

# In-depth: Risk Sharing in Public Retirement Plans

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NASRA is a non-profit association whose members are the directors of the nation's state, territorial, and largest statewide public retirement systems. NASRA members oversee retirement systems that hold more than two-thirds of the over \$4 trillion held in trust for 19.6 million working and 10 million retired employees of state and local government.

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# Introduction



One of the primary objectives of a retirement plan is to generate an adequate source of retirement income by allocating a portion of employees' compensation from their working to their retired years. Multiple factors affect the successful achievement of this objective, but certain factors are particularly important: the adequacy of contributions and investment returns, successfully anticipating the rate of inflation and how long plan participants will live. Each of these factors presents a risk, defined as the possibility of an event resulting in a financial loss compared to what is anticipated. For example, if investment returns fall short of expectations over a sustained period, a loss will ensue that must be recovered, either in the form of lower retirement income or higher required contributions, or both. In retirement plans, most risk comes in one of three forms:

- ▶ Investment risk, which is the possibility that investment returns will fall short of expectations
- ▶ Longevity risk, or the chance that the plan participant will live longer than projected or outlive their assets; and
- ▶ Inflation risk, or the risk that prices for goods and services will erode the value of a retirement benefit.

Defined benefit (DB) plans are the most common type of retirement plan, serving as the primary retirement benefit for the vast majority of public employees. DB plans typically assign most risk to the employer. By contrast, defined contribution (DC) plans, which are predominant outside of the public sector, place most risk on employees. A third type of retirement plan—hybrid plans—are intended to distribute risk among employees and employers, by combining elements of both plan types.

Within each of the three common types of retirement plan—DB, DC, and hybrid—risk may be assigned to employers and employees differently. How risk is distributed is a function of the retirement plan design, i.e., the framework of a retirement plan, including such characteristics as required contributions, the age and length of service need to qualify for benefits, the level of benefits, vesting periods, and who bears each of the plan's different types of risk.

For any retirement plan, a fundamental equation underlies its long-term ability to pay benefits:

$$C + I = B + E$$

**Contributions plus investment earnings equals benefits plus expenses.**

The revenue a retirement plan receives must, over time, equal the cost of the benefits and expenses the plan pays. Complying with this mathematical reality requires actuarial balance: the many assumptions and expectations used to estimate the required cost of a pension plan must be approximately correct over time. If (and in most cases, when) the plan's actuarial experience strays from assumptions, balance must be restored. If actuarial experience is worse than expected, balance must be restored through higher revenues, lower payments, or both. Who bears these costs, how, and when are questions that the retirement plan design must address.

Nearly every state in recent years enacted reforms to pension plans within their purview. As a result, although most public employers in the U.S. have retained DB plans, in many plans, more risk has shifted from employers to employees.

In some cases, these reforms reduced benefit



levels or increased contributions, or both, for participants who already were participating in the plan. For example, in certain states, retirees' future cost-of-living adjustments have been lowered, even though state statutes and the plan's benefit policy did not previously anticipate these reductions in benefits. Future cost-of-living adjustments were also reduced for some active, working public employees, and they were required to work longer, or until a higher age, before they would qualify for a retirement benefit. Some public employees also had higher contributions imposed upon them, and, in many cases, public employers were required to pay higher costs to make up for public pension fund investment and other shortfalls.

Changes like these might be thought of as de facto risk-sharing: plan participants learned that they were bearing some of the plan's risk, even though those risks were unknown and perhaps not understood previously.

Risk-sharing plans, as described in this paper, are different from traditional retirement plans in two important ways: first, compared to traditional DB and DC plans, they distribute risk among employees and employers; and second, they articulate who bears what risks and how, before the loss or gain actually transpires. This type of retirement plan design allows plan stakeholders to understand the rules in advance. Instead of retroactively applying the consequences of retirement plan risk after the negative outcomes are already experienced, shared-risk plans allow participants to understand and to anticipate the outcomes of risky events before they happen. Shared risk plans are intended to increase the predictability of financial outcomes resulting from both positive and negative events affecting plans, sponsors and beneficiaries.



**NASRA believes that certain elements of retirement plan design promote the achievement of core stakeholder retirement plan objectives. These features are:**

- ▶ **Mandatory participation in the employer-sponsored retirement plan**
- ▶ **Cost-sharing of the plan between employers and employees**
- ▶ **Retirement assets that are pooled and professionally invested**
- ▶ **A plan that is designed to replace a targeted level of income**
- ▶ **Lifetime benefit payouts, i.e., a benefit that cannot be outlived**
- ▶ **Survivor and disability benefits that accompany the retirement benefit**
- ▶ **Access to a supplemental, voluntary retirement savings plan**

A primary consideration for any retirement plan sponsor is which types of risk, and in what proportion, are most appropriately borne by individuals, and which risks are best borne collectively, by institutions. Some of the features of retirement plan design supported by NASRA are specifically intended to address matters of retirement plan risk. For example:

- ▶ Cost-sharing of the plan between employees and employers ensures that both parties will bear some portion of the plan cost.
- ▶ Pooling and investing assets professionally function as a form of insurance in which individuals transfer their risk to a group, effectively lowering overall plan risk. Shifting investment risk from individuals to the group optimizes the plan's risk and reward profile, as the group is better positioned to produce lower plan costs, higher benefits, or both, through



lower investment expenses and higher overall investment returns.

- ▶ Maintaining a plan that is designed to target a certain level of income reduces the risk of uncertainty for plan participants by informing them of what level of benefit the employer is providing. This enables individual plan participants to make decisions regarding any additional retirement income, which may be addressed partly or wholly through another recommended plan design feature, i.e., access to a supplemental, voluntary retirement savings plan.
- ▶ Lifetime benefit payouts address longevity risk: as with an insurance product, pooling the risk of how long participants will live produces lower costs and higher benefits than would be available were each participant left to manage their own individual retirement account.<sup>1</sup> Because of economies of scale, their long—effectively perpetual—investment horizon, and the lack of a profit motive, states and local governments generally are able to provide an annuity at a lower cost than financial services firms in the private sector.

These examples illustrate a fundamental premise underlying the concept of insurance: some forms of risk are better borne by a group, while others may be left to individuals. Indeed, manifold retirement plan outcomes present lessons into how to optimize retirement plan costs and benefits. Plans in which either employers or employees bear all, or substantially all, risk can lead to bad outcomes for plan stakeholders.

Plans in which risks are strategically and optimally assigned to stakeholders that are best positioned to bear those risks may be found to be more sustainable than plans that assign a disproportionate share of risk to stakeholders

that are not in a position to bear those risks.

The elements listed above reflect NASRA's position on retirement plan design for employees of state and local government. Each state and political subdivision that sponsors or participates in a retirement plan for its employees must make a determination as to the type of retirement plan and plan design that best enable the employer to achieve the objectives of its many stakeholders. NASRA endorses:

- ▶ Participation of all relevant stakeholders, including government employers, their plans, their employees, plan beneficiaries and retirement and other taxpayers in discussions and processes pertain to the design and financing arrangements of public retirement plans.
- ▶ Policy-driven decision-making that recognizes the retirement security and workforce management purposes of public employee retirement systems and that is based on objective and pertinent information that fairly reflects the long-term horizon and economic effects of public plan financing, benefit adequacy and benefit distributions.

The purpose of this paper is to increase knowledge and awareness of the wide variety of options that are currently being used to design and finance retirement benefits; it is not an endorsement of any particular plan design or feature. This paper describes risk-sharing features that are incorporated into public pension plans and provides case studies of specific

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plans that employ risk-sharing structures. NASRA acknowledges the assistance of each of the retirement systems highlighted in the case studies for the information provided to make this paper possible.

The shared-risk case studies are intended to identify and describe retirement plans and features embedded in retirement plans that comply with the recommended elements of retirement plan design described above, and that distribute risk among employees and employers according to a specific plan. In addition, the array of examples of risk sharing plan design also demonstrate that states can, and do, seek tailored solutions to pension plan benefit obligations that best meet the needs of their stakeholders.

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1 [Nari Rhee and Flick Fornia, "Still a Better Bang for the Buck: An Update on the Economic Efficiencies of Defined Benefit Pensions," National Institute on Retirement Security, December 2014](#)

# Types of Risk Sharing



# Variable Employee Contribution Rates

## Risk-sharing plan design features

Required employee contribution rates that may change based on the plan's actuarial experience.

A

As discussed in the [NASRA Issue Brief: Employee Contributions to Public Pension Plans](#), nearly all public employees are required to

contribute toward the cost of their retirement benefit. Employee contributions typically are established as a fixed percentage of salary in statute or by retirement board policy. In such cases, the employee contribution rate may be raised or lowered only by an act of legislation or change in policy. By contrast, some public pension plans maintain an employee contribution rate that varies, depending on the plan's investment performance or actuarial condition. In these cases, the employee contribution rate can be increased or decreased automatically depending on predetermined factors.

Compared to a fixed contribution rate, a variable employee contribution rate exposes employees to risk, especially investment, longevity, and inflation risk. A pension plan's condition is affected by investment performance, longevity experience, and other actuarial factors; actuarial experience pertaining to these factors drives changes in the plan's required cost. Plans with variable employee contribution rates expose employees to a portion of the risk associated with adverse investment or actuarial events that might cause the plan's funding condition to decline and required cost to increase. In most cases, this arrangement also enables employees to benefit from any improvements in the plan's funding condition and commensurate decrease in required cost through lower

employee contribution rates.

**Variable contribution rates are longstanding features of some plans, while other plans more recently adopted variable rates.** Below are different types of variable contribution rates and examples.

## Total Actuarially Determined Cost Driven

Some states set employee contribution rates in relation to the total actuarially-determined contribution rate. This variable contribution rate approach for employees represents the most direct exposure to total plan experience among those states using this risk sharing mechanism. Some states share equally, while others provide some ratio to risk exposure:

- ▶ Total required contribution rates for the **Arizona State Retirement System, Nevada Public Employees Retirement System, and Wisconsin Retirement System** are actuarially determined and shared equally by employees and employers. If actuarial experience requires an adjustment to the total contribution rate, in either direction, the increase or decrease is shared in equal amount by each group. This risk sharing approach exposes both the employer and the employee to the same financing risk for the plan.
- ▶ Public safety officers who first participate in the **Arizona Public Safety Per-**



## Compared to a fixed contribution rate, a variable employee contribution rate exposes employees to risk, especially investment, longevity, and inflation risk

**sonnel Retirement System** beginning July 1, 2017, and who elect or default into a combination hybrid plan, are required to contribute one-half of the total defined benefit plan contribution rate.

- ▶ 2018 legislation established a risk-sharing cost management mechanism for the **Colorado Public Employees' Retirement Association** (PERA) that

is based on the relationship between PERA's blended total statutory contribution rate and the actuarially-determined contribution (ADC) rate, which reflects the plans' required cost and can change depending on actuarial experience affecting the plans' funding condition. When the blended total PERA required contribution rate is less than 98 percent of the ADC, employer and employee contribution rates are increased by 0.5 percent annually, with total increases capped at 2.0 percent. When the PERA contribution rate is equal to or greater than 120 percent of the ADC, the employer and employee rates are commensurately reduced, but not below the current contribution rates.

- ▶ The **Public Employee Retirement System of Idaho** board may increase the total contribution rate, with the amount of the increase shared between employees and employers.
- ▶ The total contribution rate for the **Iowa Public Employees' Retirement System** is actuarially determined for each membership class within the system. Statute directs employees to pay 40 percent of the total rate, with employers responsi-

ble for the remaining 60 percent. Also, the IPERS board has authority to adjust the total contribution rate up, or down, by one percent annually.

- ▶ Effective in fiscal year 2020, contribution rates for the **Maine Public Employees' Retirement System** Participating Local District (PLD) Consolidated Retirement Plan are determined by a new methodology that shares risk between employees and employers. Contribution rates will be subject to annual change based on a 55/45 percent employer/employee split. Contribution rates are capped at 12.5 percent and 9.0 percent for employers and employees, respectively.
- ▶ Members of the **Michigan Public School Employees' Retirement System** (MPERS) hired on or after February 1, 2018, are required to select from one of two plan options: a default defined contribution plan, or a combination defined benefit/defined contribution hybrid plan. Those who elect to participate in the hybrid plan must contribute 50 percent of the total plan contribution rate, which changes to reflect actuarial experience gains and losses. Any unfunded liability created as a result of the employers' failure to pay their share of the required cost does not result in a corresponding increase to the employee rate. This plan design is described more fully in the MPERS case study ([see page 33](#)).
- ▶ Members of the **Pennsylvania State Employees' (SERS) and Public School Employees' (PSERS) Retirement Systems** hired beginning January 1, 2011, and July 1, 2011, respectively, are subject to a "shared-risk/shared-gain" provision that could result in a higher

or lower employee contribution rate depending on fund investment performance. The shared-risk (gain) portion of the rate is equal to 0.5 percent of salary for every 1.0 percent that the SERS or PSERS investment return is less (greater) than the assumed rate, for a 3-year period, capped at 2.0 percent above (below) the basic contribution rate. Legislation in 2017 established the shared-gain provision for these members and raised the shared-risk/shared-gain contribution rate to 0.75 percent of salary, not to exceed 3.0 percent above or below the basic contribution rate, for SERS and PSERS members hired on or after January 1, 2019, and July 1, 2019, respectively.

