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Contents

Editor's Introduction	1
<i>By Jeanette Cooper</i>	
A Middle Ground for Public Plans	2
<i>By Rowland Davis</i>	
Comments on the Paper	23
<i>By Joe Tomlinson</i>	
Comments on the Paper	25
<i>By Evan Inglis</i>	
Author's Response to Comments	28
Funding of Public Sector Pension Plans	30
<i>By Chun-Ming (George) Ma</i>	
Comments on the Paper	59
<i>By Stephen W. I. Cheng</i>	
Author's Response to Comments	61
The South Dakota Retirement System Generational Benefit Structure	62
<i>By Douglas J. Fiddler, R. Paul Schrader and Robert A. Wylie</i>	
Comments on the Paper	89
<i>By Brian B. Murphy</i>	
Comments on the Paper	95
<i>By Todd Tauzer</i>	
Authors' Response to Comments	100
Multiple Employer Pension Plan Risk-Sharing Model	102
<i>By Sandra J. Matheson and Gene Kalwarski</i>	
Comments on the Paper	126
<i>By Jean-Pierre Aubry</i>	
Authors' Response to Comments	129

Editor's Introduction

By Jeanette Cooper

This issue of *The Retirement Forum* presents the four prize-winning papers from the Retirement 20/20 Call for Models for Public Pension Plans Contest, which was conducted in 2018, and includes commentary from reviewers of these papers and replies from the authors.

Retirement 20/20 is a Society of Actuaries (SOA) initiative started in 2005 to discover retirement designs that go beyond traditional defined benefit (DB) and defined contribution (DC) plans. The goal of this initiative is to mitigate both the employer and employee risks inherent in the current DB and DC framework.

The winning papers include both theoretical and current real-world models.

Our first paper, "A Middle Ground for Public Plans" by Rowland Davis, divides a retirement program into two distinct and separate pieces—a Tracker Plan to accumulate funds while actively working and a sustainable payout program. In his comments on the paper, Joe Tomlinson points out the design elements within the model that reduce risk including the importance of the Quantitative Evaluation System. Additionally, Evan Inglis raises questions on intergenerational equity and the design's complexity.

George Ma's paper, "Funding of Public Sector Plans," explains the intergenerational inequity found in Canada's current funding approach for DB plans. Ma then provides an alternative sustainable model to address this along with practical considerations on how Canadian law would need to be amended to accommodate the model. Stephen Cheng provides a number of suggested enhancements.

Turning to real-life models, Doug Fiddler, Paul Schrader and Robert Wylie demonstrate how flexible benefit features support fixed contributions while statutory funding thresholds address when changes are needed. Their paper, "The South Dakota Retirement System Generational Structure," explains how these tenets work in practice. Brian Murphy comments on the principles-based approach used by the System. Todd Tauzer looks at the System from an Enterprise Risk Management perspective.

The last paper, "Multiple Employer Pension Plan Risk-Sharing Model" by Sandra Matheson and Gene Kalwarski, describes their work with the Maine Public Employees Retirement System to modify the multiple employer Consolidated Participating Local District Retirement Plan. The updated plan is based on a shared-risk model designed to distribute the risk of adverse investment and liability experience among the plan's stakeholders. Jean-Pierre Aubry compares the model's risk levels with other common retirement plan designs and comments on the implications of how the risk is allocated.

With the COVID-19 pandemic, people around the world are spending more time contemplating and evaluating risk. We hope that reading these papers will provide insights into the risks that public sector retirement plans face and offer ideas for managing those risks.

We thank the authors and discussants for their thoughtful treatment of this topic.

Jeanette Cooper, FSA, EA, FCA, MAAA, is a vice president and consulting actuary in Segal's Atlanta office.

A Middle Ground for Public Plans

By Rowland Davis

In this paper I propose two specific ideas for risk-sharing programs that I think could reasonably be implemented (together or separately) in the public plan space and would represent a middle-ground approach that might ease the current tensions between participants and sponsors:

1. **A program for accumulating funds during the active employment phase, which I call the Tracker Plan.** This is a defined contribution plan, but also includes a variable contribution feature that offers support for participants when investment performance falls short of expectations.
2. **A program for paying lifetime benefits to participants after retirement.** This is based on a collective risk-sharing fund that follows specific rules for payment of a base benefit amount, as well as bonus payments when the fund earns investment returns that build some surplus in the fund. The fund is designed to be fully sustainable for future years, without any liability or cost to the sponsor.

I will illustrate how these two ideas can be evaluated using a specific quantitative evaluation framework developed as part of a Society of Actuaries (SOA) *research project*. This framework is intended to aid in the evaluation of any new retirement program designs, with a specific goal of allowing direct comparisons of key results with other proposed designs.

1. Background Thoughts

A full-scale summary of the current public plan space is beyond the scope of this paper. Other groups have good summaries available (e.g., Pension Research Center, Center for State and Local Government Excellence). I only want to characterize my own personal view of the critical issues that motivate my thinking. The public plan space in the United States currently remains dominated by defined benefit plans—unlike the private sector. In recent years these defined benefit plans have been characterized by rising cost levels, triggered by unfunded pension obligations. State and local legislative bodies have seen pressure to reduce benefit levels and bring costs down. There is often a political dimension to the tensions: current participant interests are represented by unions and (generally) the political left, while cost control efforts are more strongly supported (generally) by the political right. In many situations it seems that middle ground, or compromise, solutions are never seriously considered. One side fights to preserve the status quo, while the other side often pushes the more extreme alternative of putting public plans on a path to conventional defined contribution designs.

Obviously, standard defined benefit plans and standard defined contribution plans represent the two ends on the spectrum of who bears risk. My view is that a middle ground solution should be the target, one where risks are shared to some degree between the participants and the sponsors, and also among participants collectively. I fully recognize the difficulty of changing the focus of opposing sides in the current environment, but clearly the starting point is to develop ideas for consideration and to illustrate the value of these ideas. My hope is that over time these ideas might take root and lead to implementation in one or more visible situations. Following successful implementation in a few cases, others can feel more comfortable taking the same path. I also think that opportunities are significant for innovation in the relatively new type of public plan set up by several states, under the so-called Secure Choice initiative, that cover workers in the private sector who lack coverage under an employer plan. Currently

these plans are legally constrained during the accumulation phase, but these restrictions may fade over time—and the payout phase seems perfect for implementation of new designs.

2. Evaluation Framework: General Description

Because I intend to use a specific evaluation framework in the analysis of my design ideas, this framework should be outlined first. The Retirement 20/20 initiative started several years ago with a very open conversation about how innovative ideas could be developed and implemented in the evolution of the non-Social Security portion of the U.S. retirement system. A while later, a measurement framework was developed to aid in discussions and comparisons of different ideas. However, this measurement framework was qualitative in nature, and a need was recognized that a quantitative evaluation framework should be added to the overall measurement and evaluation process. In late 2015 a research project was initiated by the SOA for this purpose, and I was the lead researcher. While the project may eventually continue into another phase, the technical aspects of the quantitative evaluation framework (QE framework) are now developed and will be used in this paper.

The QE framework includes the following general components:

- A set of well-defined metrics that should be determined for each proposed retirement system design
- The specific methods that should be used for the calculations
- The specific assumptions that should be used for the calculations
- Separate (but connected) models for developing metrics for the accumulation phase and for the payout phase, predicated on the concept that these two parts of any retirement program are fundamentally separable (i.e., any accumulation structure may be combined with any payout structure to form a complete retirement system)

The standardized set of metrics, methods and assumptions allow direct comparison of quantitative results when analyzing different design ideas. In this paper I am not including full documentation of all the metrics, methods and assumptions, but further information can be found on the SOA website. In Appendix A to this paper I include some more information on the QE framework.

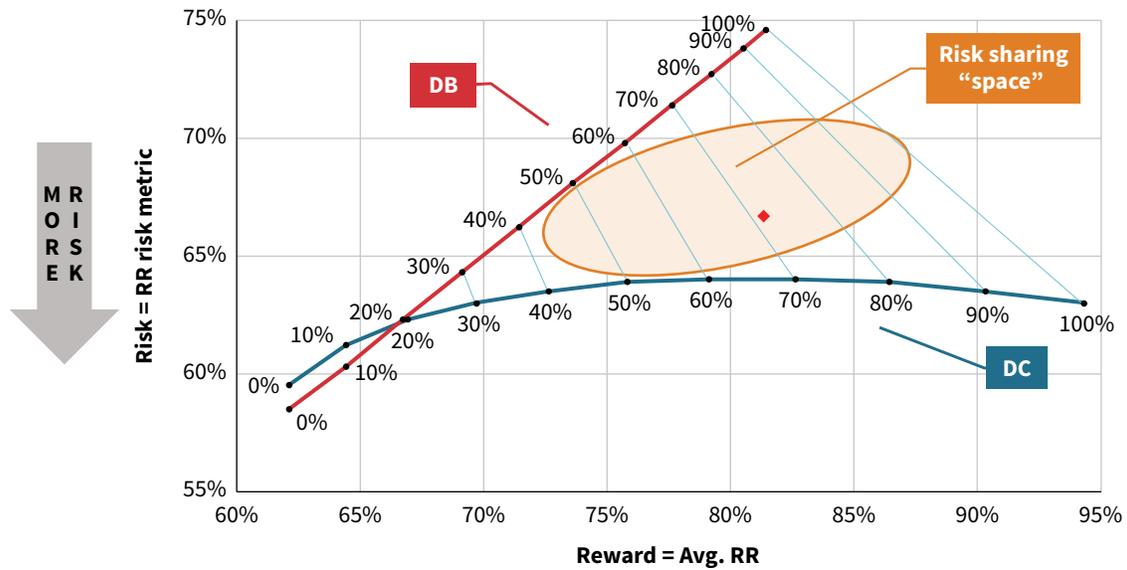
3. QE Framework for the Accumulation Phase

One of the goals of the QE framework is to clarify the risk-sharing nature of a proposed design—both the degree of risk sharing and the financial efficiency of the specific design. To help with this, the framework includes sets of baseline metrics for both a standard defined benefit (DB) plan and a standard defined contribution (DC) plan. Because the simplest risk-sharing design is some combination of a DB plan with a DC plan (“combo plan”), the framework can combine the baseline DB and DC metrics to obtain metrics for any combo plan. These combo plan metrics can then be used as a baseline for evaluation of any other type of risk-sharing design.

The QE framework uses a variety of metrics for the accumulation phase, but the most important ones are the benefit metric (i.e., replacement ratio) and the cost metric (i.e., cost as a level percent of pay over the full career). Graphically, these baseline metrics can be used to show what might be called the “risk sharing” space where the results for any risk-sharing design will plot. This is most easily illustrated using the benefit metric graph in Figure 1.

FIGURE 1

Graph Using the Benefit Metric



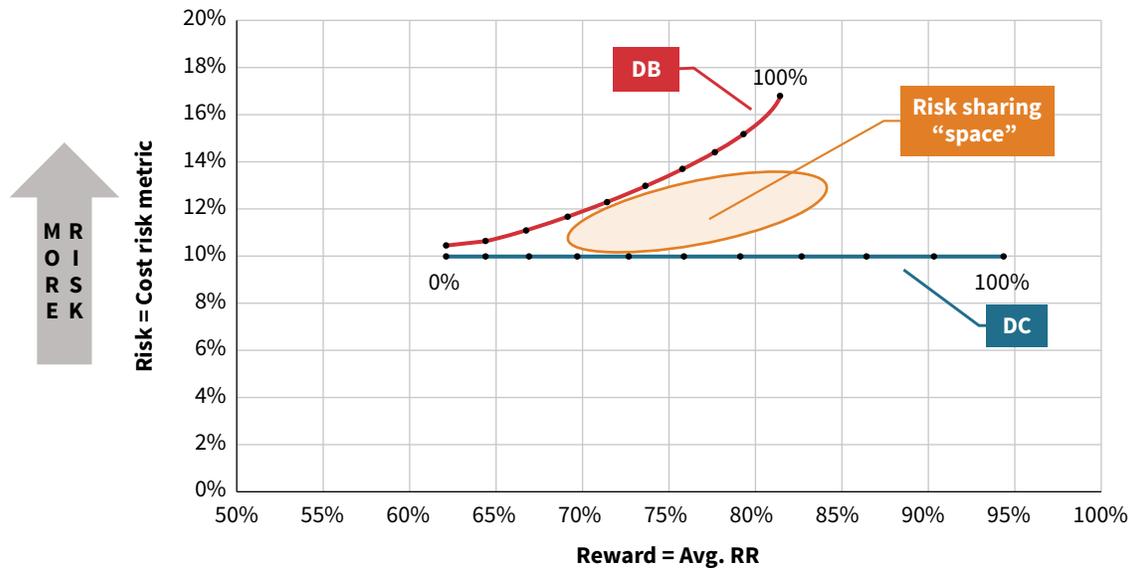
Here are notes to understand the graph in Figure 1:

- The metrics are based on the replacement ratio (“RR”) outcomes, including Social Security, produced at age 67 from a 10% of pay contribution (DC plan) or a 10% of pay average cost (DB plan). The reward metric on the horizontal axis is the average RR produced. The risk metric on the vertical axis is the average RR for the bottom quintile of outcomes (i.e., a conditional tail risk metric).
- The blue line shows the baseline DC plan results, and the orange line shows the baseline DB plan results. In both cases, the level of investment risk increases as you move from left to right. The data point labels indicate the percentage allocation to risk assets, with the balance in fixed income.
- The space in between the two lines is the risk sharing “space.” The red diamond might indicate where the results from a specific risk-sharing plan proposal plot. For any such point, there will also be some combo DB-DC arrangement that will produce the same results. The QE framework provides a tool for determining this equivalent combo plan (for this hypothetical example, it is a 20% DB + 80% DC plan with a 69% risk asset allocation for each).
- Note that while the DB plan results seem to dominate the DC plan results when we look only at the benefit metrics, the reverse is true when we look at cost metrics. In this cost space, the cost risk metric is the average cost for the highest quintile of outcomes. For any standard DC plan, this will always be just 10% of pay (i.e., no cost risk), but for any standard DB plan the cost risk will be higher than this, depending on the level of investment risk taken. The graph in Figure 2 shows the risk sharing space plotted using cost metrics, instead of benefit metrics.

This procedure opens the door to an evaluation methodology for any proposed risk-sharing design—namely, use the equivalent combo DB-DC plan as a benchmark for comparison. This will be illustrated later in this paper when I evaluate the Tracker Plan.

FIGURE 2

Graph Using the Cost Metric



4. The Tracker Plan Design

At the participant level, the major goals for the Tracker Plan are to:

- Provide an automatic path for participants to follow in accumulating the assets required to meet their retirement income needs.
- Control the risk of adverse outcomes, where assets are insufficient to meet needs.

At the macro program level, the major goals are to:

- Operate the plan(s) and manage the investments efficiently, professionally and at a low cost to the participants.
- Keep employer obligations, both financial and administrative, at reasonable and manageable levels, with a known upper limit on annual cost under worst-case conditions.
- Never have any unfunded obligations.

To meet these objectives, the Tracker Plan design is structured as a defined contribution plan, but with a variable add-on contribution feature (with a fixed maximum, or cap) designed to control downside risk for participants. More specifically, the Tracker Plan is designed to push some level of additional contribution into the accumulation process whenever negative investment outcomes result in a level of accumulation that falls below some specified target level. The idea is that this dynamic support mechanism can help limit the probability of inadequate benefit levels from a DC plan, while maintaining an acceptable upper limit on the cost.

With traditional defined contribution arrangements, two of the most common criticisms are that they are too risky for participants, and that participants lack the skills and training needed to make the

critical financial and investment choices required for successful outcomes. The Tracker Plan meets these problems with a primary emphasis on risk control and simplicity:

- For each participant there is a single investment vehicle that gradually decreases risk over the course of a career (i.e., the target date fund concept is used).
- There is a standard contribution pattern to follow throughout the participant's career, designed to accumulate to the required target amount at retirement. This could be either a flat rate at all ages, or an age-graded schedule. For this paper I will just analyze a flat-rate approach. Participants could be given an option to contribute at a different rate, possibly subject to some limits.
- Progress toward the target is monitored (based on a hypothetical straw man for each cohort), and adjustments are made according to a fixed set of operational rules based on tracking error. If performance is adverse and the fund is tracking below the desired target path, then additional contributions may be triggered, up to a fixed maximum add-on.

Risk control is a critical objective, and specific measures and standards are needed to determine whether the amount of risk is contained within reasonable levels. My suggested standards are that (1) with about 90% confidence, the participant will (over a full career) meet or exceed the desired target asset accumulation, and (2) for those cases where the target is not met, the shortfall can be managed with relatively painless steps, which would include working no longer than one year beyond the regular retirement date. These specific standards became my benchmark test for each design option I analyzed with the Monte Carlo simulation model that is part of the QE framework toolkit. Through an iterative process I refined each of the design parameters to achieve the risk control standard. The following subsections describe the specific Tracker Plan model that resulted from this process. There are subjective calls made along the way, but mostly these were to maintain a balance between simplicity of design and achieving improvements in the risk control outcomes.

5. Retirement Income Target

The first parameter choice is to select a target level for retirement income. For this paper, I use a target 70% income replacement ratio at age 67, inclusive of Social Security, for a worker with career earnings at median U.S. levels. This means that at age 67 the total income available from Social Security benefits plus the Tracker Plan benefits will be equal to 70% of the gross income at the time of retirement.¹ The Tracker Plan benefits are based on annuitizing, with market-priced annuity factors, the accumulated funds at age 67. The annuity includes a post-retirement increase factor of 2.5% per year, and the pricing includes a 5% loading factor to approximate group product pricing. The Social Security benefit used is based on retirement at age 67 in 2053, and this produces a 39% replacement ratio for Social Security alone. To meet the 70% overall target, the Tracker Plan benefit should therefore replace 31% of pre-retirement income. More specifically, recognizing the risk control objectives stated in the previous section, the Tracker Plan benefit should equal or exceed 31% of final pay with about a 90% probability, and should almost never fall much below 25% of final pay (a 5%–6% shortfall is about what a worker can expect to recover by working to age 68 instead of to age 67).

¹ In an earlier paper on the Tracker Plan, I used a more generous 75% replacement ratio target at age 65. The actual target used for any design should be based on goals mutually agreed to by the sponsor and representatives of the participant group. The design parameters used for the earlier paper are also somewhat different than those used in this paper.

6. Tracker Process and Design Parameters

The truly unique feature of the Tracker Plan is a set of automatic adjustments that will help keep accumulations on the desired path toward the required target. These adjustment provisions are a key part of the risk control process, and they facilitate a sharing of risk between workers and employers. The primary adjustment occurs when investment performance is adverse and the fund is tracking below the desired target path, which triggers additional contributions, up to a fixed maximum add-on (which ensures that this remains a DC plan with no sponsor liabilities). Optional adjustment features that might also be considered are:

- If a fund has better than expected investment performance and a positive tracking error above some trigger point is created, then a reduction in investment risk could be implemented. This would operate to protect the “surplus” in the fund (and in any scenario similar to 2008–2009 would have been very effective in cushioning losses for those near to retirement).
- A positive tracking error as described previously might also trigger a decrease in contribution rates, but limited to a “claw-back” of any previous positive additional contributions. This would be a way to reduce the cost for the variable contribution feature.

In this paper I will use a design model that has only the positive additional contribution feature.

The tracking process does not need to be done at the individual participant level, as long as all plan features remain standardized. Separate tracker funds are established for each individual age cohort, or (subject to further testing) for cohorts in 3- to 5-year age groups. A hypothetical account can be tracked for each of these tracker cohort funds, based on the assumption of a worker making the scheduled contributions, and earning the investment returns actually realized by that tracker fund. The tracking error for this hypothetical account will be monitored, and on an annual basis the level of the tracking error will be used to trigger any needed automatic adjustments for all workers in that tracker fund. Within each tracker fund, workers will all be treated exactly the same way.

The next step in the design process is to develop the target accumulation path that will serve as the tracking benchmark. The contribution rate required for 90% of the scenarios to meet the 70% replacement ratio target at age 67 can be determined using assumptions about expected returns and inflation, and reflecting the uncertainty of these by using the Monte Carlo simulation model. An investment policy must be specified. The design analyzed for this paper uses a somewhat conservative target date fund for investments (the glide path for the risky asset allocation declines from 60% at age 35 to 20% at age 65). With this investment policy, a base contribution of 10.6% of pay is required to meet the replacement ratio constraints. At each age through the career the resulting accumulated values can now be calculated for all scenarios and expressed as a percent of pay. From the simulated range of pay multiples at each age, the median value is used as the tracking benchmark, or target accumulation, at each age. For each cohort tracker fund, the tracking error will be measured against this benchmark. If there is a negative tracking error that exceeds some threshold defined by the plan, then additional contributions would be triggered for all the participants in that tracker fund. The graph in Figure 3 illustrates the target path for the design parameters used in this paper. The dotted line shows the trigger level for additional contributions, which is based on an age-graded schedule of the tracking error limits (see Table 1). The tracking error threshold becomes tighter, in percentage terms, as participants approach retirement.

FIGURE 3

Graph of Target Path by Age for Accumulation (% of Pay)

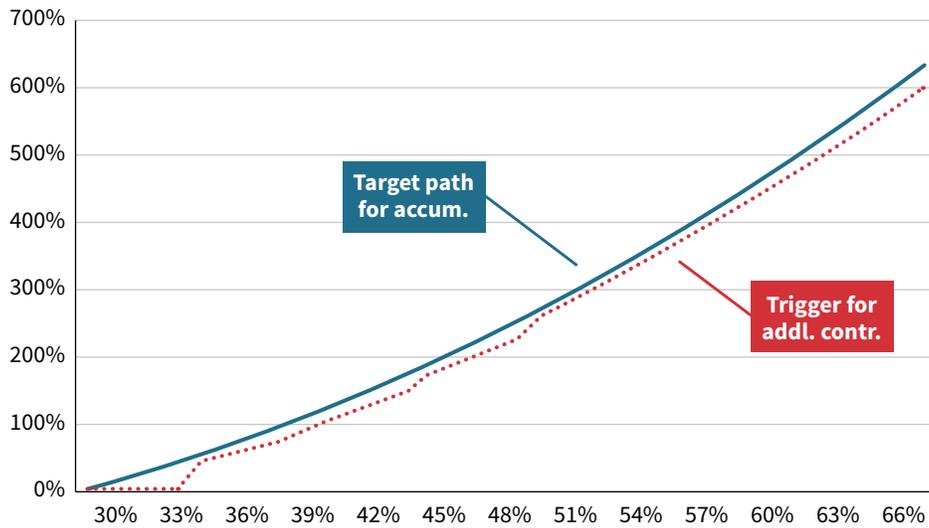


TABLE 1

Age-Graded Schedule of Tracking Error Limits

AGE	TRIGGER
<35	NA
35–39	–20%
40–44	–15%
45–49	–10%
>=50	–5%

The final design choice is how large the additional contributions should be, whenever they might be triggered. This could be defined in various ways, but I use three parameters to define the size of the additional contributions:

1. **Correction target.** The starting point for calculating any additional contribution is the tracking level, but this parameter determines whether the full tracking error is used or whether the corridor margin is subtracted first. Basically, the choice is between trying to get back to the target level itself or back to the corridor around the target. The net amount can be referred to as the “adjusted tracking error.” The design choice I use for this paper is the use of the full tracking error (i.e., the goal is to move back to the target path).
2. **Correction speed.** This parameter would set the number of years, which is used to divide the “adjusted tracking error” to derive the additional contribution amount (before application of the cap). For example, if 3 years is used here, the additional contribution amount would be twice as large as compared with using 6 years—and the intended time frame for getting back on target would be correspondingly shorter. For this paper I am using a period of 5 years (i.e., the additional contribution would be equal to 20% of the tracking error).
3. **Cap on contribution adjustments.** This puts the upper limit on any additional contribution amount, which is what keeps the plan within the defined contribution family. For this paper I set the cap at 50% of the base contribution amount, or 5.3% of pay ($= 50\% \times 10.6\%$ base contribution rate).

This completes the basic definition of the Tracker Plan design being used for this paper. I have made design choices to illustrate how the Tracker Plan can work. Other choices for the design parameters are acceptable, and the choices made should be based on the goals and constraints specific to each situation. The QE framework includes a specific module that can be used by researchers to test alternative design options, as well as some analysis that has already been done on how results change with different design parameters.

7. Accumulation Phase Analytics

7.1 COST

There are various ways to analyze the additional contribution feature of the Tracker Plan design just described. This section will review several of these. Probably the most important from the plan sponsor’s viewpoint is the overall range of cost. The average total cost for this sample Tracker Plan is 11.5% of pay (= 10.6% base contribution [employee + employer], plus 0.9% average for the additional contributions). The maximum annual cost for any single cohort would be 15.9% of pay (= 10.6% base contribution [employee + employer] × 150%), but in any single year the employer would be funding multiple cohorts and this maximum amount would be extremely unlikely to occur for all cohorts at the same time. Table 2 is the range of total cost based on the simulation model:

TABLE 2

Range of Total Cost Based on Simulation Model

%TILE	BASE	ADDL.	TOTAL
99%	10.6%	3.1%	13.7%
90%	10.6%	2.1%	12.7%
75%	10.6%	1.4%	12.0%
50%	10.6%	0.7%	11.3%
25%	10.6%	0.2%	10.8%
10%	10.6%	0.0%	10.6%
1%	10.6%	0.0%	10.6%

Table 2 shows that the effective worst case produces a cost for the additional contribution feature of 3.1% of pay. The median level of cost is 0.7% of pay. There is about a 25% chance that the cost will be at, or very close to, zero.

From the participant’s point of view, the focus is on how much they might benefit from the additional contribution feature. Using the sample employee from the QE framework (hired at age 30 and retired at age 67), there is about a 15% chance that they would never need any additional contributions because of favorable investment performance. Table 3 shows the distribution range for the number of years (over the 37-year career) where additional contributions would be paid, and the cumulative amount received (as % of pay):

TABLE 3

Distribution Range and Cumulative Amount Received for Number of Years With Additional Contributions

%TILE	# YRS.	% PAY
99%	22	110.6%
90%	15	77.2%
75%	10	50.9%
50%	5	25.4%
25%	2	8.3%
10%	0	0.0%
1%	0	0.0%
Mean	6.6	32.6%

The typical participant could expect additional contributions totaling between 25% and 33% of pay over their career, which is equivalent to another 2½ to 3 years’ worth of contributions. In the worst quartile of investment outcomes, the additional contributions become equivalent to more than 5 years’ worth of contributions.

7.2 BENEFITS

The Tracker Plan design is built around the goal of mitigating downside risk for the participants, in a cost-effective manner. The sample plan discussed in this paper set out very specific goals for the control of downside benefit risk, so the analysis of benefit results is focused on:

- Does the plan design meet the goals?
- How much is participant risk reduced, relative to a standard DC plan?

Table 4 shows the full range of replacement ratios for the sample Tracker Plan design and compares them with the range of results using standard DC plans with contributions set at three different levels: (1) the 10.6% base contribution rate for the Tracker Plan, (2) the 11.5% expected average contribution rate for the Tracker Plan, and (3) a 12% contribution rate equal to the 75th percentile cost for the Tracker Plan. Downside, or shortfall, risk probabilities are also shown for replacement rate targets of 70% and 65%. All results are for the 37-year career sample employee used in the QE framework.

TABLE 4

Replacement Ratios for Sample Tracker Plan

%TILE	TRACKER	DC Plan w/ contr. rate:		
		10.6%	11.5%	12.0%
99%	94.2%	93.0%	97.6%	100.2%
90%	84.8%	83.5%	87.2%	89.3%
75%	79.8%	77.7%	81.0%	82.8%
50%	75.6%	73.1%	76.0%	77.7%
25%	72.4%	69.3%	71.8%	73.2%
10%	69.8%	66.0%	68.3%	69.6%
1%	66.0%	61.3%	63.2%	64.3%
Mean	76.6%	74.0%	77.0%	78.6%
Shortfall risk:				
70% RR	11.0%	30.4%	16.2%	11.3%
65% RR	0.2%	6.8%	1.8%	1.8%

Table 4 shows a significant reduction in shortfall risk versus a DC plan with a contribution rate equal to the 11.5% average Tracker Plan cost, and even a noticeable reduction when the contribution rate is raised to the 75th percentile cost level of 12%. This illustrates the efficiency of a design like the Tracker Plan, with a dynamic variable contribution targeted specifically to mitigate poor investment performance.

7.3 SENSITIVITY TO INVESTMENT POLICY

The results analyzed so far are based on a fairly conservative target date fund approach (60–20 glide path), which is equivalent to a flat 38% risk asset allocation (i.e., both produce the same mean DC plan accumulation value at retirement). In this section the same results will be produced using a more typical target date fund (90–50 glide path), which is equivalent to a flat 68% risk asset allocation. This will show the sensitivity of results to the level of investment risk in the allocation policy selected.

With the increased risk asset allocation, the base contribution rate required to meet the replacement ratio goal (70% RR with 90% confidence) drops to 9.5% (from 10.6% previously). The average expected cost for the additional contribution feature increases to 1.2% of pay (from 0.9% previously). Table 5 shows the full range of cost using the higher risk asset allocation.

TABLE 5

Full Range of Cost Using Higher Risk Asset Allocation

%TILE	BASE	ADDL.	TOTAL
99%	9.5%	3.4%	12.9%
90%	9.5%	2.6%	12.1%
75%	9.5%	1.9%	11.4%
50%	9.5%	1.1%	10.6%
25%	9.5%	0.4%	9.9%
10%	9.5%	0.1%	9.6%
1%	9.5%	0.0%	9.5%

Table 6 shows the full range of replacement ratios using the higher risk asset allocation and compares them with the range of results using standard DC plans with contributions set at three different levels: (1) the 9.5% base contribution rate for the Tracker Plan, (2) the 10.7% expected average contribution rate for the Tracker Plan, and (3) a 11.4% contribution rate equal to the 75th percentile cost for the Tracker Plan. Downside, or shortfall, risk probabilities are also shown for replacement rate targets of 70% and 65%. All results are for the 37-year career sample employee used in the QE framework, as before.

The overall summary of the changes relative to the Tracker Plan using a lower risk asset allocation is as follows:

- The base rate drops by 1 percentage point, and the total expected cost drops by 0.8 percentage points, using the percent of pay cost measure.
- The mean replacement ratio increases by 7.7 percentage points, or about 10%.
- Shortfall risk is essentially the same at the 70% RR target, but the probability of falling below a 65% RR increases from 0.2% to 3.2%.

TABLE 6

Full Range of Replacement Ratios Compared With DC Plans

%TILE	TRACKER	DC Plan w/ contr. rate:		
		9.5%	10.7%	11.4%
99%	129.8%	127.3%	138.5%	145.0%
90%	103.4%	100.2%	108.0%	112.5%
75%	90.8%	87.0%	93.1%	96.6%
50%	81.6%	77.0%	81.8%	84.6%
25%	74.8%	69.8%	73.7%	75.9%
10%	69.4%	64.4%	67.6%	69.4%
1%	62.2%	57.3%	59.6%	61.0%
Mean	84.3%	79.9%	85.1%	88.1%

Shortfall risk:

70% RR	10.5%	26.3%	14.5%	11.1%
65% RR	3.2%	11.2%	7.0%	5.0%

7.4 COMPARATIVE

The QE framework is designed to facilitate comparison of different plan designs, especially risk-sharing designs. The framework will be used to compare the Tracker Plan with other risk-sharing designs. I previously noted that for any design, an equivalent combo DB + DC plan can be determined, which will produce the same key benefit metrics. The equivalent combo plans can then serve as benchmarks to evaluate different designs.

Many of the comparative metrics in the QE framework are based on results with a standardized mean *cost* of 10% of pay for each program, which then allows for direct comparison of the benefit results and cost risk results. However, another approach in the QE framework is to standardize the plan results based on a specific *benefit* objective. One of those standardized benefit objectives is to derive the cost for each plan that would be required to produce a 70% replacement ratio (including Social Security) with a 90% confidence level (i.e., no more than about 10% of the simulation results for a full career sample employee would fall below the 70% replacement ratio target). This is the same benefit objective that I used to derive the specific Tracker Plan design discussed in this paper.

With this fixed benefit objective, a simple graph can be used to illustrate for any proposed plan design the degree of risk sharing, and the cost efficiency relative to the combo DB-DC plans. Figure 4 shows the graph for the Tracker Plan, using the more conservative asset allocation policy (a target date fund with a 60–20 glide path). The blue portion of each bar indicates the expected average cost level, and the orange portion indicates the “cost risk metric” level (i.e., the average cost in the worst quintile of outcomes). The large bar on the right is for the plan under evaluation (here the Tracker Plan), while the smaller set of bars to the left show results for various combination blends of a standard DB plan and a standard DC plan—which spans the full range of risk-sharing possibilities.

The dotted blue line maps into the risk-sharing space at a point between the 50% DB–50% DC combo plan and the 25% DB–75% DC combo plan, indicating a significant degree of risk sharing for this Tracker Plan design. We then can see that the dotted orange line maps to a very similar location, indicating that the Tracker Plan has a cost risk almost the same as the equivalent combo plan. The specific results here are that the equivalent combo DB-DC plan is a 35% DB–65% DC blend, and the cost risk metric for this equivalent combo plan is 12.7% of pay. This compares to a cost risk metric for

FIGURE 4

Results with a Lower Allocation to Risk Assets (Conservative 60–20 TDF for DC; Flat 38% for DB)

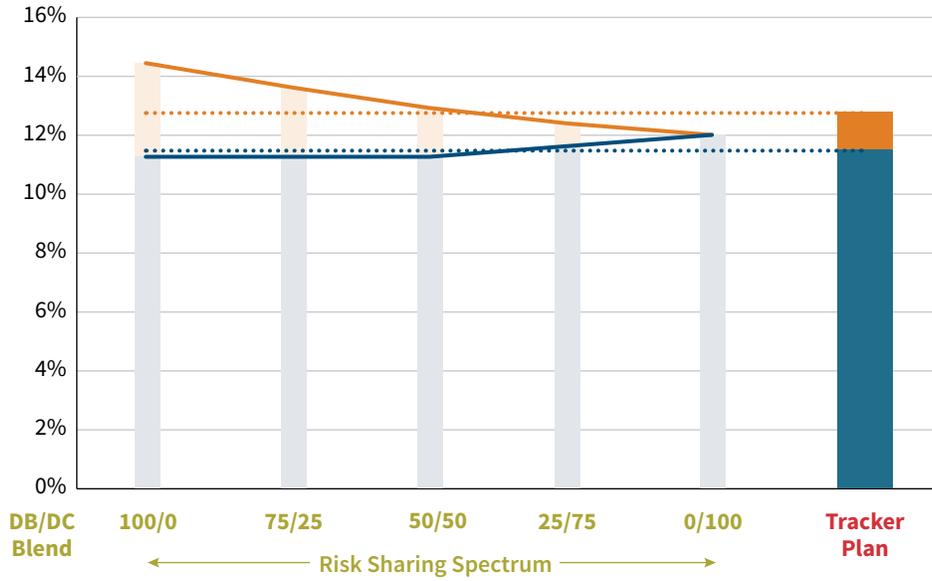
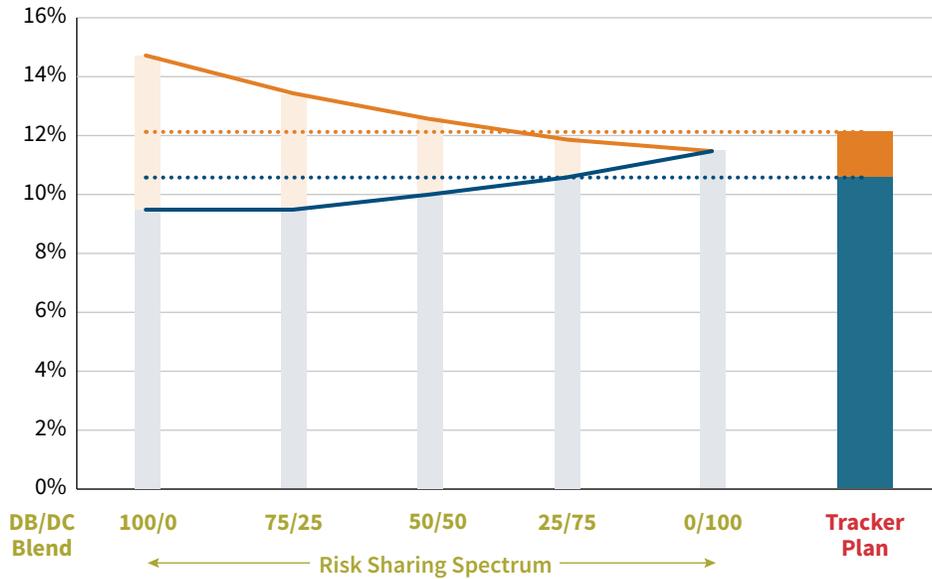


FIGURE 5

Results with a Higher Allocation to Risk Assets (Typical 90–50 TDF for DC; Flat 68% for DB)



the Tracker Plan of 12.8% of pay. They both have a mean cost equal to 11.5% of pay. Since the Tracker Plan is a hybrid DC plan with an absolute cap on sponsor cost and no sponsor benefit liabilities, this seems to be a very favorable outcome—essentially the same cost risk as a combo program that includes a significant DB plan component.

Typically, within the QE framework these types of comparisons would be done at various levels of investment risk. Figure 5 is the same graph, but now using a higher allocation to risk assets (a target date fund with a typical 90–50 glide path).

Now the Tracker Plan maps into the risk-sharing space more toward the DC end of the spectrum. The equivalent combo DB-DC plan here is a 20% DB–80% DC blend, and the cost risk metric for this equivalent combo plan is 11.8% of pay. This compares to a cost risk metric for the Tracker Plan of 12.1% of pay. They both have a mean cost equal to 10.7% of pay. While the relative efficiency for the Tracker Plan is now somewhat less than with the lower risk investment policy, the result still looks good for a plan with no sponsor benefit obligations.

To further illustrate how the QE framework can be useful in comparing various plan designs, I have included in Appendix B the same type of analysis for one other risk-sharing design currently used by at least one large public plan—namely the State of Kentucky, which recently adopted a form of cash balance DB plan design.

8. Payout Phase: A Collective Risk-Sharing Program

The previous sections described the Tracker Plan—a program designed to accumulate funds prior to retirement, with a special focus on the control of downside risk for participants. Now I want to focus on the payout phase,² where the accumulated funds at retirement need to be converted to a sustainable income stream for the lifetime of the retired participant. The concept I propose is a collective fund, with both investment and mortality risk shared among the group of retired participants, and also across different cohorts of retired participants (i.e., intergenerational risk sharing). Such a fund needs to be sustainable for all future years, and there should be no recourse to sponsor financial support (i.e., no liabilities or cost for the sponsor). To accomplish this, the fund must rely on some set of rules for dynamically adjusting the level of benefits depending on the level of funding relative to some measure of future benefit payments (i.e., funded status). I believe this structure provides a way to offer important features to retiring participants:

- Pooling of mortality risk on a very cost-efficient basis
- Guaranteed lifetime benefits
- Modest equity exposure to enhance long-term returns, with intergenerational risk sharing to mitigate short-term volatility
- Much more stable pricing for conversion of the lump sum accumulation into an annuity stream
- A natural way to manage aggregate, long-term longevity risk through the variable benefit features of the collective fund

This type of collective payout arrangement is not constrained to the Tracker Plan design. It could be used for any traditional DC plan or for a cash balance DB plan.

² My prior paper on the Tracker Plan concept dealt only with the accumulation phase.

9. Collective Payout Program: Summary of Plan Provisions

Here I describe the key features of a prototype design that I have tested using the QE framework for payout programs. Obviously, this is just one illustration of a fund that fits into the collective risk-sharing family. Alternative choices for the plan design parameters are plausible (subject to testing for sustainability).

