Salaries of active participants by age, and

(c) Liabilities for active participants versus inactive participants and beneficiaries.

Most of these data are available from the plan's 2012 actuarial report conducted by the Hay Group.[40] In some cases, it is necessary to make reasonable assumptions about missing information.

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[39] For details, see Office of Rep. Mike Tobash, "Hybrid Plan to Address Pennsylvania's Public Pension Crisis," accessed February 4, 2015, http://www.reptobash.com/Display/SiteFiles/139/OtherDocuments/PensionPlan_06_14.pdf.
[40] Hay Group Inc., "Commonwealth of Pennsylvania State Employees' Retirement System: 2012 Actuarial Report; Defined Benefit Plan," June 5, 2013.

Under the common "entry age normal" approach to accounting for and funding pension liabilities, contributions are calculated so that they will be a stable share of employees' salaries over the course of their careers. This approach facilitates the calculation of equity shares of pension investment portfolios. For each employee age, total salaries are calculated by multiplying the number of employees by the average employee salary (table 2). For each age, the optimal equity share of investment from Lucas and Zeldes is applied.[41] The total equity share of the portfolio dedicated to funding liabilities for active employees is the salary-weighted average of these age-specific equity shares. That is, the percentage equity share for each age group is multiplied by that age group's salaries as a percentage of total payroll. The sum of these figures is the equity share for the portfolio as a whole. For Pennsylvania SERS, the portfolio equity share for liabilities associated with active employees is 28 percent (table 3).

However, liabilities for active employees make up only a share of Pennsylvania SERS total liabilities. Approximately 3 percent of total SERS liabilities are for inactive employees who are vested in their benefits while 45 percent of liabilities are attributable to current beneficiaries (table 3). These latter two classes of liabilities are essentially bond-like: they are fixed in value and have no correlation with future long-term wage growth, and thus, according to Lucas and Zeldes, there is no case for hedging such liabilities with stocks.[42] The total equity share of the SERS portfolio is the liability-weighted average of the equity shares for each liability category. In simple terms, if the equity share of investments for active employees is 28 percent and liabilities for active employees make up 52 percent of total liabilities, then the equity share of the overall SERS portfolios would be 15 percent (table 3).

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[41] Lucas and Zeldes, "Valuing and Hedging."
[42] Ibid.

Table 2. Number and Salary of Pennsylvania State Employees' Retirement System Employees by Age

Age	Number of employees	Average salary ($)
Under 20	41	23,554
20–24	1,676	28,479
25–29	5,148	35,730
30–34	7,067	41,493
35–39	7,424	44,851
40–44	9,840	47,991
45–49	11,658	49,785
50–54	14,923	51,670
55–59	15,049	52,724
60–64	8,256	52,781
65+	3,051	53,349

Source: Author's calculations, from Hay Group Inc., "Commonwealth of Pennsylvania State Employees' Retirement System: 2012 Actuarial Report; Defined Benefit Plan," June 5, 2013.

Table 3. Construction of Investment Portfolio for Pennsylvania State Employees' Retirement System

Employee category	Number of employees	Liabilities ($ billions)	Liabilities as percentage of total	Equity share (%)	Bond share (%)
Active	106,408	25.836	52	28	72
Inactive	6,725	1.632	3	0	100
Beneficiaries	117,061	22.095	45	0	100
TOTAL	230,194	49.564	100	15	85

Source: Author's calculations, from Hay Group Inc., "Commonwealth of Pennsylvania State Employees' Retirement System: 2012 Actuarial Report; Defined Benefit Plan," June 5, 2013.

Note: SERS does not disaggregate liabilities between active and inactive employees; they are assumed to be proportional to population.

If one assumes a current long-term nominal bond yield of 3.0 percent and an equity risk premium of 3.5 percent over the bond yield—consistent with the risk premium assumed by the Social Security Administration's actuaries—then the optimal portfolio to fully fund Pennsylvania

SERS liabilities would have an expected yield of approximately 3.5 percent. Put another way, such a portfolio would fully satisfy the pension criterion of intergenerational equity, which holds that taxpayers should fully pay for the compensation of public employees, including their deferred pension benefits, at the time that taxpayers receive services from those employees. Unfunded liabilities passed to future generations—whether explicit liabilities or contingent liabilities that would become active in the case that pension investments produce returns below expectations—violate this precept. Many pension stakeholders will be dumbfounded at how such a conservative portfolio might be considered optimal to fully fund future pension benefits. But, as explained earlier, this belief arises from misunderstandings regarding the definition of "fully funded."

The finding above has repercussions for how one views the funding health of the Pennsylvania SERS plan as an ongoing concern. The plan's liabilities are currently discounted at a 7.75 percent interest rate, the projected return on SERS investments. However, these investment returns are uncertain, even over the long run, while SERS benefits are intended to be guaranteed. Indeed, SERS has less than a 50 percent chance of achieving its expected return, even over long periods of time. Discounting the plan's liabilities at a matching portfolio yield of 3.5 percent more captures the fact that the plan is expected to pay benefits even if its investments do not yield 7.75 percent. Given this 3.5 percent risk-adjusted discount rate, SERS' funding ration declines from a reported 59 percent to 32 percent, while its unfunded liabilities rise from $17.8 billion to $53.4 billion.

But these results also offer insights into the potential transition costs of closing SERS to new entrants. In the case of Pennsylvania SERS, this would shift the appropriate discount rate from the open-plan yield of 3.5 percent to an all-bond yield of about 3.0 percent when all active employees begin collecting benefits. Even if this change in discount rate occurred

instantaneously—such as if a hard freeze were implemented—it would reduce the plan's measured funding ratio from 32 percent to 30 percent and increase annual contributions necessary to amortize SERS unfunded liabilities by about 11 percent. Under a soft freeze, as envisioned here, the discount rate would rise over the course of roughly 45 years as more long-term liabilities were eliminated.