- ▶ Employees participating in the **Utah Retirement Systems** first hired on or after July 1, 2011, may elect to participate in a hybrid plan or a defined contribution plan. For those electing or defaulting into the hybrid plan, employee contributions are required when the cost of the defined benefit portion of the plan exceeds 10 percent of covered pay (12 percent for public safety). No employee contributions are required if the plan's cost is below that threshold; and to-date, no employee contributions have been required. This plan design is described more fully in the URS case study ([see page 51](#)).

## Normal Cost Driven

Employee contribution rates for some plans are established in relation to the normal cost or the cost of the benefit accrued by participants of the plan each year, which can result in a variable rate. The risk exposure to employees is less under this arrangement than one in which

the total plan contribution rate is shared because changes in the size of the plan's unfunded liability do not affect the normal cost.

- ▶ Members of the **Connecticut State Employees' Retirement System** hired beginning July 1, 2019, are required to make additional contributions of up to one-half of any increase in the normal cost rate resulting from the plan's investment return falling below the plan's 6.9 percent assumed rate of return, with the total increase capped at 2.0 percent. This provision does not account for smoothing or other actuarial methods that limit recognition of an actuarial loss. In the event that changes to actuarial assumptions produce an increase in the normal cost, stakeholders must consider whether or not an increase to the employee contribution rate is appropriate.
- ▶ Members of the **California Public Employees' Retirement System**, the **California State Teachers' Retirement System**, and many other local government employees California hired since January 1, 2013, are required to contribute at least one-half of the annual normal cost of their pension benefit.

## Milestone Driven

In some cases, employee contribution rates are maintained until such time as specified funding or actuarial developments are achieved. For example:

- ▶ Members of the **Montana Public Employees Retirement System** contribute 7.9 percent of salary, which will be reduced to 6.9 percent when the plan's actuarial valuation determines that the amortization period is below 25 years.

- ▶ Members of the **Montana Teachers' Retirement System** contribute 8.15 percent of salary, which reflects a base contribution rate of 7.15 percent plus a 1.0 percent supplemental contribution rate which can be reduced by their board when certain criteria are met for improving the plan's actuarial condition.
- ▶ The employee contribution rate for the **North Dakota Teachers' Fund for Retirement** has increased from 7.75 percent in fiscal year 1998 to 11.75 percent as of fiscal year 2015, and state law directs the rate to return to 7.75 percent once the plan attains 100 percent-funded status.



# Contingent or Limited Cost-of-Living Adjustments

## Risk-sharing plan design features

A retirement benefit adjustment contingent upon or whose level is affected by external factors, such as the funding level of the plan or its fund's investment performance; or that is dependent on the retiree's age or length of retirement.

### A

A cost-of-living adjustment (COLA)<sup>1</sup> is a retirement plan feature whose purpose is to reduce or offset the effect of inflation on the purchasing power of a retirement benefit. Many public pension plans include a COLA that is automatic, meaning the increase is provided without required action by the pension plan sponsor, such as a legislature, city council, or retirement board. This type of benefit is calculated as part of the normal cost and is typically prefunded as part of the actuarial contribution rate.

The [NASRA Issue Brief: Cost-of-Living Adjustments](#) discusses how, in most cases, automatic COLAs are linked to some external factor, typically the rate of inflation. Appendix A of the Issue Brief lists COLA provisions that are in place for statewide and other public pension plans, including those with risk-sharing features. Most automatic COLAs are capped or limited in the annual amount of the adjustment; for example, some automatic COLAs provide an annual increase of the rate of actual inflation, not to exceed two percent. By contrast, other COLAs are simply a fixed percentage increase, such as two percent, regardless of the actual rate of inflation.

By providing an automatic COLA tied to the rate of inflation, the cost of the COLA is included as part of the cost of the plan, a cost that typically is shared by employers and employees. When actual inflation exceeds the

amount of the COLA, employees bear the risk of inflation above the amount provided by the COLA through reduced purchasing power of their retirement benefit. A COLA shares risk between plan participants and employers when it protects a retirement benefit against only a portion of the full rate of inflation or when the COLA protects only a portion of the retirement benefit against inflation. Each of the variations of public pension COLAs discussed below is a form of risk-sharing between employees and employers. For example, in the case of a pension plan that provides a COLA tied to the rate of inflation up to two percent, if inflation is three percent, the risk and cost of the first two percent of inflation is part of the cost of the plan, typically shared by and employees and employers, and employees alone bear the risk—and cost—of the additional one percent.

Some public pension plan sponsors do not provide an automatic COLA, and others eliminated COLAs in recent years. For example, the Florida Legislature in 2010 eliminated all future COLA service credits for plan participants, meaning that service accrued after that date will not qualify for a COLA benefit. Similarly, in 2012, the Wyoming Legislature approved a bill prohibiting payment of any COLA until the plan reaches full funding, “plus the additional percentage the retirement board determines is reasonably necessary to withstand market fluctuations.”<sup>2</sup> Plans such as these

**When actual inflation exceeds the amount of the COLA, employees bear the risk of inflation above the amount provided by the COLA through reduced purchasing power of their retirement benefit**

that do not provide a COLA effectively expose participants to all inflation risk.

### **Delayed Onset/ Minimum Age of Eligibility**

In the case of a COLA that requires retirees to wait a certain period of time or to attain a certain age, employ-

ees bear the risk of inflation for the duration of the waiting period. Once the employee qualifies for the COLA, the employer bears the risk, up to the limit of the benefit, if applicable. As an example, participants in the New York State & Local Retirement System and the New York State Teachers' Retirement System qualify for a COLA at age 62 with five years retirement or at age 55 and retired 10 years. This COLA creates an incentive for participants to work longer and reduces the length of time employers must protect retirees against the effects of inflation. Employees working longer and receiving a COLA for a shorter period each are plan provisions that reduce the cost of the plan.

### **Applied to Only a Portion of the Benefit**

Although most automatic COLAs for public employees apply to the full retirement benefit, COLAs in several states are applied to only a portion of the benefit. Massachusetts, for example, limits COLAs for state employees and teachers to the rate of inflation, not to exceed 3 percent annually, applied to only the first \$13,000 of benefits. Retirees with benefits above this threshold bear all inflation risk

for that portion of their benefit, as well as all inflation risk when inflation exceeds 3 percent. Employers are not responsible for bearing the risk—and cost—of inflation above these thresholds.

### **Tied to Investment Performance**

A variety of approaches are in place among public pension plans to link investment returns to COLA provisions. Because a pension plan's funding condition often is significantly affected by its fund's investment performance, linking the provision of a COLA or the size of the COLA to a plan's investment performance can foster risk-sharing between the employer and plan participants. Strong investment returns can be shared with retirees via a benefit adjustment and also can serve to reduce employer plan costs. A COLA whose provision is based on the achievement of a specific investment return, or threshold, effectively distributes some portion of both inflation and investment risk to retired participants.

Similarly, some plans provide a COLA only if investment performance reaches a certain threshold, such as the plan's actuarial investment return assumption. For example, many retired members of the Maryland State Retirement & Pension System are eligible for an automatic annual COLA of 2.5 percent as long as the fund's investment return in the previous year was greater than or equal to the system's assumed rate of investment return (which is presently 7.45 percent). If the prior year's assumed rate of return was not achieved, then the COLA is equal to the lesser of 1.0 percent or the increase in CPI.

As discussed in the Wisconsin Retirement System (WRS) case study ([see page 55](#)), the WRS administers a post-retirement cost-of-living

benefit for retirees that the plan refers to not as a “COLA” but as a “benefit adjustment.” The amount of retirees’ benefit can rise or fall in a given year depending on the fund’s investment performance, smoothed over a five-year period. The retirement benefit can never fall below a floor established as the initial retirement benefit level. Wisconsin’s risk-sharing post-retirement benefit feature is credited as a key factor contributing to the plan’s solid funding level and relatively low and stable costs over many years. This feature works as a relief valve reducing pressure on plan benefit payments following periods of relatively poor investment performance and rewarding retirees only after periods of strong investment performance.

The Louisiana State Employees’ Retirement System provides a COLA based on both the plan’s funding level and the plan’s investment return. For the plan to provide a COLA, its funding level must be at least 55 percent and the fund’s investment return must be positive. When the investment return exceeds the plan’s investment return assumption and the plan’s funding level is above 55 percent, a COLA is paid based on the actual rate of inflation and limited depending on the plan’s funding level.

## Contingent Upon Actuarial Soundness of the Plan

As discussed in the South Dakota Retirement System (SDRS) case study ([see page 41](#)), the SDRS COLA is based on the actual rate of inflation, with a minimum annual increase of 0.5 percent and a maximum of 3.5 percent. The maximum is further limited to the percentage that, if assumed to be paid in all future years, is projected to result in a funded ratio of at least 100 percent. The first COLA paid in 2018 under this new provision was 1.89 percent, based on the June 30, 2017, actuarial valuation. With future COLAs assumed to equal 1.89 percent,

the plan’s funded ratio is 100.1 percent, indicating that SDRS has sufficient assets to afford an ongoing COLA at this rate while remaining fully funded. This calculation will be performed anew each year using updated factors of the plan’s funding level and the actual rate of inflation. **The design of this COLA helps the SDRS meet several important policy objectives, including paying some COLA each year, minimizing the negative effect a COLA might have on the plan’s funding level, and maintaining the plan’s fixed contribution rates.**



## Employee-funded

Upon retirement, participants in the Nebraska State Employees’ Retirement System may elect to take an actuarial reduction in their benefit to fund a permanent, annual 2.5 percent COLA. Retirees who select this option are taking on longevity risk: those who die before their actuarially-assumed age will receive lifetime benefits that are lower than projected, and the employer will experience an actuarial gain. Conversely, retirees who outlive their actuarially-assumed age will receive more in lifetime benefits than projected, creating an actuarial loss for the employer. In either case, by providing a COLA that is paid for only by plan participants, the employer shifts all inflation risk to retirees. Retirees in the Nebraska plan who do not elect the COLA are bearing inflation risk: these retirees accept a higher initial benefit that is likely never to change, exposing the retiree to whatever inflation ensues during the remainder of their life.

1 The term “cost-of-living adjustment” (COLA) is used here to refer to post-retirement benefit adjustments whose chief or sole purpose is to offset the effects of inflation on a retirement benefit. Some public retirement systems that administer post-retirement benefit adjustments refer to this benefit using terms other than as a COLA.

2 [WY Stat § 9-3-453 \(2014\)](#)



# Cash Balance Hybrid Plans

## Risk-sharing plan design feature

A retirement benefit based on an account balance with a credited investment return that is lower than the plan's expected investment return, determined actuarially based on the retiree's age at retirement, and that may share positive investment experience with plan participants.

A

A cash balance (CB) plan is an employer-sponsored retirement benefit combining elements of both defined benefit (DB) and defined contribution (DC) plans. Compared to DB plans, CB plans place more risk—especially investment and longevity risk—with plan participants. As with DB-DC hybrid plans (discussed on page 21), CB plans also provide a fixed level of retirement income, combined with a level of retirement income that is variable. Unlike DB-DC plans, which are made up of two distinct plans, CB plans provide retirement income from a single source, i.e., the cash balance plan itself.

As with DB plans, CB plans require participants to reach a designated age, years of service, or both, in order to qualify for a retirement benefit. CB plans also provide a lifetime retirement benefit once the plan participant qualifies and retires, and—like DB plans—cash balance plan assets are pooled and professionally invested in diversified portfolios. CB plan participants do not manage or invest their assets, and their lifetime benefits are ultimately based on investment credits and actuarial assumptions and methods used to annuitize the cash balance at retirement.

CB plan retirement benefits are determined by the value of the participant's retirement

account (their cash balance) and their age at retirement. By contrast, DB plans use a formula that includes the plan participant's years of service, average salary, and a multiplier. The benefit from a CB plan is determined by annuitizing the participant's cash balance at retirement. The older the participant, the higher the benefit or annuity will be. This manner of determining the benefit level in a CB plan is more consistent with that of a DC plan in cases when a DC plan is annuitized. In practice, few DC plans are actually annuitized.