- There is a single investment pool, invested 35% in risk assets (U.S. and non-U.S. equities) and 65% in a core-type fixed income fund. For the most part, I would assume index funds are used to minimize expense charges. (I assume an expense charge of 0.25% each year, including administrative and investment expenses.)
- At retirement the lump sum is transferred into the collective payout fund, where it is used to purchase a base annuity income. Pricing would be based on a conservative estimate of the long-term expected return on the portfolio. The pricing structure would remain fixed from year-to-year, but the board would have authority to change it if there are significant changes in future return expectations or for periodic updates of mortality assumption. Any change could be phased in over a period of years. For the plan discussed in this paper, I use a 5.5% interest rate for the annuity prices, which is approximately the 25th percentile net return expected over a 30-year period in the QE framework simulation model. If the 10-year Treasury yield is ever higher than 6%, then the annuities would be priced using the 10-year Treasury yield plus 50 basis points to approximate market pricing in the high-yield environment.
- The annuity will include a 15-year certain period, which provides something very close to a “return of principal” guarantee for retirees.
- The base annuity benefit would be increased by a fixed 2.5% COLA factor each year after retirement, subject to the adjustment features described later.
- The fund would most often be in a surplus position relative to the liability for the base benefit, using a 5.5% discount rate. (More details on funded ratios will be shown in a later section.) If the funded ratio exceeds 110%, then onetime bonus payments would become payable for the following year, based on a published schedule. The schedule I used is based on this formula, where FR is the funded ratio at the beginning of the year: $\text{Bonus \%} = \text{FR} - 100\% + \max(0, \text{FR} - 130\%)$. As an example, if the funded ratio was 141%, then the bonus percent would be 52% (applied to the base benefit amount). The bonus percent is capped at 100%.
- These bonus payments are for a single year only—they do not become part of the future base benefit income. However, the board always has full discretion to make special ad hoc decisions. If the funded position of the plan is very strong, the board could decide to issue some of the bonus in the form of an increase in the base benefit, increasing the liabilities of the plan.
- If the funded ratio falls below a specified trigger level for two out of the preceding three years, then the 2.5% COLA is suspended for the following year. Once the funded ratio has exceeded a specified second trigger for two out of the preceding three years, the COLA is reinstated. For this paper, I set the first trigger at 85% initially, increasing to 90% after 20 years of fund operation, and then to 95% at year 30. The second trigger, to restore the COLA, is set at the first trigger plus 10 percentage points.
- The board would always reserve the right to reduce annuity benefits in emergency situations, to maintain sustainability. (In my testing, this type of adjustment was never required.)
- Finally, collective risk-sharing programs generally have something like an evolutionary process, as the fund rules operate over time to build toward the target level, or range, of surplus assets. To support this process, I have assumed that for the first 5 years of operation the fund would pay no bonuses, nor would there be any COLA suspensions.

10. Payout Phase Analytics

10.1 FUNDED STATUS

With the previously described plan and using the QE framework simulation model, I ran a multicohort forecast of results to ensure the sustainability of the fund. Table 7 shows the range of funded ratios at various times after the fund starts operation. The “liability” is measured as the present value of expected base benefits, including future COLAs (even though these are not guaranteed), using a 5.5% discount rate (the same rate used to price the annuity conversion factors).

TABLE 7

Range of Funded Ratios After Fund Start-up

PERCENTILE RANGE	Years After Fund Start-up					
	5	10	20	30	40	50
95%	111%	115%	128%	136%	142%	150%
75%	103%	105%	114%	124%	129%	133%
50%	98%	99%	106%	114%	120%	125%
25%	94%	93%	98%	106%	111%	116%
5%	87%	83%	87%	91%	99%	103%

Shortfall probabilities

<100%	61.8%	53.8%	31.1%	14.5%	6.4%	2.4%
<90%	10.8%	16.9%	8.4%	4.2%	0.8%	0.4%

While the evolution is slow, the fund ultimately stabilizes with a median funded ratio of about 125%, and only rare occurrence of less than a 100% funded ratio (and almost never below 90% funded.) Even during the process of building surplus levels, however, the fund operates very effectively, as I will show in the next section.

10.2 BENEFITS

Table 8 shows some statistics for the bonus payments that would be payable across the lifetime for various retiree cohorts. These results also illustrate the evolutionary process of a collective fund like this.

TABLE 8

Bonus Payments Payable Across the Lifetime

	Cohort #			
	1	11	21	31
Average % of years with bonus	20%	44%	68%	80%
Average bonus when paid	16%	23%	27%	31%

Even the very first retiree cohort under the program could expect to receive significant bonus payments, on average, over their lifetime. The bonus impact grows substantially as the plan reaches a more mature level of expected funded status. Although the initial cohort cannot expect to benefit as much from bonus payments, the value they receive from the favorable annuity pricing is still very substantial (as will be illustrated later).

Table 9 summarizes some results for COLA suspensions over the first 25 years of retirement.

TABLE 9

COLA Suspensions Over First 25 Years of Retirement

	Cohort #			
	1	11	21	31
No COLA suspensions	72%	70%	78%	88%
Between 1 and 5 suspensions	25%	26%	19%	10%
More than 5 suspensions	3%	4%	3%	1%

For all cohorts, there is at least a 70% expectation that they will not experience any COLA suspension during the first 25 years of retirement. Ultimately, that expectation is close to 90% for later cohorts. Experiencing more than five COLA suspensions is rare.

10.3 COMPARATIVE

The QE framework has a relatively straight-forward approach for comparative analysis of different payout program designs. First, a set of *baseline* benefits are determined from the simulation model:

- Initial accumulated fund balances are set at age 67 for each scenario equal to the standard DC plan accumulation using a typical target date fund and a 37-year accumulation period.
- These lump sums are then converted to lifetime benefits using fixed-price annuities that include a CPI COLA, and which are priced with a 5.85% discount rate (the expected return from a fund with a 30% risky asset allocation, as in a conservative DB plan). There is no load in the pricing, and no death benefits are assumed.

The intention is that these *baseline* benefits represent something like the best-case scenario from the participant’s point of view.

Next the benefit stream generated from any payout program design can be calculated for each scenario using the simulation model. The ratio of these benefits to the baseline benefit for each year of each scenario are calculated, and these ratios are used as the basis for analysis. Various metrics are available, but the primary ones for comparative analysis are developed as follows:

- Develop a risk-adjusted version for each ratio, reflecting the basic goal of maintaining a mostly level income stream, adjusted for inflation. Since the baseline benefits are fully CPI-indexed, the goal is for the benefit ratio measure to remain relatively uniform throughout the retiree’s lifetime. If later years show significantly inflated values relative to the inflation-adjusted starting value, these results will receive a reduced weight. Conversely, if values in later years show significantly decreased values relative to the inflation-adjusted starting value, these receive a higher weight.
- Split the retiree lifetime into the first 25 years after retirement (approximately the life expectancy), and all years after that.
- For each of these periods, determine the average value of the risk-adjusted metric described previously.

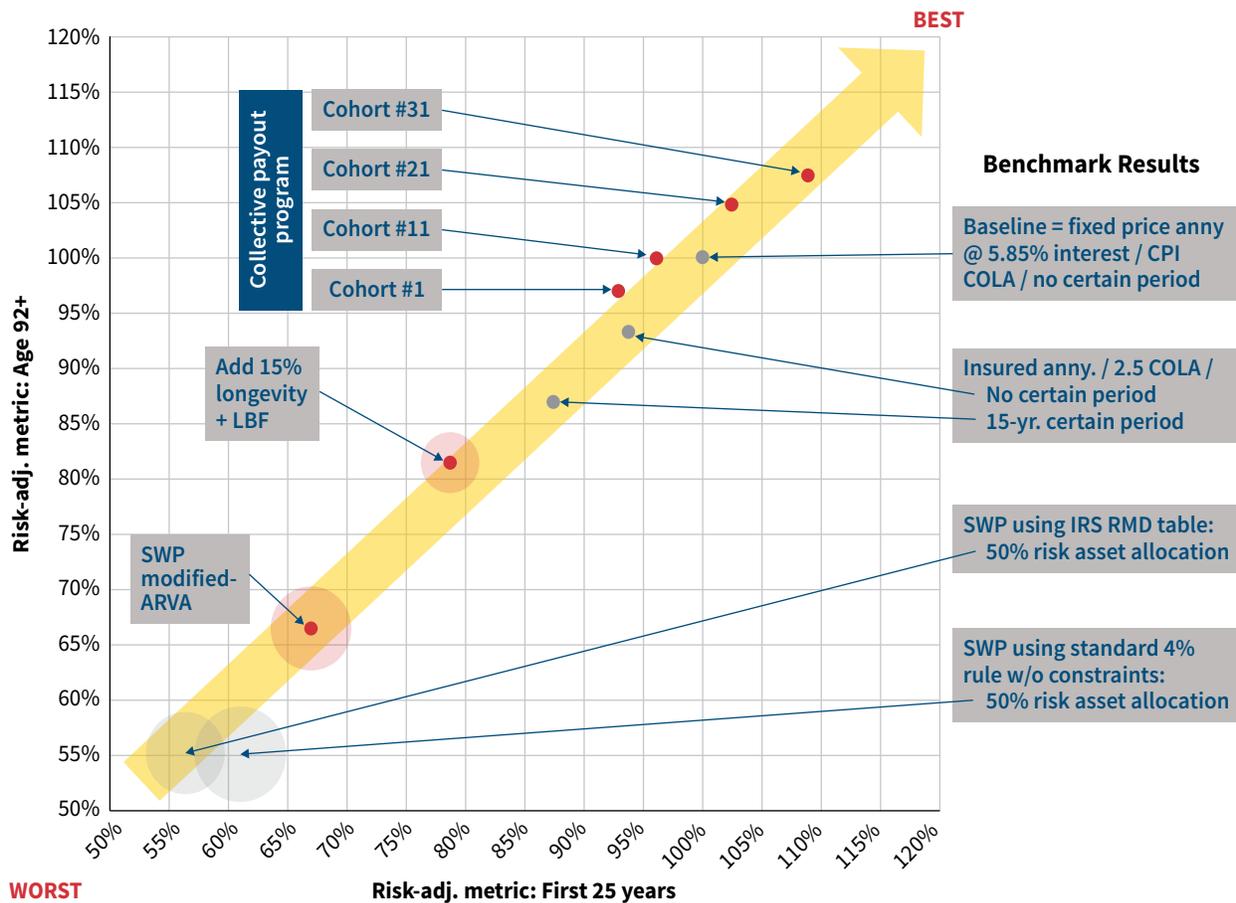
The results can then be plotted in a graph, as shown in Figure 6. This graph also contains the results for some important benchmark designs, including insured annuities as well as several structured withdrawal plans (SWP)

- The standard “4% Rule” (initial payment is 4% of lump sum accumulation, with later payments increased by CPI).
- Withdrawals based on the IRS required minimum distribution life expectancy factors.
- Withdrawals based on an enhanced SWP using the annually recalculated virtual annuity (ARVA) methodology (with specific modifications). This is not a standard benchmark, but it is shown here to help illustrate the value of the collective program relative to a good SWP that includes no annuitization, or mortality risk pooling.
- The enhanced ARVA/SWP above, but with 15% of the accumulated balance used to purchase a longevity annuity starting at age 85, with a longevity bridge fund (LBF) to fund benefits up to age 85. This is also not a standard benchmark, but helps show the value of mortality risk pooling.

Where a shaded circle appears around a plotted result, that indicates liquidity at age 85 (accessible wealth as a multiple of pay). Results for the collective payout program are plotted for various retiree cohorts.

FIGURE 6

Evaluation Summary Chart



The graph shows how well the collective program performs, relative to all of the other plotted results. This is true even for the first retiree cohort. The values improve noticeably as the program reaches a more mature state.

11. Transition Issues

Navigating the transition process is a major issue in moving to a new plan design. Every situation will be unique, and legal issues vary from state to state. However, new designs should offer at least the financial flexibility to accommodate various types of transition arrangements. With the Tracker Plan, cohorts are generally established based on years to retirement, with a funding target set for the cohorts. In a transition arrangement, there could be special cohorts established for midcareer employees and the funding target for those cohorts could be determined with recognition of the value of currently expected levels of benefits under the existing defined benefit formula. This would lead to contribution levels that, with the support of the tracking process, will keep employees on a path to maintain their current expectations at retirement—albeit within a defined contribution plan, instead of a defined benefit plan. We have seen how the Tracker Plan can be designed around specific targets, along with the desired confidence level for achieving the target. Obviously, early retirement benefits and other ancillary benefits will also need recognition in any negotiation of the value trade-off decisions.

12. Conclusion

I believe that public programs will eventually move away from being mostly defined benefit plans, but I hope that they do not follow the private sector and move to standard defined contribution designs. There are many good designs that will work better for participants—some already proposed, others yet to be discovered. These are middle ground designs where risk is shared between the sponsor and the participants, and also collectively among the participants. The quantitative evaluation framework provides a set of tools and a methodology that should facilitate the acceptance of these new designs.

Appendix A: The Quantitative Evaluation (QE) Framework

The QE framework includes the following general components:

- A set of well-defined metrics that should be determined for each proposed retirement system design
- The specific methods that should be used for the calculations
- The specific assumptions that should be used for the calculations
- Separate (but connected) models for developing metrics for the accumulation phase and for the payout phase, predicated on the concept that these two parts of any retirement program are fundamentally separable (i.e., any accumulation structure may be combined with any payout structure to form a complete retirement system)

The standardized set of metrics, methods and assumptions allow direct comparison of quantitative results when analyzing different design ideas. The calculations and metrics use a stochastic economic simulation model to capture the full range of risk and reward for both benefit levels and for cost levels.

Table A1 shows some of the key economic assumptions (i.e., either the mean or median value from the full set of stochastic scenarios). The simulation model is specifically designed to model an economy “in equilibrium,” to avoid the need to constantly adjust relative to current market conditions. The stability of the assumption set is critical to the process of comparing results that might be derived from design studies done at different times. While this type of simulation model is not appropriate for some purposes (i.e., actual pricing or liability valuations of any specific product or plan), it is completely appropriate when confined to comparative analysis purposes.

TABLE A1

Key Economic Assumptions

	BASELINE ASSUMPTION
Price inflation	2.50%
Real wage growth	0.50%
Nominal wage growth	3.00%
Real yield on 10-yr Treas	1.80%
Nominal yield on 10-yr Treas	4.30%
Credit/duration spread for “Core Fixed Income”	0.20%
Nominal “Core Fixed Income” returns	4.50%
Risky premium for risky assets	3.50%
Nominal risky asset returns (gross, long-term compounded)	8.00%

Any retirement system includes both an accumulation phase (where benefits are accrued and assets are accumulated and invested to support the payouts that commence at retirement) and a payout phase (where accumulated assets are converted to some form of payout stream). The QE framework is predicated on the concept that accumulation structures and payout structures are fundamentally separable, such that any accumulation structure may be combined with any payout structure to create a complete retirement system. Because of this feature, the framework provides specific metrics (and supporting analysis) for each of these two separable parts of any system.

Since the primary goal of this framework is to facilitate comparisons on a consistent basis for various retirement system designs, the metrics are developed using a highly standardized model, with well-defined sample employees, calculation methods, and assumptions (both demographic and economic). The framework is based on a stochastic simulation process, as this is the only way to properly quantify the various risk and reward metrics that are needed for an adequate analysis.

For the accumulation phase, the metrics focus primarily on the range of benefits provided at the point of retirement and the range of possible cost for the sponsor. At a basic level, the accumulation phase is a completely scalable entity, in that the level of benefits for any structure (inclusive of a specified investment strategy) can be scaled up or down simply by adjusting the contribution inputs. Therefore, to facilitate comparisons, a standardized scale is needed, and this is done by specifying that total contributions (employee, plus expected sponsor) are assumed to equal 10% of pay over the active career.³ The analysis can then focus on the expected level of benefits produced from this contribution, and the range of uncertainty for both the benefits and the sponsor cost. This 10% of pay assumption should not be considered an integral part of any design proposal, but merely a way to standardize results for comparative purposes. For any specific implementation of a design, the final level of contributions/costs (and how they may be split between participants and sponsor) should be based on the evaluation of desired benefit levels relative to adequacy standards, and cost constraints that may exist.

³ In addition to being a round number, the 10% of pay contribution is deemed a reasonable choice for two reasons: (a) current levels of total contributions (employee + employer) into U.S. 401(k) plans for private employers are about 10% of pay (in Vanguard 2015 data for participating employees, the median rate is 8.8% and the average rate is 9.5%), and (b) for the benchmark employee used in the framework, a 10% of pay contribution into a standard defined contribution plan using a typical target date investment fund over the full career produces a total replacement rate (annuitized plan benefit, plus Social Security) that will generally (i.e., with a probability greater than 50%) exceed 70% of final pay, which can be viewed as something of a minimal target to maintain the preretirement standard of living for a median income worker.

The accumulation phase metrics are based on a benchmark employee (or age cohort, for collective structures) with a starting age of 30 and retirement at age 67 following a continuous 37-year period of participation. The pay level and the career pay progression are designed to be representative of U.S. median income levels. The key benefit metric is the replacement ratio at age 67 (lifetime benefits, including Social Security, divided by final pay at retirement). For funds accumulated in a defined contribution plan, the lifetime benefit is determined by applying market-priced annuity factors for each scenario (i.e., the annuity price is a function of the market interest yields at retirement under the stochastic simulation model).

For the payout phase, the metrics show how benefits are distributed across the period of retirement, with separate metrics for income payments and for death benefits, and with the range of uncertainty shown for all of these. To standardize the payout phase metrics for comparative purposes, the starting accumulation amount at retirement is set (for each scenario in the stochastic model) at the age 67 balance under a standard defined contribution plan using a typical target date fund for investments and an assumed 10% of pay contribution level. A *baseline* set of annual income payments for each scenario in the stochastic model is calculated by applying a fixed-price annuity factor to the age 67 balance (i.e., the annuity is priced with a fixed 5.85% interest rate, including a CPI-based COLA priced at an assumed 2.5% inflation rate). The benefits generated by the payout design under analysis are then divided by the baseline benefits to develop a ratio, and this ratio (% of baseline benefit) is the basis for the metrics used in the payout phase of the QE framework.

Appendix B: Analysis of Kentucky Plan

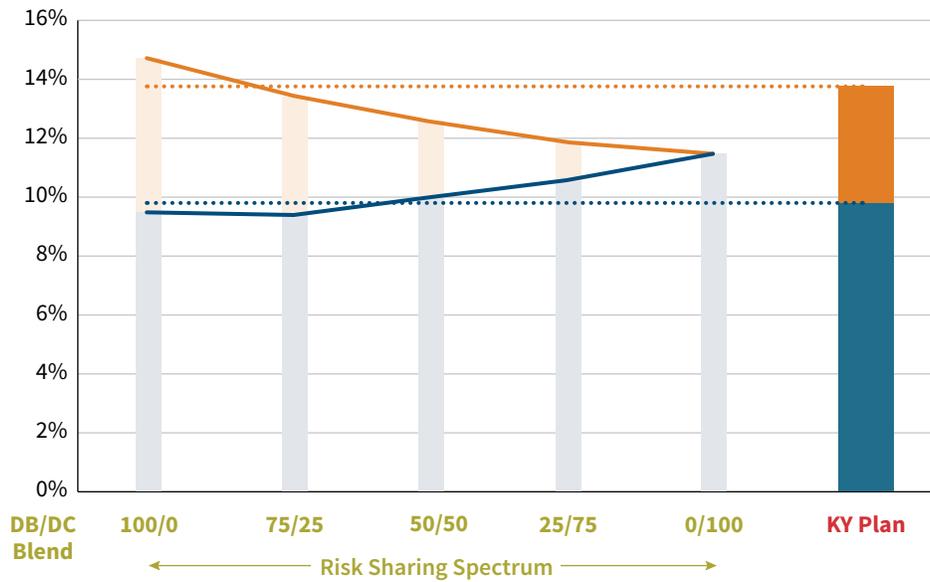
In this appendix I will also use the QE framework to analyze the risk-sharing design currently used by at least one large public plan—namely the State of Kentucky, which recently adopted a form of cash balance DB plan design. I describe this plan as a “participating cash balance” design, since the cash balance credits each year will depend on actual fund investment returns. This type of plan has been presented as an option to a number of other large public plans, and the design specifics can be modified to meet goals/constraints for benefits or cost. The specific formula used in the Kentucky plan to determine the annual investment credit is as follows:

- The credit rate is equal to 4%, plus 75% of the excess fund return over 4%—based on the 5-year moving average return
- Employees who terminate before retirement only receive the flat 4% credit rate

Figure B1 is the same graph for the State of Kentucky plan as previously shown in Figure 5 for the Tracker Plan—showing the cost for the plan to provide 90% probability of achieving a 70% total replacement ratio (inclusive of Social Security). For this illustration we use a 68% risk asset allocation (i.e., this would be comparable to the second Tracker Plan graph in the paper).

FIGURE B1

Results with a higher Allocation to Risk Assets (Typical 90–50 TDF for DC; Flat 68% for DB)



The average cost is 9.9% of pay (compared to 10.7% for the Tracker Plan with this level of investment risk), which matches the average cost for a combo plan with a 50% DB and 50% DC split. But now the cost risk metric is much higher at 13.8% of pay (compared to 12.7% for the Tracker Plan, and 12.6% for the equivalent 50/50 combo plan). This participating cash balance plan design is less efficient at controlling cost risk, and since all cash balance plans are in the defined benefit category, there is also exposure to sponsor liabilities and uncapped cost levels. In this case, the advantages of the Kentucky plan (relative to a 50/50 combo plan) would have to be based on other features—perhaps packaging/communication (the plan in effect provides a 4% guaranteed return), but this graph helps illustrate the implicit cost of any guaranteed return feature in a plan design. A more complete analysis would require comparison of the full range of benefit outcomes, which is beyond the scope of this paper.

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Comments on

“A Middle Ground for Public Plans”

By Joe Tomlinson

Rowland Davis has done a masterful job demonstrating that risk-sharing arrangements can be developed for public pension plans that efficiently share the risks between plan sponsors and participants. He shows that it's feasible to achieve a middle ground between defined benefit (DB) plans that leave all the risk with the plan sponsors and defined contribution (DC) arrangements that transfer all the risk to participants.

Of course, it's one thing to say it's feasible to share risks, but quite another to demonstrate how this can be done effectively. The very extensive background for this paper is work by Davis on an SOA-sponsored project to develop a comprehensive system to quantitatively evaluate existing or proposed pension plans—an evaluation system that can be applied to public plans or private plans, US-based or international. The general approach involves simulation modeling of pension plans and generating performance measures in terms of average costs and cost risks for sponsors, and expected benefits and variability of benefits for participants. His system does this separately for the accumulation phase during the working years and the payout phase during retirement.

Most of the paper involves Davis's describing the evaluation of a specific pension plan proposal he has developed. The proposal for the accumulation phase, which he calls the Tracker Plan, basically provides an approach to monitoring accumulation progress toward a replacement ratio goal at retirement and making periodic automatic adjustments to keep the progress on track. The sponsor may be required to make additional contributions, but only up to a cap. The risk to participants is that accumulations will finish below target, but Davis has designed the plan so that there is a high probability of meeting the asset accumulation target, with manageable shortfalls in the small minority of cases where the target is not met. Davis goes into much more detail in the paper to describe the plan design specifics. There are a number of moving parts in the design, but a key objective is to have a design that adjusts automatically and greatly simplifies things for participants who are typically ill-equipped to manage the various features and options applying to their own personal pension funding.

Performance measures shown for the Tracker Plan include percentiles of base plus additional costs, percentiles for numbers of years requiring additional contributions (based on an assumed age 30 to 67 accumulation span), and percentiles of replacement ratios (and comparison to pure DC plans with varying contribution rates). These measures are shown for both conservative and aggressive asset allocations. For any plan design, including the Tracker Plan, Davis also demonstrates that the degree of risk sharing can be assessed by matching against an equivalent combination DB and DC plan.

Utilizing the Quantitative Evaluation system developed by Davis provides a way to evaluate proposed risk-sharing plans like the Tracker Plan and also provides the tools needed to build and adjust a proposed plan to meet specific risk-sharing objectives.

Davis makes the case that any pension plan design can be split into an accumulation phase and a payout phase, and these two phases can be evaluated separately with different performance measures. For this paper, he proposes a collective payout program for the payout phase. This particular program includes base annuity income with a 2.5% COLA plus a provision for bonus payments under a pricing structure

that remains fixed from year to year. The plan would be designed to build a surplus with the expectation of improving benefits for cohorts as the plan matures. Performance measures include the percentile ranges of plan-funded ratios for decades after start-up, expected bonus payments by cohort, and projected COLA suspensions when funding is inadequate.

Davis also shows an Evaluation Summary Chart. For this he develops a risk-adjusted payout measure, reflecting a basic goal of providing level real income. This is similar to an economic utility measure in that high levels of benefits receive reduced weight and decreased benefits receive higher weight. Results for the first 25 years (approximate life expectancy) are shown separately from results for the later years. These measures can be shown on a graph, which compares the particular plan being studied to a variety of base plans. In particular, Davis charts the projected performance for the collective payout program and shows how this plan compares favorably to other payout arrangements, and how performance is projected to improve for cohorts over time.

For the collective payout arrangement, Davis is able to show very favorable results from a combination of mortality risk pooling, guaranteed lifetime benefits, stable annuity pricing, and intergenerational risk sharing under modest equity exposure. The results are markedly more favorable than for systematic withdrawal plans that lack the benefits of mortality risk pooling and intergenerational risk sharing—certainly a result worth sharing with plans sponsors, financial advisors, politicians, and the general public, who may take false comfort from a “build-your-own-pension” investment-only approach.

Overall, for the combined Tracker Plan and Collective Payout Program, Davis is able to demonstrate in very specific terms how a risk-sharing arrangement can be set up to eliminate funding liabilities for plan sponsors and control costs and, for participants, to provide a much more secure benefit structure compared to a pure DC plan. The key to all of this is the availability of a comprehensive Quantitative Evaluation (QE) system rather than having only qualitative assessments and/or ad hoc quantitative measures.

The SOA is supporting further work on the QE system with the specific aim of making the system more user-friendly, so that it can be used more widely by the actuarial community and in academic research on pension plan design. There are certainly opportunities to help public plans derisk in ways that maintain retirement security for participants, rather than simply dumping DB plans and shifting to pure DC structures. Unfortunately, in the private sector, pension plans have already moved significantly in the direction of shifting all the retirement risk to participants. However, if any openness develops for shifting modest risk back to plan sponsors (or to government entities), the QE system is the ideal tool for evaluating proposals to achieve this objective.

This is a continuing SOA initiative that deserves significant attention from the actuarial community.

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Comments on

“A Middle Ground for Public Plans”

By Evan Inglis

Rowland Davis has presented two interesting concepts that might improve the state of retirement systems in the public sector. Traditional defined benefit (DB) plans like those currently sponsored in the public sector have created financial challenges for plan sponsors, and ultimately some of them may not be able to deliver the benefits that have been promised to their members. Plan designs like the ones in this paper offer the potential to support secure retirements while relieving plan sponsors of the challenges of insuring guaranteed benefits while investing pension funds in growth-oriented assets.

The two concepts presented in the paper are a **Tracker Plan** accumulation design that adjusts contributions to a defined contribution (DC) system with the objective of meeting a replacement ratio target and a **Collective Risk-Sharing Fund** to pay annuity-like retirement income benefits. The concepts in the paper utilize important concepts:

- *Risk-sharing*, which reduces the financial implications of retirement systems on public plan sponsors and their constituencies, e.g., taxpayers, and
- *Longevity pooling* through lifetime income payments, which enables a financially efficient delivery of retirement income.

The concepts presented are both built in a DC framework but include aspects typically associated with DB plans. In particular lifetime income payments are usually associated with DB designs in the US, but there is no reason that a DC accumulation system cannot be paired with annuity payouts as is done in the paper.

The other key aspect of DB systems used in the design is variable costs. In the typical DB design the benefit amounts are fixed (and supposedly guaranteed) such that the cost can change significantly as conditions, particularly asset returns, materialize. Along with variable costs, the Tracker Plan utilizes a kind of unfunded benefit liability when account balances get too far from the target. The tracker design manages this cost volatility and envisions that a limit will be placed on the level of costs. In this way, the magnitude of the problems with controlling the cost of a defined plan is reduced to what appears to be a manageable level.

Although the paper illustrates valuable plan concepts that have much potential, the specific approach seems quite complex. The complexity may be manageable for state or large city systems, but most smaller systems certainly would not be suitable candidates for the approach.

In part the complexity in the paper is related to the illustrations of the risk and reward tradeoffs using a unique and sophisticated approach—the QE Framework—not to the design itself. However, the determination of specific provisions for a tracker program is based on a sophisticated analysis that would create challenges for both designers of the plan and participants in the plan. For example, it is relatively straightforward to envision a plan that targets a 70% replacement ratio, but many people will have a hard time envisioning what it means to target a 70% replacement ratio with 90% confidence. For the plan illustrated in the paper, the median expected outcome is replacement of about 75% for the low-risk asset allocation and about 80% for the high-risk allocation, not 70%. It's unclear why a target replacement

ratio would be determined based on 90% confidence of reaching that level. Apparently, the idea is that 70% is a desired minimum but the plan sponsor would be willing to fund the extra amount for the higher levels.

It's obvious to someone who is familiar with stochastic modeling that the ultimate replacement ratio will likely be higher than 70%; however, most people responsible for plan design, even in large systems, will have a hard time grasping this. The difference between a 70% replacement ratio target and a target of 70% replacement with 90% confidence would present a challenge in communication to leaders who are responsible for considering and approving the design. The additional complexity, after implementation, of tracking the accounts for separate cohorts based on a stochastic distribution of pay multiples adds to this issue.

It isn't clear how the Tracker Plan target replacement ratio is supposed to be adjusted for someone who will not work their entire career in the system. The adjustment mechanism in the program appears to be designed for members who are not only the same age but have been in the system for the same amount of time.

A number of questions arise related to the capital markets modeling needed to design and implement a tracker-type plan. Generally, periods of high returns reduce expectations for future returns (equity and bond prices rise, which increases past returns but reduces the potential for future returns) and vice versa. However, the approach described in the paper presumes that a single set of capital market assumptions can be used for the entire duration of the plan.

The capital market assumptions presented look unrealistically high at the time of publication and for the foreseeable future. Thus, the contributions required for the type of replacement ratio target envisioned would be much higher. In addition, modeling the relationship between returns and wage growth in a realistic way would be a challenge. There would certainly be a high likelihood that real-world outcomes would not be consistent with modeling based on so many parameters.

The tracker concept seems somewhat unusual in that it focuses on cost adjustments in only one direction: participants are to receive the benefit of higher returns but also receive downside protection, albeit with a limit. The idea of "clawbacks" is mentioned but only to the extent that they offset prior contribution increases. If a particular replacement ratio target is deemed appropriate by a plan sponsor, it seems likely that they would want to reduce their contributions if the target could be reached at a lower cost. This approach seems especially odd given that the initial contribution level is set based on a 90% chance of reaching the replacement ratio target. If the assumptions are valid, then using that level of confidence will mean that the accounts for most cohorts will provide for more income than originally targeted.

Throughout most of the discussion it appears that the author envisions contributions to be coming entirely from the employer, but "a worker making scheduled contributions" is also referred to. It would be helpful to consider how employee contributions are intended to be or could be incorporated in this type of approach.

In summary, with regard to the Tracker Plan, the admirable goals of providing for specific replacement targets, managing contribution volatility, and recognizing the uncertainty of future outcomes might be achieved to a large extent by designs that are less complex.

The Collective Payout Program is another interesting design that has potential to achieve important objectives, primarily by pooling longevity risk and including growth-oriented assets (e.g., equities) in the retirement portfolio. Longevity pooling enables retirees to spend their retirement savings without worry

about running out of money and thereby increases spending and security during retirement relative to the amount of savings. The inclusion of growth-oriented assets like equity and real estate will, over time, provide returns that increase with inflation and therefore are an important part of an effective retirement portfolio even with the volatility and uncertainty that they entail.

The collective nature of this kind of scheme may lose its appeal in some situations. To start, it would seem difficult to get a collective scheme up and running on a fully transparent basis. Since the collective nature of the scheme is essentially funded by the first participants, any initial communication of the scheme might need to be vague on this point unless it is just steamrolled through over the objections of the initial participants. Another alternative might be to incur additional cost for the plan sponsor to make the initial cohorts feel less disadvantaged. Further down the line, various cohorts of participants may be confused or feel disadvantaged (rightly or wrongly) due to the sharing among cohorts.

The complexity of the collective payout scheme may also be an issue. The criteria for either bonus payments on the one hand or suspension of COLAs on the other might be hard for participants to keep track of, and thus changes to their benefits may arise unexpectedly. The nature of the scheme is to control the level of these changes and to push them toward being positive surprises rather than negative, but they would still be unexpected without some focused effort to communicate. Income that is less predictable cannot be used as effectively as income that is more predictable.

The Evaluation Summary Chart (Figure 6) notably excludes a simple variable annuity structure where benefits would be adjusted each year based on returns relative to a benchmark. This type of structure can also adjust benefits based on mortality experience. Presumably this kind of benefit would fall among the collective payout dots on the chart and would raise the question “What additional value is being created by the collective nature and complexity of the design?”

A fixed benchmark return for this type of scheme may create problems. Expected returns change from year to year and are subject to longer term trends such as the nearly four decades of decreases in interest rates that have been experienced through 2019. As mentioned above, expected returns change with bond yields and equity prices, and both the effectiveness of the scheme and the fairness among cohorts would depend on a reasonable method for adjusting the benchmark return expectation. This is dealt with only briefly, and for some reason adjustments for market conditions are suggested only for a very high interest rate environment.

The two concepts—the Tracker Plan and the Collective Risk-Sharing Fund—are similar in that they both share risks with some limits, but they work very differently. Although the point is made in the paper that the accumulation and payout phases can work independently, these two designs seem like a potentially awkward combination. The different approaches, both fairly complicated, might create more confusion among members in combination since there is little in the way of a unifying theme to tie them together. The author seems to want to present two interesting concepts with merit on their own, but the paper implies that it might make sense to pair them with each other.

In summary, these kinds of designs offer the potential for significant and important improvements over conventional DB systems in the public plan space. By reducing the impact of asset returns on plan sponsor costs and eliminating the potential for big deficits, plan sponsors would find the level of financial risk related to these designs much easier to manage. The biggest question is whether there are more straightforward approaches that allow for similar improvements.

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Author's Response to Comments

By Rowland Davis

I would like to thank both Joe Tomlinson and Evan Inglis for their thoughtful comments.

Joe's comments highlight what I feel is a very important part of the paper, i.e., how the Quantitative Evaluation Framework (QEF) might be used by actuaries and other professionals to evaluate, and especially to compare, alternative plan designs. Joe and I both felt that this was a missing component of the Retirement 20/20 initiative from several years ago. I would like to especially thank Joe for his contributions to this effort, serving as the lead for the Project Oversight Group (POG) on this project as it was developed during the three years from 2016 through 2018. I share Joe's hope that this project will continue forward with support from the profession.

Evan's comments cover quite a range of issues, some very specific and some more general. I want to briefly respond to some of the specific issues, then spend most of my response on what I believe are the bigger issues.

- Several comments relate to the economic and capital market assumptions used for the simulation modeling that produce metrics for the evaluation of the plan designs. Here I will not try to respond specifically, but rather mention that these issues were comprehensively discussed among the members of the POG, and the support for the choices made is documented in Appendix L of the QEF Background Document, which can be found at "[Background Document: Quantitative Evaluation Framework for Retirement Benefit Systems](#)." I realize that in the world of economic modeling, nothing will satisfy every observer, but we tried very hard to develop a well-grounded approach that was suitable for the specific purpose of having a consistent risk-reward framework for comparison of plans.
- On the collective payout scheme, Evan raises the legitimate question about equity between early cohorts and later cohorts. This is always an issue for collective arrangements, and for accumulation schemes it can be a major (sometimes fatal) design hurdle. However, for the collective payout arrangement, my analysis using the QEF framework shows that although later cohorts will have better results (on average), even the very first cohort shows outcomes significantly better than anything currently available from any commercial insured products or any structured payout system designed for an individual. Clearly, the communication of the plan to participants will need to be handled with care—but that was beyond the scope of my paper.
- In my paper I presented both an accumulation design and a separate payout design, and I tried to indicate that each of those designs could and should be viewed as separable components. That is, in most cases any accumulation design can be coupled with any other payout design. I may not have been as clear about this as I intended, because Evan felt that I implied the two components should perhaps be viewed as a package. They could be packaged together, of course, but I did not design them in any special way to be viewed as a package. Indeed, I would say that I believe the payout design might be promoted as an option that could be added to any existing defined contribution (DC) plan with substantial added value for the sustainability of retiree income levels through time, without the liabilities inherent with a defined benefit (DB) plan. Especially good candidates would include existing large DC plans for public employees (e.g., the State of Florida; TSP for Federal employees) and the relatively new DC plans created by several states for workers not covered by an employer plan (e.g., California, Connecticut, Illinois, Maryland, Massachusetts, New Jersey, Oregon, and Washington).

Now I want to take a step back to address the more general concerns raised by Evan. For the most part, the common theme in Evan's general comments was "too much complexity." I will certainly plead guilty to including significant amounts of detail in my paper, both for the underlying decision process used to construct the designs and for the evaluation of the designs using the QEF. This paper really was intended to have an "engineering" perspective, so I think the detail is appropriate. A whole separate paper could be devoted to the more practical issues of implementation and communication—and I hope that someday that might happen if either of these design ideas gain traction. I personally believe that the designs in the paper are fully capable of being implemented in a way that participants can understand and appreciate. I hope that readers will appreciate that the details in the paper are there for this technical audience, but when it comes time to implement any plan, the marketing department can help make it all work for participants. I love driving a well-designed car that hides the extreme complexity under the hood!

To be sure, both of my designs have several "moving parts" to make them work. But I am a firm believer that the best plan designs for a sustainable future retirement system will be risk-sharing plans—and by definition such plans need well-crafted moving parts to function well. The best plans will incorporate dynamic rules to control variable contribution rates, variable benefit levels, or both. These dynamic rules should operate on auto-pilot to the maximum degree possible, to avoid the operational risks that we have seen unfold in the DB plan universe. There is no way to have risk sharing without these features, so the design process becomes a balancing act between simplicity and plan effectiveness. I always support simplicity to the maximum extent possible, as long as the plan effectiveness meets whatever standards and goals are established. The QEF that is described in my paper was developed precisely to encourage new ideas about risk-sharing designs, with specific metrics to measure their effectiveness. I hope our profession will continue to explore this important area, and if simpler designs can be found that provide effective outcomes, I will be the first to support them.

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Funding of Public Sector Pension Plans

By Chun-Ming (George) Ma

Abstract

Public sector pension plans in Canada have moved toward more risk sharing with plan participants. Economic literature indicates that well-designed intergenerational risk sharing within collectively funded pension plans can be welfare-enhancing vis-à-vis an individual benchmark based on optimal life-cycle savings and investments. In this paper, we examine the funding approach currently applied to defined benefit pension plans in Canada and find that it does not allocate the cost of pension benefits across different generations of stakeholders in an ex ante fair manner. This has prompted us to redesign the funding model to better address the issues of intergenerational equity and long-term sustainability related to public sector pension plans. The paper ends with a discussion on a number of issues that will have to be resolved to enable our proposed model to legally and effectively operate in Canada.

1. Introduction

In Canada, 86 percent of employees employed in the public sector are covered by workplace pension plans of which 91 percent are participants of defined benefit (DB) pension plans.¹ In recent years, public sector pension plans have moved toward more risk sharing with plan participants. For example, several large public sector pension plans in Ontario are now organized as jointly sponsored pension plans (JSPPs),² under which gains or losses are shared by both employers (by drawing on government tax revenues, directly or indirectly) and plan participants. Inflation protection, used to be guaranteed, is gradually changed to be provided only to the extent the funding of the plan is determined to be sufficiently healthy. Other forms of risk sharing, such as the target benefit or shared-risk plan model, have also been introduced or proposed by the federal and provincial governments (Alberta, 2014; British Columbia, 2015; New Brunswick, 2015; House of Commons of Canada, 2016).

Against a background of low interest rates, higher stock market volatility and increasing longevity, plan trustees and those responsible for funding pension plans (the “funding entities”), in either the public or private sector, face many challenges in managing the current and future financial health of their pension plans. In the space of public sector pension plans, these challenges include:

- **Security.** How to ensure that the pension benefits promised to or targeted for employees are adequately protected?
- **Affordability.** How to ensure that the pension benefits are met with a reasonable level of costs that does not take financial resources away from other societal needs?
- **Intergenerational equity.** How to ensure that the cost of pension benefits is fairly distributed across different generations of taxpayers and/or employees?
- **Cost stability and predictability.** How to maintain a stable and predictable pension budget, without compromising the needs for security, affordability and intergenerational equity?