This scenario suggests that, properly viewed, the transition costs of closing a public DB plan to new entrants while shifting to an investment portfolio more appropriate to the shrinking duration of liabilities are very small. For instance, CalPERS envisions that closing the plan suggests a gradual increase in the bond share of its portfolio from about 16 percent to around 60 percent once all participants are retired.[43] If one assumes a 3.0 percent bond return and a 3.5 percentage point equity premium, this suggests an ultimate reduction in the expected yield on CalPERS's investment portfolio from 5.9 percent to 4.4 percent, a difference of 1.5 percentage points. The Lucas-Zeldes results show that these results are founded in an overweighting toward stocks in CalPERS's initial portfolio, which is based on CalPERS's apparent view that for active employees, the plan should hold a portfolio with roughly twice the stock weighting that investment advisers would recommend for individual investors. The Lucas–Zeldes model shows that, in reality, the difference in expected yields between an open and a closed plan is far smaller, around 0.5 percentage point.

As noted above, the portfolios suggested by the Lucas-Zeldes model are for what might be called a truly fully funded plan, meaning a plan that could guarantee the payment of future benefit liabilities without imposing contingent liabilities on future generations to bail out the plan if needed. That is a substantially stronger level of funding than is termed full funding by most

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[43] CalPERS, "Impact of Closing the Defined Benefit Plan."

public plans, which instead aim to have a 40–50 percent chance of their investment portfolio being sufficient to meet future payments, with a recourse to future taxpayers more likely than not. For the transition costs argument, this means that claims from pension actuaries that an open plan may employ a very risky investment portfolio while a closed plan must hold only bonds are based on two different standards. In the first standard, the open plan is fully funding its obligations only in the looser, 50-percent-chance use of the term; taxpayers could still be on the hook in the future. In the second standard, the closed plan is truly fully funding what it owes in the sense that benefits could be paid without recourse to the taxpayer.

Consistency demands that investment-based transition costs be considered on a level playing field. If a plan sponsor is happy to impose contingent liabilities on future generations when a pension plan is open, it could continue to do so once the plan is closed. If so, the plan would gradually shift its stock-heavy investment portfolio to one that is slightly less stock heavy, with an expected return about 50 basis points lower. Because the government is the ultimate guarantor that pension liabilities will be paid, the general fund of the government would supplement the pension fund if needed and collect any final surplus that exists when the plan is fully closed. Alternatively, if the plan sponsor believes that a closed plan must invest conservatively, then logic dictates that an open plan should invest only slightly less conservatively, with a portfolio that at most returns about 50 basis points more per year.

A third alternative for pension stakeholders who still maintain that long time horizons negate investment risk is for the state or local government sponsoring a plan to offer a line of credit to a plan that is closed. The plan could maintain the same risk-heavy portfolio as when it was open and use the line of credit to extend the duration of the plan's investments. Should the plan require funds, it could call on its sponsor to make as-needed contributions, which, at least

according to plan advocates' logic, could eventually be repaid as time reduced the risk of plan investments. This view is not strongly supported by any evidence cited here, but it is a policy that is consistent with the arguments presented by plan advocates and allows for a DB plan to be closed without incurring any transition costs. However, the claims of substantial investment-based transition costs made by public pension actuaries and other stakeholders are based on a faulty view of pension investing in which a plan, without any stated rationale, can justify taking on almost unlimited risk with its investments.

Conclusions

Public employee retirement systems are constantly seeking ways to meet the rising costs of DB plans. The discussion above leads to several conclusions.

First, the pension plans of US public-sector workers take on substantially more investment risk than similarly situated private-sector workers are likely to take on in their retirement plans. CalPERS, the largest US public plan, invests more than twice as much in equities as would an individual investor of the same age following a 100-minus-age rule. US public plans also take on significantly greater investment risk than US corporate plans or public-sector plans in other countries. The best explanation for this greater risk-taking is accounting standards, which apply only to US public plans and allow the plans to credit themselves with higher returns on risky investments before those risks have borne out. This approach lowers current pension contributions, because contributions are based on the expected return on plan investments, but shifts an expensive implicit put option to future generations of taxpayers.

Second, a plan looking to truly fully fund its obligations—that is, to guarantee payment of future benefits without recourse to future taxpayers—would hold a significantly more

conservative investment portfolio. However, this does not mean an all-bond portfolio. Because stock returns may be correlated with wage growth over long time periods, a public plan may choose to invest in stocks. For a sample plan—Pennsylvania SERS—around 28 percent of assets dedicated to funding the liabilities of active employees, or around 15 percent of total plan assets, could rationally be invested in equities.

Third, a plan that became closed to new entrants—a soft freeze—would gradually shift to a less stock-heavy portfolio as the duration of its liabilities shortened. This more conservative portfolio would have a lower expected return. However, the extent of such a shift would be small—around 50 basis points in expected yield—and would take several decades to be realized. During this time, total plan liabilities should shrink as the pool of active participants shrinks. Thus, there would be no time at which total liabilities for a closed public plan would be larger than for the same plan had it remained open.

Thus, some support exists for the claim of investment-based transition costs: a closed plan would hold a safer, lower-yielding portfolio than a plan that remained open. But these differences are small and unimportant relative to the diminution of liabilities that would gradually take place as a DB plan were closed to new entrants. Policymakers have a number of reasons to support or oppose closing public DB pension plans and shifting employees to DC, CB, or hybrid pensions, but so-called transition costs should not be a major factor in those considerations.