CB plans feature hypothetical participant accounts, also known as notional accounts, whose balance is based on the sum of contributions paid into the account, typically by employees and employers, and the annual investment credits applied to those contributions. A CB plan normally provides a guaranteed minimum annual rate of interest credit, such as 4.0 percent, which is specified as part of the plan's design, and can be changed only by its governing authority.

The annual interest credit is the amount that CB accounts are increased each year (beyond contributions by employers and employees), regardless of the plan's actual investment return. Among CB plans in the public sector, annual account balance credit rates range from less than 3.0 percent up to 7.0 percent. CB plans may apply a higher credit rate to ac-

**CB plan retirement benefits are determined by the value of the participant's retirement account (their cash balance) and their age at retirement**

counts when the plan's investment experience is strong, and as shown below, some public sector CB plans regularly do so.

A cash balance plan reduces the employer's investment risk by promising a retirement benefit that relies on an investment credit that is characteristically lower than the expected investment return of a typical defined benefit plan. **Compared to a DB plan, a CB plan places more longevity risk on plan participants by providing a retirement benefit that is based on the employee's age at retirement.**

For example, an employee who retires at age 65 will receive a larger benefit than one who retires at age 55 with the same cash balance amount: actuarially, the younger retiree is expected to live longer and therefore will receive more benefit payments, making the actual cost to the plan identical for each retiree. By contrast, a typical DB plan may reduce benefit payments for early retirement but otherwise places longevity risk on the employer, as the amount of a DB plan benefit is not based on the employee's age at retirement. The exception is when the retiree selects some type of joint annuity option.

Relatively few states and cities sponsor CB plans for their employees, but this number is growing: since 2002, three states—Kansas, Kentucky, and Nebraska—have added new CB plans. A listing of statewide CB plans, with information describing their terms and benefits, is provided below.

### CB plans in use among states

The following discussion briefly describes the statewide cash balance plans that are currently in place for broad employee groups, and the accompanying table, *Key Characteristics of Cash Balance Plans*, presents key facts about each plan.

### Texas

The two oldest active CB plans in the public sector are the Texas Municipal Retirement System (created in 1947) and the Texas County & District Retirement System (created in 1967). These are large statewide retirement plans covering tens of thousands of plan participants. As of fiscal year 2017, the TMRS funding level is approximately 87 percent, with an average employer contribution rate of 13.5 percent. The TCDRS has an actuarial funding level of 89 percent and an average employer contribution rate of 12.3 percent. As with a typical DB plan, the funding shortfall in these plans is caused by actuarial experience that differs from expectations. Although each plan has a unique actuarial experience, these shortfalls are due chiefly to variances in each plan's demographic and financial experience relative to actuarial assumptions.

The TMRS and TCDRS are structured to give employers flexibility in the design of their retirement plan, to help employers meet their individual human resources management needs. The systems administer agent plans, meaning that each of their hundreds of employer members have their own actuarial experience and plan cost, rather than sharing an actuarial experience and costs with other employers. TMRS and TCDRS also permit their employer members to select benefit levels from a prescribed range of choices, including the normal retirement age, vesting period, and years of service needed to qualify for a normal retirement benefit. Employers may also select from a range of options for employee contribution rates, and employers may elect whether or not provide a COLA, and if so, at what level.

### California

In addition to its primary DB retirement plan, the California State Teachers' Retirement System (CalSTRS) administers two cash balance





plans: one for part-time community college employees and one that supplements the DB plan for full-time educators.

The CB plan for community college employees was created in the 1990s to provide retirement benefits for part-time employees. The plan covers approximately 40,000 members, nearly all of whom are active participants, as the plan is young and most participants have not reached retirement eligibility. As of 2017, the plan's actuarial funding level was over 115 percent.

The other CalSTRS plan is the Defined Benefit Supplement (DBS) plan. CalSTRS members who participate in the DB plan are also required to participate in the DBS plan, which is a supplemental cash balance plan. The DBS plan was created in 2000 to provide supplemental retirement benefits to members of the DB program for earnings that cannot be used for determining the benefit under the DB plan. The DBS covers approximately 640,000 members, around two-thirds of whom are active plan participants. The plan also has about 63,000 retirees. Only CalSTRS DB plan members who have retired since 2001 receive some benefit from the DBS plan. As of 2017, the plan's actuarial funding level was about 118 percent.

The annual interest credit on both CalSTRS CB plans is linked to the U.S. Treasury rate, resulting in a more modest interest credit compared to other public sector CB plans. The CalSTRS board considers paying an additional earnings credit (AEC) above the minimum guaranteed rate when the plan's funding level is at least 113 percent; the CalSTRS board has regularly distributed an AEC.

## Nebraska

Cash balance plans in Nebraska became effective in 2003 for new state hires and newly hired employees of most counties in the state,

replacing the DC plans established in the 1960s provided for previously hired employees. As of 2018, the Nebraska State CB plan had an actuarial funding level of 104.2 percent, and the County CB plan had an actuarial funding ratio of 107.5 percent.

Nebraska statutes permit the Public Employees' Retirement Board to grant benefit improvements (which take the form of additional interest credits applied to plan accounts) if the plans have no unfunded actuarial accrued liability, and as long as the improvement does not cause an increase in the required cost of the plan above a designated threshold. (This provision is consistent with COLA provisions in South Dakota and Wisconsin, discussed elsewhere in this paper, that require that provision of a COLA will not impair the plan's funding condition.) Since the plans' inception, state and county plan participants have received benefit enhancements—interest credits above the guaranteed minimum—seven times, or in one-half of the available years. The average annual increase during this period has been approximately 2.5 percent.

## Kansas and Kentucky

The Kansas PERS CB plan was established in 2011, applying to all new hires beginning January 1, 2015. The Kentucky CB plan was established in 2013 for new state and local government employees (not teachers) hired beginning January 1, 2014. The new CB plans in both states replaced DB plans previously provided to employees; assets for both CB plans are pooled with their respective systems' legacy DB plans and do not receive a separate actuarial valuation.

Relatively few states and cities sponsor CB plans for their employees, but this number is growing

## Key Characteristics of Cash Balance Plans

Year plan approved	Employee groups affected	Contributions	Rate of return applied to cash balances	Benefit payment options
<b>CA State Teachers</b> 1995 for the Cash Balance Benefit Program; 2000 for the Defined Benefit Supplement	The Cash Balance Benefit Program is optional for part-time and adjunct educational workers; the Defined Benefit Supplement is a cash balance plan provided to full-time educators	EEs in the Cash Balance Benefit Program typically pay approximately 4% of earnings, depending on local bargaining agreements; Defined Benefit Supplement EEs contributed 2% from 2001-2010. Beginning in 2011, ER and EE contributions to the Defined Benefit Supplement are 8% each on compensation in excess of one-year of service credit. ER must contribute at least 4% for Cash Balance Benefit participants and the combined EE/ER rate must be at least 8%	Guaranteed minimum interest rate is based on 30-year U.S. Treasury bonds for the period from March to February immediately prior to the plan year (2.89% for plan year 2018-19)	Lump-sum and/or monthly lifetime annuity or period certain monthly annuity
<b>KS PERS</b> 2012	Mandatory for EEs of state and local government, including education employees, hired after 1/1/15	EEs contribute 6% ER pay credits are between 3-6% depending on how long the member has been employed. ER contributions are actuarially determined (subject to statutory caps)	Members are guaranteed an annual rate of return of 4% on their accounts. Accounts may also receive a dividend credit equal to 75% of the investment returns above 6%, calculated on a 5-year rolling average	Retiring participants may annuitize their cash balance and may elect to take up to 30 percent as a lump sum. Participants may also elect to use a portion of their balance to fund an auto-COLA
<b>KY RS</b> 2013	Mandatory for new state and local EEs, judges, and legislators who become members on or after January 1, 2014	EEs contribute 5%; public safety EEs contribute 8% State contributes 4%; 7.5% for public safety EEs	Employee accounts are guaranteed 4% annual return; accounts also receive 75% of all returns above 4%	Member may choose annuity payments, a payment option calculated as the actuarial equivalent of the life annuity, or a refund of the accumulated account balance

\* EE = employee; ER = employer



Year plan approved	Employee groups affected	Contributions	Rate of return applied to cash balances	Benefit payment options
<p><b>NE County and State</b></p>	<p>2002</p> <p>Mandatory for county and state EEs* hired after 2002 and those hired previously who elected to switch from the DC plan</p>	<p>State EEs contribute 4.8%, county EEs contribute 4.5%</p> <p>State contributes 156% of EE rate; counties contribute 150% of EE rate</p>	<p>Based on the federal mid-term rate plus 1.5%. When the mid-term rate falls below 3.5%, EEs receive a 5% minimum credit rate.</p> <p>When favorable returns combine with an actuarial surplus, the governing board may approve a dividend payment to EE accounts</p>	<p>Retiring participants may annuitize any portion of their cash balance and take a lump sum of any remainder. Members electing an annuity may also elect to take a reduced benefit with an automatic annual COLA</p>
<p><b>TX County and District</b></p>	<p>1967</p> <p>Mandatory for EEs of 600+ counties and special districts that have elected to participate in the TCDRS</p>	<p>EEs pay 4%, 5%, 6%, or 7% depending on ER election.</p> <p>ERs pay normal cost plus an amount to amortize the unfunded liability; as of 2017, the plan's amortization period is 20 years</p>	<p>7% (set by statute), used to reduce ERs' costs. Members' accounts receive an annual interest credit of 7% as specified by statute.</p>	<p>Lifetime annuity based on EE final savings account balance, less any EE-elected partial lump-sum payment, plus ER matching</p>
<p><b>TX Municipal</b></p>	<p>1947</p> <p>Mandatory for EEs of 800+ cities that have elected to participate in the TMRS</p>	<p>EEs pay 5%, 6%, or 7%, depending on ER* election</p> <p>ER pays 100%, 150%, or 200% of EE rate, also depending on ER election, plus an needed amount to amortize UAAL within a 25-year closed amortization period</p>	<p>5% (set by statute): The TMRS Board determines the allocation of any excess amounts; the board is authorized to distribute such amounts a) to reduce cities' unfunded liabilities; b) to EEs' individual accounts, and/or c) to a reserve to help offset future investment losses</p>	<p>Lifetime annuity based on EE final account balance, including ER matching and other credits, less any partial lump sum, depending on EE election</p>

\* EE = employee; ER = employer



# DB-DC Hybrid Plans

## Risk-sharing plan design features

A traditional defined benefit pension plan with a reduced benefit accrual rate, combined with a defined contribution plan.

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As discussed in the [NASRA Issue Brief: State Hybrid Retirement Plans](#), one of the earliest forms of risk-sharing in retirement plans is the

DB-DC hybrid plan, an employer-sponsored retirement benefit that features a traditional defined benefit (DB) plan coupled with a separate defined contribution (DC) plan. Although the two plans operate independently of one another, they typically are administered by the same retirement system; both are mandatory from a participation perspective and their employer and employee contribution requirements vary among systems. Like cash balance plans ([see page 15](#)), DB-DC plans provide a retirement benefit tied partly to market performance: the DB portion of a DB-DC plan is fixed and guaranteed, based on the employee's salary and length of service; and the DC portion is variable, based on the amount of contributions, the investment performance of invested contributions, and the employee's decision regarding the treatment of DC plan assets after terminating or retiring.

Because the DB plan component of DB-DC plans provides a lower multiplier than most other public sector DB plans, this component provides a more modest pension benefit than most public sector DB plans. For example, a DB-DC plan that features a retirement multiplier of 1.0 percent will produce a promised benefit equal to one-half of the amount that would be provided by the same plan with a multiplier of 2.0 percent. The employer's level

of risk in such a plan is half of what it would be under that same plan. Other than the lower multiplier, with its lower benefit and reduced level of employer risk, the DB component of DB-DC plans sponsored by states generally is identical to stand-alone DB plans: they provide a lifetime benefit that is based on the employee's length of service and final average salary.

**DB-DC plans provide a retirement benefit tied partly to market performance: the DB portion of a DB-DC plan is fixed and guaranteed, based on the employee's salary and length of service; and the DC portion is variable, based on the amount of contributions, the investment performance of invested contributions, and the employee's decision regarding the treatment of DC plan assets after terminating or retiring**

The DC plan component of DB-DC plans sponsored by states is similar to 401k plans in the private sector, placing all or most risk on the plan participant. DB-DC plan participants are responsible for making decisions regarding their investment choices and how their assets are managed, both during their working years and after they leave employment, whether through termination, retirement, disability, or death.