¹ According to the latest available information from Statistics Canada as of October 2017.

² These include the Ontario Teachers' Pension Plan (OTPP), the Healthcare of Ontario Pension Plan (HOOPP), the Ontario Municipal Employees Retirement System (OMERS), the Colleges of Applied Arts and Technology Pension Plan (CAAT) and the OPSEU Pension Trust (OPT).

Typically, collective pension funds in Canada invest partly in fixed income assets and partly in equity (e.g., stocks) and other real assets. The risk premium from equity and other real assets, if realized, can help lower the cost of benefits and make the pension plan more affordable. However, fluctuations in market returns could lead to mismatch between the pension fund assets and liabilities. Consequently, contributions or benefits (or both) are often required to be adjusted as a function of the surplus or deficit of the plan.³ Frequent contribution adjustments, however, would make it difficult for the funding entities to budget for their pension costs. Despite this potential drawback, it may still be desirable for public sector pension plans to invest in risky assets in anticipation of higher returns. Given their long-term nature, systematic investment risks can be shared among many generations during a long period of time. This inter-temporal risk smoothing, if properly designed and managed, can potentially enhance the welfare of the plan stakeholders (including taxpayers and employees.)

In this paper, we re-examine the Canadian regulatory funding framework for DB plans from a risk-sharing standpoint and find that it is not conducive to the fair allocation of pension costs across different generations of stakeholders. We then consider trade-offs between benefit security, cost stability as well as intergenerational equity within collectively funded pension plans, and propose a new funding model to better address the issue of intergenerational equity for public sector pension plans in Canada. Our model is designed based on the following concept: “The cost of pension benefits provided to a generation of participants should be funded, to the extent possible, over the service periods of that generation.”

The balance of the paper is organized as follows. Section 2 provides an overview of the Canadian regulatory approach to assessing the funded status of a DB plan as well as the approach advocated by financial economists (the “financial economics” approach). Section 3 discusses the risk-sharing characteristics of collectively funded pension plans. Section 4 looks at the issue of intergenerational equity from several perspectives, and suggests a definition of it for the purpose of funding public sector pension plans. Section 5 evaluates the current Canadian funding approach from the standpoint of intergenerational equity. Section 6 proposes an alternative funding model with a focus on promoting intergenerational fairness. The model includes an explicit funding margin to mitigate discontinuity risk. Monte Carlo simulations are conducted on a model plan to demonstrate the potential funding outcomes under the proposed funding model. Section 7 discusses a number of issues that need to be resolved to enable the proposed funding model to legally and effectively operate in Canada. Section 8 concludes.

2. Funding Assessment of DB plans

There are different approaches to assessing the funding position of a DB plan, which can produce different results in terms of costs and liabilities. In this section, we provide a brief summary of two funding approaches that are known to pension practitioners in Canada.

2.1 CANADIAN REGULATORY APPROACH

In Canada, sponsors of employment-based DB plans have been required to fund their pension plans on both a going concern basis and a solvency basis. Pension standards legislation such as the Ontario Pension Benefits Regulation (Ontario, 2017) prescribes that the funding entity must contribute a minimum amount equal to the normal cost plus amortization of any unfunded liabilities every year. Both the normal cost and plan liabilities are determined based on the assumption that the plan would remain in place indefinitely. They are dependent on the actuarial cost method (also referred to as “funding method”) used to allocate the cost of pension benefits to different periods of service. Additional

³ A plan is said to have a deficit if the value of its assets falls short of the value of its liabilities (both values are determined based on a valuation of the plan). On the other hand, a plan is said to have a surplus if the value of its assets exceeds the value of its liabilities.

contributions are required to be made if a solvency deficiency is determined to exist. A valuation based on solvency assumes that the plan terminates immediately and looks at whether it holds enough assets to pay out all benefits accrued to-date by the plan beneficiaries. The results of a solvency valuation are highly dependent on current market conditions. When interest rates are low and equity markets are volatile (the way they have been in recent years), they have the effect of increasing the obligations that must be borne by the funding entities.

Public sector pension plans in Canada are for the most part exempt from the volatile solvency funding requirement. In the meantime, there has been a move to reduce the volatility of contribution obligations for DB plan sponsors in the private sector as well. In 2016, Quebec passed a law to remove the requirement to fund DB plans on a solvency basis across the board (Quebec National Assembly, 2015). As a trade-off for eliminating the need for solvency funding, employers will have to put money in a stabilization reserve even when they have fully funded their plans on a going concern basis. It is intended that the reserve will help pension plans to better withstand future financial and demographic shocks. Ontario, the largest pension jurisdiction in Canada, has also introduced a new funding framework based on an enhanced going concern requirement while requiring funding on a solvency basis only if a plan's solvency funded status falls below 85 percent (Ministry of Finance, Ontario, 2017).

A noticeable feature of Canadian funding regulations is that the going concern funding requirement is invariably determined using a funding method called the unit credit cost method.⁴ It will be argued that this is an inappropriate method for funding public sector pension plans as it would infringe the principle of intergenerational equity.

2.2 FINANCIAL ECONOMICS APPROACH

In the United States, there has been an ongoing controversy over what funding method and discount rate should be used to measure the funding obligations of DB plans.

Traditionally, actuaries in the United States have used (1) the entry age normal cost method⁵ to allocate the cost of pension benefits and (2) a discount rate based on the expected rate of return on plan assets. On the other hand, financial economists have advocated for the application of financial economics principles (e.g., the law of one price) to pension finance (Joint AAA/SOA Task Force, 2006; Bartholomew, Gold, Pitts, & Pollack, 2016). They argue that DB plan obligations should be determined using (1) the traditional unit credit cost method, without the projection of future salaries, and (2) a discount rate based on the observed market yields on risk-free traded securities (e.g., U.S. Treasuries) that match the benefit cash flows in amount and timing but payment is assumed to be certain. They further argue that pension funds should be invested to hedge the accrued liabilities so as to facilitate the maintenance of full funding across time, minimize risk adjusted costs, and avoid potentially costly risk taking.

The funding measures advocated by financial economists are similar to the solvency normal cost and solvency liability stipulated in the Canadian funding standards.

⁴ This funding method falls into the family of benefit allocation methods. It may go by different names such as “traditional unit credit,” “accrued benefit,” “projected unit credit” and “projected benefit method prorated on service.” A comprehensive treatise on funding methods can be found in *Pension Mathematics for Actuaries* (Anderson, 1992).

⁵ This funding method falls into the family of cost allocation methods.

3. Risk-Sharing Characteristics of Collectively Funded Pension Plans

In Canada, typical employment-based pension plans in the public sector are collectively funded and involve pooling of risks (e.g., investments, longevity) among stakeholders including taxpayers, current and future employees and/or retirees. Where there is a funding deficit arising from negative experience under a plan, it is met with an increase in the contributions from the employer (and participants if applicable), or a decrease in the benefits payable to participants if the law permits. The burden of deficit funding is typically spread over a number of years and is thus shared not only by current stakeholders but also by future stakeholders. On the other hand, a funding excess arising from positive plan experience could potentially benefit current and/or future stakeholders in the form of benefit improvements, contribution holidays or surplus refunds.

The long-term nature of public sector pension plans allows for smoothing of risks among many generations of stakeholders. Economic literature suggests that intergenerational risk sharing can yield welfare gains vis-à-vis an individual benchmark based on optimal life-cycle savings and investments from an ex ante perspective (Cui, Jong, & Ponds, 2011). Where a plan is free from the risk of winding up, it is optimal to diversity risk over as many generations and as many time periods as possible. In this way, financial and demographic shocks are smoothed out as broadly as possible across both individuals and periods so that each individual in each period is affected as little as possible. It is also worthy of note that plans that adjust both contributions and benefits, as a function of surplus or deficit, are better able to withstand risks (financial or demographic) than plans that allow for adjustments only in contributions or benefits.

In reality, there is a limit to the scope for intergenerational risk sharing. If a plan becomes seriously underfunded as a result of past adverse experience, today's taxpayers and/or young employees may voice their concerns by exerting pressures to change the rules that force them to pay for the materialized deficits from the past. This political risk could jeopardize the sustainability of the plan.

4. How Is Intergenerational Equity Defined?

Where there is no sharing of risks as in individual defined contribution (DC) pension plans, the issue of equity would not normally arise as (1) the same rate of contributions is paid on account of each participant, and (2) the benefits received by participants are simply equal to what their contributions and accompanied investment earnings provide. Other types of pension plans normally involve a varying degree of risk pooling or sharing. Any deviation between the actual and expected plan experiences would give rise to either a gain or loss, which in turn would cause a change to the plan's funding requirement or a change in the benefits payable to participants or retirees. A contribution or benefit change made in response to a funding shortfall or excess is a form of risk sharing, which would not only affect the financial well-being of current stakeholders but could also affect future stakeholders. More pooling of risk would seem to contribute more to the risk of inequity, either intragenerational or intergenerational.

In the context of public sector pension plans, intergenerational equity can be looked at from more than one perspective (TheTerryGroup, 2015):

- **Government budget office.** The financial director may take the view that “taxpayers should be required to pay the same cost (as a percentage of pay) for pension benefits.” As such, they may want to maintain a stable pension cost budget over time. If a large funding shortfall arises as a result of poor investment performance, the budget office may decide to cut future benefits for younger employees to make room for funding the cost of benefits accrued by older employees. This would seem to compromise intergenerational equity at the employee level.

- **Covered employees.** They (or their representing unions) may take the view that “employees who perform the same service should receive the same pension benefits, regardless of when they are employed.” While individual equity is achieved among employees, equity between today’s and future taxpayers may be in question. Rising taxes to fund promised benefits as a result of unfavorable plan experience could impair taxpayer equity.
- **Advocates for other public services.** The pension benefit accrued by an employee is not paid until some time in the future. As a consequence, taxpayers may not want to fully pay the cost of pension benefits earned by public employees, especially if doing so means cutting back on other vital services such as health care or education. This would tend to shift a portion of the costs of public services⁶ received by today’s taxpayers to future generations of taxpayers. Furthermore, absence of advance funding could impair the security of benefits promised to employees.

For the purpose of exploring the issue of intergenerational equity, we define a generation of participants in a plan as a group of employees who join the plan within a specific time frame, say, a calendar year after the plan inception. Employees who joined the plan in the year of plan inception are grouped together as the initial generation. In the context of funding a pension plan, one intuitive definition of intergenerational equity might be as follows: “The cost of pension benefits provided to a generation of participants should be funded over the service periods of that generation.” However, there are some complexities in applying this seemingly simple concept to pension plans where there is a significant degree of risk pooling across overlapping generations of participants.

The first issue is how to attribute the cost of future benefits to different periods of service. Different funding methods (i.e., actuarial cost methods) produce different cost patterns over an employee’s career. Which one is more suitable for use with public sector pension plans?

The second issue is how to determine the cost of future benefits. We need to make assumptions about employees’ future life spans (before and after retirement), future salary growth and/or inflation with respect to benefits that are adjusted according to wage or price inflation. Furthermore, we need to discount the projected benefit cash flows to the present. Due to the uncertain nature of these assumptions, the calculated cost is always an estimate. If we use overly conservative assumptions, we may overestimate the cost; the current generation of taxpayers may likely overpay and, in effect, transfer wealth to a future generation. If we use overly optimistic assumptions, the current generation may underpay and, in effect, transfer a financial burden to a future generation.

This brings us to the third issue. More often than not, the assumptions used to determine the cost of future benefits will not be exactly realized in the future. To the extent that the actual experience deviates from the expected experience, a gain or loss will arise. Should such a gain or loss be fully and immediately reflected in the cost to be paid by today’s taxpayers (and/or covered employees if applicable), or should it be spread over a number of years and shared with future taxpayers? How would a particular amortization method of gains and losses impact the financial well-being of different generations of stakeholders?

⁶ Public employees’ pension benefits are a part of the costs of public services.

5. Issues with the Canadian Approach to Funding Public Sector Pension Plans

Most public sector pension plans in Canada are prefunded DB arrangements that are complementary to the nation's social security system. The sponsoring entities and, in many instances, the covered employees, are required to contribute toward the cost of pension benefits as those benefits are accrued.

5.1 FUNDING METHOD

The funding requirements under Canadian pension legislation are typically drafted based on the unit credit cost method (the "UC method"). This method defines:

- A **normal cost**, being the present value of retirement and other benefits⁷ accrued by participants in the year following the valuation date
- An **accrued or actuarial liability**, being the present value of retirement and other benefits accrued by participants, pensioners and other beneficiaries for service up to the valuation date

As noted in Section 2, financial economists also propose to allocate the cost of pension benefits using the UC method, but the benefits are computed without the projection of future salaries even if the benefits are salary-related.

A DB pension plan typically provides a uniform benefit accrual rate with respect to service. Under the UC method, the normal cost for a participant would increase with the age of the participant. The normal cost of a plan is the sum of the normal costs for all participants in the plan, which is typically expressed as a fixed rate per participant (in either dollar amount or percentage of pay). This fixed rate would be the contribution rate applied to every participant in the plan for current service accruals. Clearly, the rate is higher than the UC normal cost rate for young participants and lower than that for older participants.

The contribution rate developed under the UC method has the effect of passing the buck to future generations of taxpayers. The taxpayers' funding burden against employees' current service accruals would increase with the passage of time. Appendix A shows how the funding burden related to participants' benefits is shifted from the present to the future.

To limit the shifting of costs from today's taxpayers to future taxpayers, we contend that the pension benefits provided to each generation of participants should be funded over the service periods of the participants in that generation, by either a level dollar amount or a level percentage of pay (as the case may be). A level cost method such as the entry age normal cost method would serve to achieve this purpose.

5.2 DISCOUNT RATE

Another contentious issue regarding the funding of public sector pension plans is what discount rate should be used to calculate the cost of pension benefits. The choice of the discount rate has a material impact on the calculated cost values. For the purpose of a going concern valuation, actuaries have traditionally used a discount rate that includes an expected additional return from equity and other risky investments (the "expected return" discount rate). On the other hand, financial economists have advocated that DB plan obligations should be valued using a discount rate based on the market yields on safe assets⁸ (the "risk-free" discount rate). Either approach is acceptable in Canada, but it is more common for actuaries to calculate the plan's funding obligations using the expected return discount rate (Canadian Institute of Actuaries, 2015).

⁷ Projected with future salary growth, if applicable.

⁸ For example, long government bonds

While the use of a risk-free discount rate would provide a market value proxy for participants' accrued pension rights, it is not suitable for determining the cost of pension benefits for funding purposes. Public sector pension plans are entities that are designed to exist for the long term. The contributions made to fund the pension benefits are typically invested in a portfolio of assets, which include equity and other risky assets. Regardless of which discount rate is used to measure the plan obligations, there will always be a mismatch in values between the plan's assets and liabilities. To keep a DB plan in financial balance, the contribution rate will need to be adjusted periodically to absorb any surplus or deficit. We will show that using the expected return discount rate (based on the *median* expectation about future fund returns⁹), in combination with a properly designed amortization rule for surpluses and deficits, will add to intergenerational equity, while the use of a risk-free discount rate will not.

In Appendix A, we apply both discount rate assumptions to a model DB plan and project the funding outcomes by Monte Carlo simulations. As the risk-free discount rate does not reflect the risk premium that the pension fund can expect to earn, taxpayers are required to pay contributions at a higher level upfront. As experience unfolds later, the reserve buildup through higher contributions might likely turn out to be too large. Excess reserve would then be released from the pension fund via contribution holidays or surplus refunds.¹⁰ This appears to contravene the principle of intergenerational equity, as today's taxpayers are forced to pay more to the potential benefit of future taxpayers. Use of the expected return discount rate would avoid this *ex ante* unfair outcome.

5.3 AMORTIZATION METHOD

Mismatch between assets and liabilities would give rise to either a surplus or deficit. Under Canadian pension legislation, any deficit reported in a regulatory filing for a DB plan must be amortized by means of a level annual dollar amount or percentage of pay, over a period of not more than 15 years. However, a surplus up to a certain limit may be retained in the plan (or used to improve benefits) and needs not be amortized as in the case of a deficit.

In a public sector DB plan where participants' benefits are predefined while the contributions made to fund the benefits are adjustable, the taxpayers would bear the funding risk. If the contributions currently being paid are adjusted to fully absorb any deficit or surplus, no part of the funding imbalance would be shifted to future taxpayers but contributions could fluctuate markedly from year to year. On the other hand, if deficit and surplus are both amortized over a long time period, part of the funding imbalance would be absorbed by future taxpayers. Variability of contributions would be less pronounced, but a portion of the surplus or deficit would remain unamortized until sometime in the future.

In a target benefit plan where contributions are predefined (CIA, 2015), participants would bear the funding risk through adjustments to their benefits. In a JSPP, the employer(s) and participants are jointly responsible for correcting any funding imbalance through adjustments to contributions and/or benefits.

The choice of an amortization method would affect the variability of contributions (or benefit payments). The longer the amortization period, the more gradual will be the adjustments to the contributions (or benefit payments) and the greater the tendency of a transfer of funding burden (i.e., deficits) or wealth (i.e., surpluses) to future generations of stakeholders. The future funded status of the plan would vary over a wider range relative to that resulting from a shorter period of amortization.

Another issue to be considered is the manner by which surplus and deficit are amortized. If surplus and deficit are amortized in separate and different ways (e.g., surplus is immediately recognized whereas

⁹ The return, which is estimated to be realizable 50 percent of the time

¹⁰ Assume that there is no legal barrier.

deficit is spread over an extended period), the equity balance between different generations of stakeholders might potentially be upset.

In Appendix A, we apply several amortization periods to a model DB plan and show how they might impact the distributions of future contribution rates.

6. Design of a Funding Model for Public Sector Pension Plans

In the financial management of a pension plan, the trustees may be given multiple mandates, which could include (1) benefit security, (2) cost affordability, (3) intergenerational equity and (4) contribution (or benefit) stability. These mandates do not always align with each other. For instance, measures taken to strengthen the security of benefits (e.g., use of conservative assumptions, immediate funding of deficits, buildup of a solvency reserve, taking less investment risk) could adversely affect the fulfillment of the other mandates. A key challenge is to design a funding model that would enable the trustees to manage these competing goals, in the light of the stakeholders' needs.

6.1 DESIGN CONSIDERATIONS

Generally speaking, the government as a sponsor of public sector pension plans has the power to tax and the ability to survive the ups and downs of the business cycle. As such, public sector employers tend to be less concerned with insolvency risk¹¹ than their private sector counterparts and can follow a long-term approach in funding their pension plans. Given the trend toward more risk sharing within the public sector space, a greater emphasis should be placed on the fair allocation of pension costs (or benefits) among different generations of stakeholders than to the protection of participants' accrued pension rights in the event of employer insolvency.

For plans with an adopted investment policy that reflects the risk plan stakeholders can bear, we design a funding model based on the following three considerations:

1. Intergenerational equity
2. Contribution (or benefit) stability
3. Benefit security

We have excluded cost affordability from our deliberation, as we believe that it should be considered separately in conjunction with the retirement income goal of and the investment risk assumed by the plan.

6.2 INTERGENERATIONAL EQUITY

As discussed in Section 5, ex ante intergenerational equity can be achieved by adopting the funding approach described here.

Funding Method. Use of a funding method to allocate the cost of pension benefits over the service periods of plan participants such that the allocated costs are as level as possible.

- The *aggregate entry age normal* cost method (Anderson, 1992) is appropriate for this purpose. Under this method, a target normal cost rate is defined for the plan based on the representative attributes (e.g., gender, entry age, salary) of new entrants. The accrued liability for participants who are accruing pension benefits is calculated as the present value of their future benefits less the present

¹¹ It is noted however that there have been instances of municipal bankruptcies in the United States (e.g., the city of Detroit), putting additional financial strains on their already underfunded pension systems.

value of their future contributions based on the target normal cost rate. The accrued liability for pensioners and other beneficiaries is calculated as the present value of the pension benefits payable to them.

Discount Rate. Use of the expected rate of return on plan assets as the discount rate.

- Contrary to the position taken by financial economists, we argue that there is a direct connection between how much is required to pay for the cost of pension benefits and what pension fund assets will earn. The higher the realized return from pension fund investments, the lower will be the contributions required. Thus a discount rate based on the expected return on plan assets should be used to estimate the cost of pension benefits for funding purposes. Doing so would avoid ex ante unfair distributions of contributions¹² across different generations of stakeholders.

Amortization Method. Use of the expected average remaining service or lifetime as the amortization period.

- In a plan where only contributions are adjustable, it is reasonable to amortize any surplus or deficit through contribution adjustments over the future service periods of the participants who are currently in the plan.¹³ This would moderate the fluctuations in contributions relative to shorter periods of amortization while limiting the transfer of past deficits or surpluses to future generations of taxpayers.
- If only pensions in pay are adjustable, it is reasonable to amortize any deficit or surplus through pension adjustments over the future lifetimes of the individuals who are in receipt of a pension.

6.3 FUNDING OUTCOMES—AN ILLUSTRATION

To gain some insights into the impacts of the funding approach described in Section 6.2, we apply it to the model plan described in Appendix B together with the risk-sharing mechanisms described in Table 1, and simulate the future funding outcomes in terms of contribution rates, pension payments and funded ratios.¹⁴

TABLE 1

Risk Sharing Mechanisms

RISK SHARING MECHANISM	DESCRIPTION
RS1	Funding imbalance is absorbed by adjusting the contribution rate to be paid on account of the current participants in the plan, over their expected future service periods
RS2	Funding imbalance is absorbed by adjusting the pension payment to the current pensioners, over their expected future lifetimes
RS3	Funding imbalance is absorbed by adjusting the contribution rate (as in RS1) and pension payment (as in RS2) simultaneously, on a 50/50 basis
RS4	Same as RS3, but the adjustment is limited to not more than 15% (either upside or downside) of the target contribution rate or target pension payment

¹² Or benefits, in the case of a plan where the benefits payable to participants are adjustable according to the plan experience

¹³ This is also consistent with one of the recommendations by a Blue Ribbon Panel commissioned by the Society of Actuaries. (Society of Actuaries, 2014)

¹⁴ The funded ratio of a plan is the ratio of plan assets to liabilities (however calculated), which is a measure of the financial status of the plan.

Figures 1(a), (b) and (c) show the percentile distributions (5%, 25%, 50%, 75%, 95%) of funding outcomes over the projection period.

FIGURE 1(a)

Distribution of Contribution Rate per Participant

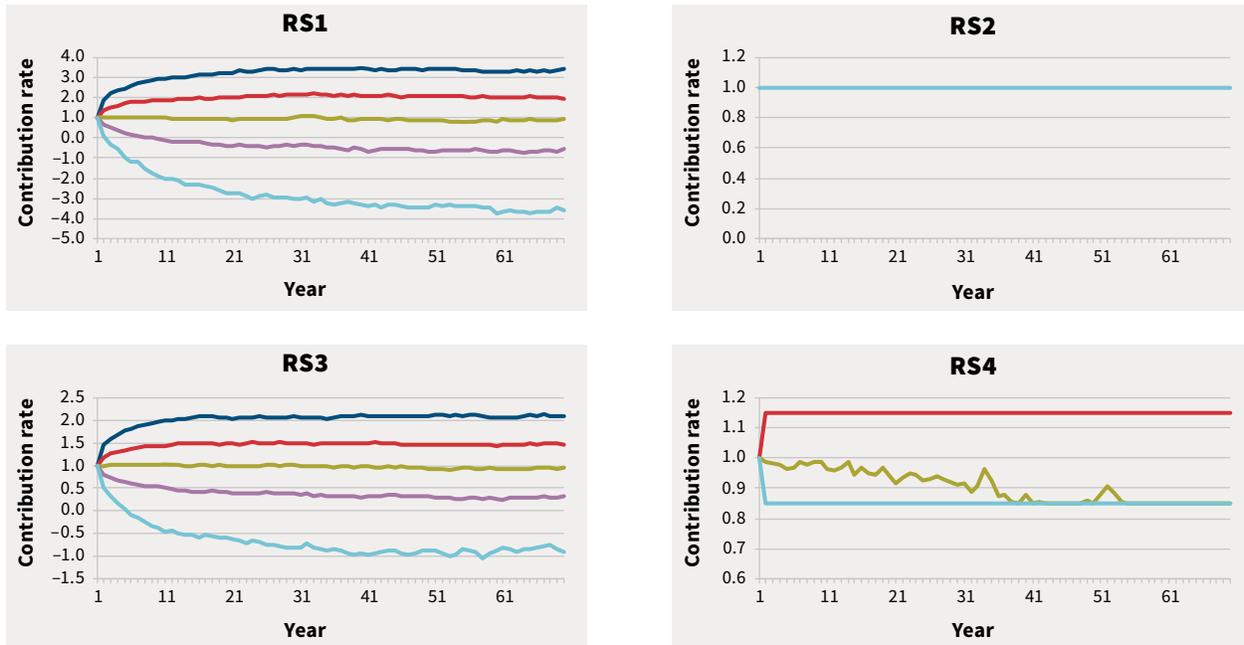


FIGURE 1(b)

Distribution of Pension Payment per Pensioner

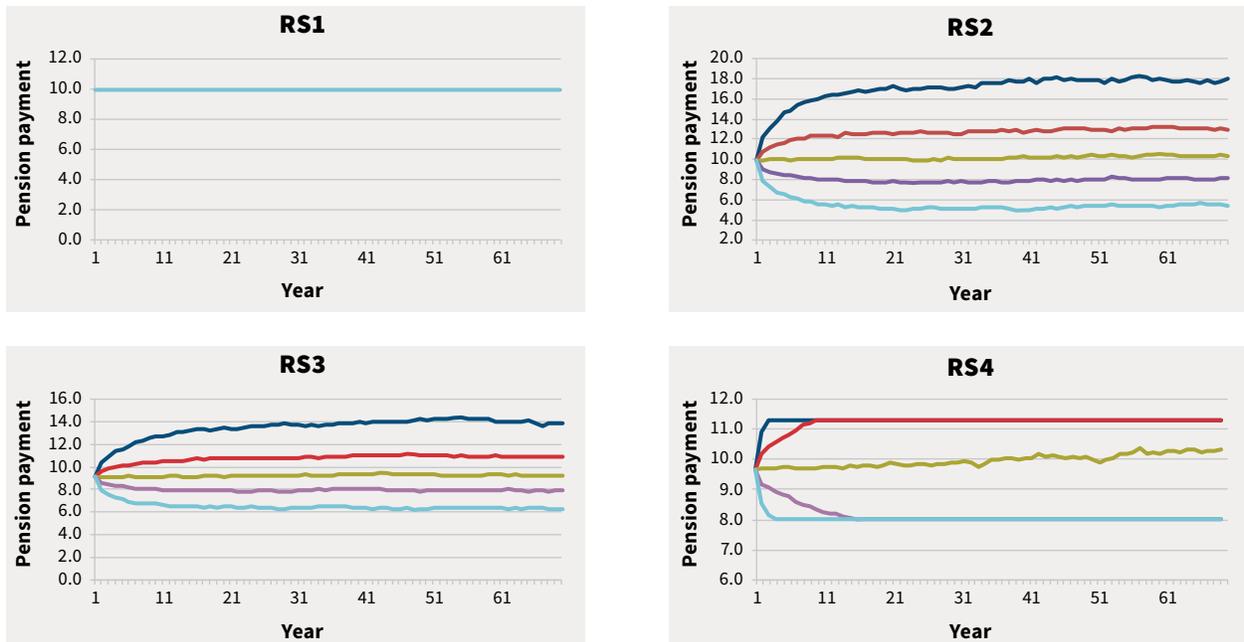
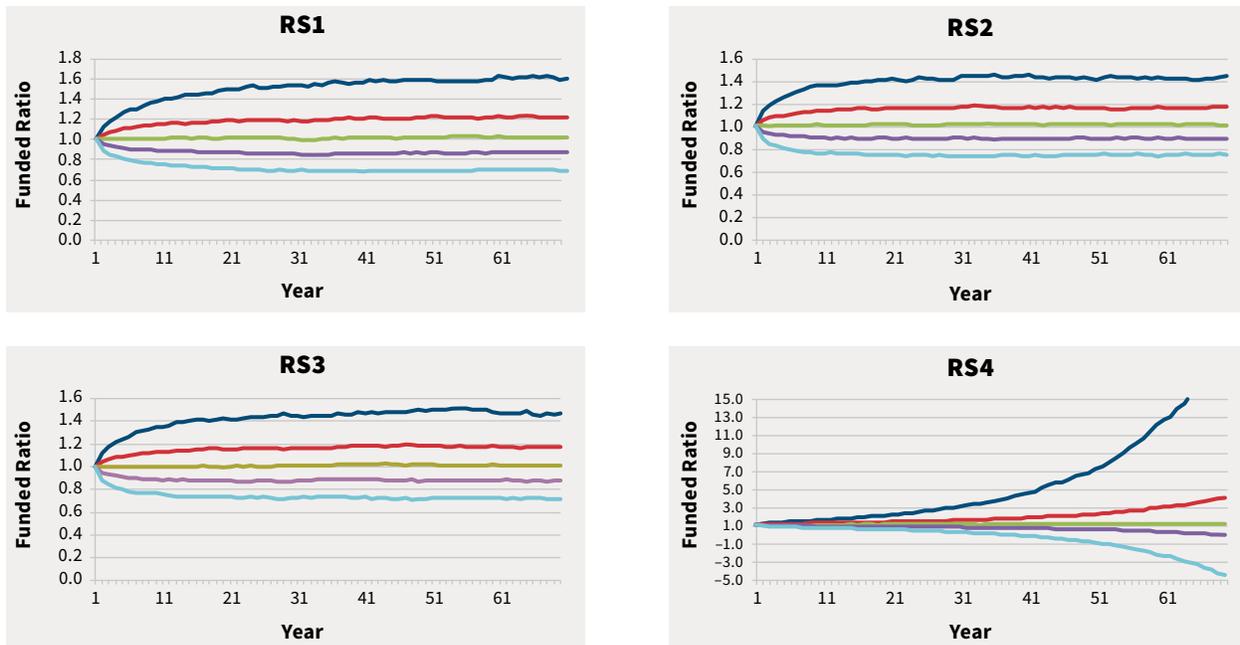


FIGURE 1(c)

Distribution of Funded Ratio

Under RS1, RS2 and RS3, the *median* funding outcomes are all close to the target level, but there could be a large variance between the actual and target outcomes at a future point in time. Risk-sharing mechanism RS3 requires the funding imbalance be borne by both active participants and retirees, and thus allocates risks over a broader base than RS1 and RS2. As a consequence, the contribution rate range under RS3 is narrower than that under RS1, and the pension payment range under RS3 is narrower than that under RS2.

The extent to which contribution rates or pension payments vary could be confined via policy such as RS4, but the application of policy boundaries could lead to very different funding outcomes. As shown in Table 2, the distribution of contribution rate or pension payment under RS4 has clusters at the lower bound (85% of target) and the upper bound (115% of target). In contrast, the corresponding distributions under RS3 extend beyond the policy bounds of RS4 and are more or less symmetrical.¹⁵

Furthermore, the distribution of funded ratio under RS4 is expected to expand over time. It could reach extreme levels (either upside or downside) in later years with the possibility of ruins (as the pension fund runs out of money, i.e., when the funded ratio becomes negative). In contrast, the funded ratio under RS3 falls within a relatively uniform range after 35 years or so and does not fall below 0.7 in most times (to be specific, 95% of the time).

¹⁵ In fact, the distribution of contribution rate (pension payment) under RS3 is somewhat left (right)-skewed. This asymmetry is due to the effect on contribution or benefit adjustment associated with investment gains (relative to the discount rate) being greater than that associated with investment losses.

TABLE 2

Distribution of Contribution Rate and Pension Payment Under RS4

Contribution Rate Range	Percent Frequency (%) Distribution of Contribution Rate				
	YEAR 5	YEAR 10	YEAR 20	YEAR 40	YEAR 60
0.85–0.90	44.9	46.3	48.9	50.6	51.2
0.90–0.95	4.2	2.2	1.3	0.8	0.7
0.95–1.00	3.4	2.5	2.0	1.2	0.8
1.00–1.05	3.8	2.4	1.9	1.2	0.6
1.05–1.10	3.5	2.6	1.2	1.4	1.0
1.10–1.15	40.3	44.1	44.8	44.9	45.9
All	100.0	100.0	100.0	100.0	100.0

Pension Payment Range	Percent Frequency (%) Distribution of Pension Payment				
	YEAR 5	YEAR 10	YEAR 20	YEAR 40	YEAR 60
8.0–8.5	11.1	21.1	28.4	35.6	38.7
8.5–9.0	10.4	9.3	7.2	3.5	2.9
9.0–9.5	13.6	10.3	6.8	4.2	3.2
9.5–10.0	14.9	10.4	7.0	5.1	3.4
10.0–10.5	16.1	9.0	6.8	4.2	2.2
10.5–11.0	12.1	8.1	6.2	3.8	1.9
11.0–11.5	22.0	32.1	37.7	43.8	48.0
All	100.0	100.0	100.0	100.0	100.0

6.4 SUSTAINABILITY

While ex ante intergenerational equity can be achieved by adopting the funding approach described in Section 6.2, some generations may be worse off from an ex post perspective if they inherit a material deficit from previous generations as a result of an adverse shock (financial or demographic) in the past. Serious underfunding could potentially endanger the sustainability of the plan, as in such situations future taxpayers or employees may not want to commit to or participate in the plan (Bovenberg & Mehlokopf, 2014). To mitigate this risk, the trustees may undertake measures to limit the size of deficits transferred from older to younger generations.

We show by example how a funding buffer can be put in place to reduce the downside risk. Consider the model plan with risk-sharing mechanism RS3 (see Section 6.3). Table 3 shows the distributions of projected funded ratios at selected years, based on a funded ratio of 1.0 at the valuation date (referred to hereinafter as the “starting funded ratio” or FR0).

TABLE 3

Distribution of Funded Ratio, FR0 = 1.0

Percentile Distribution	Projected Funded Ratio at End of Year			
	5	10	15	EARSL = 18
95%	1.269	1.345	1.392	1.411
75%	1.109	1.126	1.148	1.148
50%	1.000	0.996	1.003	0.996
25%	0.903	0.885	0.874	0.871
5%	0.784	0.736	0.724	0.720

For a given projection period, we set the minimum funded ratio to be reached at the end of the period (the “target funded ratio”) together with a success probability. We calculate the amount of funding shortfall based on the target funded ratio and discount it to the present using the funding discount rate. The discounted value is taken as the “value at risk,” which is spread equally among all active participants in the plan and amortized over the indicated period by means of an additional contribution to be paid on account of each participant (the “contribution margin”). Table 4 shows the results for selected target funded ratios in combination with a success probability of 95 percent. For each target funded ratio, the contribution margin varies according to the length of the projection period. Generally speaking, the longer the period, the smaller is the required contribution margin.¹⁶

TABLE 4

Contribution Margin

TARGET FUNDED RATIO = 1.00				
Year to which funded ratio is projected	5	10	15	18
Projected funded ratio at the 5th percentile	0.784	0.736	0.724	0.720
Projected funding shortfall ¹⁷	61,326	75,027	78,345	79,631
Value at risk	46,337	42,833	33,795	29,033
Contribution margin	2.95	1.55	0.93	0.71

TARGET FUNDED RATIO = 0.90				
Year to which funded ratio is projected	5	10	15	18
Projected funded ratio at the 5th percentile	0.784	0.736	0.724	0.720
Projected funding shortfall	32,916	46,617	49,935	51,221
Value at risk	24,871	26,614	21,540	18,675
Contribution margin	1.58	0.97	0.59	0.46

TARGET FUNDED RATIO = 0.80				
Year to which funded ratio is projected	5	10	15	18
Projected funded ratio at the 5th percentile	0.784	0.736	0.724	0.720
Projected funding shortfall	4,506	18,207	2,1525	22,812
Value at risk	3,405	10,394	9,285	8,317
Contribution margin	0.22	0.38	0.25	0.20

It is reasonable to limit the funding shortfall that may potentially exist when the current participants cease employment. To this end, we suggest to use the expected average remaining service life for the current participants (EARSL) as the projection period for determining a contribution margin. To ensure that the plan’s funded ratio is not less than 0.9 at the end of EARSL (18 years) with a probability of 95%, we see from Table 4 that a contribution margin of 0.46 (over and above the target contribution rate of 1.0) is needed.

Clearly, the setting of a contribution margin for a plan should take into account the desired level of benefit security (in terms of *minimum* funded ratio to be reached at a certain level of confidence) as well as the level of contributions the funding entity can afford to pay.

¹⁶ With one exception—see the bottom panel of Table 4

¹⁷ Calculated based on the target liability of \$284,100

6.5 OVERFUNDED OR UNDERFUNDED PLAN

The distributions of funded ratios shown in Table 4 were derived based on a starting funded ratio of 1.0. Different starting funding positions (before any contribution or benefit adjustments to restore financial balance) would lead to different distributions of funded ratios over time, as illustrated in Table 5.

TABLE 5

Distribution of Funded Ratio, FR0 = 0.9 & 1.1

PERCENTILE DISTRIBUTION	FR0 = 0.9				FR0 = 1.1			
	Projected Funded Ratio at End of Year				Projected Funded Ratio at End of Year			
	5	10	15	EARSL = 18	5	10	15	EARSL = 18
95%	1.178	1.292	1.345	1.386	1.358	1.440	1.456	1.475
75%	1.021	1.071	1.110	1.112	1.187	1.200	1.200	1.199
50%	0.929	0.949	0.968	0.971	1.079	1.065	1.056	1.050
25%	0.841	0.843	0.842	0.853	0.982	0.946	0.931	0.916
5%	0.736	0.720	0.709	0.703	0.850	0.789	0.763	0.753

When the funded ratio starts at 0.9 (1.1), the range of funded ratios is upward (downward) sloping over time and stays below (above) that resulted from FR0 of 1.0 (see Table 4 and Table 5). With a target funded ratio of 0.9 at the end of EARSL and a success probability of 95%, the contribution margins for FR0 of 0.9 and 1.1 are determined to be 0.50 and 0.37, respectively, which compare to 0.46 for FR0 of 1.0. As can be seen, the contribution margin varies according to the starting funding position of the plan; the lower the starting funded ratio, the higher the contribution margin needed.

The contribution margin to be paid each year is not a static amount. Rather, it is to be determined at each valuation date based on the then funded ratio of the plan.

6.6 THE PROPOSED MODEL

Based on the foregoing analysis, we propose a funding model with the following key features. The model can be applied to assess and manage the funded status of a public sector pension plan, with either adjustable contribution rates or adjustable benefits, or both.

- a. Actuarial valuations to assess the funded status of a plan are performed periodically (e.g., annual or triennial).
- b. A *target normal cost* rate is determined for the plan, using the *aggregate entry age normal* cost method and based on the representative profile of new entrants to the plan. If a plan provides a salary-related pension benefit, the target normal cost rate (as a percentage of salary) is determined by the following formula:

$$U = \frac{\sum_N PVFB_e^j}{\sum_N PVFS_e^j} \tag{1}$$

where N is a representative set of new entrants, j is any individual in N , $PVFB_e^j$ is the present value of future benefits (promised or targeted by the plan) for j calculated at j 's entry age e , and $PVFS_e^j$ is the present value of future salaries for j calculated at j 's entry age e .

The set N and rate U should be updated to reflect any material shift in the entry profile of plan participants over time.

The contribution rate to be paid on account of each active participant is the target normal cost rate, with adjustments to reflect any emerging plan experience pursuant to the plan’s risk-sharing policy; see paragraph (h) below.

- c. The plan’s *funding target* at a valuation date is determined by reference to the benefits provided under the plan (either promised or targeted) and the target normal cost rate described earlier in paragraph (b).

The accrued liability for pensioners and other beneficiaries is calculated as the present value of their accrued benefits. The accrued liability for participants who are accruing pension benefits is calculated as the present value of their future benefits less the present value of their future contributions based on the target normal cost rate. In formula, it can be expressed as follows:

$$AL_t^a = \sum_{A_t} PVFB_t^j - U \sum_{A_t} PVFS_t^j \tag{2}$$

where t is the time of valuation, A_t is the set of participants who are accruing pension benefits at time t , $PVFB_t^j$ is the present value of future benefits for individual j calculated as at time t , and $PVFS_t^j$ is the present value of future salaries for j calculated as at time t . The total of these accrued liabilities represents the plan’s funding target at the valuation date that is to be met by plan assets.

- d. A discount rate based on the expected long-term return on plan assets is used to calculate the target normal cost rate and the accrued liabilities described previously. Other assumptions used in the valuation reflect best estimate plan experience. To provide an “actuarially fair” representation of the financial position of the plan, no margins should be included in the setting of assumptions.
- e. If the pension benefits provided under the plan are adjustable based on the funding level of the plan, they should be adjusted according to the plan’s risk-sharing policy.
- f. The financial position of the plan at the valuation date, before the application of any balancing measures (see paragraph (h)), is presented as an actuarial balance sheet similar to that described in (Ma, 2017). We have omitted the entry of contribution asset (CA_t) contained therein as only participants who are in the plan at the valuation date are included for the purpose of the valuation.¹⁸ This obviates the need for making an assumption about future new entrants.

TABLE 6

Actuarial Balance Sheet Before Application of Balancing Measures

ASSETS	LIABILITIES
Fund assets (F_t)	Liability for pensioners and other inactive participants (AL_t^r)
	Past service liability for active participants (PSL_t^a)
Accumulated deficit (surplus) (D_t)	Future service liability for active participants (FSL_t^a)
Total assets	Total liabilities

¹⁸ The rationale for omitting the entry of contribution asset is as follows. The contribution rate expected to be paid on account of future plan participants is set equal to the target normal cost rate. As such, the contribution asset would be a zero entry.

All entries in Table 6 are as those defined in Section 4.2 of *An Actuarial Balance Sheet Approach to Assessing Sustainability of Target Benefit Plans* (Ma, 2017):

- F_t is the fair value of the financial and real assets held in the pension fund at time t
- AL_t^r is the present value of the pension benefits payable to pensioners and other inactive participants at time t
- PSL_t^a is the present value of accrued benefits for active participants at time t
- FSL_t^a is the difference between the present value of benefits expected to accrue for service after time t and the present value of future contributions based on the target normal cost rate
- D_t is defined as $(AL_t^r + PSL_t^a + FSL_t^a) - (F_t + CA_t)$; a negative value of D_t means that the plan is in surplus

The sum of PSL_t^a and FSL_t^a is equal to the AL_t^a defined by Equation (2).

In addition, we define the balance ratio¹⁹ of the plan at time t as follows:

$$BR_t \equiv \frac{F_t}{AL_t^r + PSL_t^a + FSL_t^a} \quad (3)$$

The balance ratio provides an indication of the financial status of the plan, based on the plan's target normal cost rate. If $BR_t = 1$, the plan is deemed to be in financial balance and no adjustments to contributions or benefits would be necessary.

- g. Where a balancing measure(s) is applied, the actuarial balance sheet should be restated to reflect its impact on the financial balance of the plan. For clarity, the following entries are included in the actuarial balance sheet displayed in Table 7:
 - i. The effect of a contribution rate adjustment would be reflected as a *contribution asset* on the assets side (denoted as CA_t), being the difference (positive or negative) between the present value of future contributions for current active participants based on the adjusted contribution rate and that based on the target normal cost rate
 - ii. The effect of benefit adjustments would be reflected as a *liability adjustment* (separately for each category of participants where applicable) on the liabilities side (denoted as ΔL_t^r and ΔL_t^a), being the difference between the present values of participants' benefits before and after adjustments

The accumulated deficit (D_t^i) in Table 7 and the balance ratio (BR_t^i) of the plan are defined, respectively, as follows:

$$D_t^i \equiv (AL_t^r + PSL_t^a + FSL_t^a + \Delta L_t^r + \Delta L_t^a) - (F_t + CA_t) \quad (4)$$

$$BR_t^i \equiv \frac{F_t + CA_t}{AL_t^r + PSL_t^a + FSL_t^a + \Delta L_t^r + \Delta L_t^a} \quad (5)$$

- h. The plan is required to adopt a risk-sharing policy that sets out the triggers for actions to address any financial imbalance (i.e., when the balance ratio deviates significantly from 1.0) as well as the

¹⁹We have substituted the name of "balance ratio" for "funded ratio" referred to hereinbefore, in order to avoid potential misinterpretations of the latter term. Under our proposed funding model, the fact that the balance ratio of a plan is 1.0 means that the plan's financial resources (i.e., fund assets plus future contributions) are expected to be sufficient to meet the plan's obligations 50 percent of the time.

TABLE 7

Actuarial Balance Sheet After Application of Balancing Measures

ASSETS	LIABILITIES
Fund assets (F_t)	Liability for pensioners and other inactive participants (AL_t^r)
Contribution asset (CA_t)	Past service liability for active participants (PSL_t^a)
	Future service liability for active participants (FSL_t^a)
	Liability adjustment in respect of pensioners and other participants (ΔL_t^r)
Accumulated deficit (surplus) (D_t)	Liability adjustment in respect of active participants (ΔL_t^a)
Total assets	Total liabilities

measures to be taken. Different measures can be applied to restore a plan’s financial balance; they are collectively referred to as automatic balance mechanism (ABM). Following is a sample design of risk-sharing policy.

Example

Consider a plan whose membership at time t comprises of both active participants and pensioners. Balancing measures will be triggered if the balance ratio of the plan, BR_t , falls outside the interval (0.95, 1.05). Where balancing actions are triggered, the accumulated deficit or surplus (i.e., D_t in Table 6) is first allocated between the active participants and pensioners in proportion to their accrued liabilities at time t . The portion allocated to the active participants, i.e.,

$$D_t^a = D_t \cdot \left(\frac{AL_t^a}{AL_t^a + AL_t^r} \right),$$

is amortized by means of an adjustment to the contribution rate to be paid on account of the active participants over their expected remaining service periods. The

portion allocated to the pensioners, $D_t^r = D_t \cdot \left(\frac{AL_t^r}{AL_t^a + AL_t^r} \right)$, is amortized by means of a proportionate

adjustment to the pensions payable to the pensioners over their expected future lifetimes. Adjustments made to the contribution rate and pension payments are to be redetermined at each valuation date based on the accumulated deficit or surplus then exists.

- i. To limit the size of funding deficits (if materialized) transferred from older to younger generations, the funding entity is required to make an extra contribution, over and above the contribution rate determined in accordance with paragraph (b) earlier, for each active participant in the plan. This contribution margin is dynamic in nature. It is to be determined at each valuation date in a manner such that the balance ratio of the plan is projected to reach a certain target level (e.g., 0.9) at the end of the expected average remaining service period for the current participants, with a specified level of confidence (say, 95%); see Sections 6.4 and 6.5.

The contribution margin will form a part of the fund assets once it is paid into the pension fund.

7. Implementation Issues in Canada

We have proposed a funding model for public sector pension plans that, in our view, is more balanced than the existing funding approaches from a risk-sharing standpoint. In this section, we consider a number of issues that will have to be resolved to enable the model to legally and effectively operate in Canada. These issues are grouped under the following two headings:

- Legislative/regulatory considerations
- Policy considerations

7.1 LEGISLATIVE/REGULATORY CONSIDERATIONS

a. Definition of Public Sector

The funding model is being proposed for public sector pension plans in Canada. However, which pension plans are considered to be in the public sector domain is less than clear. Traditionally, the linkage has been based on direct or indirect government funding to and sponsorship of these plans. However, these traditional linkages have evolved and will continue to evolve over time. The legislation should provide a clear definition of the application boundaries.

b. Plan Design

A possible design feature of a shared-risk plan is that any funding deficit or surplus could be shared between the employer(s) and the active participants as well as the retirees. Pension standards legislation should allow for some flexibility in determining the contribution rate and benefit payments for such a plan. For example, if a plan is underfunded, increasing employer contributions should not be legislatively required. Instead, the legislation should permit the deficit to be met by either an increase in contributions or a reduction in benefits.

The plan text should be required to clearly set out whether employer (and employee) contributions are fixed at a predetermined level or are allowed to increase to repair any funding deficit. Likewise, the plan text should clearly specify whether benefit reductions are permissible and how they will be applied. The legislation should permit a plan to adopt different benefit reduction profiles in the plan text, for example, providing more benefit protection to older or lower income pensioners.

The plan text should also deal with surplus situations. It should specify when and how the surplus will be applied. For instance, surplus may be used to improve benefits or to provide for contribution rate reductions.

c. Funding Requirements

The current legislative funding framework in Canada was developed based on a policy that focused on the protection of employees' accrued pension rights, whereas our proposed model emphasizes the equity balance among different generations of stakeholders. To enable the proposed model, some changes to the legislative funding requirements will be needed.

First, most existing funding rules across Canada are written based on benefit allocation methods (e.g., unit credit cost method). While cost allocation methods (e.g., entry age normal cost method) could also be used, special provisions are at times required to be retrofitted with other funding provisions, which are benefit allocation based.

If not already the case, the legislation should provide that public sector pension plans are required to fund on a going concern basis only. A valuation on windup or solvency basis is only required for disclosure purposes. The entry age normal cost method (individual or aggregate) should be prescribed as the funding method for determining the normal cost of the plan.

Second, the current funding regulations allow the application of a wide array of actuarial tools, including the making of a provision for adverse deviations (the “PfADs”) and the smoothing of assets and liabilities. Our proposed model calls for the development of an actuarial balance sheet based on market value of assets and best estimate discount rate that is reflective of the expected return on plan assets with no margins included. Presumably, the existing actuarial tools will continue to be allowed and their application might well provide a funding buffer or less volatile contributions (and/or benefit payments). However, we consider it to be more transparent to present an actuarial balance sheet that is free of the application of PfADs or smoothing, while developing an explicit funding margin to limit the extent of potential cost transfers from old to young generations. The balance ratio derived from the actuarial balance sheet would serve as a trigger for actions to address any funding imbalance that may exist at a valuation date. In the interest of clarity and transparency, the regulations should require a plan to report its financial position, before and after the application of any balancing measures, in an actuarial balance sheet similar to that described in Section 6.6.

Third, Canadian regulatory funding regime is trending toward stronger going concern requirements such as shortening the amortization period for any funding deficit from the current 15 years to 10 years. The proposed framework calls for rebalancing (through automatic balance mechanism) and the buildup of a funding margin over the expected average remaining service period of the plan participants. This would most likely be different from the fixed amortization period prescribed by current legislation. The amended regulations should allow plan stakeholders to choose an amortization method based on their funding objectives (in terms of benefit security, contribution stability and intergenerational equity).

d. Need for Harmonization

Pension regulations and funding rules across Canada are becoming progressively more diverse since their early days of adoption. While most public sector pension plans are not multijurisdictional in nature, continued harmonization of cross country funding rules would facilitate the extension of the proposed funding framework to beyond the broader public sector.

e. Tax Issue

Apart from making changes to pension standards legislation to recognize the unique characteristics of public sector pension plans, it is also necessary to amend the tax legislation (namely, the Income Tax Act): (1) to recognize plans with a risk-sharing arrangement involving both the employer(s) and participants as a legal type of retirement savings plans, and (2) to ensure that variable contributions and/or benefits determined under the terms of those plans meet the prescribed requirements.

f. Transitional Rules

In order to transition to the proposed funding framework, a plan should determine whether the fund assets are sufficient to cover the accrued liabilities determined under the new funding method as of the date of transition. Where there is a funding shortfall, it should be recognized as a debt in the budget of the pension providers and funded by way of special payments paid over a relatively short period of time (say, no more than 10 years). The present value of outstanding special payments in accordance with this fixed payment schedule will form a part of the plan assets for determining the balance ratio of the plan at any future valuation date. Where there is a funding excess as of the transition date, it should be dealt with in accordance with the plan’s risk-sharing policy.

7.2 POLICY CONSIDERATIONS

The proposed funding model calls for periodical rebalancing (through an automatic balance mechanism) and the buildup of a funding buffer to reduce downside risk. These can be best implemented by having a well-designed risk-sharing policy.

The purpose of a risk-sharing policy is to establish a blueprint and agreement upfront regarding how gains and losses are to be shared among the various stakeholder groups. The ultimate goal is to address the questions of when and who has to pay or receive, how much and for what.

A well-designed risk-sharing policy should include the following key elements:

- 1. Identification of stakeholders.** This addresses the question of “who” share the risk. Traditionally, they are the employer(s), active and retired participants. It can also be defined more broadly to include tax/rate paying public and the various generations within a stakeholder group. The identification of what constitutes a generation within a stakeholder group is particularly important in defining the time period over which rebalancing and the buildup of a funding margin are to be achieved.²⁰
- 2. Balancing mechanism.** This addresses the question of “what” are and “how much” is at stake—adjustments made to future contributions and/or future benefit accruals (or accrued benefits to the extent permitted by legislation) to achieve a state of financial balance. In reality, there will be a limit to these adjustments—these limits are de facto the “price” that the stakeholders are willing to pay and should be specified in the policy (see the following paragraph 3). The balancing mechanism may also be expanded to include other tools such as investment strategy options, or the deployment of extra funding margins to allow for any errors around the best estimate number²¹ and the release thereof for spending. These tools can be used to manage the plan’s evolving risk profile either for de-risking or for additional risk taking.
- 3. Action triggers.** This addresses the remaining question of when certain rebalancing actions have to be taken. Different measures can be triggered to a different extent at different situations or levels of pain or advantage—the pain or advantage points can be tiered based on the balance ratio of the plan. To avoid unnecessary frequent actions that may translate into excessive volatility (in terms of contribution and/or benefit adjustments), some policy flexibility should be allowed—for example, rebalancing is not required if the balance ratio is within a certain tolerable range. Where actions are necessary, such actions can be permanent or temporary. Restoration of previous actions (e.g., when risk profile reverse) should also be spelled out in the policy—for example, if benefits were temporarily reduced in the past, and if the plan’s financial situation improves, how the benefits are to be restored (prospectively or retroactively) and the priority order of restoration are important specifications.

A final comment: To develop a workable risk-sharing policy, buy-in amongst key stakeholders is important. The key to a successful consensus building begins with upfront education and stakeholder engagement regarding the plan’s risk exposures and available risk management tools and levers. Through this process, insights can be obtained regarding each group’s baselines, their principles or objectives, priorities and the price they are willing to pay (e.g., what benefits are plan participants willing to put at risk, what benefits are not to be cut and whether there should be any caps or floors). These insights will help inform what an agreeable risk-sharing policy might look like.

²⁰ Practical implementation of the funding model may necessitate the replacement of the average expected service period for the current participants (or expected remaining lifetimes for retirees) with a predetermined period or a range of periods that is representative of a generation.

²¹ This is the balance ratio upon which balancing actions are based.

A well-thought-out risk-sharing policy should be detailed enough to provide a way forward; however, it should not be too prescriptive to handicap the trustees' ability to deal with any unforeseeable conditions. The policy should be reviewed periodically to ensure continued relevance under changing internal and external environments.

8. Conclusion

Public sector pension plans in Canada have moved toward more risk sharing with plan participants. The old funding model that placed an emphasis on the protection of participants' accrued pension rights is no longer compatible with the risk-sharing mandate of intergenerational equity. We show that the funding method employed in the Canadian regulatory funding regime does not allocate the cost of pension benefits across generations in an ex ante fair manner. We reject the use of a risk-free discount rate that has been advocated by financial economists for liability measurement. We show by example that, from an ex ante perspective, use of a risk-free discount rate could lead more likely to a transfer of pension wealth from early generations to later generations. We further explore the issue of risk sharing by surplus and deficit amortizations, and conclude that (1) the amortization period should match the expected average remaining service period of current plan participants and (2) the manners by which surplus and deficit are amortized should be reasonably consistent. As to the risk-sharing design, plans where risks are shared between employers and active participants (via contribution and/or benefit adjustments) as well as retired participants (via pension adjustments) would be better able to withstand financial or demographic shocks than plans where risks are borne by a single group of stakeholders only.

While a funding approach can be designed to mitigate unfair cost (or wealth) transfers across generations from an ex ante perspective, some generations may be worse off from an ex post perspective if they have to pay for a material deficit due to adverse events that occurred in the past. This exposes the plan to discontinuity risk and raises concerns about its sustainability. To address this risk, we show how a funding margin can be put in place to limit the extent of potential cost transfers from older to younger generations.

With these considerations, we design a funding model for public sector pension plans based on the premise that the pension benefits provided to a generation of participants should be funded, to the extent possible, by level costs paid over the service periods of that generation. Our model requires the adoption of a risk-sharing policy with automatic balance mechanism, as well as the provision of a dynamic funding margin to limit downside risk.

Finally, we discuss a number of issues that will have to be resolved by government policy makers and plan stakeholders to enable the proposed model to legally and effectively operate in Canada.

Appendix A: Illustration of Funding Impacts Due to Funding Method, Discount Rate and Amortization Method

In this appendix, we demonstrate by example how the choice of funding method, discount rate and amortization method would impact the funding outcomes, as were discussed in Section 5. We consider a model DB plan that provides an annual pension of b for each year of service, so an employee who retires with 35 years of service will receive an annual pension of $35b$. We assume that one employee enters the plan at the plan inception and at each anniversary thereafter, and all employees start working at age e and retire at age y .

To be consistent with the principle of intergenerational equity, the pension benefits provided to each generation of participants would be funded by the end of their service periods. The “actuarially fair” contribution rate c , to be paid at the beginning of each year over the service period of a generation, can be solved from the following actuarial equivalence equation:

$$c \cdot \ddot{a}_{e:y-e} = \left[(y-e) \cdot b \right] \cdot v^{y-e} \cdot {}_{y-e}p_e \cdot \ddot{a}_y \quad (12) \quad (6)$$

where,

\ddot{a}_y is the monthly life annuity factor at age y ;

i is the discount rate used in the valuation, and v is the inverse of $1+i$;

$\ddot{a}_{e:y-e}$ is a temporary life annuity calculated using a service table and an interest rate of i ;

${}_{y-x}p_x$ is the probability that a participant currently aged x will remain in the plan until age y , computed using a service table; this probability is equal to 1 in our example.

This is the normal cost rate determined under the entry age normal cost method (the “EAN method”), which is dependent on the generation’s entry age e but not on their attained age.

A.1 FUNDING METHOD

For each age cohort $x < y$, the normal cost rate determined under the UC method is as follows:

$$NC_x^{UC} = b \cdot v^{y-x} \cdot {}_{y-x}p_x \cdot \ddot{a}_y \quad (12) \quad (7)$$

At time $t < y - e$, assume the plan is populated by $t + 1$ overlapping generations of participants (from age e to $e + t$) and each has one person. The contribution rate under the UC method is the average of the UC normal cost rates for all participants who are in the plan at that time:

$$c_t = \left(\frac{1}{t+1} \right) \left(\sum_{k=0}^t NC_{e+k}^{UC} \right) \quad (8)$$

Since the UC normal cost rate increases with the age of the participants, it follows that:

$$c_0 < c_1 < \dots < c_t, \text{ for } t < y - e \quad (9)$$

Thus taxpayers are expected to pay a progressively higher rate of contributions for participants’ benefit accruals as time passes.

When a cohort of participants reaches the retirement age y , we assume that their pension benefits would be immediately settled by a lump sum payment equal to their liability of $b \cdot (y - e) \cdot \ddot{a}_y$, which is denoted as B . Once the plan reaches a steady state (i.e., at $t \geq y - e$), the membership has a stationary age composition. The accrued liability and normal cost of the plan would be time-invariant (regardless of which funding method is used), and the following relationship holds:

$$AL^{UC} = \left(AL^{UC} + NC^{UC} \right) (1+i) - B \quad (10)$$

where AL^{UC} and NC^{UC} are, respectively, the sum of the UC accrued liabilities and normal costs for all age cohorts in the plan.

Thus,

$$NC^{UC} = \left(\frac{B - AL^{UC} \cdot i}{1 + i} \right) \quad (11)$$

Likewise,

$$NC^{EAN} = \left(\frac{B - AL^{EAN} \cdot i}{1 + i} \right) \quad (12)$$

where AL^{EAN} and NC^{EAN} are, respectively, the sum of the EAN accrued liabilities and normal costs for all age cohorts in the plan.

Since AL^{EAN} is always greater than AL^{UC} (see Ma, 2017)), it follows that NC^{UC} is greater than NC^{EAN} . Thus when the plan reaches a steady state, the required contribution rate determined under the UC method would be greater than that determined under the EAN method. In other words, if a plan is funded according to the UC method, taxpayers are expected to pay a contribution rate for current service accruals higher than the “actuarially fair” rate once the plan has reached a mature state.

Another way to look at the issue of intergenerational equity is to compare the net present values pertaining to different generations of participants. The *net* present value for a generation of participants is defined as the difference between the present value of pension benefits and the present value of contributions made on account of that generation, where the present values are calculated as of the generation’s entry age using the funding discount rate.

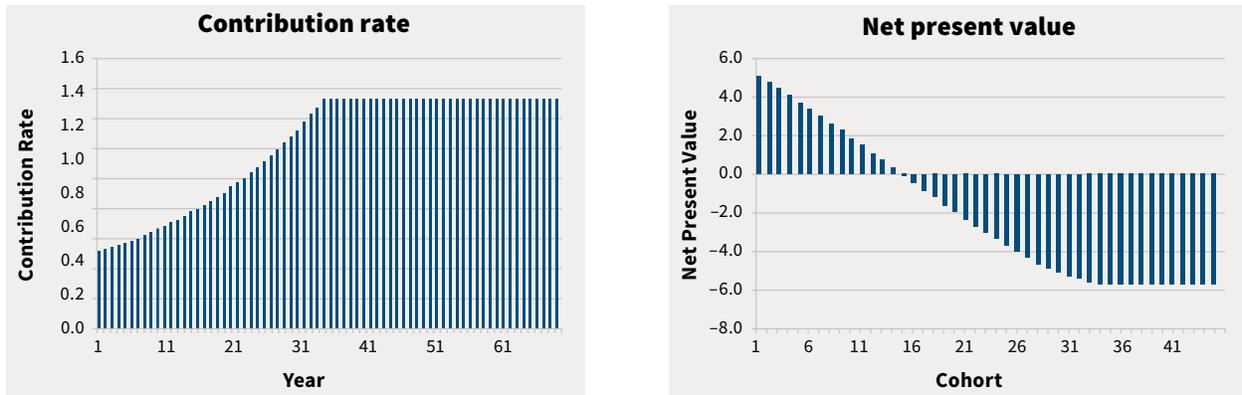
For the model plan described in Appendix B, we postulate that one employee enters the plan (with entry age 30) at the plan inception and at each anniversary thereafter. The plan eventually reaches a steady state with 35 overlapping generations of active participants (from age 30 to 64). Figure A1 plots (1) the contribution rate by year under the UC method and (2) the net present value by cohort of participants, based on the expected return discount rate of 5.75 percent per annum. It can be seen that:

- The contribution rate is lower than the actuarially fair contribution rate of 1.0 before year 27 and is higher than 1.0 from that year onward. It increases to 1.36 in year 35 and remains at that level thereafter.
- The net present values for the older generations (1st to 14th cohort) are positive, whereas those for the younger generations (15th cohort and later) are negative. Older generations of participants enjoy a net benefit gain relative to the contributions paid on account of them. This net benefit has come at the expense of the younger generations who receive a lower benefit relative to the contributions paid.

In conclusion, if a plan is funded according to the UC method, it would be an ex ante unfair arrangement for future taxpayers as they are expected to pay a higher rate of contributions for participants’ benefit accruals than their predecessors. In fact, for participants who join the plan beyond a certain date, taxpayers are expected to pay a cost higher than the actuarially fair contribution rate throughout the service periods of those participants. On the other hand, if a plan is funded according to the EAN method (or its variant), taxpayers at different times are expected to pay the same cost for participants’ benefit accruals. There is no transfer of funding burden across generations ex ante.

FIGURE A1

Contribution Rate and Net Present Value Under UC Method



A.2 DISCOUNT RATE

We conduct Monte Carlo simulations to examine the funding impacts due to the choice of discount rate assumption, using the model parameters described in Appendix B.

Figure A2 shows the (5%, 25%, 50%, 75%, 95%) percentile distributions of contribution rate and funded ratio, under the two discount rate assumptions: *expected return vs. risk-free*. The EAN method is used as the funding method for these simulations. The following observations can be made:

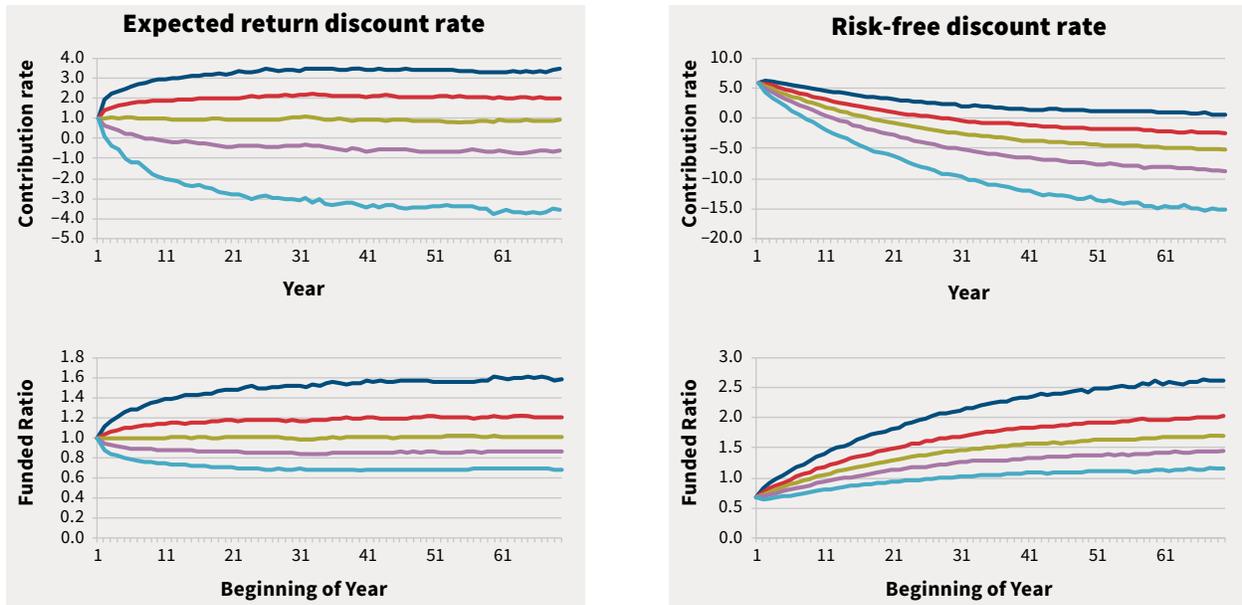
- Under the expected return discount rate assumption, the median contribution rate is close to the target level of 1.0 and the median funded ratio is also close to 1.0 throughout the simulation periods.
- Under the risk-free discount rate assumption, the median contribution rate drops from the initial level of 5.8, which is well above the target contribution rate of 1.0, and turns negative (i.e., a refund of surplus) in the 18th year. On the other hand, the median funded ratio rises from the initial level of 0.7 and begins to exceed 1.0 in the 9th year. It continues to rise to the level of 1.7 in the 50th year.

What would the funding outcomes be if the model plan is funded according to the financial economics approach, that is, use of the UC method and the risk-free discount rate? We assume that the initial fund balance equals the accrued liability of the model plan, which is estimated to be \$378,600 under the particular funding basis. The UC normal cost rate is estimated to be \$2.79 per participant per year. Our simulations indicate that the contribution rate starts at \$2.79 and its distribution is downward sloping over time, whereas the funded ratio starts at 1.0 and its distribution is upward sloping over time. The funding outcomes follow similar patterns as those shown on the right panel of Figure A2.

From an intergenerational fairness standpoint, we have provided a demonstration to refute the idea put forth by financial economists that the UC method and risk-free discount rate should be used to assess the funded status of a DB plan. With the use of a risk-free discount rate, early generations of taxpayers might likely overpay, whereas later generations could potentially profit from the wealth (i.e., excess reserve) transferred from previous generations. Use of the expected return discount rate together with the EAN method would avoid such ex ante unfair wealth transfers.

FIGURE A2

Distribution of Contribution Rate and Funded Ratio, by Discount Rate



A.3 AMORTIZATION METHOD

We conduct Monte Carlo simulations to examine the funding outcomes due to the use of different amortization methods, using the model parameters described in Appendix B. Four amortization methods are considered in Table A1.

TABLE A1

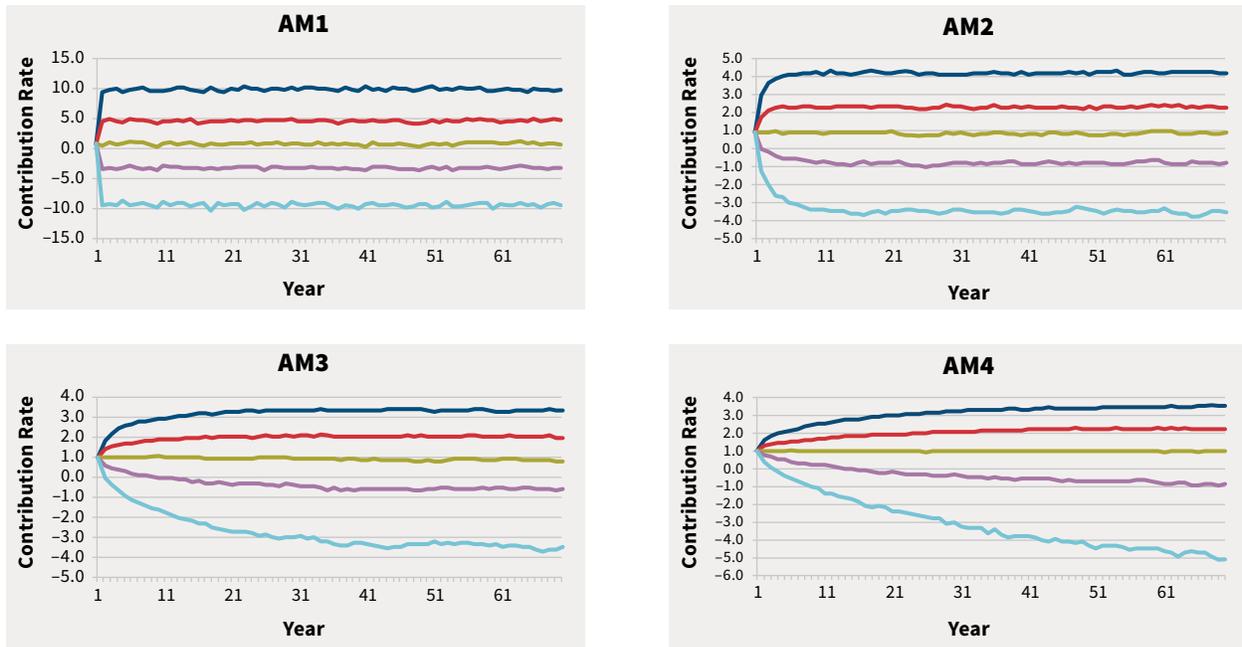
Amortization Method

AMORTIZATION METHOD	DESCRIPTION
AM1	Immediate and full recognition of deficit and surplus, by adjusting the contributions that are to be paid in the current year
AM2	Both deficit and surplus are amortized, by means of level dollar adjustments to the contributions that are to be paid over the next 5 years
AM3	Both deficit and surplus are amortized, by means of an adjustment to the contribution rate that is to be paid by the current plan participants over their expected future service periods
AM4	Both deficit and surplus are amortized, by means of level dollar adjustments to the contributions that are to be paid over the next 35 years

All of the preceding amortization methods are applied on a “fresh-start” basis at each valuation date, meaning that the amortization schedule established at the preceding valuation date is not carried forward to the current valuation date. Figure A3 shows the (5%, 25%, 50%, 75%, 95%) percentile distribution of the contribution rate, under the four amortization methods. The contribution rate is determined based on the expected return discount rate.

FIGURE A3

Distribution of Contribution Rate, by Amortization Method



The following observations can be made from Figure A3:

- Under AM1 and AM2, the surplus or deficit pertaining to the current plan participants is fully absorbed within a short period of time. The contribution rate thus fluctuates dramatically from year to year. The contribution rate range²² is broadly consistent over time and is generally wider than the other two methods. The shorter the amortization period, the wider is the range.
- Under AM3 and AM4, the year to year change in the contribution rate is less pronounced than AM1 and AM2 (at least in the early periods), due to the spreading of surpluses and deficits over longer periods. The contribution rate range expands over time as a result of the manifestation of unamortized surpluses or deficits from prior years.
- The contribution rate range under AM3 becomes broadly consistent after 35 years or so,²³ whereas that under AM4 continues to expand after 35 years. Amortization method AM3 aligns reasonably well with the proposition that the cost of pension benefits for a generation of participants should be funded over the expected service periods of those participants.

²² This is measured as the difference between simulated contribution rates at the 5th and 95th percentiles.

²³ While not shown here, the distribution of funded ratio under AM3 is also broadly consistent after 35 years. All participants who are active at time 0 will have retired at or before the end of 35 years.

Appendix B: Parameters Used for Monte Carlo Simulations

Model Plan (DB or shared-risk)

- For retired participants with 35 years of service, the target pension payable at age 65 is \$9.91 per annum, payable annually in advance.
- Initial plan membership consists of:
 - Active participants: 35 cohorts from age 30 to age 64 and each has 100 participants
 - Pensioners: 35 cohorts from age 65 to age 99 shown as follows; the annual pension payable to each pensioner is \$9.91

AGE	65	66	67	68	69	70	71	72	73	74	75	76
#	100	98.8	97.4	95.9	94.3	92.6	90.8	88.8	86.7	84.5	82.1	79.5

AGE	77	78	79	80	81	82	83	84	85	86	87	88
#	76.8	73.8	70.6	67.1	63.3	59.3	55.1	50.8	46.5	42.2	37.9	33.6

AGE	89	90	91	92	93	94	95	96	97	98	99
#	29.4	25.4	21.5	17.9	14.6	11.6	9	6.8	5	3.6	2.5

- Target contribution rate: \$1 per participant, payable at the beginning of each year of employment. This is the normal cost rate determined under the EAN method and the expected return discount rate assumption indicated as follows.

Funding Basis

- Funding method: EAN method
- Two alternative discount rates are considered: (1) expected return on plan assets of 5.75% per annum; (2) risk-free rate of 2.5% per annum
- No pre-retirement decrements before age 65
- Static mortality decrements after age 65
- For simulation purposes, it is assumed that the funding basis is fixed throughout the simulation period

Projection Basis

- Initial fund balance is set equal to the plan liability based on the expected return discount rate assumption, estimated to be \$284,100; thus, the initial funded ratio is 1.0 under the expected return discount rate scenario
- Static investment policy: 50% in bonds and 50% in equities, periodically rebalanced to maintain the same asset mix
- Pension fund returns:
 - Future years' distributions of fund returns are independently and identically (IID) distributed
 - Return factor over any one-year period, $1 + R$, is assumed to follow a lognormal distribution with a mean of 5.6% and standard deviation of 7.26%
 - Expected value of R is 5.75% p.a.

- Membership with stationery age composition: In this circumstance, the plan liability is time-invariant under either discount rate assumption
- Unless otherwise indicated, both deficit and surplus are amortized, on a fresh-start basis, by means of an adjustment to the target contribution rate that is to be paid by the active participants over their future service periods

References

- Alberta. (2014). *EMPLOYMENT PENSION PLANS REGULATION*. Retrieved from Service Alberta: http://www.qp.alberta.ca/1266.cfm?page=2014_154.cfm&leg_type=Regs&isbncdn=9780779781812&display=html
- Anderson, A. W. (1992). *Pension Mathematics for Actuaries* (3rd ed.). Winsted, Connecticut: ACTEX Publications, Inc.
- Bartholomew, E., Gold, J., Pitts, D., & Pollack, L. (2016, November). *Financial Economics Principles Applied to Public Pension Plans*. Retrieved from <http://www.pensionfinance.org/papers/PubPrin.pdf>
- Bovenberg, L., & Mehlkopf, R. (2014). Optimal Design of Funded Pension Schemes. *The Annual Review of Economics*, 6:445–74.
- British Columbia. (2015). *PENSION BENEFITS STANDARDS REGULATION*. Retrieved from bclaws: https://www.bclaws.gov.bc.ca/civix/document/id/complete/statreg/71_2015
- Canadian Institute of Actuaries. (2015, June). *Standards of Practice – Pensions*. Retrieved from <http://www.cia-ica.ca/docs/default-source/standards/sp060915e.pdf?sfvrsn=0>
- CIA. (2015). *Report of the Task Force on Target Benefit Plans*. Retrieved from <http://www.cia-ica.ca/docs/default-source/2015/215043e.pdf>
- Cui, J., Jong, F., & Ponds, E. (2011). Intergenerational risk sharing within funded pension schemes. *Journal of Pension Economics & Finance*, 1–29.
- Gagne, C. (2015). Closing the Generations Gap: Managing Intergenerational Equity Risk. *CIA – Seeing Beyond Risk*.
- House of Commons of Canada. (2016, October). *Bill 27 – An Act to amend the Pension Benefits Standards Act, 1985 (dormant)*. Retrieved from <http://www.parl.ca/DocumentViewer/en/42-1/bill/C-27/first-reading>
- Joint AAA/SOA Task Force. (2006). *Pension Actuary's Guide to Financial Economics*. Retrieved from Society of Actuaries: <https://www.soa.org/professional-interests/pension/research-thinking-ahead/pen-finance-resources.aspx>
- Ma, C. (2017, April). *An Actuarial Balance Sheet Approach to Assessing Sustainability of Target Benefit Plans*. Retrieved from <http://www.cia-ica.ca/docs/default-source/2017/217045.pdf?sfvrsn=0>
- Ministry of Finance, Ontario. (2017, May). *Strengthening and Modernizing Workplace Pensions*. Retrieved from https://news.ontario.ca/mof/en/2017/05/strengthening-and-modernizing-workplace-pensions.html?_ga=2.36445856.1819056607.1509465882-873330854.1502139041

New Brunswick. (2012). *Shared Risk Plans Regulation, NB Reg 2012-75*. Retrieved from New Brunswick Statutes and Regulations: <https://www.canlii.org/en/nb/laws/regu/nb-reg-2012-75/latest/nb-reg-2012-75.html>

Ontario. (2017, July 1). *Pension Benefits Act R.R.O. 1990, REGULATION 909*. Retrieved from <https://www.ontario.ca/laws/regulation/900909>

Quebec National Assembly. (2015, November). *Bill 57 – An Act to amend the Supplemental Pension Plans Act mainly with respect to the funding of defined benefit pension plans*.

Society of Actuaries. (2014). *Report of the Blue Ribbon Panel on Public Pension Plan Funding*.

TheTerryGroup. (2015, April). *What is Intergenerational Equity?* Retrieved from <http://www.terrygroup.com/news-and-ideas/what-is-intergenerational-equity>

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Comments on

“Funding of Public Sector Pension Plans”

By Stephen W. I. Cheng

This is an excellent paper written by George Ma, both from an academic perspective and from a practical application point of view. There are many design, legislative, regulatory and governance issues to overcome before this proposed funding model or similar concept would become widely accepted and used. This paper is thought-provoking and well organized. I have only the following few comments and suggestions for enhancement as well as identifying some areas of clarification.

Suggestions for Enhancement

- In the first paragraph of Section 1—Introduction, there is a sentence “Inflation protection, used to be guaranteed, is gradually changed to be provided only to the extent the funding of the plan is determined to be sufficiently healthy.” It may be worthwhile to mention that some plans include inflation protection as part of the overall actuarial liabilities, while others may have a separate “Inflation Adjustment Account” to identify separately how well the inflation protection is funded. Perhaps a differentiation between the two and whether inflation protection needs to be separated from the overall plan funding should be considered within the proposed funding model and framework.
- Include a legend for the color-coded lines in the figures (pages 40, 54, 55 and 56) for the different percentile (5%, 25%, 50%, 75% and 95%) distributions.
- Elaborate more on the Monte Carlo stochastic model. The article did not disclose the number of runs simulated.
- In Subsection 5.2—Discount Rate, I would suggest a discussion of the stability of discount rate, “expected return” versus “risk-free,” be included. Higher equity asset allocation may result in higher volatility in the discount rate as well as plan contributions.
- It may be worthwhile to include a reference to the fact that for non-negotiated cost pension plans, when a plan’s actuarial excess exceeds 25% of the actuarial liabilities, the Canadian income tax legislation prohibits further contributions by the employer until the excess surplus has been utilized to meet current and future service funding requirements.
- The first paragraph in Subsection 5.3—Amortization Method on page 8 has a reference to the amortization of the going concern deficit over 15 years. Similar information should be provided for the amortization of solvency deficiency over five years and that existing amortization payments for the going concern deficit as well as solvency deficiency over the ensuing five-year period are allowed to be recognized as a “solvency asset adjustment” for determination of the required amortization of new solvency deficiency.
- There are many reciprocal transfer agreements between different public sector pension plans in Canada. I would suggest that the author address the suitability of this funding model to specify the use for purposes of reciprocal transfers. This would likely eliminate the needs for public sector plans to frequently update their actuarial assumptions applicable for reciprocal transfers.