## DB-DC plans provide a lifetime benefit that is based on the employee's length of service and final average salary

The oldest DB-DC plan is the one administered by the Indiana Public Retirement System, which since 1955 has maintained these plans for public school teachers, state employees, and employees of political subdivisions in the state that have elected to participate. The Indiana PRS investment function developed and maintains proprietary investment funds available only to plan participants.

More recently, in 1996, the Washington Department of Retirement Systems established a DB-DC plan for certain new hires. Since then, other states established new DB-DC hybrid plans, either on an optional (meaning the employee could choose between the traditional DB plan or the DB-DC hybrid) or mandatory for new hires. Two states—Oregon and Rhode Island—established new DB-DC hybrid plans, in 2004 and 2011, respectively, switching many current active participants from a DB plan to the new hybrid plan. The more common method for establishing DB-DC hybrid plans is to require participation for new hires only and to permit existing DB plan participants to elect to join.

DC plans administered by the Washington Department of Retirement Systems as part of their DB-DC hybrid plans permit participants to invest in a portfolio that emulates the one in which DB plan assets are invested. This investment option provides participants with access to some asset classes, such as alternative investments that participants may not access otherwise, and at a relatively low cost.

Most plans provide life-cycle funds, which are funds that adjust the mix of investments in stocks and bonds based on a participant's age or projected retirement date. Each DB-DC plan maintains a default investment option for participants who fail to make an active election as to how their assets should be invested; default investments in many cases are life-cycle funds.

Similar to 401k plans, the DC component of DB-DC hybrid plans imposes all or most of the plan's risk on participants. The DC component places responsibility on participants for making investment choices and determining how the plan's assets are used upon termination, through changes in employment status, retirement, disability, or death.

Financing arrangements for both the DB and DC plan components vary by plan: for some plans, employers pay the full cost of the DB component, and in other cases, that cost is shared with employees. Similarly, cost-sharing arrangements for DC plans also vary.

The accompanying table, *Summary of Key Features of Select DB-DC Plans*, presents basic plan design and financing arrangements for selected DB-DC plans sponsored by states. Each of the DC plans listed provide a range of risk-based investment options, from conservative to aggressive. Some investment options are proprietary funds developed and maintained by the sponsoring retirement system, accessible only to participants in that plan. Other options provide access to retail mutual funds. Several plans offer access to a brokerage window, permitting participants to trade in individual equities and other securities.

The table also lists the withdrawal options available to participants who terminate or retire. Each plan permits participants to take all or part of their DC plan assets as a lump sum or to roll the assets over to another retirement plan. In addition, some of the plans permit annuitization of DC plan assets, which converts the assets into a lifetime retirement benefit. Annuities may be sponsored by the retirement plan, while in other plans, annuities are purchased through a third-party provider.

## Summary of Key Features of Select DB-DC Plans

	DB benefit formula (having met age/service requirements)	DB plan contributions	Employer DC plan contributions	Employee DC plan contributions	DC plan investment options	Default DC plan investment options	DC plan withdrawal options
<b>Arizona Public Safety Personnel</b>	Graded multiplier ranging from 1.5% (with 15 years) to 2.5% (with 25 years) depending on years of service x years of service x final average salary = annual benefit	EE and ER contribute 50% of the total plan contribution rate	3.0%	3.0%	Menu of options including target date funds, index funds, mutual funds, and bond funds	Target date fund based on a retirement age of 65	Rollover, lump sum, annuity
<b>Colorado Fire &amp; Police Pension Plan</b>	1.5% x years of service x highest average salary = annual benefit	The board of directors of FPPA annually determines the DB/DC split of the contributions to the plan.	Any excess amount not needed to fund the DB plan is contributed to the Money Purchase Plan.	Any excess not needed to fund the DB plan is contributed to the Money Purchase plan.	19 options, including a broad range of fixed income and equity funds, 11 target date funds, and a brokerage window	Age appropriate Target Date Fund	Lump sum, monthly periodic payments, monthly lifetime benefit, annuity from outside provider
<b>GA Employees' RS</b>	1% x years of service x final average salary = annual benefit	EE contributes 1.25% and ER contributes the remainder of the annual actuarially determined contribution rate	100% ER match on EE's 1st 1% of salary and 50% match on next 4% of salary for a maximum ER contribution of 3%	EEs hired before 7/1/14 auto enroll at 1% of salary contribution; EEs hired as of 7/1/14 auto enroll at 5% of salary; EEs may vary contribution rate up or down; participants may opt-out of the DC plan within 90 days of their date of hire	15 options ranging from conservative to aggressive, plus 6 lifecycle funds	Lifecycle funds based on age	Rollover, annuity, lump sum, partial lump sum, installments

## Summary of Key Features of Select DB-DC Plans (continues)

	DB benefit formula (having met age/service requirements)	DB plan contributions	Employer DC plan contributions	Employee DC plan contributions	DC plan investment options	Default DC plan investment options	DC plan withdrawal options
<b>Indiana Public RS</b>	1.1% x years of service x final average salary = annual benefit	ER funds the DB benefit	None	3% of salary	7 options ranging from conservative to aggressive, and 10 target date funds, all administered by the retirement system	The Guaranteed Fund, which earns a fixed rate established annually by the Board	Annuity, rollover, partial lump sum and annuity, deferral until age 70½
<b>Michigan Public Schools RS</b>	1.5% x years of service x final average salary = annual benefit (normal retirement age is subject to change based on mortality tables)	EE contributes on a graduated scale based on pay; ER contributes an actuarially determined amount. New hires after 1/31/18 contribute 50% of the total plan contribution rate of 12.4%	ER matches 50% of EE's contributions, up to 1%	2% of salary	Choice of active and passive investment options, target date funds, and a brokerage age window	Target Retirement Fund that matches the year the participant will be eligible to retire	Lump sum, consolidation from other plans, direct rollover to an IRA, periodic distribution
<b>Ohio Public Employees' RS</b>	1% x up to 35 years of service x final average salary + 1.25% x years in excess of 35 x final average salary = annual benefit	ER funds the DB benefit	None	10% of salary	16 OPERS-sponsored funds including core and target date funds, plus a brokerage window	Target date fund closest to the year the participant turns 65	Annuity, including partial lump sum, lump sum or rollover
<b>Ohio State Teachers' RS</b>	1% x years of service x final average salary = annual benefit	2% of EE and ER contributions fund the DB benefit	None	12% of salary	8 STRS Ohio-sponsored options ranging from conservative to aggressive plus a guaranteed return option and target date funds	Earliest target date fund	Annuity including partial lump sum, lump sum or rollover

DB benefit formula (having met age/service requirements)	DB plan contributions	Employer DC plan contributions	Employee DC plan contributions	DC plan investment options	Default DC plan investment options	DC plan withdrawal options
<b>Oregon PERS</b> Varies depending upon date of hire and which of 3 DB plans EE is enrolled in	ER funds the DB benefit	Optional	6% of salary	Effective 1/1/18: 10 Oregon PERS sponsored target date funds, Previously all DC plan contributions were invested in a single, pooled fund that mirrors the DB plan fund	Target date fund based on year of birth	Lump sum payment or in installments over a 5, 10, 15, or 20-yr period or the EE's anticipated lifespan
<b>Rhode Island ERS</b> 1% x years of service x final average salary = annual benefit	State EEs and teachers contribute 3.75% to the DB plan; muni EEs contribute 1% or 2% based on COLA choice; municipal police and fire contribute 9% or 10% based on COLA choice.	ER contributes between 1-1.5% for EEs covered by Social Security, and between 3-3.5% for non-covered EEs, depending on service as of 6/30/12	State and local EEs and teachers contribute 5% to the DC plan; 3% for municipal police and fire EEs not covered by Social Security	12 target date funds and 10 funds ranging from conservative to aggressive	Age appropriate target date fund	Lifetime annuity, lump sum distribution, or distribution in installments (rolling assets into an IRA or leaving assets in the plan).
<b>Tennessee Consolidated RS</b> 1% x years of service x final average salary (maximum annual pension benefit of \$80k, indexed by CPI)	EE contributes 5% to the DB plan ER contributes 4%	ER contributes 5% to the DC plan	EEs contribute 2%, with opt-out feature	11 target date funds and 16 options ranging from conservative to aggressive	Age appropriate Target Date portfolio	Lump sum, periodic payments, minimum required distributions; beneficiaries may use a combination of more than one method
<b>Utah RS</b> 1.5% (2% for public safety/fire) x years of service x final average salary = annual benefit	ER pays up to 10% of pay; 12% for public safety/fire; if DB costs more, EE pays the difference.	ER pays into DC the difference between DB plan cost and 10% (12% for public safety). Currently 1.58% and 1.26%, respectively.	EE contributions optional. State employees may receive a match of up to \$26 per pay period.	8 self-directed core funds ranging from conservative to aggressive. 12 target date funds; brokerage window.	Age-appropriate target date fund	After 4-year vesting period: lump sum, partial balance, periodic distribution, based on: time period, or rate of return assumption, or life expectancy.

## Summary of Key Features of Select DB-DC Plans (continues)

DB benefit formula (having met age/service requirements)	DB plan contributions	Employer DC plan contributions	Employee DC plan contributions	DC plan investment options	Default DC plan investment options	DC plan withdrawal options
<p><b>Virginia RS</b></p> <p>1% x years of service x final average salary = annual benefit</p>	<p>EE contributes 4% to the DB plan; ER contributes an actuarially determined amount to fund the DB benefit (less employer DC contributions)</p>	<p>Mandatory ER contributions of 1% - increases with EE contributions up to 3.5% maximum</p>	<p>EEs may contribute up to 5% to the DC plan (1% minimum)</p>	<p>11 options ranging from conservative to aggressive, plus 10 target date funds.</p>	<p>Target date funds based on the participant's age at enrollment</p>	<p>All or part of the balance may be taken as a lump sum, in periodic payments, or as an annuity; or rolled over to another retirement account</p>
<p><b>Washington Department of RS</b></p> <p>1% x years of service x final average salary = annual benefit</p>	<p>ER funds the DB benefit</p>	<p>None</p>	<p>5% to 15% of salary depending on EE</p>	<p>Either the total allocation portfolio, which mirrors DB plan fund, or 7 self-directed funds ranging from conservative to aggressive, plus target date funds</p>	<p>Target date funds based on the participant's age at enrollment</p>	<p>Lump sum, direct rollover, scheduled payments, personalized payment schedule, and annuity purchase</p>



# Case Studies



# Colorado Public Employees' Retirement Association

## Risk-sharing plan design feature

Automatic changes to employee contribution rates and benefit levels triggered by a designated ratio of contributions paid relative to actuarially determined contributions.

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The Colorado Public Employees' Retirement Association (PERA) is the largest retirement system in the state, administering pension and other benefits for teachers, state employees, and employees of local governments that have elected to participate in the PERA. Most public safety personnel employed by local governments in Colorado participate in a separate retirement plan. PERA participants do not participate in Social Security.

Seven years after the Colorado Legislature approved significant pension reforms, declining projections of future investment returns frustrated efforts to reduce the plan's unfunded liabilities and amortization periods. The reforms approved in 2010 were substantial and included higher retirement ages for both new hires and many members already working; higher required contributions for employers and employees; and lower cost-of-living adjustments, including for those already retired. Yet by 2017, the period over which the plans' unfunded liabilities were projected to be amortized remained well above the statutory limit of 30 years.

In response to the difficulty the plans were experiencing in improving funding levels and reducing unfunded pension liabilities, the Colorado PERA board in 2017 proposed a number of changes to the plans' design and financing structure. In addition to further benefit reduc-

tions for plan participants and higher contributions from employers and employees, the board also recommended that the legislature adopt a set of risk-sharing provisions to distribute plan costs and risks among employers and plan members. These provisions were recommended on a contingency basis, to be implemented in case the changes proposed to the plan design and financing arrangement did not achieve their intended outcome.

During its 2018 session, the Colorado Legislature considered and largely adopted the proposed changes to the PERA plan design and financing structure, culminating in passage of SB 18-200, Concerning Modifications to the Public Employees' Retirement Association Hybrid Defined Benefit Plan Necessary to Eliminate With a High Probability the Unfunded Liability of the Plan Within the Next Thirty Years. As the legislative moniker implies, the goal of the approved reforms was to eliminate the plans' unfunded actuarial accrued liability within 30 years.