Suggestions for Areas of Clarification

- Starting on page 32, and used consistently throughout the paper, there is a reference to “collective pension funds in Canada,” which is a somewhat generic and not well-defined term. I would suggest replacing “collective pension funds in Canada” with “pension funds for collectively funded pension plans in Canada.”
- On page 34 in the bullet “Government budget office,” I think “finance director,” not “financial director,” was intended.
- The first paragraph in Subsection 5.3—Amortization Method on page 37 refers to “deficit reported in a regulatory filing for a DB plan.” There are many different regulatory filings required for a DB plan. I would suggest that a specific reference to “any deficit reported in an actuarial valuation report for funding purposes and the associated cost certificate filed with the pension regulator” be used here.
- The first sentence in 7.1.a on page 48 reads “The funding model is being proposed for public sector pension plans in Canada.” It may be better phrased as “This proposed funding model is suitable and hence recommended to be adopted for use by public sector pension plans in Canada.”
- In the second paragraph in Subsection 7.1.b—Plan Design, I would suggest the use of either the word “amortize” or “eradicate” to replace the word “repair” in the phrase “to **repair** any funding deficit.”
- In the first paragraph on page 49, the second sentence refers to “valuation on windup.” It should be changed to “valuation on a hypothetical windup” so as not to be confused with an actual windup.
- In the second paragraph on page 49, it is recommended that “the **making** of a provision for adverse deviation” be changed to “the **inclusion** of a provision for adverse deviation.”

Kudos to George Ma for such an excellent article.

Stephen W. I. Cheng, FSA, FCLA, is managing director & senior consulting actuary at Westcoast Actuaries. He can be reached at stephen.cheng@westcoast-actuaries.com.

Author's Response to Comments by Stephen W. I. Cheng

By Chun-Ming (George) Ma

I am pleased that Mr. Cheng confirms the merits of my paper, which he describes as “thought-provoking and well organized.” In his review, he has provided some suggestions for enhancement as well as some editorial and wording changes to the paper, to which I respectfully respond below.

Suggestions for Enhancement

- Regarding the first suggestion, I acknowledge that there may well be different approaches to delivering inflation protection, which could affect how the related cost is recognized in the overall plan funding. However, the main focus of my paper is to redesign the Canadian funding model to better address the issues of intergenerational equity and long-term sustainability. I do not attempt to elaborate on how the proposed funding model should be adjusted in specific plan design scenarios.
- Regarding the second suggestion, I agree that showing a legend for color-coded lines in the indicated figures would add clarity. As to his suggestion for more elaboration on the Monte Carlo stochastic model, I would point out that the parameters used for the Monte Carlo simulations employed in my research are described in Appendix B to the paper. The distributions of funding outcomes presented therein are each developed from 2,000 runs of simulations. I do not consider this to be a critical disclosure item.
- Regarding the third suggestion, I disagree with his comment that “[h]igher equity asset allocation may result in higher volatility in the discount rate as well as plan contributions.” The discount rate under the “Expected Return” approach is derived based on the expected *long-term* investment return of the pension plan fund. Higher equity asset allocation would give rise to a higher discount rate but would not necessarily lead to a greater volatility in the discount rate (if the same asset allocation is maintained over the long term). In contrast, the use of the “risk-free” discount rate for liability measurement would introduce unnecessary volatility that distorts the measures of public pension plan liabilities and contribution requirements.
- Regarding the fourth suggestion, the reference to the Canadian tax law is perhaps too Canadian-specific. While the paper discussed mainly the shortcomings of the Canadian funding model, it was actually written for the audience in both the US and Canada.
- Regarding the fifth suggestion, again, the reference to the amortization of solvency deficiency is perhaps too Canadian-specific.
- Regarding the sixth suggestion, it is my view that the issue of reciprocal asset and liability transfers should fall within the purview of the Canadian pension regulatory or legislative authorities. The issue is beyond the scope of the paper.

Suggestions for Editorial and Wording Changes

I agree that the editorial and wording changes that Mr. Cheng proposes would add clarity to the paper.

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The South Dakota Retirement System

Generational Benefit Structure

By Douglas J. Fiddler, R. Paul Schrader and Robert A. Wylie

Abstract

Public sector retirement systems in the United States are currently significantly underfunded with generally increasing contribution requirements even after several years of outstanding investment returns since the great recession. The South Dakota Retirement System (SDRS) provides retirement income security for approximately 27,000 benefit recipients and close to 60,000 active and terminated members through a hybrid plan blending the budgetary certainty of a defined contribution plan with the cost efficiencies and risk pooling of a defined benefit plan. When SDRS was created in 1974 as a consolidation of numerous separate systems, policy makers wisely set a budget for member and employer contributions and most important, set statutory funding thresholds and requirements for changes when needed, ensuring the system would operate within the agreed upon budget. Numerous changes through the years have adapted benefits to changing economic conditions, all while remaining within the resources provided by the fixed, statutory contributions. The current plan provisions meet the SDRS retirement income replacement goals and include flexible benefit features that help ensure the fixed funding will continue to support the benefits. However, no system can function in all economic conditions without adjustments, and therefore the management of the SDRS adheres to specific funding thresholds that require changes when crossed and regular assessment of the risk of crossing the thresholds. The result is a funded status consistently near the top of all statewide plans. In short, through fixed contributions, flexible benefits, cost-efficient risk sharing and consistent long-term above market investment returns, the SDRS provides the maximum sustainable lifetime income possible within the fixed contributions available.

1. Introduction

The current funded status of state and local defined benefit pension plans is worrisome at best. After an extended period of favorable investment returns following the great recession, studies put the median funded ratio in the 70 to 75 percent range with rapidly increasing actuarially recommended contributions. These results are based on each plan's actuarial assumptions, including a median discount rate of 7.5 percent. In addition, approximately 24 percent of statewide plans receive less than 90 percent of the actuarially recommended contribution (NASRA, 2017). Frequently, the funding policy of a plan results in lengthy amortization periods of unfunded liabilities based on increasing member pay, which for many plans results in increasing unfunded liabilities for several years. If equity markets experience a correction, many more plan sponsors may find themselves unable (or simply unwilling) to adequately fund the retirement system at the expense of necessary government operations.

This dilemma has resulted in policy makers considering, and in some cases implementing, the conversion of defined benefit plans to alternative retirement designs that have a more stable contribution requirement for the employer. Defined benefit plans are frequently portrayed as unsustainable or resulting in unacceptable employer cost risks.

Under these same economic conditions, some plans have maintained a fully, or near fully, funded status, adopted more conservative assumptions than average, and continued to provide solid benefits. One such

example is the SDRS. This paper presents an example of a defined benefit plan with hybrid and variable benefit features—a real-world solution that has worked over a sustained period.

SDRS is a cost-sharing, multiple employer retirement system covering essentially all public employees in the state. Several separate systems were consolidated into SDRS in 1974, and SDRS has a long history of fixed, statutory contributions, hybrid benefits, flexible benefits and comparatively high funded ratios—SDRS's funded ratio based on the fair value of assets is 100 percent as of June 30, 2017, and has been at or above 100 percent in 22 of the last 27 actuarial valuations dating back to 1986.

SDRS provisions and operations have evolved over the 40 plus years the system has been in operation. The model presented in this paper is based on the provisions applicable to members hired on or after July 1, 2017.

The fundamental features that have led to SDRS's financial stability are:

- Fixed, statutory member and employer contribution rates
- Flexible defined benefits designed to meet specified income replacement goals
- Statutory funding measurement thresholds requiring corrective actions
- Outstanding internal investment management
- Administration by a retirement board focused on its fiduciary responsibilities and advocating on behalf of the plan's sustainability
- Oversight by a bipartisan legislative committee working in partnership with the retirement board

Because SDRS operates with fixed, statutory contributions, benefits necessarily must have some variable features. Benefit reductions in the form of cost-of-living adjustments (COLA) have been upheld as permissible in South Dakota Circuit Court (Tice, 2012). This model is presented in the context of an environment of fixed contributions that permits benefit adjustments; however, many of the principles and processes can be adapted to function in more restrictive legal environments or different fiscal conditions.

Establishing and adhering to specific and measurable objectives applicable to funding, member benefits provided, system investments and expense management have been key to the SDRS success and are outlined in detail in this paper. Specific statutory funding thresholds requiring corrective actions have ensured SDRS stays on course.

In short, the SDRS design combines the budgetary certainty of a defined contribution plan with the cost efficiencies, risk sharing and lifetime income of a defined benefit plan and is based on several important principles.

2. Principle-Based Plan Design

2.1 BASIC RETIREMENT PLAN STRUCTURE

General Principle

Both defined benefit and defined contribution plans have attractive features that should be considered in the plan structure.

A pure defined benefit plan provides fixed benefits and variable contributions based on the amount required to actuarially fund the benefits in accordance with the sponsor's funding policies. Actuarial

assumptions are adopted to predict future experience as accurately as possible when setting contribution rates and determining funding progress. Experience that is different from what is assumed results in contribution requirement changes.

Contribution requirements will vary over time as environmental or demographic changes are reflected. Even with ideally set benefit levels, there may be political pressure to increase benefits during favorable economic periods and conversely, there will likely be stress on the sponsor's budget and pressure for reforms during unfavorable economic times.

Defined benefits typically become more valuable as employees get closer to retirement age. Employees who leave early in their career frequently receive little or no value from the employer contributions.

A pure defined contribution plan avoids the fluctuating contribution requirements by fixing the contribution rate. There is no need for actuarial assumptions. Contributions are defined and the benefits are variable as determined by the contributions and actual investment performance alone. All investment, longevity and benefit sufficiency risk is borne by the individual member. Benefits are typically provided as a lump sum at retirement, with the availability of an individual annuity purchase at the market price.

Defined contribution plans are touted as providing a more equitable distribution of employer-funded benefits between short, partial, and full career employees and providing fully portable retirement benefits.

SDRS Application

The SDRS design is a hybrid defined benefit plan with fixed, statutory contributions, significant benefit flexibility, and statutory funding thresholds requiring additional benefit changes. Early in its history, SDRS adopted hybrid plan provisions (see details under section 2.8, "SDRS Specific Provisions") to increase the value of benefits for employees who did not stay until retirement. This change corrected a weakness of defined benefit plans and provided a significantly more equitable distribution of benefits.

2.2 BUDGET

General Principles

Every retirement system should delineate an acceptable range of employer and member contributions and identify the specific plan provisions subject to change when the actuarial requirements of a plan exceed the range.

In any retirement system, contributions and investment return must support benefits and system expenses. In a typical defined benefit system, actuarial assumptions and funding methods determine contribution requirements based on member data and the fixed benefit provisions. Assumptions and methods must adhere to the applicable Actuarial Standards of Practice, but also reflect current conditions and opinions of future conditions. Economic, demographic and political conditions change over time. Investment markets and corresponding funding levels change over time. Public sector retirement systems operate over multiple decades that can include significant economic and demographic shifts.

Economic and demographic environment changes will require actuarial assumption modifications. If the environment has changed significantly, recommended funding costs may escalate significantly. An expectation of unlimited employer contributions to fund unalterable benefits is unreasonable and impractical. Without an explicit range of acceptable contributions, a steeply increasing contribution requirement could stress governmental budgets, crowd out essential government services and become

prohibitively unaffordable for employees. An explicit, acceptable range delineates when benefit adjustments must be considered.

SDRS Application

Member and employer contribution rates are equal and fixed in statute, and system benefits must be managed within the resources provided by the fixed, statutory contribution rates. Actual contributions have always matched the statutory rates in South Dakota regardless of economic conditions.

Fiscal conservatism is a cornerstone of South Dakota government management and operations. When the consolidated system was formed in 1974, employers were concerned with the prospect of contribution increases that would stretch already limited employer budgets and employee affordability. By setting the employer contribution rate at an acceptable level (and maintaining it at that level), employers can budget effectively, managing both the government workforce costs and the budgetary needs of other government services. Equal member contributions ensure the shared responsibility for providing retirement resources and address the corresponding budgetary concerns of employees. Fixed contributions prevent a transfer of costs from one generation of workers to the next. Benefits were initially set with some conservatism based on the fixed and limited resources and recognizing the preference for increasing benefits when resources permit over reducing benefits when conditions require.

2.3 BENEFIT EFFICIENCY

General Principle

Whether contributions, benefits, or both contributions and benefits vary, it is beneficial to both system members and employers to provide benefits as efficiently as possible.

The defined benefit plan structure allows pooling of longevity risk and investment timing risk and typically requires lower expenses than defined contribution plans. Multiple studies have demonstrated defined benefit plans provide more benefit per contribution dollar than defined contribution plans (Fornia, 2014).

In the past, subsidies have been included in the SDRS plan design. For this purpose, a subsidy refers to a benefit or feature that increases the value of the benefit and is available to only a portion of the membership meeting certain criteria. Notable examples are special early or early retirement features that provide an unreduced benefit or a benefit reduced less than an actuarially equivalent reduction. The rationale for including subsidies is typically to accomplish a secondary goal subordinate to the primary goal of efficiently and equitably providing retirement benefits. However, these secondary goals often change over time. For instance, providing a subsidized early retirement benefit may reduce employer payroll costs if it is possible to replace experienced, higher paid employees with newly hired employees. But a subsidized early retirement benefit may also encourage valuable employees to retire and seek employment elsewhere at a time of low unemployment and a scarce supply of potential new hires. In addition, subsidizing early retirement features can often lead to demands that result in institutionalized “double dipping” such as provisions that allow both retirement and the immediate return to employment or DROP type programs that “bank” retirement benefits while working.

In SDRS’s experience, subsidies available to only a portion of the membership can be very expensive and inequitable and therefore should be avoided or minimized. SDRS provisions applicable to the original tier of benefits included special early retirement and early retirement subsidies. Those subsidies increased the total SDRS normal cost for retirement benefits by approximately 15 percent while providing increased benefit value only to those members who were eligible for special early or early retirement and otherwise prepared to retire prior to a typical full retirement age.

Certain other provisions can be subject to member or employer manipulation. For example, if benefits are determined using a final average pay formula, caution should be exercised to ensure compensation cannot be artificially increased in the period leading up to retirement. This type of manipulation can take many forms, including inclusion of optional or overtime pay, contracts intentionally structured to bump salary right before retirement, or any provision that gives members options to increase includable compensation. If salary manipulation cannot be avoided, longer final average pay periods, maximum pay increase limits close to retirement or a career average formula may be necessary to distribute benefits equitably.

SDRS Application

SDRS has revised numerous plan terms over the years as subsidies, inequities or unanticipated cost issues have been identified. Examples include:

- Removal of all terminal pay from the definition of compensation
- Elimination of an optional spouse benefit that proved difficult to adequately price
- Restructuring of return-to-work provisions
- Revision to disability and preretirement survivor benefits to avoid duplication with Social Security benefits
- Charging full actuarial cost for service purchases

These efforts have continued in the structure of the benefits applicable to employees hired on or after July 1, 2017. For example, no subsidized early retirement provisions are provided and early retirement benefits are reduced 5 percent per year for each year prior to age 67 normal retirement (which approaches an actuarially equivalent reduction while being simpler to communicate). A 5-year final average compensation period is used to dampen the impact of any significant late-career salary spikes. In addition, compensation increases above 5 percent in the years approaching retirement are excluded from the calculation of retirement benefits. Finally, items that are includable in compensation are carefully defined and monitored.

2.4 BENEFIT ADEQUACY AND INCOME REPLACEMENT GOALS

General Principle

Plan benefits should be structured to replace a percentage of income in retirement considering benefit adequacy needs and resources.

Systems should define the income replacement that allows career employees to maintain the same standard of living in retirement that they enjoyed during employment. Most living expenses are periodic, so the goal should be expressed as lifetime income in retirement—not on the accumulation of wealth. The income replacement goal should consider the cost of maintaining a standard of living, changes between pre- and post-retirement needs, Social Security participation, the availability of health insurance coverage and other relevant factors. In most cases, income needs in retirement will be less than during employment because retirees no longer need to save for retirement and other work-related costs are higher than retirement-related costs (Purcell, 2012).

While meeting total income replacement needs may not be feasible, benefit accrual levels should be set based on resources available for members who work an entire career in positions covered by the system. Benefits should not be structured to fully meet the income replacement goals for a member who works less than a career. Exceeding the income replacement goal should not be a target.

The system's normal retirement age should be established considering traditional retirement ages, Social Security retirement ages and increasing life expectancies.

Inflation protection after retirement is a key element of benefit adequacy and should be specifically addressed.

Objectives should also be established for benefits upon disability, preretirement death, and termination of employment prior to retirement.

SDRS Application

The SDRS Board of Trustees has established income replacement goals to provide SDRS retirement income of 55 percent of final average compensation for career SDRS members and to promote total retirement income of 85 percent of final average compensation including SDRS benefits, Social Security and personal savings.

Virtually all SDRS members participate in Social Security. The SDRS benefit goals have been established considering the income replacement provided by Social Security at retirement, disability and pre-retirement death to provide an acceptable total benefit considering both sources. Benefits upon termination of employment are higher than typical as discussed in section 2.5 of this paper.

Career members are defined as general members who work 30 years, judicial members who work 20 years and public safety members who work 25 years. Benefit multipliers are sufficient to reach the 55 percent income replacement goals for career members.

SDRS's normal retirement age is set at age 67 for general and judicial members and age 57 for public safety members. No subsidized early retirement benefits are provided.

SDRS's goal is to provide partial inflation protection after retirement, but the COLA payable is limited to the resources available.

2.5 BENEFIT EQUITY

General Principle

Benefits should be distributed equitably among employees who leave public employment midcareer and those who stay to retirement.

As noted earlier, a fair criticism of a pure defined benefit plan is the very low benefit value for employees who leave employment relatively young and prior to reaching retirement eligibility.

SDRS Application

SDRS provides vested employees a choice at termination of employment between a lump-sum payment of accumulated member contributions and 85 percent of the employer contribution with interest if vested, or a deferred retirement benefit indexed with the SDRS COLA (including COLAs during the deferral period). Vesting occurs after 3 years of credited service. Nonvested employees receive the accumulated member contributions and 50 percent of the accumulated employer contributions.

2.6 ADJUSTABLE BENEFIT FEATURES

General Principle

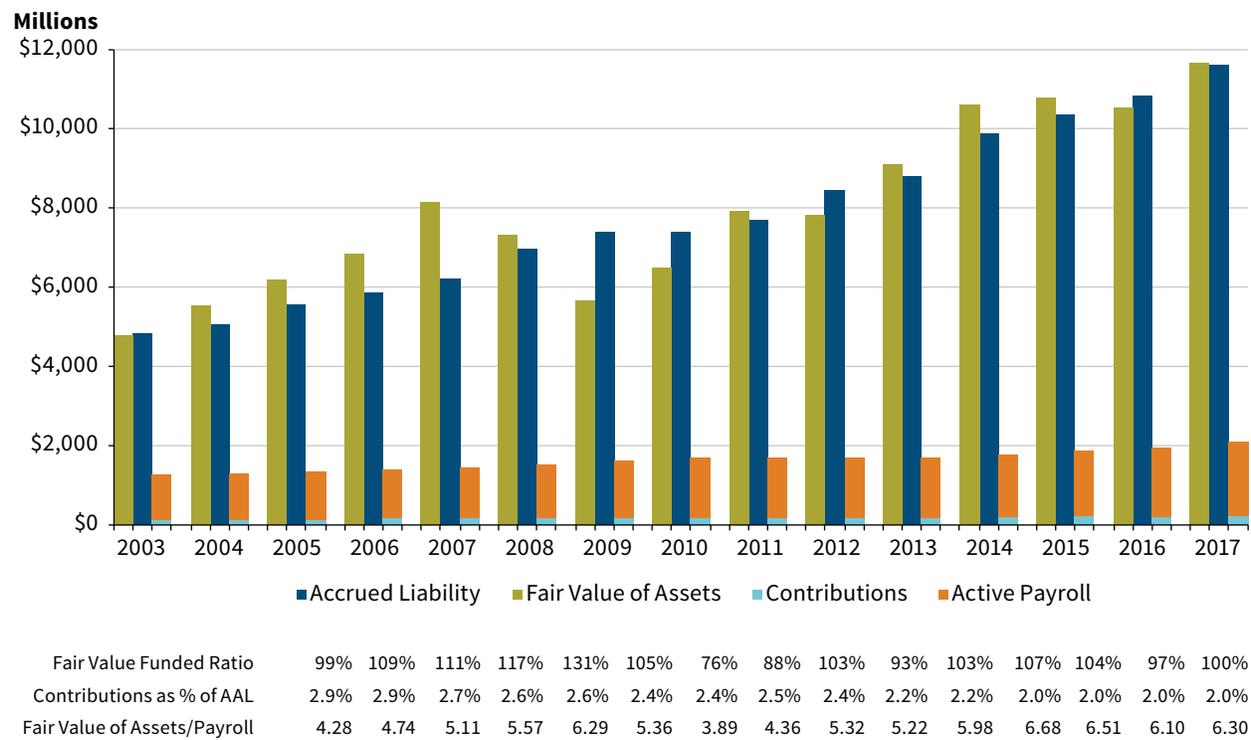
Most public defined benefit plans have now significantly matured resulting in a high percentage of the plan's total accrued liabilities due to retired members.

As a result, liabilities and assets of plans are a high multiple of covered payroll, and an asset or liability loss of significant magnitude will now require a larger portion of payroll to fund. If a system has an established contribution budget, losses may push the contribution requirement above the budget. If a system does not have an established contribution budget, losses may push the contribution requirement above a practical limit, forcing choices between appropriately funding the system, funding essential government services, or even abandoning the defined benefit model. In short, mature traditional defined benefit plans may find it impossible to solve funding issues with contribution increases alone.

Since 2003, SDRS assets and liability have grown significantly faster than covered employee payroll (see Figure 1).

FIGURE 1

Comparison of SDRS Accrued Liability, Assets and Payroll



This trend has been observed elsewhere (Boyd, 2016) and makes solving funding shortfalls through increased contributions alone exceedingly difficult.

Flexible benefit features that vary based on inflation and funding measures mitigate the impact of gains or losses on mature plans. An effective flexible feature adjusts system benefits and liabilities in coordination with system assets or contribution requirements. For example, COLAs can be linked to inflation and limited to an amount that accomplishes a specific funding goal. Adjustable benefit features can also be linked to investment return.

SDRS Application

SDRS has two main flexible benefit features, the COLA and the variable retirement account. The COLA varies with inflation, between 0.5 percent and 3.5 percent, but the maximum COLA is restricted

to the percentage that is affordable on a long-term basis. The variable retirement account varies a portion of the member's accrued benefit based on actual investment returns. Both are described more fully in the following pages.

2.7 THRESHOLDS FOR CORRECTIVE ACTIONS

General Principle

Defined benefit retirement systems are long-term enterprises that over time and changing economic conditions will experience changing funding measurements and contribution requirements.

If prudently managed, a retirement system can provide financial security in retirement for generations of members. However, without predefined acceptable limits, systems and their sponsors can face annual debates, and unclear needs for action, over a declining funded status or increasing contribution requirements. Much like setting an acceptable contribution budget, establishing a funding threshold that would require realignment of contributions and benefits is key to avoiding a gradual deterioration of funding and the need to make more substantial changes later.

SDRS Application

As stated previously, member and employer contribution rates are fixed in statute. Flexible benefit features will help maintain the funded status of SDRS in most economic environments. However, in a severe or sustained period when experience is worse than assumptions, the funded status could deteriorate requiring additional actions.

SDRS has two primary thresholds that require recommendations for benefit changes. The first is a requirement that the fixed, statutory contributions meet a minimum actuarial requirement to support the benefits. In alignment with the SDRS Board of Trustees funding policy, the fixed statutory contributions must be sufficient to pay normal costs and expenses and amortize any unfunded actuarial accrued liability over 20 years or less.

The second threshold is based on the system's funded ratio. Early on in SDRS's history, a funded status that remained below 80 percent for 3 years would require recommendations for benefit changes. In practice, the only time the funded ratio dropped below 80 percent, benefit reductions were immediately recommended and enacted. With the recent changes in COLA provisions that automatically adjust the benefits and funded ratio, the threshold for an acceptable funding ratio was increased to 100 percent.

South Dakota statutes require the SDRS Board of Trustees to immediately recommend benefit reductions to the legislature if either of these thresholds is not satisfied.

2.8 SDRS SPECIFIC PROVISIONS

System provisions are described for general members who constitute 93 percent of SDRS membership. Public safety and judicial members have different contribution rates, retirement eligibility provisions, and benefit formulas. A brief, simplified description of the rationale for each provision is also provided.

- **Participation.** Virtually all public employers participate in SDRS. All full-time, permanent employees of participating employers are members of SDRS. Mandatory participation is key to ensuring a stable plan membership and growing asset pool that is large enough to provide economies of scale.
- **Contributions.** Member and employer contributions are each 6 percent of compensation. As described earlier, fixed contributions are relatively modest and equally shared between members and employers.

- **Normal retirement age.** Age 67 with 3 years of service. Aligned with Social Security and reflects increased life expectancies.
- **Final average compensation.** Average of highest 5 consecutive years within the final 10 years of compensation. Within the final 10 years of compensation, compensation exceeding 105 percent of the prior highest year compensation is excluded from the determination of final average compensation. The retirement benefit should be based on compensation near retirement to provide adequate income replacement. The 5-year averaging period and the compensation caps help prevent large, late career increases from generating unexpected liabilities that have not been properly funded.
- **Normal retirement benefit.** 1.8 percent of final average compensation times years of service. Approaches income replacement goal of 55 percent of final average compensation for a career (30-year) member and is affordable within fixed, statutory contributions.
- **Early retirement benefit.** Available 10 years prior to normal retirement age. Normal retirement benefit reduced by 5 percent per year before normal retirement age. Avoid subsidizing early exits and encouraging early retirement that exacerbates the South Dakota workforce shortage. Subsidies available to a portion of membership may lead to demands for higher benefits to others.
- **Surviving spouse benefit.** Optional joint and survivor benefits are available with actuarially reduced member benefit. Provide option for member to protect spouse, but avoid subsidies that would be available only to married members.
- **Variable retirement account.** Notional account credited with 1.5 percent of compensation each year and increased by the actual investment return of the SDRS trust fund. Employees are provided a minimum benefit of the amounts credited, effectively a career minimum 0 percent investment return. Payable at retirement, death or disability as a lump sum, rollover or converted to a supplemental retirement benefit. Contribution can be reduced or eliminated if fixed benefit normal costs approach fixed contributions. Links a portion of liabilities directly to asset performance, which avoids any adequacy risk to the plan. Provides source of onetime funds at retirement and is affordable within fixed, statutory contributions.
- **Supplemental retirement benefit.** Optional benefit based on the conversion of a rollover or variable retirement account to an annuity. The conversion rates are based on a discount rate set annually and intended to be between available commercial annuities and SDRS's assumed rate of investment return. The rate is based on an assumed investment return rate that can be achieved with a 75 percent likelihood. Allows members to convert retirement assets to additional guaranteed lifetime income. Rates set to protect the plan from added costs in most environments.
- **Vesting.** Members become vested with three years of service. Early vesting distributes benefits over the entire workforce except for very short-term employees.
- **Termination benefit.** Nonvested members receive a refund of member contributions and 50 percent of employer contributions, accumulated with interest (at a rate set annually based on the yield of a 91-day U.S. Treasury bill). Vested members can elect to take a normal or early retirement benefit after meeting the eligibility requirements. Their accrued benefit is increased with the SDRS COLA before and after benefit commencement. Alternatively, vested members may elect to receive a refund of member contributions and 85 percent of employer contributions, accumulated with interest. Benefits for short service members are competitive with benefits that would be provided by a defined contribution plan. Refund of employer contributions set at 85 percent to consider cost of disability and survivor benefits provided while active. COLA provided during deferral to prevent dilution of purchasing power.
- **Disability benefit.** Disabled members receive the greater of their accrued benefit or 25 percent of final average compensation at the date of disability. Provides adequate disability benefits considering available Social Security benefits.
- **Survivor benefit.** Surviving spouses of members who die while employed receive the greater of the member's accrued benefit, or 25 percent of the final average compensation at the date of death.

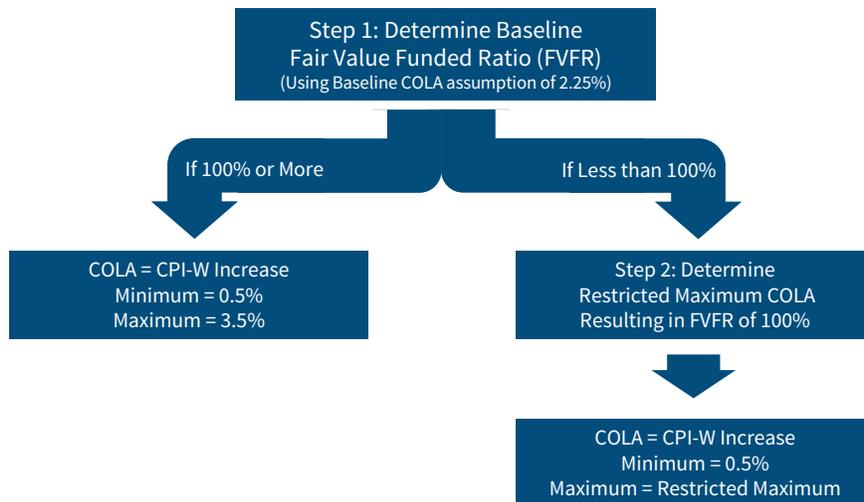
Benefits are payable immediately while there are eligible children and again payable when the spouse reaches age 67 without eligible children (available 10 years earlier with 5 percent per year reduction). The benefit is increased with the SDRS COLA before and after benefit commencement. Provides adequate survivor benefits considering available Social Security benefits.

- **SDRS COLA.** All benefits except refunds of accumulated contributions are increased annually by the SDRS COLA. The COLA is paid each July 1 and is equal to the percentage increase in the third calendar quarter CPI-W and further limited as follows:
 - If the fair value of assets meets or exceeds the actuarial accrued liability calculated assuming future COLAs are equal to the baseline COLA assumption (currently 2.25 percent): CPI-W increase with a 0.5 percent minimum and a 3.5 percent maximum.
 - If the fair value of assets is less than the actuarial accrued liability calculated assuming future COLAs are equal to the baseline COLA assumption (2.25 percent): CPI-W increase with a 0.5 percent minimum and a restricted maximum determined as the maximum amount that, if future COLAs are equal to the restricted maximum, the fair value of assets exceeds the actuarial accrued liability.

This partially protects retirees from loss of purchasing power. Additionally, it is imperative to avoid COLA increases that cannot be afforded based on current fixed resources. The annual SDRS COLA determination process is shown in Figure 2.

FIGURE 2

Annual SDRS COLA Determination Process



2.9 REFLECTION, EVALUATION AND NEXT STEPS FOR SDRS

SDRS is continually evaluating its benefit structure and cost, as well as its policies and goals.

Specific thresholds are in place to indicate when additional changes are needed to ensure benefits remain supported by the fixed, statutory contributions. In addition, actuarial gains and losses are examined annually to identify any sources of unexpected cost increases that may point to potential areas requiring reform.

Several features have been preliminarily identified for consideration if future changes are required. These include:

- Extending the final average compensation averaging period beyond 5 years, or even adoption of a career average basis
- Increasing the normal retirement age to reflect increased life expectancies (automatic increases will be considered)
- Suspending contributions to the variable retirement account
- Reducing or suspending the SDRS COLA
- Adding additional flexible benefit features

The board of trustees' policies allow consideration of benefit improvements if, after the prefunding of the total cost of any improvement, the funded ratio remains above 120 percent. Potential benefit increases have also been preliminarily identified, but would be subject to additional rigorous study prior to implementation if SDRS funding approaches the 120 percent threshold. Likely improvements would include onetime contributions to the variable retirement account or filling in any shortfall between COLA increases and inflation.

2.10 POTENTIAL ADAPTATIONS FOR APPLICATION TO OTHER SYSTEMS

While many of the SDRS philosophies and approaches reflect the fiscal conservatism inherent in South Dakota government, they are transferrable to significantly different political and economic environments:

- Fixed, statutory contributions may not work in many situations, but contribution limits seem inevitable. It is unreasonable to expect support for unlimited contribution increases driven by the actuarial costs of absolutely fixed benefits. Establishing a threshold for contributions that, if reached, would drive mandatory benefit (or member contribution) adjustments may be a more palatable solution. Establishing the thresholds in advance is advisable.
- Contribution holidays and failure to make the agreed-upon contributions have clearly contributed to the growth in unfunded liabilities though are not as important as other factors (Munnell, 2015). A consistent funding practice is imperative.
- The variable SDRS COLA feature could be modified to target contribution rates or a funding period rather than a funded ratio. Researching and reconsidering the rationale for the existing COLA may provide insight into economic shifts that resulted in a COLA that is mismatched with inflation and/or the original purpose of the feature.
- The variable retirement account could be expanded or reduced as a percentage of the total benefits. SDRS has set the credits to the variable retirement account at approximately 12 percent of the total member and employer contributions. A higher allocation to the variable retirement account would necessarily reduce the fixed benefit provisions and directly allocate more investment risk to plan members.
- Of course, any of the other variables (contribution rates, benefit multipliers, normal retirement age, final average compensation periods) can be modified to fit specific needs.
- Spending "surpluses" on benefit improvements should be approached with caution to avoid adding liabilities to the plan at market highs. A procedure for considering when, and under what conditions, benefit improvements are advisable is essential.

In addition to the principle-based plan design considerations, major contributors to the SDRS success have been a clear, consistent, and responsible allocation of responsibility for governance as well as the establishment of policies for benefit delivery, funding, and overall management of SDRS.

3. System Governance

The structural authority over plan design and operation is critically important. For a public retirement system to be sustainable, plan benefits and design, actuarial assumptions and funding policies must periodically adapt to economic and demographic changes. Recommendations for change must consider long-term implications under a variety of economic scenarios and should therefore be initiated by an informed and objective body with the primary focus of sustainably delivering retirement income to plan members. The governing body must consider the impact of any changes on members, employers and any other stakeholders.

3.1 GOVERNING BODY COMPOSITION AND AUTHORITY

Retirement plan governance takes many different forms. Most often, a retirement board is the primary governing body of the plan. Ideally, a retirement board will have representatives of members, employers, and other stakeholders to represent the various parties impacted by plan decisions.

However, the authority granted to retirement boards varies greatly. Some boards have authority only over the administration of the plan, with no ability to advocate for or against changes that may impact the plan's sustainability. Other boards routinely advocate with legislatures or councils on behalf of the plan.

To consistently and effectively act in the best interest of the plan and its membership, it is imperative that the entity with the most expertise and experience be an advocate for the plan to ensure the plan is operated in an efficient and sustainable manner. A retirement board is the logical choice for that advocacy role, and must then possess the knowledge, expertise and objectivity to advocate on behalf of the plan. This in turn requires individual board members to accept their fiduciary duty to operate the plan for the long-term benefit of all plan members. Board members must stay informed on current benefit practices and legal and actuarial matters and the financial condition of the plan.

The retirement board may also have authority over investment decisions. Because of the complexity involved and the critical importance of investment returns to the plan, bodies that oversee investment decisions should be composed of investment professionals. The most effective structure is two specialized boards, separately overseeing plan decisions and investment decisions, but acting cooperatively.

SDRS Application

The SDRS Board of Trustees is the governing authority of SDRS and is responsible for:

- Formulating and communicating a sound pension policy
- Establishing goals and objectives for SDRS
- Ensuring the financial integrity of the system
- Proposing legislative changes believed necessary or beneficial
- Adopting rules necessary to implement the governing statutes
- Adopting an administrative budget and submitting it to the executive and legislative branches of state government for approval
- Appointing an executive director as the chief executive and operations officer of the system

The SDRS Board of Trustees is composed of 16 voting members who represent specified groups of members, employers or the executive branch. The State Investment Officer is a nonvoting, ex officio member.

Investment decisions are overseen by a separate board of investment professionals. Additional discussion is in Section 4.

3.2 LEGISLATIVE OVERSIGHT

State legislatures govern state retirement systems. In many states, one or more legislative committees that may have minimal experience with the complexities of retirement systems and have numerous other responsibilities initially review legislation impacting retirement systems. Ideally, to avoid competing political agendas and to provide a source of knowledge and familiarity, a single committee should oversee a state retirement system. The committee should preferably be a standing, bipartisan, bicameral body with the primary shared interest of promoting the sustainability and affordability of the system. Any proposal to modify system provisions should be thoroughly vetted by this committee to analyze long-term cost and policy implications.

SDRS Application

Bipartisan, bicameral standing retirement laws committees (RLC) of the South Dakota Legislature oversee bills relating to the pensions, annuities and benefits of employees and officers in public service. Any potential legislation impacting SDRS is assigned to the RLC for initial consideration (South Dakota Legislative Rules).

SDRS board members or their representatives provide recommendations in testimony to the RLC for each bill with a significant impact on the system. Most important, the board is the SDRS expert and routinely advocates for or against any proposed legislation that materially impacts SDRS. The immediate and long-term cost impact of any significant proposals is analyzed prior to recommendations, considering the most likely future conditions, but also alternative economic conditions. Proposals are reviewed in the context of equity for the membership as a whole.

For the success of SDRS, a culture of collaboration and trust must exist among the board of trustees, the RLC and the executive branch. All parties must be committed to the long-term sustainability of the system and resist any urge to enact unfunded mandates or to use temporary surpluses to create permanent liabilities. The board of trustees works to maintain communication with the RLC members throughout the year, keeping them informed of upcoming and/or potential issues as well as the financial status of SDRS. An annual joint meeting of the RLC and the board is held and the RLC is provided with an annual update of the financial condition of SDRS at the start of each legislative session. In addition, SDRS annually prepares a formal report to the governor and legislature summarizing the funded status of SDRS as well as current issues and initiatives.

Legislation is rarely enacted without consensus among RLC and board of trustees members. While this seems impossible in today's politically charged environment, it has been achieved in South Dakota and is key to the success of SDRS. All stakeholders are committed to working together for the long-term sustainability of the system. Trust and confidence in the board of trustees' recommendations and stewardship of SDRS has been earned over time.

3.3 POTENTIAL ADAPTATIONS FOR OTHER PLANS

Certain basic SDRS principles can be adopted and adapted for use in other constructs.

- Every potential plan modification must be evaluated for its long-term cost impact, including the potential costs if economic or demographic conditions change.
- Modifications that benefit only a portion of the plan membership should be critically evaluated and avoided.
- Temporary funding surpluses should not be used to fund permanent benefit increases.
- A single body of experts (ideally the retirement board) should be charged with ensuring the fiscal sustainability of the system and must therefore actively advocate on the plan's behalf.

- Legislative oversight should be assigned to a single standing committee that also accepts the responsibility, in partnership with the retirement board, for ensuring sustainability.
- Every defined benefit retirement plan should establish policies governing benefits and funding and should specify potential actions to take when the experience does not meet assumptions.

3.4 GOVERNING BODY POLICIES

To ensure consistency in actions, the plan's governing body should establish a mission statement and policies governing key positions. A mission statement should clearly establish the overriding purpose of the body.

Two equally important policies are a funding policy and a benefit policy. Whether the governing body establishes fixed benefits and has variable contributions, or establishes fixed contributions and has variable benefits, the policies defining the benefit goals and contribution limits should be explicit.

As noted earlier, the benefit policy should establish the target benefit for a career member based on an income replacement goal that allows a member to maintain the same standard of living in retirement as during employment. Ideally, benefit goals are also established for employees who leave midcareer, who become disabled or die while in employment, and for inflation protection after retirement.

The funding policy should specify the actuarial funding method, the actuarial asset method, and the amortization period and method to be used. Ideally, the funding policy should also specify an acceptable range of employer contribution rates and objectives for funding measures.

SDRS Application

The SDRS board of trustees' mission statement:

To plan, implement, manage and efficiently administer financially sustainable retirement income programs within the fixed resources available.

The mission statement acknowledges that SDRS operates based on fixed contribution rates. In addition, the system must be financially sustainable and must be efficiently managed.

The SDRS Board of Trustees' income replacement goal:

Provide lifetime income replacement of at least 55 percent of final average compensation for career employees in each membership class.

Promote total lifetime income replacement of at least 85 percent of final average compensation, including income from SDRS, Social Security, and personal retirement savings of at least one times annual compensation at retirement.

The total income replacement goal of 85 percent was based on a comprehensive study evaluating the required income level to maintain a standard of living into retirement, considering the changes that happen at retirement. No one set percentage will be the right percentage for the entire population. Lower paid members will need a higher percentage than more highly paid members, and other individual circumstances will vary considerably. As noted earlier, nearly all SDRS members also participate in Social Security. In addition, personal retirement savings is a necessity for employees who work less than a full career, retire early or have unusual income needs in retirement.

The SDRS funding and system management policies are shown in Table 1.

TABLE 1

Managing SDRS Based on Fixed, Statutory Contributions

FUNDING OBJECTIVES	CONSIDERATION OF BENEFIT IMPROVEMENTS	REQUIRED CORRECTIVE ACTION RECOMMENDATIONS
<p>A fair value funded ratio (fair value of assets ÷ actuarial accrued liability) of 100 percent or more</p> <p>A fully funded system with no unfunded liabilities under the entry age normal cost method</p> <p>Actuarially determined benefits that are variable and can be supported by fixed, statutory contributions that are equal to or greater than the actuarial requirement of:</p> <ul style="list-style-type: none"> • Normal cost plus expenses when system is fully funded • Normal cost plus expenses, and payment of unfunded liabilities over a period not to exceed 20 years if system is not fully funded 	<p>A fair value funded ratio of over 120 percent is required before considering benefit improvement recommendations.</p> <p>The cost to fully fund the recommended benefit improvement is also limited to the net accumulated actuarial investment gains and losses, with gains recognized over a 5-year period and losses recognized immediately.</p> <p>After fully funding the cost of the benefit improvement, the fair value funded ratio must be at least 120 percent and all funding objectives must continue to be met.</p> <p>Proposed benefit improvement must be consistent with both the board’s long-term benefit goals and sound public policy with regard to retirement practices.</p>	<p>The annual report to governor and retirement laws committee (RLC) will include corrective action recommendations if SDRS does not meet both of the following conditions:</p> <ul style="list-style-type: none"> • Fixed, statutory contributions sufficient to meet the actuarial requirement • Fair value funded ratio of 100 percent or more <p>The report shall include recommendations for the circumstances and timing for any benefit changes, contribution changes or any other corrective action, or any combinations of actions to improve the funding conditions.</p>

Key components of the funding and system management policies are:

- An acknowledgment that the system will be managed within fixed, statutory contributions
- A target of 100 percent fair value funded ratio, including recommendations for corrective actions if the target is not met
- A benefit improvement policy that requires a funded ratio of 120 percent after fully funding the total cost of any improvement before considering any improvements

The funding and system management policies have changed over time, but the fundamental tenet of fixed contributions with specified thresholds for benefit improvements and corrections has been instrumental in SDRS’ success.

Many of the Board of Trustees’ positions are summarized in the following South Dakota Perspective on Public Employee Retirement Benefits and SDRS.

Benefit Policy Positions

- A defined benefit plan is preferred because it is the most efficient and advantageous design for members, employers, and taxpayers.
- Hybrid features that combine the advantages of both defined benefit and defined contribution plans are essential for an equitable distribution of benefits to both career and noncareer members.
- Variable benefits based on affordability measures are essential for sustainability, and the COLA is the most logical benefit feature to vary.
- Benefits should meet specific income replacement objectives; excessive benefits must be avoided.
- Provisions and practices that result in higher than intended and/or artificially inflated benefits must be avoided and corrected to protect scarce resources and to reinforce adherence to our goals.

Governance and Plan Management Positions

- The SDRS Board of Trustees must have the expertise, knowledge and resources and act as fiduciaries in accordance with SDCL 3-12C-202 to recommend benefit and funding policies and to actively lead SDRS.
- Fixed contributions are a prudent financial decision, and SDRS benefits must be managed accordingly since:
 - Variable contributions may require significant and unpredictable higher costs.
 - Contribution increases alone are not adequate to solve funding issues for mature plans.
 - If costs are not controlled, SDRS will be replaced by a defined contribution plan.
- A realistic planning horizon for mature systems like SDRS is 10–20 years because of the duration of our liabilities.

Funding Policy Positions

- The SDRS funding policy must specify minimum funding standards to dictate when changes are required or should be considered.
- Reliance on our long-term past investment results exclusively is not realistic.
- Future mortality improvement must be considered in actuarial assumptions.
- Actuarial methods and funding policies that result in expected increasing unfunded liabilities (referred to as negative amortization) are unacceptable.
- Contribution rates with a 50 percent chance of funding actuarial liabilities are not acceptable unless accompanied with flexible benefits.
- Recommendations for corrective actions are required under SDCL 3-12C-228 unless both the fixed, statutory contributions are sufficient to meet the actuarial requirement and the fair value funded ratio is 100 percent or more.
- Risk measures must be developed and communicated to provide transparent disclosure of the likelihood of meeting the funding policies and benefit goals of SDRS.

A well-funded defined benefit plan with fixed, shared member and employer contributions and hybrid, variable features is the most efficient and advantageous design for members, employers and taxpayers.

3.5 ACTUARIAL ASSUMPTION SETTING

Actuarial assumptions must adhere to the Actuarial Standards of Practice and should reflect the best possible estimate of future events that impact the timing and amount of benefit payments. Setting the discount rate is the biggest challenge.

Assumptions must consider the purpose of the measurement. For actuarial valuations used to determine a plan's funding requirements, the assumptions should reflect the estimated cost of funding benefits, and therefore, the discount rate should be based on the expected investment return for the plan's asset allocation.

Whether the benefits or the contributions are fixed, the purpose of the measurement is to determine if the current contributions with expected future investment returns will be sufficient to support current benefits.

For a plan with fixed benefits and variable contribution rates, a discount rate less than a reasonable estimate of plan investment return would result in higher current and lower future contributions. Likewise,

a discount rate greater than a realistic estimate of plan investment return would result in lower current contributions, ultimately requiring increased future contributions.

For a plan with fixed contribution rates and variable benefits like SDRS, a discount rate less than a reasonable estimate of plan investment return would result in reductions in current benefits and increased future benefits. Likewise, a discount rate greater than a reasonable estimate of plan investment return would result in increased current benefit and require future benefit reductions.

The difficulty lies in establishing the best estimate for future investment return. The temptation to bias the assumption selection to protect the status quo, in either contribution rates or benefits, must be avoided. It is prudent to establish and commit to the assumption selection process independently before analyzing the cost or affordable benefit implications of potential assumptions. Ultimately, required contributions or affordable benefits will be determined by actual experience. Care must be taken to avoid the political lure of setting optimistic assumptions and thereby postponing benefit and/or contribution adjustments. Overly optimistic assumptions have never solved a plan funding issue; they only serve to delay and exacerbate the issue.

SDRS Application

Because contributions are fixed, actuarial assumption changes may require benefit adjustments. Assumptions should therefore be adjusted periodically, but not so often as to cause too frequent benefit adjustments. SDRS actuarial assumptions are reevaluated every 5 years in conjunction with an experience analysis. For SDRS, overly conservative assumptions could disrupt the balance of benefits between generations of retirees as easily as overly optimistic assumptions. Care must be taken to avoid both. Assumptions are set as realistically as possible and consider recent experience without completely disregarding prior experience.

The discount rate is set as the assumed investment return with significant credibility given to the forward-looking analysis of the state investment officer, but opinions of other investment professionals are also considered.

Assumptions are recommended by the staff actuary and must be adopted by the Board of Trustees. The external actuary reviews the recommendations for reasonableness and compliance with the Actuarial Standards of Practice.

SDRS's annual actuarial valuation assesses whether the fixed, statutory member and employer contributions are sufficient to support the current benefits. Annual adjustments to the COLAs paid to retired and terminated members are possible based on the results of the valuation. The assumed investment return must therefore be based on a realistic view of future investment performance, avoiding overly conservative or overly optimistic assumptions. While it is impossible to accurately predict the future, any bias in the estimation of future returns will distort the balance of benefits paid to current and future generations of retirees.

SDRS uses a discount rate of 6.5 percent in its annual actuarial valuations. The rate was established as the result of an experience study that analyzed the South Dakota Investment Council's benchmark asset allocations. The views of the South Dakota Investment Council on forward-looking return expectations for each asset class were used and were compared with the expectations of other investment and actuarial professionals. The SDRS Board of Trustees and staff believe the 6.5 percent investment return assumption is a realistic, forward-looking assessment of future investment returns given the South Dakota Investment Council's benchmark asset allocation and current economic conditions.

SDRS also uses the fair value of assets as the actuarial value, with no smoothing. Because of the variable benefits and the statutory requirements, immediate recognition of all experience variations is prudent.

3.6 LEGAL FRAMEWORK

The plan must obviously comply with all applicable federal laws. In addition, plan details and structure must be established in statute. This includes the contribution and benefit structure, administration, oversight, investment authority and required financial reporting.

For a retirement plan to be sustainable through a variety of economic conditions, either contributions or benefits, or both contributions and benefits, must change to adapt to changing conditions. State statutes should specify the constraints on each and/or specific conditions that would require reconsideration.

SDRS Application

SDRS has received a current favorable determination letter from the Internal Revenue Service and meets all applicable requirements for a qualified plan under the Internal Revenue Code.

Member and employer contribution rates are equal and fixed in statute. Benefit provisions are defined in statute, as are statutory funding measurement thresholds that require recommendations for changes if crossed. When the thresholds were crossed in 2009, 2010 legislation reduced future COLAs. The change was challenged and upheld in South Dakota Circuit Court (Tice, 2012).

The composition of the board of trustees, election requirements, duties and responsibilities are all established in statute.

3.7 ADMINISTRATIVE COSTS

Administrative costs reduce the amount of contributions available to pay future benefits and therefore, operational efficiency is desirable. The cost efficiency of the plan and the quality of the administrative services should be evaluated periodically by an independent source. The impact of administrative expenses should be included in any annual cost calculation.

SDRS Application

Statutes limit administrative costs to 3 percent of member and employer contributions in any year. Provisions for expenses are included in the annual normal cost. For this purpose, they are assumed to be 2 percent of contributions. In practice, expenses are typically 1.7 percent to 1.8 percent of contributions.

SDRS also contracts with an outside benchmarking firm to annually assess the cost efficiency and customer service quality of SDRS administration. Areas of higher cost or lower rated service are targeted for improvement. The last evaluation for fiscal year 2016 showed SDRS administrative costs to be 7 percent less than its peer average despite significant costs of a new administrative system and a size disadvantage compared to the peer group. In addition, the SDRS service score of 85 exceeded the peer average of 83 (CEM, 2017).

3.8 EMPLOYEE COMMUNICATION

Members need to understand the benefits payable from the plan to build their own financial plan for retirement, as well as in the event of disability or death while working. Additional retirement savings are likely to be required for most members, particularly those who work less than a full career or elect to retire early.

In addition, when given a choice between different benefits members must be given adequate information to make an informed choice and to understand the financial consequences of each.

SDRS Application

SDRS maintains a website providing detailed material on the SDRS benefit structure as well as position papers on the philosophy of the SDRS benefit design. Additional retirement savings in the SDRS administered 457 plan are encouraged to meet retirement income needs. In addition, members are provided an annual benefit statement illustrating their accrued and projected retirement benefits. Group and individual counseling sessions are held around the state frequently, and the SDRS website provides an interactive benefit projection system.

SDRS members do not have an option with regard to participating in SDRS or an alternate plan design. However, vested SDRS members do have an option at termination of employment between a lump sum payment of employee and employer contributions or a deferred annuity. A personal detailed comparison of the benefits available under each option is provided to each terminating member to ensure a complete understanding of the financial implications of each choice. The vast majority of SDRS members wisely elect the deferred annuity. For example, 80 percent of terminating members with at least 15 years of service and 85 percent of terminating members with at least 20 years of service elect the annuity.

3.9 MORAL HAZARD RISK

Moral hazard is defined as a lack of incentive to guard against risk where one is protected from its consequences.

This can occur, intentionally or unintentionally, with public employee pension plans in several areas including:

- Advocating for or approving changes that personally benefit the individual
- Adopting generous benefits without the resources to fund them
- Avoiding, or delaying, adequate funding because of budgetary issues
- Political pressure
- Reluctance to present unwelcome news

Unintentional moral hazard can be minimized or eliminated through clear communication of the consequences of action or inaction and a thorough vetting of all proposals for change. Education, transparency and complete disclosure are essential to avoid misunderstanding.

Intentional moral hazard can also be minimized by the plan structure and operating procedures.

SDRS Application

SDRS has minimized the moral hazard risk through its governance structure, its operating policies and practices, and a clear delineation of fiduciary responsibilities. Board members consider the sustainability of SDRS to be their primary responsibility, not benefit increases.

The state has adopted a mandatory disclosure requirement for state employees and members of boards to report any conflicts of interest or compensation payable as a result of the position of responsibility.

The sound funded status of SDRS is a source of considerable pride to the state. The board of trustees, legislature, and executive branch operate in partnership to continue that success. Statutory contributions have always been paid. Changes are approached with caution and only after complete vetting of the consequences. Politics have not been a factor.

Actuarial assumption recommendations are made without regard to the consequences on SDRS's funded status and/or benefits provided, and the advice and recommendations of the South Dakota Investment Council as well as the reviewing actuary are required before action is taken.

In short, a culture exists in South Dakota to hold the system accountable for the management of SDRS, to avoid any protection of the consequences of actions involving SDRS, and to operate transparently.

4. Investments

Investment decisions should be the responsibility of investment professionals because of the complexity involved and the critical importance of investment returns to the assets of the plan. The most effective plan governance structure is two specialized boards, separately overseeing plan decisions and investment decisions, but acting cooperatively.

SDRS Application

The South Dakota Investment Council (SDIC) is responsible for the investment of SDRS funds. SDIC members are selected based on their finance and investment expertise and oversee the professional investment staff. The goal of SDIC is to add value over the long term compared to market indexes. Risk is managed by diversifying across multiple asset categories and reducing exposure to expensive asset classes.

After extensive study, SDIC established an asset allocation policy benchmark for the plan that is 70 percent equity-like risk and 30 percent bond-like risk. Equity-like risk is the percentage invested in stocks plus any embedded equity exposure of other asset categories, particularly during times of market stress. Bond-like risk is the percentage invested in investment grade bonds plus any embedded bond exposure of other asset categories. This allocation balances the expected long-term returns available from the market with the downside risks.

SDIC policy also establishes acceptable ranges around the benchmark allocation for each asset class. A valuation process drives allocations within the ranges based on the present value of estimated future cash flows. Disciplined adherence to the long-term value approach is essential especially during underperforming periods. Stakeholders' buy-in is critical to the success of any investment plan.

The primary investment objective for SDRS assets is to achieve and exceed over the long term the return of the council's capital markets benchmark. The capital market's benchmark reflects SDIC's benchmark asset allocation applied to index returns for each asset category. This objective has been accomplished for 91 percent of all rolling 10-year historical periods, as well as all such rolling 20- and 30-year periods (SDIC, 2017).

A secondary objective is to achieve and exceed over the long term the median return earned by peer funds. Comparison to peer funds can help in assessing performance as most peer funds have similar long-term return objectives. This objective has been accomplished for all rolling 10-, 20- and 30-year historical periods (SDIC, 2017).

Investment fees are kept low by internally managing most plan assets. Total costs are expected to average 40 basis points, including external managers used primarily for the real estate and private equity asset categories. This cost is below a benchmark of peer funds particularly after considering fund size and asset mix.

Over the 44 years since inception of SDRS, the annualized total rate of investment return on SDRS assets is 10.4 percent, compared to a benchmark return of 9.4 percent. Returns are before fees for periods before 2014 and after fees since then (SDIC, 2017). Over the last 10 challenging years, the SDRS annualized return has been 6.1 percent net of all investment expenses (SDRS, 2017).

The cooperative effort of SDRS and SDIC has worked well for South Dakota.

5. SDRS Experience and Future Issues

Much of SDRS's structure has been in place for decades while other features have been revised in recent years to adapt to changing economic and demographic conditions. The history of consistent contributions, frequent benefit improvements and rare corrective actions, together with the current funded status, give the best indication of the viability of the system's sustainability.

5.1 EXPERIENCE TO DATE AND CURRENT FUNDED STATUS

SDRS was consolidated in 1974. General member contributions were initially 5 percent of pay for both members and employers. In 2002, the legislature increased contributions to 6 percent of pay for both members and employers in conjunction with a corresponding proportional increase in future benefit accrual rates. SDRS contributions have never been changed in response to a funding requirement; the only changes have been in early efforts to better balance the contributions and benefits of general members with those of public safety and judicial members.

Since consolidation, experience better than assumed has allowed the board of trustees, in accordance with its policies, to recommend legislation to improve member benefits 12 times. Each time benefit formulas have been improved, the benefits of then retired and terminated vested members have been recalculated to reflect the improved provisions. All benefit improvements have been limited in scope, generally applying to a restricted period of service. The present values of all improvements have been fully funded in advance from reserves.

In 2009, the statutory funding thresholds requiring corrective actions were crossed for the first time after the historic market downturn in 2008–2009. Legislation in 2010 reduced future SDRS COLAs and linked them to inflation and the funded status, together with other, less significant changes. The changes brought SDRS funding measurements back in alignment with the statutory requirements. Subsequent market recovery brought SDRS's fair value funded ratio back over 100 percent by June 30, 2011. The COLA changes were challenged and upheld in South Dakota Circuit Court and the decision was not appealed.

Actuarial assumption changes were adopted in late 2016 to be first effective June 30, 2017, and would have again resulted in SDRS funding measures falling short of the statutory thresholds had they been effective for the June 30, 2016, actuarial valuation. Legislation was enacted in 2017 that changed the COLA to the current structure outlined above.

The June 30, 2017, actuarial valuation was the first based on the current actuarial assumptions that include a 6.5 percent assumed investment return, 2.25 percent inflation, and generational mortality based on the RP-2014 mortality table and MP-2016 improvement scale, and assets at fair value.

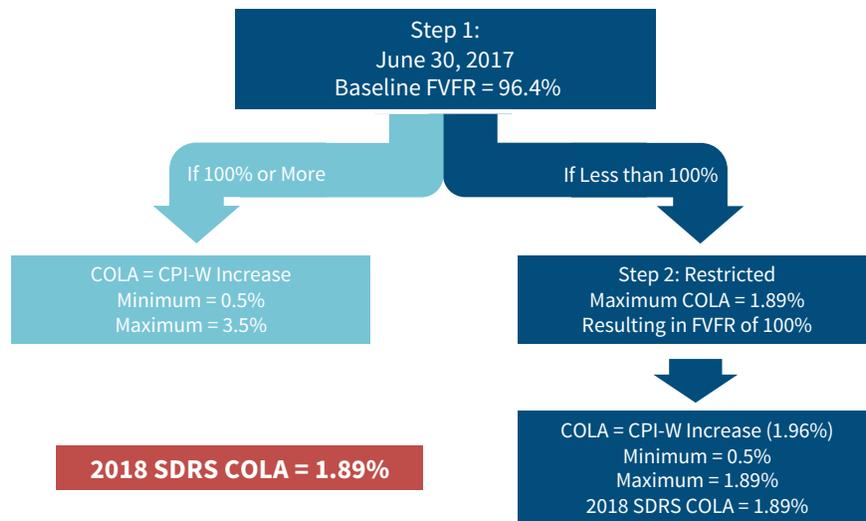
As noted previously, the determination of the COLA for 2018 was the first under new provisions and is a two-step process as illustrated in Figure 3.

1. The fair value funded ratio is first calculated assuming future COLAs are equal to the assumed long-term rate of inflation of 2.25 percent. That baseline fair value funded ratio was 96.4 percent as of June 30, 2017.
2. Because the funded ratio with the baseline COLA was less than 100 percent, a restricted maximum COLA is determined as the maximum COLA that if assumed for all future COLAs, the fair value funded ratio is at least 100 percent. The restricted maximum COLA was determined to be 1.89 percent.

The inflation measure used by SDRS, the increase in the third calendar quarter CPI-W from the prior year, was 1.96 percent and is the same basis used for Social Security COLA adjustments. As a result, the SDRS COLA will be 1.89 percent for the July 2018 increase.

FIGURE 3

The Determination of the 2018 COLA



SDRS 2017 actuarial valuation results were finalized assuming the restricted maximum COLA of 1.89 percent remains unchanged for future years, resulting in a published fair value funded ratio of 100.1 percent. Gains or losses would be required to increase or decrease future years' restricted maximum COLA.

5.2 RISK MEASUREMENT REPORTING AND FUTURE MANAGEMENT ISSUES

SDRS is refining its risk management analysis and reporting to provide current and useful planning information to the board of trustees and the RLC of the likelihood of future COLA levels and the possibility of required additional benefit changes.

Future SDRS annual funding results will fall into three potential categories:

1. **Full COLA range.** Baseline fair value funded ratio is at least 100 percent; COLA is equal to inflation between 0.5 percent and 3.5 percent.
2. **Restricted maximum COLA.** Baseline fair value funded ratio is between approximately 84 percent and 100 percent; COLA is equal to inflation between 0.5 percent and the restricted maximum, that if assumed for all future COLAs, results in a fair value funded ratio of 100 percent.

3. **Minimum COLA/corrective action required.** Baseline fair value funded ratio is less than approximately 84 percent; COLA is equal to 0.5 percent; corrective action (benefit reduction) recommendation required to be made to legislature.

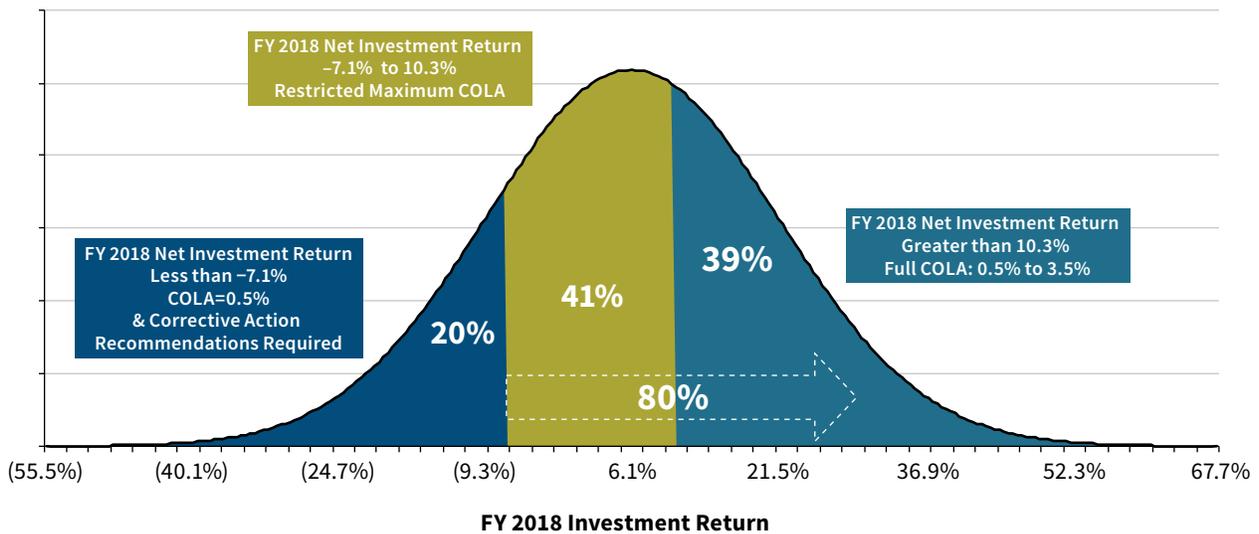
SDRS reports quarterly on the minimum investment returns necessary for each potential funding result looking at 1-year, 2-year and 3-year periods. The South Dakota Investment Council’s mean expected return and standard deviation assumptions for the benchmark asset allocation are then used to determine likelihoods for each of the three potential outcome ranges over each of the periods.

For instance, for fiscal year 2018 1-year net investment returns required for each result and the expected likelihoods for each, as shown in Figure 4, are:

1. **Full COLA range.** Net investment returns greater than approximately 10 percent; expected likelihood approximately 39 percent.
2. **Restricted maximum COLA.** Net investment returns between approximately -7 percent to 10 percent; expected likelihood approximately 41 percent.
3. **Minimum COLA/corrective action required.** Net investment returns less than approximately -7 percent; expected likelihood approximately 20 percent.

FIGURE 4

One-Year Forward Outlook



For fiscal year 2018, the automatic COLA adjustments are expected to result in a COLA above 0.5 percent and a published fair value funded ratio based on the restricted maximum COLA, if applicable, of 100 percent with a likelihood of approximately 80 percent (potential results 1 and 2). Conversely, there is an expected 20 percent likelihood that fiscal year 2018 investment losses are large enough that the automatically adjusting features will be exhausted and additional benefit reductions will be required to remain above the statutory funding thresholds. These likelihoods are based on the South Dakota Investment Council’s assumed investment portfolio statistics for the benchmark asset allocation, which include a mean expected return of 6.10 percent and a 1-year expected standard deviation of 15.4 percent (note mean expected return is slightly less than the actuarially assumed net investment return of 6.5 percent but essentially equal after considering the excess of statutory contributions over the minimum statutory funding requirements).

The same results for 2-year and 3-year forward-looking periods are reported quarterly to the board of trustees (see Figures 5 and 6, respectively).

FIGURE 5

Two-Year Forward Outlook

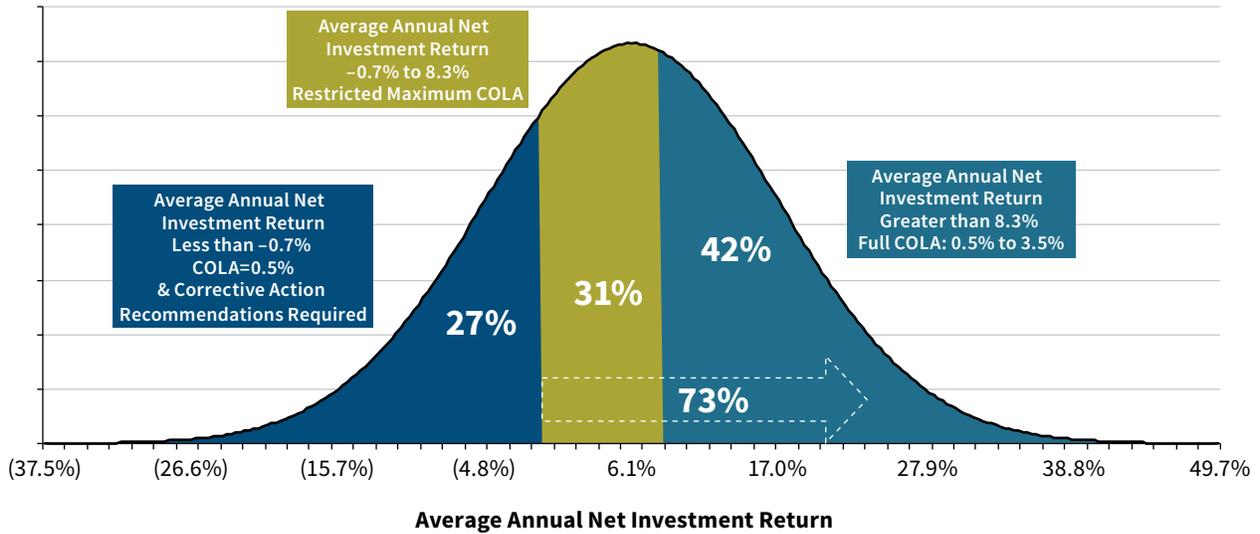
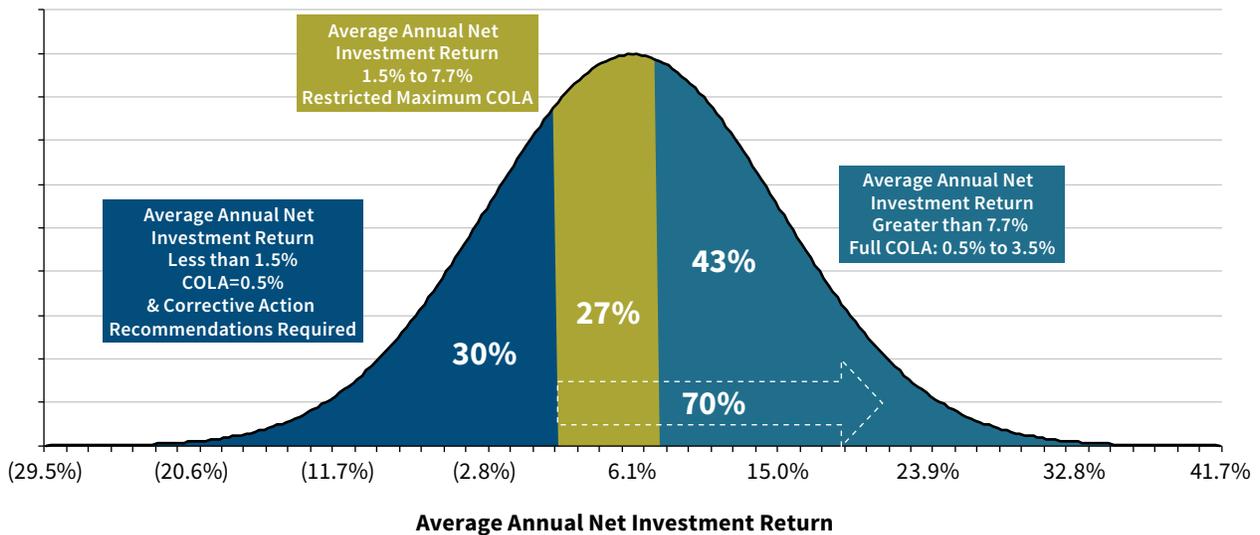


FIGURE 6

Three-Year Forward Outlook



The message to stakeholders is the automatically adjusting features will be adequate during most economic conditions, but in extreme economic events, additional legislative changes may be required to remain above the statutory funding thresholds. Regardless of SDRS's flexible benefits and current funded status, the future will bring unexpected challenges and the board of trustees must remain diligent in managing the system for sustainability.

This risk analysis focuses on investment returns. Other metrics are still being developed for noninvestment related risks that will have an impact on funding measurements. However, the annual investment return has historically been the far greatest source of funding volatility. Demographic gains and losses have, at their highest, been only a fraction of the impact of annual investment volatility. In addition, only the newest system members have the variable retirement account as part of their benefit structure. As the population transitions to the new tier structure, the stabilizing impact of the variable retirement account on the plan's funded status will grow and lower the likelihood of required additional corrective actions.

Actuarial assumptions for public sector retirement plans are required to be reasonable assumptions with no significant optimistic or pessimistic bias (except if margins for adverse deviations are explicitly included and disclosed). If assumptions are indeed unbiased, they should be near the median of expected future results. In a defined benefit system with fixed benefits, contribution rates that change annually based on an actuarial recommendation, and assumptions set near the median of expected future results, contribution rates would be expected to increase from one year to the next with a likelihood of approximately 50 percent. Smoothing processes or contingency funding would mitigate some of the volatility.

While the typical defined benefit system has approximately a 50 percent chance of requiring increased contributions in any year, the automatically adjusting benefit features in SDRS reduce the likelihood of necessary corrective actions in the next year to approximately 20 percent.

6. Summary and Application to Other Systems

The basic tenets of the SDRS structure are a contribution budget, flexible benefit features that respond to investment returns and overall system experience, and statutory funding thresholds that require corrective actions. Each of these can be adapted to a plan sponsor's specific goals, but could be limited by legal or constitutional protections in some jurisdictions.

SDRS has a fixed contribution budget. Other plans may find a variable employer contribution with a specified maximum more appropriate; however, it would be beneficial to establish the maximum well before contribution requirements approach that limit. Required contribution increases above a specified threshold (but less than the maximum) could be allocated with a greater proportion to required member contributions than employer.

SDRS has two primary features that vary with investment performance and funded status. The variable retirement account grows with actual investment return and the COLA varies with funded status and inflation. Both adjust a portion of the liabilities based on the assets available to pay the benefits. The COLA is the most logical benefit feature to vary because of its cost significance and its application to current and future retirees. Other plans should consider a flexible COLA, particularly if past fixed COLAs have significantly exceeded inflation, as COLAs were generally designed to protect retirees from the loss of purchasing power due to inflation. SDRS's COLA is designed to vary based on a comparison of a baseline funded ratio to 100 percent. Other plans could consider varying the COLA based on a comparison to a lower funded ratio or based on reaching a specified funding period or date to eliminate an unfunded liability.

Adding a cash balance feature like the variable retirement account, in conjunction with a scaled-back defined benefit, can also partially protect plan funding requirements from the impact of future investment volatility.

Finally, SDRS has specified funding thresholds that require plan benefit adjustment if not met. South Dakota law has allowed the adjustment of the COLA applied to all benefits, even those currently in pay status. Whether accrued or future benefits can be adjusted, it is critical for a plan's sustainability to establish funding thresholds that call for change in advance. Without such clearly defined markers, political expediency can easily force the delay of tough decisions until it is extremely unlikely for a plan to return to a responsible funding status and reasonable contribution requirement.

The SDRS model has worked well to date and will continue to evolve with changing conditions. Both members and policy makers have accepted the risk-sharing features as essential elements for a sustainable retirement system.

References

- Boyd, Donald J., and Yimeng Yin. How Public Pension Plan Demographic Characteristics Affect Funding and Contribution Risk. *ROCKINST.org*, 2016, http://rockinst.org/wp-content/uploads/2018/02/2016-12-07-Pension_Demographic_Characteristics-1.pdf (accessed April 22, 2018).
- CEM Benchmarking Inc. *South Dakota Retirement System Pension Administration Benchmarking Results Fiscal Year 2016*. Paper presented to the SDRS board of trustees, April 5, 2017.
- Fornia, William, and Nari Rhee. Still a Better Bang for the Buck: An Update on the Economic Efficiencies of Defined Benefit Plans. *NIRSONline.org*, 2014, https://www.nirsonline.org/wp-content/uploads/2017/07/bangforbuck_2014.pdf (accessed April 22, 2018).
- Munnell, Alicia H., Jean-Pierre Aubry, and Mark Carefelli. How Did State/Local Plans Become Underfunded? *Center for Retirement Research at Boston College, State and Local Pension Plans, Brief Number 42*, January 2015, http://crr.bc.edu/wp-content/uploads/2015/01/slp_42.pdf (accessed April 22, 2018).
- National Association of State Retirement Administrators (NASRA). Public Fund Survey: Summary of Findings for FY 2016. Aggregate Actuarial Funding Level Percent, Median Investment Return Assumption, Average Percent of ADC Received, *NASRA.org*, 2017, <http://www.nasra.org/publicfundsurvey> (accessed April 22, 2018).
- Purcell, Patrick J. 2012. Income replacement ratios in the health and retirement study. *Social Security Bulletin*, 72, no. 3, <https://www.ssa.gov/policy/docs/ssb/v72n3/v72n3p37.html> (accessed April 22, 2018).
- South Dakota Investment Council (SDIC). 2017. Annual Report Fiscal Year 2017, https://sdic.sd.gov/docs/AnnualReport_2017.pdf (accessed April 22, 2018).
- South Dakota 93rd Legislative Session Joint Rules (as adopted January 17, 2018). 2018, page 24, <http://www.sdlegislature.gov/docs/legsession/2018/JointRules.pdf> (accessed April 22, 2018).
- South Dakota Retirement System (SDRS). 2017. Actuarial Valuation as of June 30, 2017, *SDRS.SD.gov*, <http://sdrs.sd.gov/docs/2017SDRSValuationReport.pdf> (accessed April 22, 2018).
- Tice v. State of South Dakota*, Civil No. 10-225 (Circuit Court of the 6th Judicial Circuit, Hughes County, Judge Mark Barnett), April 11, 2012.

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Comments on

“The South Dakota Retirement System Generational Benefit Structure”

By Brian B. Murphy

I greatly appreciate the opportunity to provide comments on this paper. This is a well-written paper that I recommend to public plan stakeholders and to anyone interested in variable benefit plans. I would also refer them to the paper by Lee Gold entitled “In Search of a More Efficient Retirement Plan” in the April 2019 *Retirement Forum* and to the paper describing features of the Wisconsin plan entitled “A Variable Benefit Plan for the Public Sector” in the July 2019 issue of *In the Public Interest*.

This paper describes a principles-based approach to retirement benefit design and implementation and discusses specifics of the approach taken by the South Dakota Retirement System (SDRS) with respect to its “Generational” members, i.e., those members hired on or after July 1, 2017.

Background

In the public sector some plans have a fixed contribution rate—a rate that is set in statute and is changed rarely and only by an action of the governing body. The theory behind the fixed rate is that good and bad experiences will even out over time, so there is no need to change the rate unless things get really bad or really good. The more common situation, though, is that the contribution rate is set according to the results of an actuarial valuation. These latter plans could be called “variable rate” plans. There are two parts to the theory behind variable rate plans:

- There will always be money available to satisfy a retirement system’s funding needs.
- The plan sponsor bears all the risks and reaps the rewards of a plan’s experience, whatever it is. So when experience is good, taxpayers reap the reward through reduced contribution rates. When experience is bad, taxpayers suffer the consequences. In particular, active participants and retirees are immune from the effects of experience in either direction.

How have these theories worked? Well, for most years beginning in about the mid-1980s and ending around the turn of the century, public plans experienced really overwhelming investment gains. Benefits were raised in both fixed rate plans and plans whose contribution rates varied with actuarial valuation results. At the same time, and in many cases, contributions were reduced, even in fixed rate plans. So the plan sponsor did not bear all the risk and reap all the rewards in the variable rate plans, and the contribution rate in the fixed rate plans was not really fixed. It was not only good experience that caused these things to happen, it was also the presumption that good experience would continue indefinitely. In that regard, investment return assumptions were raised materially between the mid-1980s and 2000. When it became more difficult to achieve the new higher investment return assumptions, plans increased their allocation to risky assets.

Then the new millennium came along, the tech bubble burst, and the credit crisis happened. Required contribution rates went up significantly. Benefit cuts and plan closures were rampant. In some cases, the plan changes were forced through as part of a bankruptcy process. Money was not always available

to meet retirement plans' funding needs. Active participants and beneficiaries were not immune to the effects of plan experience.

In the public sector, even in those plans whose contribution rate is set by the results of an actuarial valuation, contribution rates are often more fixed than variable. In reality, in many public jurisdictions, contribution rates can vary only within narrow bounds. Otherwise benefits will be changed.

The question becomes will they be changed by a well-thought-out process that is part of the plan design, or will they be changed through another process that could be arbitrary and suboptimal?

The South Dakota Plan

The South Dakota Retirement System has developed a principles-based approach for maintaining the balance between benefits and contributions. By enunciating principles as this plan does, it will provide guidance to future trustees and legislators and hopefully will help them avoid some of the mistakes that many plans have made.

The SDRS is a fixed rate plan. In the public sector, a fixed contribution rate is an ideal situation from the employer perspective because of the difficulty of raising tax rates. The problem with a fixed rate plan is that it cannot provide fixed benefits. A fixed rate plan must have some variability in the output (benefits) since at least one of the inputs (investment return) can be quite volatile, particularly as the funded ratio grows. In response, the SDRS provides benefits that are intended to vary within limits based upon plan experience. It is a fixed rate, variable benefit plan. It is worth noting that this phrase could also describe a defined contribution plan. From the employer perspective the plan operates like a defined contribution plan, but the employee mostly sees defined benefits.

The principles-based approach to benefit design and implementation that the paper outlines is very well done. It is important to put principles first if the mistakes of the past are to be avoided. Before providing comments on the principles outlined in the paper, I want to discuss what I see as the fundamental principle of retirement plan design.