The legislation was multi-faceted, affecting benefit levels in various ways, and differently for different employee groups, and raising contribution rates for participants and most

**Seven years after the Colorado Legislature approved significant pension reforms, declining projections of future investment returns frustrated efforts to reduce the plan's unfunded liabilities and amortization periods**



employers.<sup>1</sup> The new law also establishes triggers for changes to employee contribution rates and benefit levels dependent on a designated ratio of contributions actually paid relative to actuarially determined contributions.

These adjustments, as described in the table below, would be made to employee contribution rates, employer contribution rates, a direct payment made by the State of Colorado (currently \$225 million annually), and cost-of-living adjustments, or annual increases, for retirees. **These provisions are unusual among public pension plan shared-risk provisions in that that they are contingent, to be implemented only if or when actual contributions fall outside a specific ratio relative to actuarially determined contributions.**

The changes in benefits and additional contributions from Colorado PERA members, employers, and the state are projected to eliminate the plans' unfunded liabilities over 30 years, and the shared-risk provisions are designed to produce that outcome. Consistent with shared-risk provisions in place in plans in other states, these provisions are defined in advance, allowing all plan stakeholders to understand and anticipate what changes will be made if the plans stray from their projected path to full funding.

<sup>1</sup> [Senate Bill 18-200: Impact of Changes](#)

## Shared-Risk Elements of Colorado PERA Plan Design Approved in 2018

Actions the board implements, proportionately among each affected group, if the plans' actual contributions are less than 98 percent of the actuarially determined contribution	Actions the board implements, proportionately among each affected group, if the plans' actual contributions are greater than 120 percent of the actuarially determined contribution
Employer contributions may be increased by up to 0.5% in a year, with a cap of 2.0% above employer contribution rates in effect in July 2019	Employer contributions may be reduced by up to 0.5% in a year, with a floor of employer contribution rates in effect in July 2018
Member contributions are increased by up to 0.5% in a year with a cap of 2.0% above the July 2021 member contribution rate.	Member contribution rates are decreased by up to 0.5% in one year, not to fall below the 2018 member contribution rates.
The annual increase (COLA) is reduced by up to 0.25% in one year, not to be reduced below a floor of 0.5%	The annual increase (COLA) is increased by up to 0.25% in one year, not to exceed a cap of 2.0%
The "direct distribution," a payment into the fund by the state, is increased by up to \$20 million in one year, not to exceed \$225 million	The "direct distribution," a payment into the fund by the state, is reduced by up to \$20 million in one year, with a floor of \$0

# Maine Public Employees' Retirement System Participating Local District (PLD) Consolidated Plan

## Risk-sharing plan design features

Required employee contribution rates and retiree cost-of-living adjustments (COLAs) that may change based on the plan's actuarial experience.

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The Maine Public Employees' Retirement System (MainePERS) administers retirement and other benefits for substantially all public employees in the state, including state employees, teachers, and employees of participating local governments. MainePERS administers three defined benefit pension plans for the state: a state and teacher plan, a judicial plan, a legislative plan; and two plans for employees of participating local districts (a consolidated plan and an agent plan). More than one-half of public employees in Maine do not participate in Social Security.

Previously, in 2011, the Maine legislature enacted pension reforms affecting all state plans, including a three-year suspension of the retiree cost-of-living adjustment (COLA) and changes to eligibility for normal (unreduced) retirement for new hires and active members with fewer than five years of service as of July 1, 2011.

In May 2018, the MainePERS Board approved several changes to the Participating Local District Consolidated Plan (PLD Plan) based on principles of sharing risk more equitably than done previously through employer rate changes, employee fixed cost increases, and reductions of benefits and COLAs. The changes, which were developed by the system in coordination with its consulting actuary, impact active members, participating employers, and retirees, and are intended to preserve

the sustainability of the plan and control future costs.<sup>1</sup>

As of fiscal year 2016, the PLD Plan was 86 percent funded on an actuarial basis, down from 91 percent as of fiscal year 2014, following a reduction in the plan's investment return assumption, 2014 plan benefit and COLA reductions, and tepid investment markets. Given the uncertainty of future investment performance, the system and its actuary conducted a stress test to assess the impact of varied future investment returns on the system's financial and actuarial condition. The test revealed a strong likelihood that the plan's cost could double within a decade, which was viewed as an intolerable outcome that would likely again precipitate benefit cuts, COLA freezes, and, potentially, employers withdrawing from the plan.

The stated policy for the newly adopted risk-sharing framework is to pay every member's basic benefits throughout their lifetime while preserving the plan's funding level and promoting balance among key objectives, including keeping plan costs manageable and predictable, and preserving an attractive retirement benefit that holds its value over time. The new plan is intended to achieve this balance through a variable contribution rate which shares the impact of negative – and positive – investment and actuarial experience among current active members and participating employers within a minimum and maximum range of contributions. Retiree COLAs are

**The test revealed a strong likelihood that the plan's cost could double within a decade, which was viewed as an intolerable outcome**

preserved by smoothing losses in excess of employer and member caps into future COLAs, which can result in frozen or reduced COLAs, and restoring full COLA eligibility when markets rebound.



**The changes to the MainePERS PLD Consolidated Plan reflect the system's desire to distribute a greater share of the plan's risk to core plan participants, and to prevent, rather than react to, a decline in the plan's financial or actuarial condition.**

## Variable Contribution Rates

Effective in fiscal year 2020, contribution rates for members and employers will be calculated annually by the plan's actuary based on a 45/55 percent member/employer split of the total plan contribution rate. Plan aggregate contribution rates will be capped at 12.5 percent for employers and 9.0 percent for members, with the aggregate caps based on individual rate caps for the 11 sub-plans within the PLD plan. This arrangement promotes predictable member and employer costs, with some room to accommodate any increases necessary to absorb the impact of negative actuarial experience.

## Potential COLA Impact

Eligible retirees from the PLD Plan may receive an annual COLA, following a 24-month waiting period, equal to the annual change in consumer price index (CPI), up to 2.5 percent. If, however, in a given year the actuarial experience of the plan causes the total cost of the plan to exceed the established contribution rate caps, the COLA may then be reduced by a pre-determined formula of smoothing excess losses and future gains into the COLA eligibility. This is expected to negate reflexive reactions such as reductions in the COLA cap or COLA freezes. Retirees have the best chance under

this model of maintaining purchasing power throughout their retirement

## Shared Gain

Conversely, when investment gains or other actuarial experience exceed the plan's assumptions, the retiree COLA may be increased based on the CPI up to 2.5 percent in a year, and member and employer contribution rates may be reduced to floors of 6.2 percent and 7.7 percent, respectively.

1 [Martin Z. Braun, "Public Pensions Adopt Cost Sharing Mechanisms to Stem Volatility," Bloomberg, 17 July 2018](#)

# Michigan Public School Employees' Retirement System

## Risk-sharing plan design features

Required employee contribution rates that may change based on the plan's actuarial experience; a normal retirement age that can change based on the plan's mortality experience; and required closure of the plan if funding level falls below a specified level.



The Michigan Public School Employees' Retirement System (MPERS) is managed by the Michigan Office of Retirement Services, which administers pension and other retirement benefits for employees of the state, public school districts, and public colleges and universities in the state. Most MPERS participants are also covered by Social Security.

In the wake of the Great Recession and the 2008-09 market decline, the Michigan Legislature initiated the first of a series of changes to retirement benefits for public school employees. These changes were intended to reduce future pension costs and lower the overall level of risk of providing retirement benefits to public school employees in Michigan. The legislature in 2010 closed the MPERS defined benefit (DB) plan to those hired on or after July 1, 2010, replacing it with a side-by-side, or DB-DC hybrid plan, known as Pension Plus I, featuring a DB plan combined with automatic enrollment in a defined contribution (DC) plan. In 2012, the legislature established a DC plan as an optional primary retirement benefit for those hired on or after September 26, 2012, with the hybrid plan serving as the default choice for those who did not make an active election. As of September 30, 2017, approximately 80 percent of eligible employees elected or defaulted into the hybrid plan, with the remaining 20 percent electing the DC-only plan.<sup>1</sup>

In 2018, the legislature created a second hybrid plan tier for those hired on or after February 1, 2018, and established a DC plan as the default retirement benefit for this group. The new tier features as an elective option a new DB-DC hybrid plan which includes several features intended to distribute different types of risk between active members and participating employers. Known as the Pension Plus II plan, this plan distributes risk between employees and employers in some ways that are typical of DB-DC plans and in other ways that are unique to this particular plan design.

## Variable Contribution Rates

As discussed in the chapter on DB-DC hybrid plans ([see page 21](#)), employees' bearing of the investment risk is typically restricted to the DC plan component, which requires employees to make their own investment choices and to manage their own longevity risk. The MPERS Pension Plus II plan requires employees to bear investment, as well as other risks, not only in the DC plan, but also within the DB component. This is accomplished through a requirement that the total plan normal cost contri-

**These changes were intended to reduce future pension costs and lower the overall level of risk of providing retirement benefits to public school employees in Michigan**

## The MPSERS Pension Plus II plan requires employees to bear investment, as well as other risks, not only in the DC plan, but also within the DB component

tribution rate, currently 12.4 percent, be shared equally between members and employers. Any increase or decrease to the total contribution rate resulting from changes to the plan's funding condition, must be shared equally between the two groups. There are, however, two exceptions: members are not responsible for any increases resulting from employers' failure to pay the full required contribution, and the employer's normal cost is subject to a floor and can never fall below 6.2 percent or the previous fiscal year contribution rate, whichever is higher.

The investment risk that Pension Plus II members are required to bear is balanced by the establishment of the employer contribution rate floor, which means that in years when there is positive actuarial experience relative to assumptions, those gains will not be used to reduce employer contribution rates below the floor, but rather will be used to more rapidly eliminate any existing unfunded liability, or build a surplus in the pension fund.

The Pension Plus II plan also uses a lower assumed rate of return, specified by statute at 6.0 percent, compared to 7.0 percent currently used for the Tier I hybrid plan and 7.05 percent for the closed DB plan. This lower rate also reflects the goal of reducing the plan's overall level of investment risk by requiring employers to make greater contributions than they would if a higher assumed rate of return were used.

### Shared Longevity Risk

Within DB-DC plans, employees' exposure to longevity risk is typically restricted to the

DC plan component, which provides a benefit available from the accumulated balance of a participant's individual account, an amount that potentially could be exhausted within the participant's retired lifetime. However, participants in this plan type are typically shielded from longevity risk within the DB plan component, which provides lifetime retirement income upon attainment of certain age and/or service levels. This arrangement, which characterizes most DB-DC plans, is also true of the MPSERS Pension Plus I plan, in which school district employers previously bore the risk of changes to the plan's funding condition, and the corresponding increased cost that might result from participants' longevity experience differing from assumptions.

With the introduction of the Pension Plus II plan, participants electing this plan share its longevity risk through a provision that calls for an increase to the minimum age of attainment for normal (unreduced) retirement, commensurate with any increase in life expectancy for the entire participant group based on the plan's actuarial experience, as described in the table below:

Actuarial Experience Result	Required Change
The cumulative mortality improvement is by less than one year, and/or the plan's funding ratio remains at 100 percent	No change is required
The cumulative mortality improvement is by more than one year, and/or the change causes the plan's funding ratio to fall below 100 percent	The Board must increase the plan's normal retirement age by at least one year, up to the maximum total increase, in whole-year increments



The law provides for an exemption to the higher normal retirement age for members who are within five-to-eight years of the normal retirement age, which is currently set at age 60, as determined by the MPSERS board.

## Plan Closure

Michigan state law directs the closure of the Pension Plus II plan if the plan's actuarial funding ratio falls below 85 percent for two consecutive years, and if the legislature fails to appropriate the funds necessary to increase the plan's funding ratio to at least 85 percent. If the legislature does not take action to close the funding gap within a 12-month period, the plan will be closed to new hires, who will participate in a DC plan. **This feature shifts current plan risk to future hires, who may not have a guaranteed source of retirement income if the risk in the Pension Plus II plan is not effectively mitigated through the automatically adjusting features included in its design.**



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1 Author's calculation based on latest valuation data found here: [http://publicplansdata.org/reports/MI\\_MI-MPSERS\\_AV\\_2017\\_53.pdf](http://publicplansdata.org/reports/MI_MI-MPSERS_AV_2017_53.pdf) (page D-4)



# New Brunswick Shared Risk Pension Plan

## Risk-sharing plan design features

A traditional pension plan featuring contribution rates and benefits that can change depending on the plan's funding level or actuarial experience as measured in periodic risk assessments.