Fundamental Principle of Retirement Plan Design

The fundamental principle behind retirement plan design, as I see it, is that the purpose of a retirement plan is to provide retirement benefits to people at the plan's normal retirement age. Although this sounds almost circular, it is worth saying, because too often retirement plans are used to satisfy plan sponsor objectives, possibly to the detriment of the plan itself. Workforce management is not the purpose of a retirement plan; wealth creation is not the purpose. So in my view, if an employer wants to encourage early retirement, for example, it should provide a financial incentive to retire early, but it should do so with a vehicle other than the retirement plan. Employees who want to build wealth should save and invest with a vehicle other than the retirement plan. To me, this implies that benefits other than normal retirement benefits should be actuarially equivalent to the normal retirement benefit. It also argues against deferred retirement option plans (DROPs), because employees who want a lump sum at retirement have other vehicles available with which to create it. Although I am not necessarily a fan of DROPs, I do not completely agree with the authors that DROP plans are institutionalized double dipping. Some DROPs are, but others are much closer to actuarially equivalent lump-sum benefits than the term double dipping would suggest.

Now I will comment on some of the principles outlined in the paper.

Benefit Efficiency

The general principle enunciated in the paper is that benefits should be provided as efficiently as possible. To me this would mean that administrative costs should be low, delivery of benefits should be prompt, mistakes should be rare, and the plan should not provide benefits that could be delivered at a lower cost or otherwise in a more efficient manner via the private sector. One example of the latter might be large in-service lump-sum death benefits. I had difficulty seeing the nexus between “efficiency” and the ensuing discussion of subsidies. I see subsidies more as an issue of benefit equity that the paper discusses elsewhere. In any case, the paper defines a subsidy as a feature that increases the value of the benefit and is available only to a portion of the population. A subsidized benefit is presumably a benefit other than a death or disability benefit that is not actuarially equivalent to the normal retirement benefit. In this regard, discussion could be devoted to the meaning of the term “actuarially equivalent.” For many years, the term meant “having the same actuarial value according to the plan’s assumptions.” Typically, the “plan’s assumptions” were the valuation interest rate and a unisex version of the valuation mortality table. So, for example, converting a lump sum into an annuity at an interest rate of 8% could be considered actuarially equivalent by that definition. For at least some benefit conversions, including service purchases, annuity purchases and even early retirement reductions, arguments are being made that actuarial equivalence should be based on market-based assumptions, and I think those arguments have merit. Although such arguments also can be made in the case of joint and survivor options, joint and survivor benefit forms do serve an important social purpose.

Benefit Adequacy and Replacement Income Goals

A retirement plan should strive to provide “adequate” benefits. Benefits beyond that level should either be variable or provided through a separate vehicle, which the South Dakota plan does. The SDRS provides a 1.8% defined benefit multiplier and a non-guaranteed notional contribution of 1.5% of pay to a separate account. Attaching a meaning to the term “adequate” and getting a proper balance between adequate fixed benefits and other variable benefits is an important and challenging item of variable benefit plan design. Entire research papers could be written on this topic.

According to the paper, inflation protection is a key element of benefit adequacy. The SDRS deals with inflation by providing a consumer price index (CPI)-limited cost-of-living adjustment (COLA) between 0.5% and 3.5%, subject to the plan’s funding situation. Essentially the COLA is intended to level out the purchasing power of the benefit over time. If there were no COLA, the plan could fail the “Benefit Efficiency” principle because it would provide greater benefits in terms of purchasing power to those who have below average life times than to others. In other words, it would subsidize early death.

Most state plans provide some level of inflation protection for their retirees. However, unfortunately, many local government retirement plans do not. I think, for example, that a plan that provides a 1.5% multiplier with a 2% compound CPI-limited COLA is a better and more transparent benefit design than a plan that provides a 2% multiplier and no COLA.

Benefit Equity

The general principle in the paper is that there should be equitable treatment between employees who leave public employment midcareer and those who work a full career. In the SDRS, the vesting period is three years. The SDRS provides a refund of employee contributions plus 50% of employer contributions to nonvested employees who terminate employment with the employer. Vested employees can choose

between a contribution refund plus 85% of employer contributions and a deferred benefit that is indexed according to the SDRS COLA. The 50% and 85% figures are not subject to the variable features of the plan. The contribution balances used for the calculation are credited with a low rate of interest (based on T-bill rates) so that presumably the plan retains most of the investment return on the contributions. Terminating employees who elect lump sums are immunized from the plan's investment risks but also from any potential investment rewards.

Adjustable Benefit Features

Two SDRS benefits are subject to automatic adjustment based on SDRS performance:

1. The plan provides a CPI-limited COLA that can vary between 0.5% and 3.5%.
2. The SDRS includes a supplemental "Variable Retirement Account" that is credited each year with 1.5% of pay and actual investment return.

If the plan is less than 100% funded, the COLA is reduced within the above bounds to the level that can be provided indefinitely.

If the plan's normal cost for fixed benefits (for example, the 1.8% retirement benefit multiplier) approaches the statutory contributions, the 1.5% credit to the variable account can be reduced or eliminated. It does not appear that poor experience by itself can cause the 1.5% factor to change, but poor experience does, of course, affect the notional account balance.

Active and inactive vested members share in both positive and negative experience due to the earnings credited on the variable account. Retirees share in negative experience through potential COLA reductions. They do not have a way to gain from positive experience. I see this as a small negative in the plan design. Once a retiree falls behind inflation whether due to the 3.5% COLA cap or to the 100% funded ratio requirement, no amount of good experience can automatically restore the inflation loss.

Because of the benefit adequacy objective, a design that would involve moving the 1.5% factor down if the COLA is below the CPI could be worthy of consideration.

Thresholds for Corrective Action

South Dakota statutes require the SDRS Board of Trustees to recommend benefit reductions if either of the following two conditions fails:

1. The statutory contribution must meet a minimum actuarial requirement to support benefits. In conjunction with the funding policy, this is interpreted to mean that the statutory contribution must at least be equal to normal cost plus expenses plus 20-year amortization of unfunded actuarial accrued liabilities.
2. The fair value funded ratio, in other words, the ratio of fair value of assets to liabilities, must be at least 100%.

It appears that only the second condition actually matters. Because the assets are not smoothed, there is a risk that temporary market correction could trigger corrective action that is proved unnecessary in the very short term.

Supplemental Retirement Benefit

This benefit allows a member to receive the variable retirement account as a lump sum or a rollover, or to convert it into a supplemental retirement benefit. The conversion is done based on a rate of return that has a probability of 75% of being achieved. Although the paper does not directly say it, I presume that these benefits do get the SDRS COLA, and that the calculation accounts for it. In any case, the conversion can be considered an example of a subsidized benefit whenever the amount provided is materially higher than would be available in the private markets. (By choosing 75% probability the frequency and extent of potential subsidy is, of course, significantly reduced from what it otherwise would be.) In particular, the system absorbs the cost of risk and spreads it across the other stakeholders. There could be reasons to provide a subsidized annuitization of Variable Account Money, since that money originated within the system and is part of the retirement benefit design. Essentially the system is providing a choice between a lump sum and an annuity from the Variable Account Money and is encouraging the annuity choice. However, I have difficulty justifying subsidizing conversion of *nonsystem* money into an annuity (rollovers from IRAs, 401k's, 457 plans). At a minimum, I would think that an upper bound should be set on the amount of such money that an individual is permitted to annuitize at a subsidized rate, although I would prefer that such conversions either be offered at market rates or not offered at all.

Moral Hazard Risk

This issue affects almost every plan, whether fixed rate or not. A discussion of lowering the discount rate or using a new more conservative mortality table almost always leads to a discussion about the effect on the contribution rate in a traditional plan and on the potential effect on benefits in a fixed rate plan. In South Dakota, recommendations for actuarial assumptions are made without regard to the funded status or benefits. That is, of course, what an actuary is expected to do. The advice and recommendation of the South Dakota Investment Council and the reviewing actuary must be taken into account before action is taken. This is an excellent protocol that certainly fosters a sound decision-making process.

Governing Body Policies

Table 1 in this section outlines Policies related to Funding Objectives, Consideration of Benefit Improvements, and Required Corrective Action recommendations. The discussion of corrective actions in this session is similar to the previous discussion except that it allows the possibility of a contribution rate increase. Since the paper was written, governing statutes and policies have been amended to remove contribution increases from the list of corrective actions.

For benefit improvements to be considered, the fair value funded ratio must be over 120% and must be at least 120% after the benefit improvement is implemented. This is an excellent policy that I have seen elsewhere. Ideally, I would like to see retirement benefits brought up to date for inflation as part of an automatic process before other benefit changes are considered. Although some might argue that the younger generation is overall seeing lower benefits than the previous generation, I think that, at a minimum, mitigation of retiree inflation loss should be on the table as part of the process. In my experience, inflation loss is poorly understood and frequently ignored when benefit improvements are being made. Finally, a plan that is over 120% funded likely has a very high ratio of assets to payroll. It would be wise to consider at least some limited derisking in such an instance.

Future Management Issues

Information presented in this section indicates that there is a 30% probability of corrective action being needed within three years. Without being able to provide an empirical reason for it, I would be much more comfortable with a three-year probability of 10% rather than 30%. To me this suggests that the plan may eventually need additional variable features.

Some alternate design considerations that might help to reduce the probability of corrective action would include the following:

- A limited amount of asset smoothing
- A different measurement threshold that would allow the funded percentage to be below 100% if the resulting amortization period is sufficiently short
- A different tilt between fixed and variable benefits
- Perhaps a lower fixed benefit multiplier
- Some flexibility on the 50% and 85% factors applicable to terminating employees
- Some flexibility on the employer or employee contribution rates.

Conclusion

Every fixed benefit plan that I work on has increased benefits in good times and decreased benefits in bad times. The benefit increases were well received by participants, of course. The decreases were unexpected shocks that caused great consternation, particularly among retirees. A well-thought-out, well-communicated, variable benefit plan can be an important tool for managing expectations and can help ensure that change, when it occurs, will be well designed and will be executed in an optimal manner. I congratulate the SDRS on the work they have done with their plan.

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Comments on

“The South Dakota Retirement System Generational Benefit Structure”

By Todd Tauzer

The South Dakota Retirement System’s (SDRS) team put their best foot forward with their treatise on the exceptional system they work on and help manage, and it’s my pleasure to provide a response in this forum.

I have had the opportunity to engage in public dialogue on public pensions across many states, and after discussing key plan risks like measured economic growth forecasts and maturing demographics, I typically could depend on a Q&A inquiry to the effect of “Haven’t defined benefit (DB) plans simply become too expensive? Shouldn’t all DB plans transition to defined contribution (DC) plans?” My immediate answer is that DB and DC plans are both vehicles by which people prepare for the objective of retirement. Over time retirement itself, not simply DB plans, has become more expensive for a variety of reasons, including slower economic and stock market growth, significantly more time between retirement and the end of life, more value on financial independence instead of family reliance, and more activity within retirement. DB plans happen to have a formal structure of anticipating many of these retirement costs ahead of time, which does not make them necessarily more expensive; it makes them more transparent.

This growth in the cost of individual retirement has made me both cautious and excited to study South Dakota’s retirement structure. If the stated goal is a fixed replacement ratio throughout retirement (as is the case with South Dakota), as general retirement gets more expensive with time, this goal seems to become increasingly difficult, and even nearly impossible with completely fixed contributions. At the same time, traditional DB plans in some cases are at levels of cost that were once unheard of, and some of those costs have nowhere to go but up, which is seemingly unsustainable to support. I will be looking to address both of these perspectives within my response.

Setting the Stage

Before diving into some of the details, the first concept that stood out to me as I reviewed this paper within the SOA’s retirement 20/20 project was deliberate proactivity. Probably the three most common criticisms of DB plans are (1) cost and financial risk, (2) potential abuses—at both a system and an individual level—and (3) portability restraints. At SDRS all three of these concerns have been identified and wrestled with, leading to established system mitigations with evident stakeholder consensus. At a high level, they were dealt with by the following:

1. Instituting shared responsibilities for funding. Active employees and their employers share pre-funding costs 50/50, and current retirees pitch in by reaping the rewards and risks from unexpected plan experience through a variable COLA. No single party is on the hook for the majority of plan funding, and the plan has additional mechanisms in place to address future unanticipated costs in a timely manner.

2. Building safeguards from abuse through a strong governance model, careful policies regarding surplus management and benefit adjustments, and established protection against compensation manipulation.
3. Augmenting the DB benefit with a variable retirement account with a minimum guarantee that is available to be paid out as a lump sum upon departure. This, along with the partial refund of DB *employer* contributions (as well as employee), provides a benefit that feels very DC oriented for those not looking to become career employees.

Strong Governance Is Key

Public pension plans in the United States have governance structures that vary significantly from state to state in both reach and content. One notable example is a dedicated pension board to oversee a system as fiduciaries. Some systems do not have such a board, and even within the majority that do, there can be a strong divergence in board make-up and board authority. In my experience, independent pension boards are central to establishing strong pension plan governance, and the more financially experienced and knowledgeable the individual fiduciaries are, the better.

When it comes to governance, SDRS has a number of notable strengths. First, following a model more commonly seen in Canada, the system has two separate boards. The Board of Trustees has representation from major stakeholder groups and oversees most roles, including funding policy, risk management, benefit adjustments, and plan administration. The South Dakota Investment Council is their second board, comprising finance and investment professionals who oversee the investments of SDRS assets. Given that most pension systems routinely manage millions or billions of dollars, the knowledge and experience this board carries seems well advised (and their track record reinforces this sentiment). In the last few years there has been a push for more financial professional involvement on pension boards as well as more professional education for all fiduciaries, and I hope both of these trends strengthen moving forward.

Another important governance component of SDRS is a common understanding of the purpose and goals of the retirement system across the system itself, the South Dakota legislature (including a dedicated Retirement Laws Committee), the executive branch, and even the courts. In my former role as Director of Municipal Pensions for S&P Global Ratings, I had the opportunity to evaluate public pension systems across all 50 states in order to anticipate their financial ramifications for state and local governments. The worst-funded systems had a common theme of political maneuvering and divisiveness that has left both public employees and taxpayers exposed and vulnerable. This disunity was evident at times not only within the legislative level but also between the legislative and judicial levels, where pension reforms on both benefits and funding policy have been reversed even years after enactment. SDRS is noteworthy in that all governance stakeholders have come together to maintain and enforce the plan they built over time, especially given the fact that the structure was challenged but upheld in court.

The final governance item I want to highlight with SDRS is the fact that all employers make their full required contribution all the time. This may seem trivial in that the contribution rate is fixed; however, on the theme of worst-funded pension systems in the nation, I have found the biggest factor toward underfunding is shorted or ineffective contributions (See “Policy Decisions, Not Markets, Will Likely Pose Greatest Future Risks”).¹ Dependable contributions made in full are essential for the funding structure of any pension plan.

¹ Spain, Carol and Todd Kanaster. (2019, September 26). “U.S. State Pension Reforms Partly Mitigate The Effects Of The Next Recession” S&P Global Ratings. <https://www.spglobal.com/ratings/en/research/articles/190926-u-s-state-pension-reforms-partly-mitigate-the-effects-of-the-next-recession-11162190>.

Holistic Risk Management

When I passed through the exam process with the Society of Actuaries, I achieved my fellowship in Enterprise Risk Management (ERM), and ever since I have been exploring methods of ERM application to public pension systems. From this risk management perspective, SDRS is a fascinating case study that I believe has more useful carryover application for other systems than does its benefit structure or legal environment. And risk management here is much broader in scope than the transfer of experience volatility risk from employers to retirees—which many systems will find nearly impossible in the current social and legal climate.

Let's start with the concept of collectively and proactively determining a plan's risk appetite, one of the foundational applications of ERM. This should be based on clear and established objectives and set forth acceptable and unacceptable risks in achieving those objectives. For SDRS, some of its prominent established goals include the following:

- Using a defined benefit plan as the most efficient and advantageous design
- Achieving lifetime income replacement of at least 55% of salary for career employees
- Promoting total lifetime income of at least 85% of salary including Social Security and other retirement vehicles
- Maintaining at least full funding and
- Providing some measure of inflation protection within retirement.

SDRS has built out a structure for benefit administration that enables these carefully designed goals while identifying and minimizing specific threats or risks. In particular, I want to highlight a few of the risks they identified as critical to manage and explore their resulting mitigations:

- Losing stakeholder support for the DB plan due to extreme growth in costs
- Changing demographics within a maturing system and
- Failing to fully fund benefits in a slowing economic environment.

Managing cost is critical to a public pension plan's long-term sustainability. Where we see pension plans in trouble, failure to manage costs over time is almost always a central factor—especially through the deferral of necessary contributions in the past in the name of then-immediate affordability. SDRS's fixed contribution structure discussed previously is its central pillar for managing plan costs. As retirement costs continue to increase in today's climate, SDRS has proactively identified several plan features that can provide greater benefit flexibility and cost management opportunity if the need arises. And even beyond this structure, it has put in place acceptable ranges and benchmarks for both administrative and investment costs, with actionable mitigations beyond specific risk tolerances.

Changing demographics is another universal threat to any form of retirement preparedness, affecting both potential costs and evolving risk sensitivities. For pension plans, increased longevity compounded with the ongoing retirement of the baby boomer generation has led to a significant shift in relative liability weight from active employees to retirees. What makes SDRS's flexible COLA benefit so compelling is that it leverages the increased retiree liability into a stronger cost control mechanism, essentially converting a risk into a strength.

Failing to fund promised benefits is the greatest single threat to the mission of a pension plan, aggravated by an economic climate that offers slower growth than the past. SDRS has addressed this threat at multiple levels. In developing its economic assumptions, it "commit[s] to the assumption selection process independently before analyzing the cost or affordable benefit implications of potential assumptions."

The ordering here is critically important and enables the development of unbiased and apolitical assumptions that lead to more efficient cost management and system sustainability over the long term. SDRS has also built multiple funding thresholds that mark particular risk tolerances and enable immediate corrective action when crossed. And SDRS sets a high bar, with a primary threshold crossing into the red whenever the plan drops below 100% funded.

Further Considerations for SDRS

SDRS is an outstanding retirement system: it is well thought out, affordable, flexible, beneficial to members, and most importantly sustainable over time. And although I believe many of its characteristics are worthy of emulation, I don't believe SDRS's future is completely free from complication or vulnerability.

As I mentioned early on, the objective of providing career employees with 55% wage replacement and some level of inflation protection in retirement creates tension with fixed contribution rates in changing economic and demographic times. And since changes in experience and assumptions flow through directly to retiree benefits, it is extremely important to proactively manage the volatility of changes in those areas. In this light, conducting an experience study and updating assumptions every five years seems too long a window to me. This leaves the potential for significant bumps that, again, will directly hit the retiree's bottom line. An immediate example that strikes me is on the topic of longevity; the article says that SDRS uses RP-2014 mortality tables with generational projections. Although this is a good start, at some point it will need to consider moving to benefit-weighted mortality (such as under the recently published Pub-2010 Public Retirement Plans Mortality Tables), which could cause a significant increase in liability.

On a related level, the inflexibility of contributions means that as time goes on, the risk of benefit reductions beyond COLA adjustments will increase. This can be seen clearly in SDRS's risk projections. In year one, there's a 20% chance that legislative change beyond COLA adjustments is needed. This 20% already seems relatively high, but for every year the projection is pushed out this probability increases, leading to a 30% chance over just three years (a 50% relative increase). These potential further adjustments would be on top of a very modest COLA of 0.5% per year.

To SDRS's credit, within the section "Reflection, Evaluation, and Next Steps for SDRS," it has already identified a list of potential levers that the legislature could further adjust. Given the significant probability of hitting this threshold soon, prudence would suggest quantifying (how much effect would each have), prioritizing, and further developing these levers. One potential addition to the list is, given that members are living longer and typically working longer, a benefit multiplier that produced 55% wage replacement for career employees 30 years ago may produce more than 55% wage replacement today. Base benefit formula reductions are certainly a tough topic to address, but completely fixed contributions may call for such consideration as time goes on.

Looking Beyond South Dakota

In this response I have laid out my perspective on one of the healthiest public pension plans in our nation, with strengths that dwarf vulnerabilities and risks. For application to other systems, it would be insincere to simply suggest that others follow South Dakota's path—the political, social, and even legal environments vary too much across states. But I have tried to highlight key lessons and principles from SDRS's experience that most certainly would benefit other systems regardless of their particular

operating landscape. These supplement the SDRS' application principles outlined in their paper and include the following:

- Proactive determination of the mission, values, and priorities that unite involved parties and actively deal with legitimate stakeholder concerns
- Sound governance where politics take a back seat to an informed and collaborative decision-making process and administration operates with dependable safeguards and
- Deliberate Enterprise Risk Management that identifies key risks like underfunding and changing demographics and establishes actionable mitigation plans when respective risk tolerances are crossed.

I look forward to following the success of SDRS for years to come.

The opinions expressed in this response are my own and not necessarily those of my employer.

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Authors' Response to Comments

By Douglas J. Fiddler, R. Paul Schrader, and Robert A. Wylie

The authors wish to thank Mr. Murphy and Mr. Tauzer for their time and effort in providing thoughtful reviews.

Both reviewers recognize that a sustainable retirement system funded by fixed contribution rates requires variability in the benefits. The South Dakota Retirement System (SDRS) has two primary variable benefit features that automatically adjust to the system's fiscal status. In addition, SDRS has statutory funding thresholds that require corrective legislation if crossed. The statutory funding thresholds are an acknowledgement that economic and demographic conditions will change in unexpected ways, and it is unlikely that a singular benefit structure will be effective through the entirety of a retirement system's existence. Indeed, since SDRS was consolidated in 1974, SDRS has seen approximately 14 significant changes to its benefit structure; a dozen of these were benefit improvements, and corrective actions reducing benefits have been enacted twice.

Both Mr. Murphy and Mr. Tauzer rightfully point to the significant probability of crossing the statutory funding thresholds and requiring corrective legislation in the near term. The authors share their concern. However, the SDRS Generational benefit design was not enacted in a vacuum. The likelihood of crossing the statutory funding thresholds and requiring corrective action legislation was calculated considering SDRS in its entirety, reflecting that most current members' benefits will be determined under the prior benefit structure. The likelihoods also reflect the current SDRS funded status, which, like most other public retirement systems, has been impacted by recent investment results and strengthening of actuarial assumptions, specifically reducing the discount rate and incorporating generational mortality assumptions.

The design of a retirement system requires prioritizing and balancing goals that are often competing. SDRS is operated on fixed contribution rates but also has established benefit adequacy and benefit equity goals. Intergenerational equity is also a concern, in both contribution effort and benefit level. While the topic is regularly discussed, the SDRS Board of Trustees has not established a target percentage that is the "right" likelihood for requiring corrective actions in all economic and demographic conditions. Because legislative corrective actions are always unpalatable, lower likelihood of requiring such legislation is preferred but is not realistic in all economic periods. In a fixed contribution rate system, lowering the likelihood of future required corrective actions necessarily requires lower benefit levels. And there is a point at which current benefit levels are sacrificed to minimize future corrective actions—that is, current benefit levels are reduced to minimize the chances that future benefit levels will need to be reduced.

The Board of Trustees focuses on the transparent disclosure of the likelihood of corrective actions under current conditions so that policy makers and stakeholders are fully informed and prepared.

One concern raised in the reviews is that temporary market fluctuations could drive corrective action legislation that appears unnecessary because the statutory funding thresholds are evaluated on a fair value of assets basis. The authors have received this feedback elsewhere. An alternative method would use smoothed assets for the comparison to the statutory funding thresholds.

SDRS views the risk of delaying corrective action legislation because of asset smoothing as a more severe risk than making corrective actions prematurely. The authors view reversing a corrective action that was

made prematurely as a much easier task than having to take increasingly severe, successive corrective actions because the funding was evaluated on a smoothed basis.

The SDRS Board of Trustees continues to discuss, evaluate, and prioritize potential future changes in the benefit structure, including incorporating additional variable features. This includes changes that may be required by the statutory funding thresholds, changes permitted by the policy on benefit improvements, and changes that may be enacted absent either of those conditions. SDRS principles and goals will guide consideration of any changes. If experience results in COLAs lagging inflation, adjustments when possible will likely take a higher priority than other changes.

We would like to reiterate our gratitude to the reviewers. The authors are proud of the framework and plan design that the SDRS Board of Trustees and South Dakota legislature has established. The design has met our expectations to date and is working as intended. However, we recognize that future economic and demographic experience will bring some unexpected developments and will require continual evaluation and modification of the SDRS Generational benefit structure.

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Multiple Employer Pension Plan Risk-Sharing Model

By Sandra J. Matheson and Gene Kalwarski

Abstract

Maine Public Employees Retirement System (MainePERS) administers the pension benefits for participants of approximately 300 participating local districts (PLDs) in a multiple employer cost-sharing plan. Although this plan is currently 87% funded, it faces modern challenges that could undermine its ongoing continuance. As a result, modifications were made to the plan design to more effectively manage contemporary risks facing defined benefit plans: specifically, adverse investment and liability experience. This framework is the basis of this paper.

The modified design is a risk-sharing framework created specifically to secure the sustainability of the PLD Consolidated Retirement Plan in a lower earnings environment. The design maintains an attractive benefit while mitigating the risk of employer withdrawal from the plan. Increased contribution rates created by either (1) short-term market volatility or (2) returns consistently below the assumed rate of return create disincentives for employer participation. This in turn creates challenges for paying benefits earned by members throughout their retirement.

The redesign starts with prioritizing payment of the basic defined benefit. Discretionary ancillary benefits are retained, modified or eliminated based on their cost and benefit to the member. Investment risk is no longer managed primarily by adjustable employer contribution rates, reductions in new member basic benefits levels, or arbitrary cost-of-living-adjustment freezes. Instead, investment risk is shared through variable contributions for both members and employers by applying minimum and maximum contribution rate caps. If ongoing plan experience losses result in contributions increasing beyond the predetermined caps, experience losses exceeding the caps are recovered by smoothing the excess amount into future cost-of-living adjustments instead of reducing the basic benefit for future members, reducing ancillary benefits for current members, or imposing arbitrary cost-of-living adjustments or freezes for retirees.

In addition, as MainePERS's goal is to limit market risk, the system has been a nationwide leader in lowering its investment expectations. Currently, the investment assumption is at 6.875%, with the expectation to lower that assumption further over time to 6%–6.5%. As a result, the plan's asset allocation also serves as a risk moderator and is set with contribution rate volatility as the primary risk.

This overall framework, in the process of adoption, strengthens MainePERS's long-term ability to pay the basic defined benefit calculated when a member retires while eliminating intergenerational transfer. It fits into the current governance structure, adding no additional administrative costs or burdens. Current laws have been considered and factored into the framework.

Although this framework was developed for a multiple employer cost-sharing plan, it has equal applicability to statewide pension plans in any financial market environment.

1. Background

Defined benefit retirement plans were created using a sound structure. They provided a safe and reliable retirement income for many private and public-sector workers for decades.

Most defined benefit plans were constructed for a less complex economic and demographic environment than the one in which we find ourselves today. The changing environment is highly unlikely to revert to that of the 1960s, 1970s, 1980s or even the 1990s. Most workers are living longer with corresponding increased income needs for health care. And while it is impossible to predict either interest rates or the interaction among fixed income and equities, there seems to be no indication that investment allocations will return to a relatively safe 40%–60% continuum between these asset classes and reasonably strong interest returns in the foreseeable future.

Most private sector employers have discontinued their defined benefit retirement plans, as lower risk instruments or high volatility portfolios play havoc with their balance sheets. They have increasingly turned to defined contribution retirement plans with predictable employer costs and risks. While their employees are adjusting to taking on their own retirement risk, pooled investments and a defined income stream are definite advantages of the defined benefit plan.

Defined benefit plans continue to be valued by public sector employees. These plans face the same increased investment volatility, creating similar challenges for public sector employers as have been experienced in the private sector.

The MainePERS PLD Consolidated Retirement Plan is no exception. This multiple-employer cost-sharing plan was once substantially overfunded, but now is 87% funded facing the volatility of the markets with a shrinking traditional fixed income portion in the trust fund portfolio.

MainePERS and its stakeholders grappled with this problem to find a solution to controlling the cost but keeping the essential or basic benefit intact. The result is a set of pragmatic changes to the plan that lowers the cost and risk. There is little choice but to take investment risk to keep costs reasonable in the long-term. However, that investment risk can be contained through the strategic asset allocation, and fairly shared among employers, members and retirees using rate caps and minimums, and smoothing excess losses into cost-of-living-adjustments rather than reducing the basic benefit for future members, reducing ancillary benefits for current members, or arbitrarily freezing or reducing the cost-of-living-adjustment for retirees.

This framework is applicable to most public defined benefit retirement plans. It keeps the defined benefit model intact while enabling members and employers to understand the value of their benefit. It responds to the Retirement 20/20—Call for Models for Public Pension Plans with a real-world solution that should enable members to count on their benefit throughout their retirement.

2. Understanding the Challenge

The PLD Consolidated Retirement Plan is a multiple employer cost-sharing defined benefit retirement plan. Demographic and economic trends over the last 30 years have created previously unexperienced, but likely lasting, challenges in maintaining full plan funding at reasonable costs while being able to offer members assurance that their benefits will be paid throughout their full retirement. MainePERS recognizes that these challenges require modification of the existing PLD Consolidated Retirement Plan

to manage the risks these obstacles present so that employers and members have justified confidence in their retirement benefit at an acceptable cost.

2.1 BACKGROUND

The use of workplace defined benefit pensions has been declining over the last decade and a half. They have been virtually eliminated in the private sector. This trend became noticeable following the 2002 market downturn when, coupled with increases in longevity, pension contribution costs began to rise. Market volatility, new accounting standards, and a lengthy low-interest rate environment continued to intertwine to further increase the unpredictability of cost and impacts on financial statements. Most private sector companies providing retirement benefits have moved to defined contributions plans for their employees to control cost and create financial statement stability.

This move toward defined contribution plans shifted the responsibility to workers to manage their own retirement savings accounts. This shift has not necessarily improved retirement readiness for many people who are no longer covered by fixed income stream retirement plans. While most employers encourage participation in their defined contribution plans, a significant percentage of participants do not fully participate or select the investment options that are best for them. Many defined contribution plan sponsors have modified their plans with successful options like opt-out, target date funds, and annuities. But these still require individual decisions, and participant success in building a secure retirement varies.

Defined benefit plans meet many of the needs that group or individual retirement defined contribution savings accounts do not. These plans provide a defined monthly payment to retirees, acting like a paycheck in retirement. This is a model most households are used to for budgeting and spending, and one that is not easily duplicated using retirement savings account withdrawals. Therefore, Social Security continues to be an attractive retirement option for workers not covered by workplace plans or who believe they have no room to save for retirement. They know how much they can expect to receive each month and what type of budget they will have in retirement.

But workplace defined benefit plans face sustainability challenges. Shifting demographics and changing economic conditions have highlighted some of the evolving structural challenges in the original design of defined benefit plans.

Most defined benefit plans were created when a mix of fixed income and equities, somewhere in a 40%–60% continuum, safely met the investment returns needed to maintain reasonable contribution costs. Strong equity returns coupled with healthy fixed income returns may have masked the growing impact of longevity increases for a time. In addition, sustained periods of strong investment returns created deceptively low annual pension costs. Sponsors sometimes used these savings to increase plan benefits or spend the savings elsewhere.

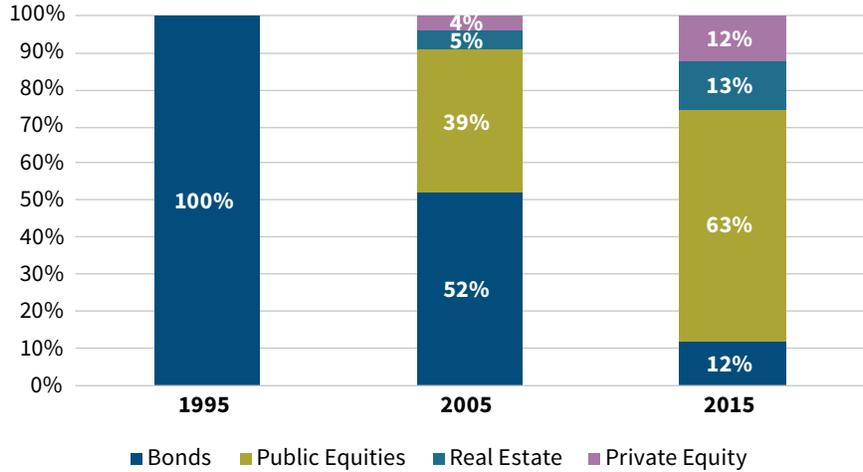
Increased contribution rates inevitably resulted from financial market reversals that followed the lengthy high investment returns of the 1990s. Unanticipated sustained low interest rates created a gradual increase in investment risk to meet the return assumption needed to contain contribution rates. Earnings volatility created by higher risk portfolios gradually increased contribution costs and unfunded liabilities.

The changing economic environment and investment landscape has had a significant impact on pension plan trust fund asset allocations. While at one point in time retirement systems could earn a 7.5% return wholly invested in lower-risk bonds, a 7.5% return today requires a well-diversified portfolio, which carries nearly three times the risk of a bond-only portfolio (see Figure 1). Remaining with a total bond portfolio is equally problematic. It would have required a substantial drop in the earnings assumption

accompanied by an increase in liabilities and contributions that can be assumed would have been unacceptable to both employers and members.

FIGURE 1

Asset Allocation Needed to Earn 7.50%



Expected Return	7.50%	7.50%	7.5%
Standard Deviation*	6.00%	8.90%	17.20%

*Amounts by which returns can vary

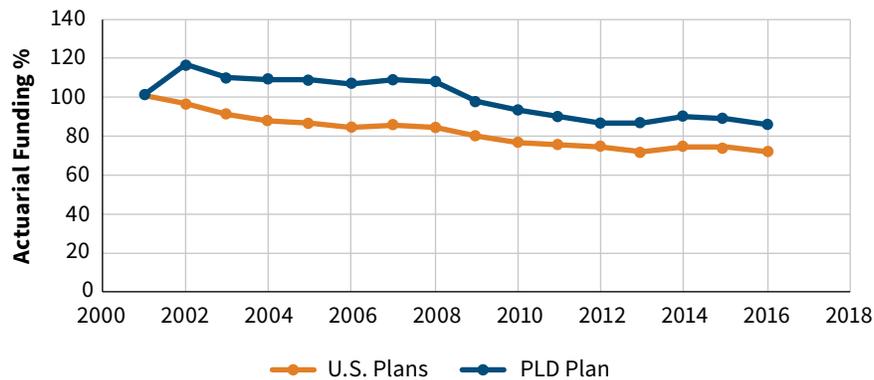
Source: Callen LLC

2.2 THE EFFECTS OF CHANGING ECONOMIC AND DEMOGRAPHIC FACTORS

Changes in the aggregate actuarial funding levels of the nation’s largest public retirement plans reflect the impact of increased longevity and evolving financial market conditions. Public Plans Data support this as average funding levels for U.S. public plans dropped from 102.1% in 2001 to 71.5% in 2016, as shown in Figure 2.

FIGURE 2

Historical U.S. Public Plan Funding Levels



Data from *Public Plans Data* Website, 2016. Center for Retirement Research at Boston College, Center for State and Local Government Excellence, and National Association of State Retirement Administrators.

The PLD Retirement Plan has followed a related funding history, as shown in Figure 2. Formed in 1994, the plan quickly became overfunded in the high earnings environment of the 1990s and employer lump-sum contributions for legacy liabilities they brought in when joining the plan. While the original contribution level for employers was an aggregate rate of 8%, employer contributions were lowered to 3% to avoid taking the plan’s funding level to 130% or higher. Contributions were scheduled to begin a gradual increase back to the aggregate 8% starting in 2009 when the recession took a large toll on the funded status, bringing it down to 90% by fiscal year 2014.

Employer rates were gradually increased by 1% per year starting in fiscal year 2010, returning to the full 8% normal cost in fiscal year 2014. The unfunded actuarial liability grew during this period. Benefit payment withdrawals and subsequent market volatility added to the declining fund balance until employer rates were further increased to 10%. The plan is now on an upward trend at 87% funded as of June 30, 2017, up from 86% a year earlier.

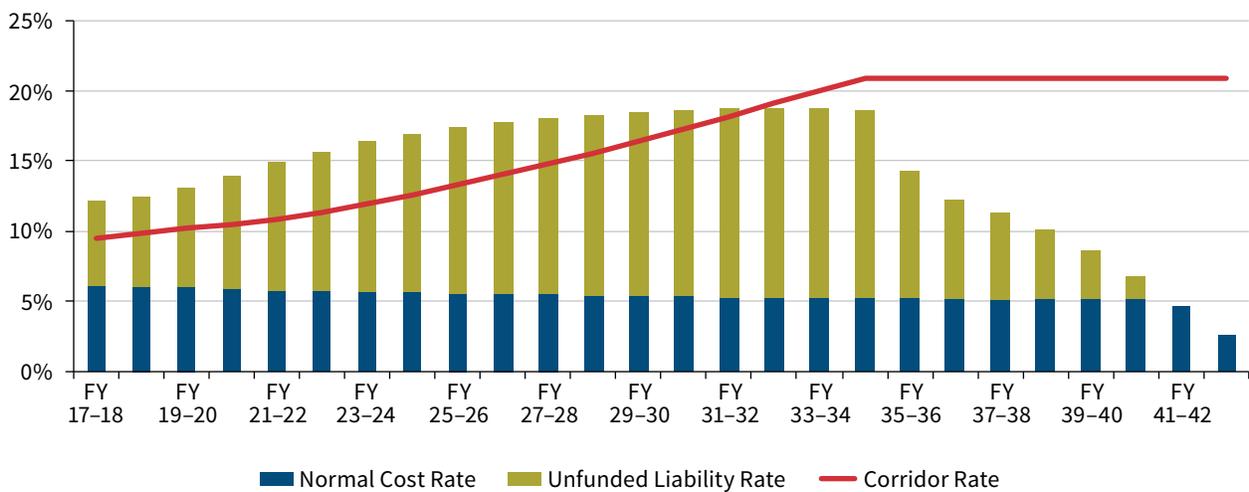
2.3 THE CHALLENGE

MainePERS recognizes that PLD Consolidated Retirement Plan employer rates could increase to more than double the original 8% without risk-mitigating measures. Significant rate increases create the greatest risk and the biggest vulnerability for the plan—employer withdrawal. Most plan employers cannot afford or will not tolerate pension rates of 15%–20%. Employer withdrawals could destabilize the plan and possibly cause it to fail. The challenge, therefore, is to create a realistic and reliable benefit at reasonable costs in a structure that can withstand shifting demographics and investment return volatility.

The importance of this challenge crystalized in 2016 when it appeared the low-return environment that occurred in fiscal years 2015 and 2016 could persist for some years into the future. MainePERS modeled how a 4% return in fiscal years 2017 through 2020 could affect the PLD Consolidated Retirement Plan employer contributions if all other factors remained constant, as shown in Figure 3.

FIGURE 3

Participating Local District Consolidated Retirement Plan Rates — Modeling 4% Returns FY17–20



Source: Cheiron Rate Modeling

The results of the modeling demonstrated that a new framework was needed to manage the economic and shifting demographic risks facing pensions today and to keep the PLD Consolidated Retirement Plan sustainable into the future with reasonable costs. The new plan framework that was developed is the basis of this paper.

3. The Current Governance and Plan Structure

The PLD Consolidated Retirement Plan is a versatile multiple employer cost-sharing plan. Governmental entities designated as “local districts” in Maine law are eligible to join and participate in the PLD Plan.

3.1 GOVERNANCE

The existing governance structure balances stakeholder involvement. This structure helps balance moral hazard risks by creating transparency and balancing stakeholder input into the plan.

- The **state legislature** is the plan sponsor the PLD Consolidated Retirement Plan, which was implemented in 1994. It has ongoing responsibility for approving some requirements of the plan.
- The **MainePERS Board of Trustees** oversees the management and administration of the plan/trust. The board implements the intent of the legislature for many plan design components through rule-making, and sets the demographic and economic assumptions, and the annual contribution rates for employers. The board performs duties as assigned by the legislature and considers recommendations from the PLD advisory committee.

The board of trustees oversees the system within their duties of prudence and loyalty to members, acknowledging that these are consistent with public stakeholder interests.

Maine statute delineates the requirement and qualifications of the eight-member board of trustees. Except for the state treasurer, these positions are subject to confirmation of the legislature.