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Legislation passed by the New Brunswick (Canada) provincial government in 2012 codified<sup>1</sup> recommendations from a task force

assigned to recommend changes to the province's retirement plans intended to forestall sharp future increases in pension costs, lower retirement plan risk, and to make retirement plans "secure, sustainable, and affordable for both current and future generations."

The new plan design, known as the Shared Risk Pension Plan (SRPP), is intended to promote intergenerational equity and risk sharing among all plan stakeholders: active participants, retirees, and sponsoring employers.

SRPP features variable benefit elements as an option for private and public employers in the province. For the several public and private employers who elected to adopt it, the SRPP provides an overarching plan design framework, including several common elements. The SRPP framework also allows for some variability and differences in certain design elements, such as contribution rates, funding thresholds, and required corrective actions.

The SRPP distributes the associated risks of accumulating and managing retirement income among current active participants, retirees, and employers through the use of three overarching elements: a "target benefit" plan design that classifies some benefits as "base"

benefits and others as "ancillary" benefits; the potential for modifying both benefit types and required contribution rates for current active participants under certain circumstances; and a framework for evaluating and managing the plan's risk on an ongoing basis.

One unique feature of the SRPP design is that accrued base benefits for current active participants and retirees (benefits earned as of a certain date for current active participants, and in payment status for retirees) are exposed to potential reductions in the same manner as future benefits. This exposure to possible reduction differs from most public pension plans – even those that have adopted forms of risk sharing in their plan design – in which accrued base benefits are legally protected from reductions.

## Plan Design


Most public pension plan designs include a base retirement benefit that is typically calculated as a percentage of a participant's final average salary for each year worked for a sponsoring employer and often is augmented through the provision of periodic cost-of-living adjustments (COLAs). Other features, such as subsidies for retirement taken prior to satisfying the requirements for normal, or unreduced retirement, may also be included in different plan designs. For New Brunswick plans adopting or converting to the SRPP, the plan design

is composed of two primary elements: base and ancillary benefits.

Base benefits provided by the SRPP are calculated in a manner similar to the example described above, as in a typical defined benefit plan, and are intended to provide a targeted level of retirement income. Ancillary benefits include COLAs and early retirement subsidies, as well as any other benefit or benefit enhancement the sponsor wishes to make available to participants depending on contingent funding.

Following conversion to the SRPP, initial contribution rates are determined based on funding requirements for specified benefits at a level necessary to provide for a 97.5 percent likelihood of providing all base benefits, and a 75 percent likelihood of providing all ancillary benefits, over a 20-year period. Temporary contributions in excess of the initial rates may be required to achieve the required risk management goals imposed by the SRPP. These additional contributions are stopped following the exhaustion of the earlier of the five- or ten-year period or the attainment of an actuarial funding ratio of 140 percent.

## Criteria for Changes to Benefits and/or Required Contributions



**Each sponsor that adopts the SRPP is required to develop a funding policy that provides for a high likelihood that targeted base and ancillary benefits will be paid to eligible participants.** However, another required element of the sponsor's funding policy is a pre-determined plan, known as a funding deficit recovery plan. The funding deficit recovery plan details changes necessitated should the plan experience a decline in its financial condition to below 100 percent funded for two consecutive years, as determined by the

plan's annual actuarial valuation, and after implementing contribution rate increases in accordance with the plan's funding policy. If this occurs, a plan may be required to increase employee and employer contribution rates by a specified amount – which can differ for plans that have adopted the SRPP model – with the modified rates remaining in place until the plan reaches a designated funding threshold of at least 105 percent.

If the plan's funding level remains below 100 percent following the contribution rate increase, the plan is required to implement its funding deficit recovery plan. This recovery plan specifies corrective measures to be taken, including reducing future ancillary or base benefits and/or and past ancillary or future base benefits for current members and the order of priority and timing for these actions. Measures may also increase employee and employer contribution rates by a specified amount – which can, again, differ depending on the plan – in order to restore the plan's funding ratio to at least 110 percent and to secure the base benefits. If the increased contributions fail to achieve this objective, the plan is required to reduce ancillary and/or base benefits, in accordance with their funding policy, until the required minimum funding level is achieved.

Conversely, an improvement in the plan's financial condition to at least 105 percent may trigger increased benefits and lower contribution rates, as prescribed by a plan's funding excess utilization plan.

An example is the New Brunswick Public Service Pension Plan (NBPSPP), which covers employees of provincial government agencies in New Brunswick, and adopted the SRPP with a conversion date of January 1, 2014. The plan specifies a list of changes, in order of priority, that are to be implemented if the funding ratio falls below 100 percent for two successive years

after first increasing employee and employer contribution rates by up to 1.5 percent each until reaching a funding level of 110 percent. The changes include:

1. Reduced ancillary benefits for service on or after January 1, 2014, for non-vested participants who retire before age 65;
2. Reduced ancillary benefits for service before January 1, 2014, for non-vested participants who retire before age 60;
3. Reduced base benefit accruals for future service (after the date of the implementation of the recovery plan) by up to 5.0 percent;
4. Reduced base benefit accruals on a proportionate basis for all members, regardless of their date of hire, for both past and future service in equal proportions.<sup>1</sup>

Similarly, the NBPSPP's funding excess utilization plan specifies actions to be taken in the event the plan's funding ratio exceeds 105 percent. The plan identifies the level of "excess" funds, calculated as one-sixth of the funds between the 105 percent and 140 percent funding levels, and 100 percent of funds above 140 percent, as available to first, restore base and/or ancillary benefits previously reduced; then to augment base benefits and reduce contribution rates; and finally, to establish a reserve for future benefit improvements.

## Risk Management

Sponsors electing to adopt the SRPP are required by law to monitor the plan's risk on an ongoing basis through the use of an annual stress test, or a periodic assessment of the impact of adverse financial or actuarial events on the plan's financial condition. These stress tests are characterized by required simulations that

assess the impact of various events on the plan's financial condition for 1,000 scenarios analyzed over a 20-year time period. Compliance with the risk management requirement of the SRPP requires the average outcome of annual stress tests to demonstrate a primary risk management goal of 97.5 percent likelihood that the plan's base benefits will be paid in full; and a secondary risk management goal of at least 75 percent of the plan's ancillary benefits will be paid, following specified events.<sup>3</sup>

Plans electing to adopt the SRPP are required to achieve both risk management goals at the time the SRPP plan design is adopted and following a permanent benefit increase. They must also achieve the primary risk management goal after a benefit improvement and following the date cumulative increases or decreases in contribution rates exceed the adjustments permitted by the plan's funding policy. Failure to achieve these percentages on average across the required simulations, following the aforementioned events, requires intervention in the form of increased funding, lower benefits, or changes to the plan's investment strategy to lower its risk exposure.

Conducting annual stress tests, in addition to having funding policies that include pre-determined policy responses to changes in the plan's financial condition, allow stakeholders to anticipate changes before they occur, and to understand the relative likelihood that changes will become necessary.

**If the plan's funding level remains below 100 percent following the contribution rate increase, the plan is required to implement its funding deficit recovery plan**

1 [Pension Benefits Act \(O.C. 2012-251\)](#)

2 [Summary of Funding Policy, New Brunswick Public Service Pension Plan](#)

3 [Alicia H. Munnell and Steven A. Sass, "New Brunswick's New Shared Risk Pension Plan," Center for Retirement Research at Boston College, August 2013](#)



# South Dakota Retirement System

## Risk-sharing plan design features

A cost-of-living adjustment contingent on the plan's funding level and the rate of inflation, limited to a rate that maintains the plan's funding level without increasing the plan cost; and a variable benefit feature embedded within the traditional pension plan funded within the plan's fixed cost framework.



The South Dakota Retirement System (SDRS) is the predominant retirement system in the state, administering pension and other benefits for nearly all public employees in South Dakota, including public school teachers, state employees, and employees of local governments that have elected to participate. By public retirement system standards, the SDRS is a young plan, formed by the consolidation of several plans in 1974. The SDRS began as a shared-risk plan, and additional shared-risk plan design features were added or clarified more recently. Two risk-sharing features are discussed here: the variable cost-of-living adjustments and the Generational benefit structure.

South Dakota statutes specify fixed contribution rates for both employees and employers, and those statutory rates changed just once in the history of the SDRS. That change (from 5.0 percent to 6.0 percent of pay matching member and employer contributions) was initiated by the governor and legislature to finance higher future benefits and not to solve a funding issue. The SDRS also maintains a funding and benefit policy in support of fixed-rate contributions, which states in part:

Fixed contributions are a prudent financial decision, and SDRS benefits must be managed

accordingly since variable contributions may require significant and unpredictable higher costs.<sup>1</sup>

Given the plan's fixed contribution rate framework, the SDRS benefits and funding policy acknowledges that benefit changes may be needed depending on changes to the plan's actuarial experience and actuarial assumptions and methods. When actuarial experience varies materially from assumptions, and when changes to assumptions and methods produce an unfunded liability, benefit levels are adjusted accordingly. According to the SDRS policy, "Variable benefits based on affordability measures are essential for sustainability."

This funding and benefits strategy has worked largely as intended: SDRS has had an unfunded liability in only four years since 1986. As a result, multiple improvements to the SDRS benefit formulas, typically applied to a limited period of service, have shared the rewards of favorable investment returns. Recent adjustments made to the SDRS plan design, some of which are described here, have exchanged the risk borne by employees of significant benefit adjustments when minimum permissible funding thresholds are not met for the risk of incremental annual benefit adjustments based on affordability. In addition, the SDRS has made a concentrated effort to eliminate benefit provisions that result in inequities and subsidies. In

**Historically, changes to the SDRS plan design reflect a consensus between the plan's major stakeholders: the state, public employers, and employees**

design reflect a consensus between the plan's major stakeholders: the state, public employers, and employees. Changes are made in the context of multiple considerations, including avoiding unfunded liabilities, ensuring benefit adequacy, maintaining the current plan cost structure, and enabling employers to attract and retain qualified workers.

### **Cost-of-Living Adjustments**

In recent years, the SDRS COLA has been central to the system's efforts to remain fully funded. (For general discussion on contingent or limited cost-of-living adjustment provision, [see page 11](#)).

In the years following the market decline of 2008-09, the SDRS market value funded ratio declined from 126 percent funded to 76 percent. In response, the SDRS board and staff and the South Dakota Legislature collaborated to design a change to the plan's COLA, with the intention of restoring the plan's funding level to 100 percent. Prior to legislation approved in 2010, the SDRS paid an automatic annual COLA of 3.1 percent. Following rejection of a court challenge to this proposed change, the new COLA was made flexible by tying the

most years, the plan's strong funding condition enabled the full employer contribution to be available to pay for benefits earned in the current year and—in contrast to many other public pension plans—was not needed to amortize an unfunded liability.

Historically, changes to the SDRS plan

benefit adjustment to the rate of inflation and to the plan's market value-funded ratio. Specifically, the provision approved in 2010 indexed the SDRS annual COLA to the actual rate of inflation, with a maximum of 3.1 percent payable when the plan is funded (using the market value of assets) at 100 percent or more, and a minimum COLA of 2.1 percent when the plan is funded below 80 percent.

This flexible COLA feature was further refined in 2017 to ensure that the COLA does not impair the plan's funding level in future years. This change, which took effect in 2018, bases the COLA on the actual rate of inflation, with a minimum annual increase of 0.5 percent and a maximum of 3.5 percent. The maximum COLA is further limited to the percentage that, if assumed to be paid in all future years, results in a funded ratio (using the market value of assets) of at least 100 percent. The first COLA paid under this new provision, based on the June 30, 2017, actuarial valuation, permits payment of a COLA in 2018 of up to 1.89 percent. With future COLAs assumed to equal 1.89 percent, the plan's market value funded ratio is 100.1 percent, indicating SDRS has sufficient assets to afford an ongoing COLA of 1.89 percent while remaining fully funded. This calculation will be performed anew each year, updated based on the plan's funding level and the rate of inflation.

The design of this COLA helps the SDRS to meet several important policy objectives, including paying some COLA each year, minimizing the negative effect a COLA might have on the plan's funding level, and maintaining the plan's fixed contribution rates.

### **Generational Benefit Structure**

Another recent change to the SDRS plan design affects new hires since July 1, 2017, who



are automatically enrolled in the new Generational benefit structure. This separate benefit structure within SDRS is primarily a typical traditional pension plan, featuring a retirement multiplier of 1.8 percent, full retirement age of 67, and matching employee and employer contributions of 6.0 percent. For public safety workers, the multiplier is 2.0 percent; full retirement age is 57, and employees and employers match contributions of 8.0 percent.

The Generational benefit structure eliminated early retirement subsidies that were embedded in the Foundation structure, which determines benefits for participants hired previously. Although the retirement multiplier is higher under the Generational structure, so is the retirement age—which is 65 for non-public safety members of the Foundation structure. Additional subsidized benefit features were also eliminated. The net effect of these changes was to reduce the cost of the plan, allowing the multiplier increase and freeing up a portion of the employer contribution rate to fund a new variable retirement account (VRA).

The VRA functions similar to a cash balance benefit: VRA assets are invested in the same manner as the DB plan fund, and participants' notional accounts are credited with an annual contribution (initially 1.5 percent of pay) and investment credits equal to the actual investment return of the SDRS fund. Unlike other cash balance plans, the return on VRA cash balances could be less than zero if the fund realizes a negative return, but aggregate returns over participant's career cannot be less than zero. VRA assets are payable to participants at the time of retirement, disability, or death. Under each of these scenarios, participants or survivors may elect to roll over their assets, take them as a lump sum, or as an annuity through an available supplemental pension benefit.

Generational members bear most of the invest-

ment risk of VRA assets during their years of active membership as actual fund returns are credited to VRA accounts. **The SDRS, however, bears investment risk associated with negative returns, so overall VRA investment risk is borne primarily by plan participants.** Participants who elect to take a lump sum upon retirement or disability bear the investment risk associated with those assets; by forgoing the option to annuitize their VRA assets, these participants also take on mortality risk, i.e., the risk they could outlive the assets. Retirees and disability recipients who elect to annuitize their VRA assets effectively shift both the investment and longevity risk of those assets back to the SDRS; however, the interest rates used to determine the annuity available as a supplemental pension benefit are set conservatively.

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1 [The South Dakota Perspective on Public Employment Retirement Benefits and the South Dakota Retirement System](#) (undated)





# Tennessee Consolidated Retirement System State, Teacher, and Higher Education Hybrid Plan

## Risk-sharing plan design features

Required employee contribution rates that may be raised and benefit accruals and retiree COLAs that may be reduced based on the plan's actuarial experience; future service accruals suspended if prescribed adjustments fail in reaching designated actuarial targets.

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The Tennessee Consolidated Retirement System (TCRS) administers retirement and other benefits for most public employees in the state, including state employees, teachers, higher education employees, and employees of participating local governments. TCRS administers two defined benefit (DB) pension plans: a closed state and teacher plan and a plan for participating political subdivisions. Most public employees in Tennessee participate in Social Security.

In 2013, the Tennessee Legislature closed the State and Teacher defined benefit plan and established a new combination defined benefit-defined contribution (DB-DC) hybrid plan for state employees, teachers, and higher education employees hired on or after July 1, 2014. Participating local governments may elect to offer their employees hired on or after that date a DB plan or a hybrid plan. The legislature used the guiding principles listed below to design the hybrid plan:

1. Provide a sufficient and sustainable benefit for a dignified retirement through a combination of TCRS benefits (DB and DC), Social Security, and personal savings;
2. Long-term solvency of the retirement system must be ensured so that current and

future retirees can rely on secure retirement benefits;

3. Share risk between employers and employees; and
4. Control costs and reduce the employer's exposure to risk and unfunded liabilities, in order to sustain TCRS employer contributions at affordable levels for the State and its taxpayers.<sup>1</sup>

Hybrid plan participants are required to contribute 5.0 percent of salary to the DB plan (which previously was noncontributory for state and higher education employees), and 2.0 percent to the DC component, unless they elect to opt-out of the DC plan.

Employer contributions to the DB plan are targeted at 4.0 percent, and employers contribute a fixed 5.0 percent to participants' DC accounts. Targeted employer contributions to the DB plan in excess of the actuarially determined contribution (ADC) are deposited into a stabilization reserve account, which is used to offset employer contributions in the event the plan's actuarial experience causes the ADC to exceed targeted employer contributions. The hybrid plan DB multiplier is 1.0 percent, and the DC plan balance may be

**A separate stabilization reserve is established for each employee group (the state, teachers, and each individual political subdivision)**

**In addition to mortality and investment risk, which all hybrid plan participants must bear to some degree within the DC plan, TCRS hybrid plan participants are also exposed to investment and inflation risk within the DB plan as well**

withdrawn as a lump sum or paid periodically, depending on the participant's election at retirement.

A separate stabilization reserve is established for each employee group (the state, teachers, and each individual political subdivision). The actuary calculates a separate ADC and the amount deposited into the stabilization reserve are contributions resulting from the difference between

the ADC and targeted rate of 4 percent. The stabilization reserve is used as the first step in controlling the cost of the plan to the employer.

This hybrid plan distributes risk between employers and employees in some ways that are characteristic of other hybrid plans and in some ways that are unique to this plan. One unique feature of the TCRS hybrid plan is the presence of employer cost and unfunded liability controls. Like most pension plans, TCRS conducts an actuarial valuation to measure its liabilities and costs and assess progress toward long-term benefit funding goals. If the annual valuation determines that the plan's actuarial experience causes the employer's DB contribution to exceed the target rate of 4.0 percent, or if the DB plan's target unfunded liability is exceeded, the following plan adjustments are to be implemented in sequential order:

1. Distribute funds from an actuarial stabilization account, to which employers contribute when the actuarially determined contribution rate is less than 4.0

percent, to offset the increase in liability and costs;

2. Reduce or suspend the plan's cost-of-living adjustment (COLA) based on changes to the consumer price index (CPI) up to maximum of 3%;
3. Shift some (or all) of the employer's DC plan contributions to the DB plan;
4. Increase employees' required contribution to the DB plan by 1.0 percent (from 5.0 to 6.0 percent);
5. Reduce benefit accruals for future service to below 1.0 percent;
6. Freeze the plan, including all future accruals.

Once the ADC is below the target rate, or if the unfunded accrued liability is below the designated maximum unfunded liability, the plan adjustments noted above in reversed order are automatically implemented the next July 1. Prescribing the cost and unfunded liability controls and the order in which they would be implemented was intended to alleviate pressure on the TCRS Board of Trustees to identify and implement changes if needed. Rather than determine after the fact what changes to employ to restore a plan's actuarial condition, this approach ensures a measured and predictable process for deciding which reforms to make in case the plan does not reach required actuarial benchmarks.

When the new hybrid plan was being designed, TCRS engaged the plan's actuary to perform a stress test on the closed plans to determine the effect of the 2008-09 financial crisis had the plans had the same cost controls in place. The results were that the COLA granted in those years would have been reduced but not eliminated.

In addition to the typical ways the TCRS hybrid plan shares risk between employers and employees, the use of triggers for benefit and financing adjustments, which depend on the plan's actuarial condition, result in additional risks borne by participants that are not typically required of participants in other hybrid plans. In addition to mortality and investment risk, which all hybrid plan participants must bear to some degree within the DC plan, TCRS hybrid plan participants are also exposed to investment and inflation risk within the DB plan as well.

## Investment Risk

In addition to bearing the risk of investment performance in their DC plan account, TCRS hybrid plan participants bear the risk of investment performance in the DB plan as well. If the employer cost or unfunded liability thresholds are breached, participants could be exposed to contribution rate increases or lower benefits, or both, depending on the severity of the cost or liability increase and whether or not initial adjustments are sufficient to alleviate the problem. Additionally, since one of the prescribed adjustments is a shift of employer DC contributions to the DB plan, participants also bear the risk of potential lower DC plan contributions, which would result in a lower benefit.

## Inflation Risk

DC plan participants bear the risk of a reduction in purchasing power (i.e., inflation) of their DC plan assets, which do not receive COLAs. The TCRS hybrid plan provides a COLA on the DB portion of the plan, which can be reduced or suspended if the aforementioned cost or liability thresholds are exceeded.

## Plan Closure

**Finally, the TCRS hybrid plan exposes participants to the risk that if adverse actuarial experience is significant enough to render all previous adjustments ineffective, that the DB plan may freeze and provide no future service accruals to participants.** This feature shifts significant risk to current active plan participants and new hires, who may not receive a guaranteed source of retirement income if the plan's prescribed adjustments are not sufficient to manage the risk contained within the current plan design. As noted above, the cost and unfunded liability controls are reversed once they return to below the prescribed thresholds.



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1 [Public Financial Management, Inc., "Tennessee Consolidated Retirement System \(TCRS\) Reform Options," February 22, 2013](#)



## Risk-sharing plan design feature

Traditional pension plans featuring a mechanism to require adjustments to actuarial methods, employee contribution rates and benefit levels based on the plan's actuarial experience, measured by changes to the employer contribution rate.



The City of Houston, Texas sponsors three pension plans for its employees: the Firefighters Relief and Retirement Fund (HFRRF);

the Municipal Employees Pension System (HMEPS); and the Police Officer Pension System (HPOPS). In 2016 each of these plans faced funding challenges, evident in part either through relatively high actuarially determined contribution rates, low funding ratios, or both.

As with other Texas cities, state statutes grant considerable authority to the Legislature to determine benefit levels and financing arrangements for Houston's pension plans. During the months leading up to the biannual legislative session that convened in January 2017, Houston's mayor, a former legislator himself, worked with the plans and other stakeholder groups to develop a consensus for making reforms to the plans' benefits and financing structures. The mayor's objective was to restore the plans' sustainability and to amortize their unfunded liabilities within a fixed timeframe. The consensus that developed from this effort became the city's proposed shared-risk retirement plan design, and ultimately was approved by the legislature and signed into law. The Houston shared-risk plan arrangement and provisions are similar to those established recently in New Brunswick, Canada, for its public employees, (see case study on page 37).

Municipal employees in Houston participate in

Social Security; police officers and firefighters do not.

The new plan designs differ slightly for each plan, but the main feature of all three is a contribution rate corridor arrangement. The objective of this arrangement is to minimize volatility in plan costs to the employer by keeping employer contribution rates within a 10-percent range (five percent above and below a designated midpoint rate). This mechanism uses prescribed triggers to adjust employee contribution rates, benefit levels and actuarial methods and assumptions, when actuarially determined contribution rates rise or fall outside the designated corridor. The legislation requires annual actuarial valuations to be conducted both by each plan and by the city; if or when a plan's valuation causes the employer contribution to fall outside the corridor, based on a closed 31-year funding period, prescribed changes must take effect. The agreement also includes a mechanism to resolve any disparity arising between the valuation findings of the city and one of the plans.

Depending on the plan and its funding level, and whether employer contribution rates have risen above the corridor maximum or fallen below the minimum, prescribed changes include:

**The main feature of all three is a contribution rate corridor arrangement**

Together these changes reduced the plans' combined unfunded liability by \$3 billion

- ▶ a reduction in the amortization period;
- ▶ a reduction in the assumed rate of investment return;
- ▶ switching the basis of the valuation from the use of the actuarial value of assets to market value;
- ▶ acceleration of liability layers;
- ▶ restoration of any benefits that may have been cut after implementation of the new plan design;
- ▶ a reduction or increase in employee contributions;
- ▶ a higher cost-of-living adjustment;
- ▶ a higher retirement age.

Other steps require the City and the plan to confer in order to reach agreement to restore the employer contribution rate to within the corridor, which may include additional changes to benefit levels.

A range of benefit reductions affecting all plan participants and higher required employee contributions are other important elements of the agreement to reform the City's pension plans. Together these changes reduced the plans' combined unfunded liability by \$3 billion. The agreement was made contingent upon approval by Houston voters of the issuance of \$1 billion in pension obligation bonds to make a down payment on reducing the plans' unfunded liabilities. This ballot item was approved in late 2017 by city voters. **Combined with the benefit reductions, the changes reduced the plans' combined unfunded liabilities by \$4 billion.**



The reform bill also required a reduction in the plans' investment return assumptions to 7.0 percent, and, as part of the city's commitment to fully eliminate its unfunded liabilities over a 30-year period, the plans switched from open to closed amortization periods, using a layered

approach, and a requirement that the city will pay its full actuarially determined contribution every year. Although reducing the investment return assumption and closing the funding period increased the plans' unfunded liabilities and costs, they were considered to be vital steps toward what the city believed was a more realistic measurement of the size and scope of its pension funding obligation.

### Midpoint Rates for City of Houston Pension Plans

Plan	Midpoint Rate
Firefighter Retirement and Relief Fund	31.89%
Municipal Employees Pension System	8.17%, growing gradually to 8.81%, plus a designated dollar amount, beginning at \$124 million annually, which in total is equal to approximately 28.5% of payroll <sup>1</sup>
Police Officer Pension System	31.77% - 32.13%

<sup>1</sup> Rate is based on plan's normal cost; this rate and the designated dollar amount are prescribed to grow gradually throughout the 31-year amortization period



# Utah Retirement Systems

## Risk-sharing plan design features

A statutory cap on employer contributions to employee retirement benefits; employee plan choice of a traditional pension or a defined contribution plan

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Utah Retirement Systems (URS) is the sole public retirement system in the state, administering pension and other benefits for nearly

all public employees, including teachers, state employees, and employees of local governments who have elected to participate. URS administers several plans, the largest of which is the Noncontributory Plan, so named because employees do not contribute to the plan: employers pay the full cost of the plan. Some other, smaller plans administered by URS require employee contributions. Public Employees in Utah participate in Social Security.

In the wake of the 2008-09 market decline, plan contribution rates were projected to increase sharply and to stay higher for the next 20 years. The Utah Legislature responded to these projected higher rates in 2010 by passing Senate Bill 63, for all newly hired employees in the state hired July 1, 2011, or later. The bill contained two key provisions: it capped the employer retirement benefit contribution at 10 percent of pay, and created a new benefits tier. Benefits and contribution requirements for those who were participating in the URS as of June 30, 2011, were unaffected by the legislation.

Under the new plan design, known as Tier 2, new hires have a choice of retirement benefit: a hybrid plan or a defined contribution plan. The employer contribution rate to both plans is 10 percent of pay and 12 percent for firefighters

and police officers. Employees who elect to participate in the defined contribution plan receive an employer contribution of 10 percent of pay. For those who elect to participate in the hybrid plan, employers contribute the 10 percent of pay (12 percent for public safety officers and firefighters) to providing Tier 2 benefits.

When the cost of the defined benefit portion of the hybrid plan is less than 10 percent, the difference is paid into a supplemental defined contribution plan account for the employee. If the cost of the defined benefit portion of the hybrid plan ever exceeds 10 percent, the employee will be required to pay the cost that is in excess of 10 percent of pay (12 percent for public safety officers and firefighters).

Since inception of the hybrid plan, the cost has remained below 10 percent: in fiscal year 2019, the cost of the hybrid plan is 8.85 percent, leaving 1.15 percent for Tier 2 plan participants to receive in a supplemental defined contribution plan. The cost of the Tier 2 plan for public safety and firefighter employers in fiscal year 2019 is 11.26 percent, leaving 0.74 percent for the employees' supplemental defined contribution account.

The bill establishing Tier 2 gives new hires one year from their date of employment to decide what plan to join. New hires may switch

**The bill establishing Tier 2 gives new hires one year from their date of employment to decide what plan to join**



between the hybrid and DC plans as they wish during their first year, but upon expiration of the one-year period, the new member remains in the plan of last election. The hybrid plan is the default option in the event no active election is made. **Through 2015, approximately 80 percent of new hires have elected to participate in the hybrid plan.<sup>1</sup>**

The 10- and 12-percent limits on employer contributions are not, however, the full cost to employers for Tier 2 employees. SB 63 also requires all employers to contribute the cost to amortize the unfunded liabilities of Tier 1 employees, including on the payroll of Tier 2 employees. This cost, which is not a factor in the Tier 2 employer contribution rate caps, varies depending on employer group and currently ranges from approximately 6.6 percent to 10.0 percent for general employees and teachers, and from approximately 12.0 percent to 20.0 percent for most employers of public safety personnel. When the Tier 1 unfunded liabilities are fully amortized, these required payments will be eliminated.

In addition to the plan's lower cost, as shown in Table 1, Utah public employers face lower risks, as their total liability is limited to the plans' designated maximum employer contribution rate. Since its inception in July 2011, the cost of Tier 2 has remained fairly stable, and through 2019, the cost remains below the maximum employer contribution threshold.

In Tier 2, public employers are protected from the effects of a market downturn or other negative actuarial experience. That protection comes in the form of a 10 or 12 percent cap on the employer cost of retirement benefits. Employers continue to make contributions to amortize the Tier 1 plan's unfunded liabilities, and therefore will remain exposed to market risk and its effect on unfunded liabilities. As the legacy unfunded liability is eliminated, employers' potential market risk also will diminish. Once these liabilities are eliminated, projected for 2037, employers' maximum retirement benefit exposure will be the maximum contribution rates established in Tier 2.

**Table 1. Comparison of Utah employer contribution rates in FY 19**

	Normal Cost	Cost to Amortize UAAL	Payment to DC plan	Total Cost	Tier 2 Savings
<b>Tier 1 Local Government</b>	11.86%	6.61%	NA	18.47%	---
<b>Tier 2 Local Government</b>	8.85%	6.70% <sup>2</sup>	1.15%	16.69% <sup>4</sup>	1.86%
<b>Tier 1 State and School</b>	12.25%	9.94%	NA	22.19%	---
<b>Tier 2 State and School</b>	8.76%	10.03% <sup>3</sup>	1.15%	20.02% <sup>4</sup>	2.17%

2 Includes 6.61% to amortize Tier I UAAL plus 0.09% to amortize Tier II UAAL  
 3 Includes 9.94% to amortize Tier I UAAL plus 0.09% to amortize Tier II UAAL  
 4 Includes 0.08% for death benefit

**Utah public employers  
face lower risks, as their  
total liability is limited  
to the plans' designated  
maximum employer  
contribution rate**

The reduction in risk that Utah employers gained shifted risk to employees hired since July 2011. Should the cost of the hybrid plan rise above the designated employer maximum contribution rate, employees will be responsible for contributing the difference. Such a cost increase could occur through a combination of more conservative actuarial assumptions, actuarial methods, and actuarial experience. The reverse is true as well; if this same combination works to reduce the employer cost, employees will have a larger percentage of pay placed in their DC plan accounts.

Five and one-half years after inception of Tier 2, employees participating in the new plan account for nearly one-third of the combined (non-public safety) membership of all plans. Of all Tier 2 participants, approximately 80 percent have elected or defaulted into the hybrid plan.

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1 [Jennifer Erin Brown and Matt Larrabee, "Decisions, Decisions: An Update on Retirement Plan Choices for Public Employees and Employers," National Institute on Retirement Security, August 2017](#)



# Wisconsin Retirement System

## Risk-sharing plan design features

Benefit accrual rates, contribution rates for current active participants, and retiree annuities are adjusted annually depending on the performance of the fund's investments.

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The Wisconsin Retirement System (WRS) administers retirement and other benefits for nearly all public employees in the state, with the main exception being those who work for the City of Milwaukee and Milwaukee County. The system's assets are managed by the State of Wisconsin Investment Board (SWIB).

The WRS was established following a 1982 merger of several public employee retirement systems in the state into a consolidated system.<sup>1</sup> One result of the merger was the consolidation of various plan designs into a common framework that provides lifetime retirement income to retired public employees, with the possibility of supplementing that income with gains from "excess" investment returns within a framework that shares the risks, and rewards, of investment and actuarial experience among core participant groups: participating employers, active members, and retirees. Most public employees in Wisconsin participate in Social Security.

All WRS members contribute to the Core Fund, which provides the greater of two benefit options for employees who vest and do not leave: the formula annuity calculation and the money purchase calculation.<sup>2</sup> The monthly benefit provided under the formula annuity option is calculated by multiplying an individual's years of creditable service, monthly final average earnings, and a formula multiplier. Full

retirement benefits for general employees and teachers are available at age 65 with five years of service. Full benefits for participants in protective service occupations are available at age 54, with fewer than 25 years of service, or age 53, with 25 years or more of service. Below is an example of the formula annuity calculation:

Years of service	Final average monthly earnings	Multiplier	Monthly benefit
30	\$4,000	1.6%	\$1,920

The monthly benefit provided under the money purchase option is based on the annuitized accumulated balance of an individual's notional WRS account, which grows with employee and employer contributions and rises or falls depending on the performance of the fund's investments. The benefit is determined by an actuarially determined money purchase factor, which depends on the member's age at retirement. Below is an example of the money purchase calculation:

Accumulated money purchase balance	Age 65-based money purchase factor	Monthly benefit
\$250,000	0.00664	\$1,660

Members may also elect to participate in an optional Variable Fund, which invests contributions in domestic and global stocks that have the potential to generate greater returns but with greater volatility.

**Surplus funds that accumulate in the Core and Variable Funds as a result of five-year smoothed investment earnings above the assumed rate of return and other actuarial factors, such as gains from longevity experience, may be used to increase annuity payments to retirees**



The WRS does not provide retirees with a traditional cost-of-living adjustment (COLA). Rather, the system’s governing board is required, under certain circumstances, to grant annuity adjustments in the form of a dividend whose value can increase, or decrease, in accordance with the respective level of annuity reserve assets of the Core Fund<sup>3</sup> and the Variable Fund.<sup>4</sup> Surplus funds that accumulate in the Core and Variable Funds as a result of five-year smoothed investment earnings above the assumed rate of return and other actuarial factors, such as gains from longevity experience, may be used to increase annuity payments to retirees. If a shortfall is created, due to investment losses or other adverse actuarial experience, annuity payments may be decreased. When annuities are decreased, the cuts may be applied only to the amount of increases that had been granted previously. Per state law, Core Fund annuity payments to WRS retirees may not be reduced below their original, guaranteed “floor,” which is established at the time of a member’s retirement. Adjustments to Variable Fund annuities may cause the benefit to fall below its original amount.

The provision of annuity adjustments is subject to an annual actuarial valuation. WRS actuaries assume a 5.0 percent investment return to fund participants’ original benefit (the aforementioned “floor” amount). Since the nominal WRS investment return assumption is 7.2 percent, if experience matched assumptions perfectly, retirees would receive a 2.2 percent annuity adjustment each year. **However, since investment experience rarely matches assumptions, and other actuarial factors must be accounted for, WRS actuaries must determine the level of annuity adjustments that can be provided, or must be recouped, in order to preserve or restore the funds’ balance.**

The requirement for actuaries to calculate the level of annuity adjustment that can be provided, or that must be recouped to preserve or restore the funds’ surplus, is similar to the South Dakota Retirement System requirement that any COLA must be sustainable and must retain the plan’s full funding level ([see page 41](#)).

The table (opposite page) shows the relationship between the funds’ investment returns and the annuity adjustments for the past twenty years.<sup>5</sup>

Since 2001, the WRS has been funded at or near 100 percent, and with employer contribution rates well below the median for peer systems. As of 2015, Wisconsin state and local pension contributions equaled just 2.2 percent of all state and local spending, which is less than half of the national average. With regular appropriation of the full actuarially determined contribution by participating employers, the shared-risk plan design helps maintain a high funding level, with predictable, stable benefits, at a comparatively low cost to employers and with little volatility in required employer contribution rates.

1 [Rachel Janke, “Wisconsin Retirement System,” Wisconsin Legislative Fiscal Bureau, January 2017](#)

2 [Wisconsin State Legislature, Public Employee Trust Fund, Wisconsin Retirement System, Retirement Annuities](#)

3 [Wisconsin State Legislature, Public Employee Trust Fund, Wisconsin Retirement System, Post Retirement Adjustments, 40.27\(2\)](#)

4 [Wisconsin State Legislature, Public Employee Trust Fund, Wisconsin Retirement System, Variable Benefits, 40.28\(2\)](#)

5 [Wisconsin Department of Employee Trust Funds, Core Fund and Variable Fund: Returns, Rates and Adjustments](#)

Year	Core Fund investment return (gross of fees %)	Core Fund annuity adjustment (gross of fees%)	Variable Fund investment return (gross of fees %)	Variable Fund annuity adjustment (gross of fees %)
1998	14.6	7.2	17.5	12.0
1999	15.7	17.1	27.8	21.0
2000	-0.8	5.7	-7.2	-11.0
2001	-2.3	3.3	-8.4	-14.0
2002	-8.8	0.0	-21.9	-27.0
2003	24.2	1.4	32.7	25.0
2004	12.8	2.6	12.8	7.0
2005	8.6	0.8	8.3	3.0
2006	15.8	3.0	17.6	10.0
2007	8.8	6.6	5.6	0.0
2008	-26.2	-2.1	-39.0	-42.0
2009	22.4	-1.3	33.7	22.0
2010	12.3	-1.2	15.6	11.0
2011	1.4	-7.0	-3.0	-7.0
2012	13.7	-9.6	16.9	9.0
2013	13.6	4.7	29.0	25.0
2014	5.7	2.9	7.3	2.0
2015	-0.4	0.5	-1.2	-5.0
2016	8.6	2.0	10.6	4.0
2017	16.2	2.4	23.2	17.0
<b>Median</b>	<b>10.6</b>	<b>2.2</b>	<b>11.7</b>	<b>5.5</b>
<b>Avg</b>	<b>7.8</b>	<b>2.4</b>	<b>8.9</b>	<b>1.5</b>