- Two positions are held by active members of Maine’s State Employee and Teacher Retirement Program. These trustees are elected by organizations named in statute.
 - One position is held by a retired member of the State Employee and Teacher Retirement Program, selected by the governor from one of three nominees from the retired teachers’ association.
 - One position is held by a retired member in any plan MainePERS administers, selected by the governor from nominations from retiree groups.
 - One position is held by an active or retired member of the PLD Consolidated Retirement Plan appointed by an association that includes many PLD employers.
 - Two positions are selected by the governor and held by individuals who must be qualified through training or experience in the fields of investments, accounting, banking, insurance or as an actuary.
 - The Maine state treasurer.
- The **PLD Advisory Committee** was created by the legislature in statute to present recommendations for or amendments to the plan to the MainePERS Board of Trustees.

3.2 STAKEHOLDERS

Local governments designated as PLDs in statute can join the PLD Consolidated Retirement Plan and offer membership to all or part of their employees. Approximately 300 **employers** participate in the

plan. Participating employers have historically been responsible for any new unfunded actuarial liabilities unless member rates established by statute or rule are adjusted.

Members are PLD active/inactive employees that have chosen or been mandated into the plan. Approximately half of all PLD members in the PLD Consolidated Retirement Plan *do not* participate in Social Security. The remainder participate in Social Security, with the PLD Consolidated Retirement Plan as a supplemental plan. Employees offered a supplemental plan must decide at time of hire whether to participate in the PLD Consolidated Retirement Plan in addition to Social Security. This is an irrevocable decision.

Retirees and beneficiaries receive retirement benefits and if entitled, cost-of-living adjustments throughout their retirement or term of eligibility.

The **public** holds governments responsible for prudent management of all employee benefits and to minimize intergenerational transfer.

The **financial markets** play a role in funding defined benefit pension benefits, similar to the role they play in defined contribution plans. Prudently managed, investments can help create retirement security.

3.3 MEMBER AND BENEFICIARY COUNTS

TABLE 1

Member and Beneficiary Counts

EMPLOYERS	ACTIVE EMPLOYEES	DISABILITY RETIREES	RETIREES	AVERAGE ANNUAL BENEFIT
294	11,195	397	8,609	\$15,707

Source: MainePers Valuation

3.4 CURRENT PLAN DESIGN

Employers can select the specific plan design they want to offer their employees from 11 defined benefit options. These options include designs in lieu of Social Security, or in addition to Social Security. See Appendix A.

The options vary to meet the needs of the member population, such as public safety employees. However, the overall structure of each option except for the defined contribution plan shares commonalities of a traditional defined benefit plan design.

3.4.1 General Plan Option Provisions

- The retirement benefit is based on a set accrual rate ranging from 1%–2.67% of average final compensation (the average of the highest three years’ earnings) for each year worked. The most common option selected is 2%.
 - Five-year vesting
 - Age 60 normal retirement age for plan members joining before July 1, 2014
 - Age 65 normal retirement age for plan members joining on after July 1, 2014
 - 25-year service retirement
- Members with an age 60 normal retirement age who retire before age 60 with 25 years of service receive a benefit reduction of approximately 2.25% for each year retired before age 60.

- Members with an age 65 normal retirement age who retire before age 65 with 25 years of service receive a benefit reduction of 6% for each year retired before age 65.
 - Members in the age 55 Plan option who retire before age 55 with 25 years of service receive a benefit reduction of either 2.25% or 6% depending on if they joined the Plan before on or after July 1, 2014.
- Disability retirement and death benefits for eligible members
 - Transferable service credits between employers covered by the PLD Consolidated Retirement Plan
 - Employer contributions remain with the PLD Consolidated Retirement Plan when a member terminates membership.
 - Group term life insurance at the choice of the employer

3.4.2 Discretionary Plan Provisions

- Up to 3% per year Consumer Price Index for Urban Consumers based cost-of-living-adjustment after one full year in retirement

3.5 CURRENT RISK ALLOCATION

The current structure of the PLD Consolidated Retirement Plan has a traditional risk distribution.

- **Members** have fixed contributions. They can bear market risk if their fixed contribution rate is increased or decreased by state statute. They also bear the risk in building their own retirement security if benefits are increased or decreased.
- **Employers** bear market risk through annual increases or decreases in contributions. When the plan is underfunded, this is the difference between the total actuarially determined rate and the member fixed rate. Employers also bear the risk of increased contributions when other employers withdraw from the plan. Withdrawal risk was not contemplated when the plan was developed and overfunded, so there are currently no withdrawal impacts to the withdrawing employer.
- **Retirees** bear market economic risk if market losses are severe enough to freeze or permanently reduce the annual cost-of-living adjustment.
- **Taxpayers** bear market volatility risk if the volatility creates significant unfunded actuarial liability cost impacts in the employer budget.

3.6 CURRENT PLAN FUNDING

The PLD Consolidated Retirement Plan is 87% funded on an actuarial basis as of June 30, 2017. Plan employers regularly pay the full actuarial required contribution less member contributions. Member contributions are deducted from pay.

3.6.1 Contribution Rates

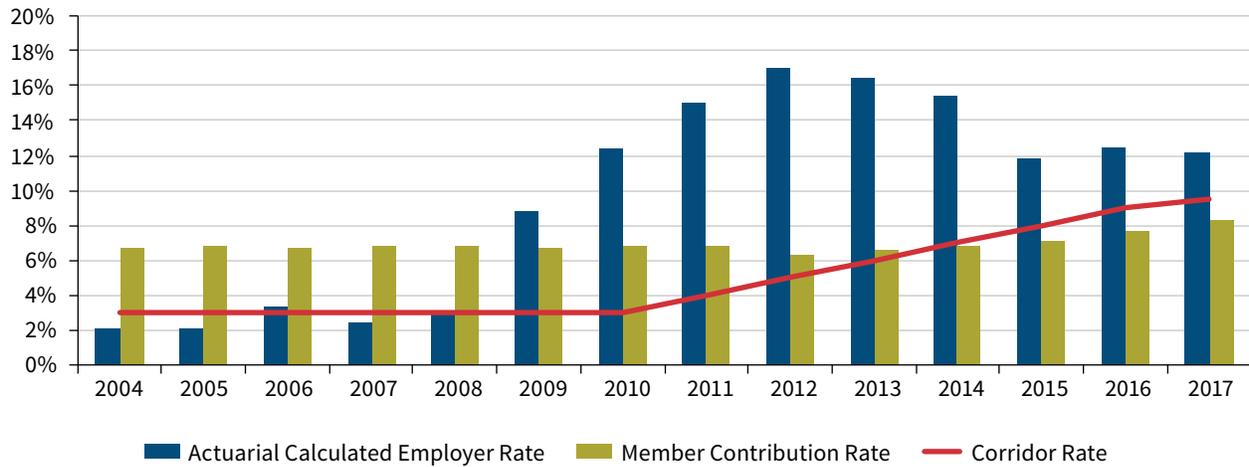
Subject to an annual corridor test, employers pay an actuarially determined rate reset annually. Members pay a percentage of payroll set by legislation and rule adopted by the MainePERS Board of Trustees. The original member rates set in 1994 stayed in place until 2013 when they were increased 0.5% per year for three years to help offset the recessionary losses.

The minimum employer rate is governed by an annual corridor funding test. If the plan's funded status (the ratio of actuarial value of assets to actuarial liability) remains within a corridor of 90%–130%, the minimum required contribution rate is fixed at the minimum required rate from the prior year. If the funded ratio falls outside of the corridor, the contribution rate is adjusted to reflect 10% of the difference between the actuarially determined rate and the prior year's minimum required contribution rate.

The 2009 market crisis created extraordinary calculated rate increases for PLD employers, as shown in Figure 4. The corridor method smoothed the losses and enabled the market recovery to bring the calculated rate down as employer corridor rates were increased to close the gap.

FIGURE 4

Participating Local District Consolidated Retirement Plan Rates — Corridor vs. Actuarial Calculated Employer Rate



Source: Cheiron Rate Modeling

3.6.2 Demographic and Economic Assumptions

Economic and demographic assumptions are updated either every five years as part of an experience study or as needed in between full experience studies.

Economic and demographic assumptions have always been set to protect plan funding and within standard actuarial guidelines. The MainePERS Board of Trustees has been forward thinking in adopting assumptions. For example, they began reducing the discount rate in 2006 from 8% to 7¾% and twice thereafter to the current 6.875% rate.

TABLE 2

Experience Study or Interim Action

	1994	1996	2001	2006	2011	2016
Discount	8.00%	8.00%	8.00%	7.75%	7.25%	6.88%
Wage Inflation	5.00%	5.00%	4.50%	4.50%	3.50%	2.75%
Mortality	Variant of UP-94	Variant of UP-94	Variant of UP-94	Variant of UP-94	RP 2000 Mortality Table	Variant of UP-2014

Source: MainePERS Valuation

3.6.3 Funded Status

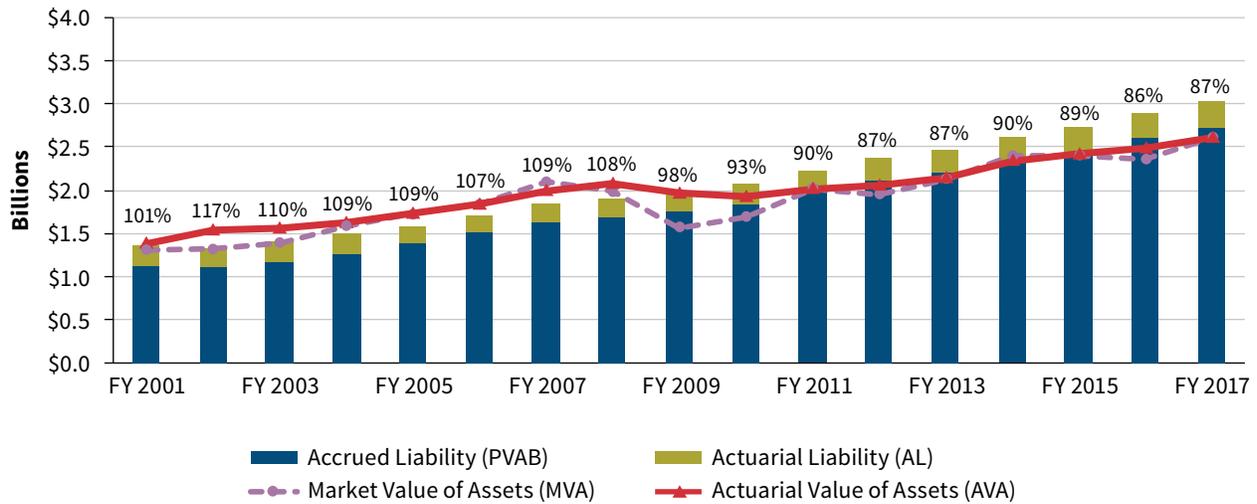
The PLD Consolidated Retirement Plan funded status was greater than 100% from the time of its inception in 1994 through the 2008 actuarial valuation. This level of overfunding was created by exceptionally strong investment returns from the 1994 inception of the plan until 2002. Lowering employer

contribution rates to 3% allowed the plan to remain 108%–110% funded until the recession knocked it down to 90% by fiscal year 2014.

To avoid employer withdrawal risk in the post-recession economy, employer rates were gradually returned to the full 8% starting in 2010 by 1% each year. Three 0.5% member rate increases were implemented in fiscal years 2015, 2016 and 2017 as a preliminary move toward member risk-sharing. These increases are intended to reverse as the plan funding improves.

FIGURE 5

Participating Local District Consolidated Retirement Plan Funding History



Source: Cheiron Trend Modeling

4. Increasing Benefit Security with a New Risk Framework

MainePERS adopted the goal of increasing the assurance that PLD Consolidated Retirement Plan members would receive their defined benefit throughout their retirement.

4.1 IDENTIFYING AND ADDRESSING RISKS TO INCREASE BENEFIT SECURITY

The first step in achieving the goal of increasing retirement benefit security was to assess the risks facing defined benefit plans. In early 2016, five primary risks threatening benefit security were identified:

1. Sustained market returns below MainePERS 6.875% earnings assumption or a significant market correction would create high or multiple rate increases to employers, members or both.
2. Employer rates that either threaten to or go too high increase the possibility that employers discontinue participation in the plan.
3. Member rates that go too high discourage enrollment in the plan, especially for younger workers.
4. The primary labor pool for local government jobs is either older or retired workers, some of whom are retired from the PLD Consolidated Retirement Plan and are drawing their benefit.
5. Permanent cost-of-living adjustment reductions or freezes that are used to mitigate employer and member rates increases make it difficult for retirees no longer working to keep up with inflation.

MainePERS convened PLD Advisory Committee to discuss these risks and a framework for keeping the benefit sustainable.

Conventional steps already in place to mitigate the economic and demographic risks to the plan were reviewed, but were recognized as falling short of fully strengthening benefit security:

- MainePERS has gradually reduced the expected investment return used to calculate funding needed to pay benefits over the last decade from 8% to 6.875% as long-term investment return expectations continue to decrease in a low-interest rate environment.
- MainePERS has kept up the funding for demographic changes that increase plan cost, such as longevity.
- Contribution rates have been increased to help restore plan funding lost in the recession.
- Changes which were made to plan requirements and discretionary benefits in 2014 include:
 - Normal retirement age increased to 65 for new members.
 - The early retirement reduction factor was increased from 2-1/8% to 6% for new members.
 - The cost-of-living adjustment was reduced from up to 4% of the Consumer Price Index for Urban Consumers (CPI-U) to up to 3% of the CPI-U.
- MainePERS adjusted its asset allocation to reduce expected risk while maintaining expected return.
- Based on the modeling discussed earlier in this paper, MainePERS recognized the 2014 steps alone were not adequate to sustain the plan during (1) an ongoing low interest rate environment, (2) future financial market corrections, or (3) shifting demographics such as longer life spans or retirees returning to work in a PLD Consolidated Retirement Plan covered position while collecting a benefit from the plan. Current state law prohibits members from re-entering the plan with certain exceptions, but generally allows members to return to their previous position after retiring at or after normal retirement age and still collect their plan retirement benefit.

Traditional tools available to restore funding, including increasing contribution rates, reducing the basic benefit for future members, reducing ancillary benefits current members or freezing or reducing cost-of-living adjustment, are not acceptable long-term measures to employers, members or retirees. Without new tools or methods to protect benefits and funding, the long-term sustainability of the plan is threatened.

4.2 NEW BENEFIT AND RISK MANAGEMENT STRUCTURE

MainePERS used a pragmatic approach to increasing benefit security by keeping the mechanics of the plan essentially unchanged; that is, the plan design should remain familiar to members and employers. The primary goal was to make sure a member could rely on receiving their basic defined benefit as determined by the formula of average final compensation × the multiplier × service credit throughout their retirement.

Changes for consideration were identified by (1) analyzing the conditions that threaten benefit security, and (2) devising a framework that mitigates these threats with changes that are straightforward and as nondisruptive as possible. The framework was designed to

1. Keep the existing basic defined benefit structure in tact
2. Modify discretionary add-on benefits
3. Create a risk-sharing mechanism that shares risk fairly
4. Protect against employer withdrawals
5. Adjust actuarial and investment decisions to continue lowering risk in the plan

No reasons were identified to change the existing governance structure, which is strong and balances stakeholder interests of maintaining the strength of the PLD Consolidated Retirement Plan. The MainePERS Board of Trustees has been changing actuarial assumptions and the strategic asset allocation over the last decade in coordination with the changing economic and demographic environment.

4.2.1 Protecting the Basic Benefit

No changes were made to the basic benefit formula of average final compensation × the multiplier × service credit. This formula provides a stable and predictable basis for member retirement saving and planning.

4.2.2 Adjusting Incentives, Subsidies and Discretionary Add-ons

All plan provisions other than the basic benefit were reviewed to determine which were part of the basic benefit and which were ancillary, or may have been added for other reasons. Ancillary benefits that were determined not to be critical to the basic benefit were evaluated as (1) nice-to-have but not necessary, (2) included in the plan to control employee behavior in the workplace such as sick-time, or (3) included for other reasons not necessarily related to retirement. Costs for these add-on provisions were estimated, and the higher cost options were modified or eliminated.

4.2.2.1 Sick/Vacation Leave Incentives

Unused sick and vacation leave may increase the final benefit calculated at retirement. These increases were classified as add-ons to the benefit because they are not part of the basic benefit formula, and vary by individual behavior. The original proposal presented to the PLD Advisory Committee was to eliminate these provisions. Removing them entirely was determined to be problematic because some members have counted on their unused sick and/or vacation leave increasing their final benefit.

The final recommendation was to maintain these provisions for members with 20 or more years of service at retirement. The original proposal was modified through the committee’s discussion and evaluation process after recognizing these provisions serve as a retention incentive which benefits both employers and the plan. See Table 3.

Keeping a level number of members in the plan is very important to the health of the plan, which is why retaining members is also considered important. Plan sustainability can be threatened when members leave and are replaced by employees that do not join the plan but choose other retirement options. In the end, this change created a smaller but still noticeable contribution rate reduction.

TABLE 3

Changes to Sick/Vacation Provisions

CURRENT SICK/VACATION LEAVE PROVISIONS	PROPOSED CHANGE
<ul style="list-style-type: none"> All retiring members may include up to 30 days of unused, paid sick and/or vacation leave in average final compensation calculation. 	<ul style="list-style-type: none"> All retiring members with 20 or more years of service at retirement may include up to 30 days of unused, paid sick and/or vacation leave in average final compensation calculation.
<ul style="list-style-type: none"> All retiring members may receive service credit up to 90 days of unused, unpaid sick and/or vacation leave. 	<ul style="list-style-type: none"> All retiring members with 20 or more years of service at retirement may receive service credit up to 90 days of unused, unpaid sick and/or vacation leave.

4.2.2.2 *Early Retirement Subsidy*

The early retirement reduction factor is frequently perceived as and referred to as a “penalty” even though it is the recovery of costs incurred when a member retires before normal retirement age. Maine PLD Consolidated Retirement Plan members retiring before normal retirement age are not charged the full cost for this added benefit. The costs of this personal choice by some members are instead subsidized by the rates of employers and all other members not retiring early.

The final recommendation was to eliminate any early retirement subsidy in its entirety so that each member choosing to retire early will fund their own early retirement. Part of this recommendation is that members may delay their cost-of-living adjustment until normal retirement age eligibility, which may somewhat decrease their individual early retirement reduction factor. Members with at least 20 years of creditable service when the change goes into effect would be grandfathered under the existing, subsidized structure. See Table 4.

TABLE 4

Changes to Early Retirement Reduction Provisions

CURRENT EARLY RETIREMENT REDUCTION PROVISIONS	PROPOSED CHANGE
<ul style="list-style-type: none"> • Benefits of all retiring members eligible to retire hired before July 1, 2014 are reduced by 2.125% for each year retiring before normal retirement age. 	<ul style="list-style-type: none"> • Retirement benefits for all retiring members eligible to retire will be reduced by the full actuarial costs to the Plan (approximately 8% per year).
<ul style="list-style-type: none"> • Benefits of all retiring members eligible to retire hired after June 30, 2014 are reduced by 6% for each year retiring before normal retirement age. 	<ul style="list-style-type: none"> • <i>Exception—current retirement subsidies will continue to be available to members with 20 or more years of service as of June 30, 2018.</i>

4.2.2.3 *Retire/Rehire Subsidy*

Retirees may be rehired into active employment and continue to collect their pensions. They do not accrue any additional benefits, but the plan loses employer contributions that would have been made toward the unfunded liability had a new or existing active member been hired instead.

This is a challenging issue complicated by evolving economic and demographic factors. Reasons this is a popular feature of the plan are:

- Retirees or those nearing retirement understand their benefit may not support them in retirement, and their supplemental retirement savings are not adequate to make up the difference. Earning two incomes, a paycheck, and a pension benefit helps them prepare for retirement.
- Retirees or those nearing retirement may not be ready to retire, but make the decision that two incomes, a paycheck and a benefit, is more beneficial than additional service credit and a higher benefit.
- Employers mistakenly calculate that they save money by not paying retirement costs for the plan, not understanding that the unfunded liability costs would be spread over fewer active members, causing the employer contribution rate to increase.
- Many local government employers are facing a labor pool shortage; the pool that does exist are older or retired workers (the average age of entry into the PLD Consolidated Retirement Plan is 37).

- Employers can enhance successful recruitment by offering a defined contribution option outside of the plan, so that rehired annuitants receive a paycheck, a benefit, and contributions to a defined contribution plan.

Under most circumstances, Maine statute prohibits MainePERS retirees from re-entering the same plan in which they were a member. Possibly this provision and the ability to receive a benefit and return to noncovered employment in an eligible position dates back to attempts to provide employers a tool to recruit for hard-to-fill positions.

MainePERS has been tracking retire/rehire each year to determine if the practice has an adverse effect on plan costs. While the data to date is not yet convincing, anecdotally it can be seen that employers and members are starting to consider this option in career planning. The recommendation was to continue the practice to assist employers in filling open positions, but add conditions that make it cost-neutral to the plan.

TABLE 5

Changes to Retire/Rehire Provisions

CURRENT RETIRE/REHIRE PROVISIONS	PROPOSED CHANGE
<ul style="list-style-type: none"> • Members who retire at or after their normal retirement age may return to employment for a MainePERS Participating Local District Consolidated Retirement Plan employer and continue to receive their Plan retirement benefit for no additional cost to the employer or retired annuitant. 	<ul style="list-style-type: none"> • Members may no longer retire at or after their normal retirement age, receive a benefit, and occupy a MainePERS covered position. • The employer can opt to pay the same total (normal and UAL) costs that are paid for other active members for retired rehires. How this is structured is up to the employer/Participating Local District Consolidated Retirement Plan annuitant, i.e., it can be paid by the employer, the rehired annuitant or both. <p style="text-align: center;">-OR-</p> <ul style="list-style-type: none"> • The employer can require the rehired Participating Local District Consolidated Retirement Plan annuitant to re-enter the plan, discontinue receiving benefits and accrue additional service credit.

4.2.2.4 Cost-of-Living Adjustment

The PLD Consolidated Retirement Plan includes a cost-of-living adjustment. This important provision assists members in adjusting to inflation throughout their retirement.

Creating a sustainable contribution rate structure required some level of cost reduction in the plan. Adjusting the cost-of-living-adjustment to more closely approximate expected inflation achieved this needed cost reduction. The PLD Advisory Committee is analyzing benefit distribution levels to decide what is the best way to distribute future cost-of-living-adjustments among retirees. See Table 6.

TABLE 6

Changes to Cost-of-Living Adjustment

CURRENT COST-OF-LIVING ADJUSTMENT PROVISION	PROPOSED CHANGE CHOICES
<ul style="list-style-type: none"> Eligible retirees receive an annual cost-of-living-adjustment on their benefit up to 3% based on the Consumer Price Index for Urban Consumers. 	<ul style="list-style-type: none"> Eligible retirees receive an annual cost-of-living-adjustment up to 3% of the first \$30,000 of their retirement benefit based on the Consumer Price Index for Urban Consumers. Annual increases on the base \$30,000 are cumulative. New eligible retirees receive their adjustments on the base in effect. <p style="text-align: center;">-OR-</p> <ul style="list-style-type: none"> Eligible retirees receive an annual cost-of-living-adjustment on their benefit up to 2.25% based on the Consumer Price Index for Urban Consumers.

4.2.3 Mitigating Contribution Rate and Economic Risks

The risk-sharing mechanism is the cornerstone change of the new PLD Consolidated Retirement Plan structure. This is because it sets the direction for other plan decisions by using contribution rate cap and minimum rates. For example, additional benefits, added investment risk, earning assumptions and other decisions must be scrutinized to determine how each decision will impact MainePERS ability to keep contribution rates safely within these boundaries and able to absorb market risk.

Market volatility can create unsustainable contribution rate volatility depending on when and in what order it occurs. As discussed earlier, trust fund allocations to equities, including MainePERS, have increased over the last 20 years as fixed income returns, specifically bonds, have declined and remained low.

MainePERS addressed this volatility by lowering its assumed rate of return from 8% in 2006 to 6.875% in 2017. In addition, risk parameters were introduced into the strategic asset allocation. While these are critical measures, further risk-management tools were needed to increase MainePERS ability to pay retirement benefits throughout members’ eligibility. The new framework does this through two mechanisms.

4.2.3.1 Contribution Rate Risk Reduction

The PLD Consolidated Retirement Plan experienced an unfortunate intersection of the 2008–2009 economic downturn and simultaneously returning plan employer contribution rates back to the original full funding costs.

As employer contribution rates gradually increased by 1% per year beginning in fiscal year 2010, few if any employers remembered the original cost of the plan was an 8% contribution rate. As a result, PLD employers became increasingly agitated over growing pension costs to which they saw no end.

At the same time, member contribution rates were increased to 8%, making it more challenging to recruit new, younger members into the plan. The combination of these factors caused MainePERS to create a new funding framework to mitigate contribution rate risk.

The new framework is based on sharing market risk more equitably than the current framework. Employers and members will share market risk, both positive and negative, through variable contribution rates adjusted annually. See Table 7.

TABLE 7

Changes to Current Rate Structure

CURRENT RATE STRUCTURE	PROPOSED CHANGE
<ul style="list-style-type: none"> Employee rates are fixed based on the plan option in which they are a member. Employer rates are variable, and are the difference between the required normal and unfunded actuarial liability rates and the employee fixed rate. 	<ul style="list-style-type: none"> Both employer and member rates will vary annually based on market performance. After setting initial base rates, 55% of future gains/losses will be allocated to employers, and 45% allocated to members. Contributions rates will be capped at 21.5% of payroll: <ul style="list-style-type: none"> – Employer cap – 12.5% – Employee cap – 9%

Rate caps may be adjusted for economic or demographic factors. At a minimum, rate caps will be reviewed at each experience study.

4.2.3.2 Cost-of-Living-Adjustment Protection

Under the traditional approach to defined benefit plan funding, reducing or freezing benefits such as the cost-of-living-adjustments is usually one of the first options to reduce retirement plan costs when contribution rates reach unsustainable levels due to adverse experience. Freezing or reducing this retirement benefit adjustment, permanently or temporarily, can provide significant funding requirement relief.

However, this traditional method disproportionately allocates market risk to retirees who are no longer earning income to offset the reduction. The new framework shares market risk with retirees more equitably.

Retirees will receive an adjusted cost-of-living-adjustment when market losses are excessive, with the goal of never freezing a cost-of-living-adjustment in response to a year of poor returns. This new framework, along with a goal to reach 120% funding of the plan currently under consideration, will avoid concerns that any of the three stakeholders receive preferable treatment. See Table 8.

TABLE 8

Changes to Cost-of-Living Risk

CURRENT COST-OF-LIVING-ADJUSTMENT RISK	PROPOSED CHANGE
<ul style="list-style-type: none"> Cost-of-living-adjustments are cumulative. Cost-of-living-adjustments may be reduced or frozen. 	<ul style="list-style-type: none"> Cost-of-living-adjustments are cumulative. When market losses are severe enough to cause employer and member rates to exceed their caps, the excess will be smoothed into future cost-of-living-adjustments. Future market gains will also be smoothed into cost-of-living-adjustments until the losses are recovered.

This approach places retirees in a more equitable position in relation to employers and members, and eliminates subjective reductions. It also enables retirees to continue to increase their benefit each year to stay closer to inflation than when subject to arbitrary freezes.

4.2.4 Withdrawal Liability

The PLD Consolidated Retirement Plan does not currently address withdrawal liability.

Provisions under consideration to protect the plan are:

Full Withdrawal

The system's actuary will calculate the unfunded actuarial liability ("UAL") of the PLD's Consolidated Retirement Plan as of the most recent valuation date that precedes the withdrawal date. The actuary will allocate a portion of the UAL to the withdrawing PLD based on the proportion of the withdrawing PLD's total covered payroll to the total covered payroll of the entire consolidated plan as of the valuation date.

The actuary then will subtract from the withdrawing PLD's UAL amount the present value, as of the withdrawal date, of UAL payments the PLD has made since the valuation and UAL payments the PLD is expected to pay through the payment of employer contributions after withdrawal on those employees who remain active members.

The withdrawing PLD may pay this withdrawal liability amount in a lump sum or amortize it over a period of up to 10 years at the actuarial assumed rate of return used in the most recent valuation that precedes the withdrawal date.

The withdrawing PLD would continue to pay the employer rate (normal cost and UAL) on its covered payroll.

Partial Withdrawal (Entering into a New Participation Agreement That Excludes New Hires in a Class of Employees Currently Covered)

The withdrawal liability amount is calculated the same way as for a full withdrawal, except that the portion of the plan's UAL that will be allocated to the partially withdrawing PLD will be based on the proportion of the PLD's covered payroll for that class of employees to the total covered payroll of the entire consolidated plan as of the valuation date.

The withdrawal liability payment can be paid in the same manner as in the case of a total withdrawal.

The PLD would continue to pay the employer rate (normal cost and UAL) on its covered payroll.

4.2.5 Change in Unfunded Actuarial Liability Amortization Method

The corridor method that has been used to set contribution rates was effective when the PLD Consolidated Retirement Plan remained funded at more than 100%. The method slowed the path to full funding, however, in the wake of the severity of the 2009 market losses.

The PLD advisory committee is recommending a change in method of the unfunded actuarial liability from the corridor to the calculated rate method to the MainePERS Board of Trustees for adoption.

4.3 RISK ALLOCATION AFTER CHANGES

The proposed structure of the PLD Consolidated Retirement Plan has a new risk distribution, which shares risk more fairly and predictably.

- **Members** bear market risk by sharing 45% of the annual market risk with employers through variable contributions within a contribution rate range of a portion of the normal cost as a minimum up to a 9% of payroll cap. They also bear the risk in building their own retirement security if benefits are increased or decreased.
- **Employers** bear market risk by sharing 55% of the annual market risk with members through variable contributions with a contribution rate range of the portion of normal cost not paid by members as a minimum up to a 12.5% of payroll cap. Employers also bear the risk of their own withdrawal liability.
- **Retirees** bear market risk when market conditions cause contribution rates to exceed the employer and member caps by having excess market losses smoothed into their annual cost-of-living-adjustments until the losses are recovered.
- **Taxpayers** bear normal budget risk of increases in the employer cap rate.

Modeling using a series of historical trust fund gains and losses demonstrates how market risk can affect the PLD Consolidated Retirement Plan stakeholders under the new framework. Cheiron modeled how the new framework would operate in a period of significant volatility, using a 25-year period beginning in 1960.

Employer and member rates are increased to their caps for an extended period. Cost-of-living-adjustments are not affected until losses begin to be smoothed in, and again begin to return to schedule when returns increase. Plan funding declines but steadily returns with market recovery. Contribution caps were set at a level acceptable to employers and members. Actual conditions or impacts on the cost-of-living adjustment may make employers and members receptive to slightly higher rates.

MainePERS strategic asset allocation set to reduce contribution rate volatility is expected to also have a dampening impact on fund volatility, which may or may not create differing impacts than this 25-year historical period of returns.

5. Transition to the New Structure

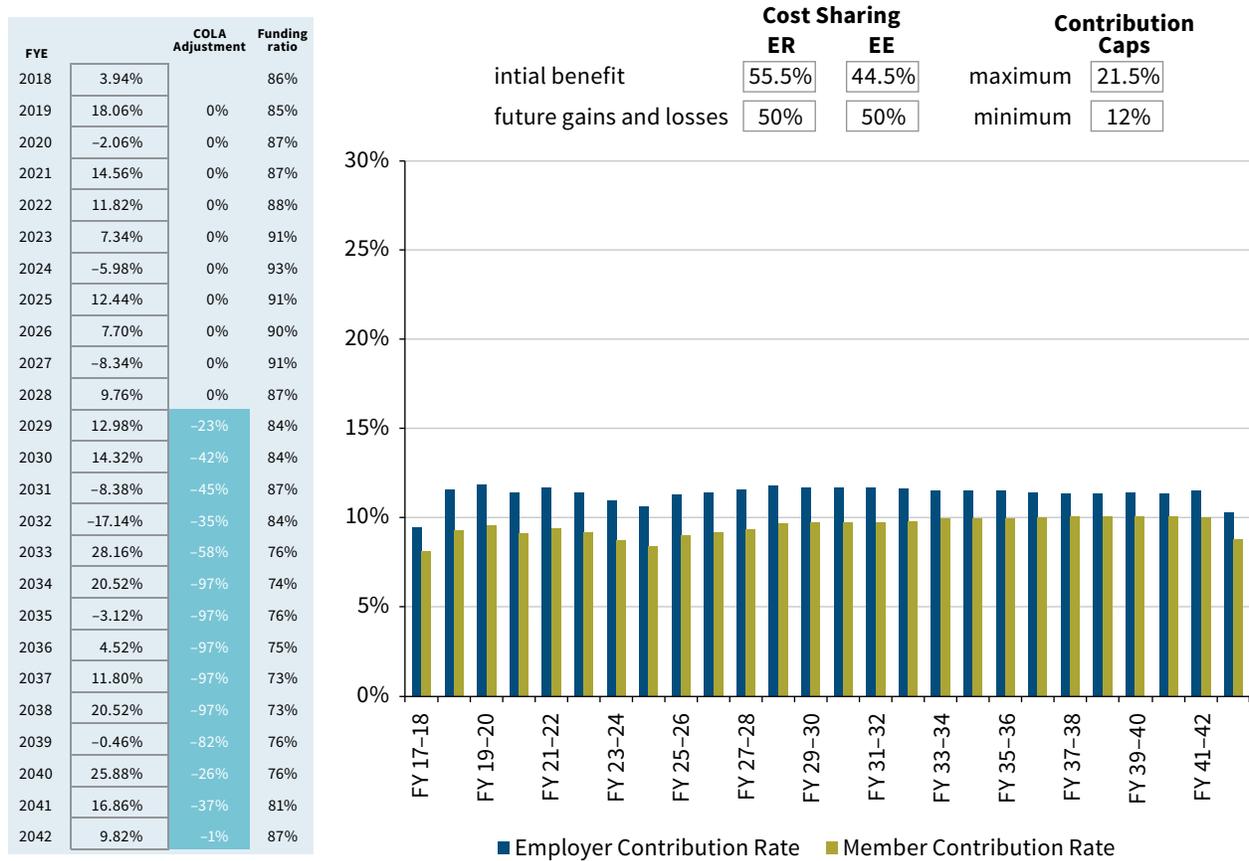
The transition to the new framework is in process. Implementation is targeted for July 1, 2018.

The first step in the transition process is stakeholder acceptance of the changes. Transition began in 2016 when the new risk framework was presented to the PLD Advisory Committee and the MainePERS Board of Trustees. The need for the new risk framework was modeled using a continuing low-interest, low-return environment and/or adverse market events. The modeling demonstrated that employer contribution rates could increase to 20% or more if these events occurred. All committee members understood this would be unacceptable to employers and that employers might begin to withdraw from the plan. See Figure 3 in section 2.3.

The PLD Advisory Committee spent a year understanding and modifying some of the benefit provisions of the risk-sharing framework. The MainePERS Board of Trustees was informed of the committee's work throughout the year.

FIGURE 6

MainePERS Participating Local District Consolidated Retirement Plan Risk Allocation Modeling



Source: Cheiron Modeling

5.1 TRANSITION STEPS

The PLD Advisory Committee reached tentative agreement on changes to the plan. Outreach to PLD Consolidated Retirement Plan members, employers and retirees to gauge their feedback was conducted during 26 two-hour presentations with approximately 500 participants throughout the state in September, October and November.

Most meetings included members, human resources, PLD managers, and occasional retirees. A separate set of retiree meetings were scheduled, with all but one meeting canceled due to lack of attendance. A comprehensive set of slides was used to create interactive discussion in each meeting. The MainePERS executive director provided all presentations for consistency. The slides have not been published because the outreach also served as a suggestion forum for possible changes to the framework.

Comments were recorded by hand and compiled. Feedback from these meetings was provided to the PLD Advisory Committee and the MainePERS Board of Trustees. One trustee and one committee member attended two different meetings and came away with the same impression as the summary of comments.

Overall, the proposed changes were well-received in the presentation. This is because the reasoning was clearly presented, and members and employers are interested in maintaining an attractive benefit at a reasonable cost that can be relied upon in retirement. There was some limited negative feedback, generally around changing incentives, subsidies and add-ons. In general, retirees did not attend, but overall those that did seemed to understand the need for change.

The PLD Advisory Committee will finalize their recommendations for changes in February 2018, which will then be presented to the MainePERS Board of Trustees.

5.2 IMPLEMENTATION

Changes are scheduled for a July 1, 2018, implementation. Steps in implementation include changes in actuarial amortization of the unfunded actuarial liability, legislation, agency rule-making, and communications with the full membership.

5.2.1 Legislation

The majority of PLD Consolidated Retirement Plan provisions are codified in agency rule. Changes to legislation are primarily focused on clarifying the MainePERS Board of Trustees authority to codify change in agency rule.

MainePERS will conduct a rule-making hearing on the changes. Rule-making is a formal three-step process in which the changes are identified and announced, an open public hearing is held, and/or written comments are received by the board of trustees, and the board takes final action.

5.2.2 COMMUNICATION WITH FULL MEMBERSHIP

Communication with the full membership will occur in at least two major forms. The first form is communicating the changes that the board will be considering under rule-making. This will enable individuals to be heard in the formal hearing. Once the final changes are adopted, a dedicated newsletter explaining the changes will be mailed to all active and inactive members, employers, and retirees.

6. Administrative Burden

MainePERS has the existing infrastructure to accommodate these changes without any additional administrative burden. MainePERS does not anticipate employers will select the higher cost, higher risk option but will have it available for any employers that wish to do so.

7. Funding and Investment Strategies for Sustainability

MainePERS considers its trust fund asset allocation to be its primary investment risk moderator. In general, traditional investment vehicles meet the needs of the risk model. New investment instruments are not specifically needed for the changes to the benefit and risk structure of the PLD Consolidated Retirement Plan. However, new investment vehicles have been adopted in the context of a strategic asset allocation that enables the asset allocation to be the primary risk moderator.

7.1 SETTING INVESTMENT GOALS AND OBJECTIVES

The system conducted a formal process in 2012 to identify major risks and to review its long-term investment strategy. This process involved the trustees, executive director and investment team, with joint participation by the system's general investment consultant and Cheiron.

MainePERS examined investment risk to determine its key investment goals and objectives. This process revealed that contribution rate volatility was the common factor among all investment risks. Contribution rates impact member and employer costs and budgets, and are a key factor in decisions to remain in the PLD Consolidated Retirement Plan. As a result, and as discussed earlier, contribution rates that are too high can lead to reactionary reductions in basic benefits for future members, ancillary benefits for current members, or arbitrary cost-of-living-adjustments reductions or freezes. Therefore, contribution rate volatility was elected as the key measure around which to base the plan’s investment objective.

An acceptable level of contribution rate volatility was determined by evaluating potential scenarios developed by the MainePERS investment consultant and Cheiron. By eliminating scenarios as either too expensive (very low contribution rate volatility leading to high contributions) or too risky (large year to year changes in contribution rates), MainePERS and the Board of Trustees selected an acceptable target level of contribution rate volatility.

7.2 STRATEGIC ASSET ALLOCATION

The strategic asset allocation to support the level of contribution rate volatility adopted by MainePERS was changed and adopted. See Table 9.

TABLE 9

Strategic Asset Allocation

MAINEPERS STRATEGIC ASSET ALLOCATION		Target		Actual
		2011	2017	12-31-17
Growth	Public Equity	55.0%	30.0%	37.7%
	Private Equity	5.0%	15.0%	12.4%
Risk Diversifiers		0.0%	10.0%	5.0%
Hard Assets	Real Estate	10.0%	10.0%	9.3%
	Infrastructure	5.0%	10.0%	8.2%
	Natural Resources	0.0%	5.0%	3.7%
Credit	Traditional Credit	10.0%	7.5%	9.0%
	Alternative Credit	0.0%	5.0%	1.7%
Monetary Hedge	US Government Securities	15.0%	7.5%	12.4%
	Cash	0.0%	0.0%	0.6%
		100%	100%	100.0%

Source: MainePERS Policy

Notable changes from prior asset allocations are:

- **High level of “alternatives.”** At 45%, the weighting to private market asset classes (Private Equity, Real Estate, Infrastructure, Natural Resources, and Alternative Credit) is high by public pension standards. The allocation is considered appropriate for the system in light of its low liquidity needs and long-term investment horizon.
- **Risk diversifiers.** These are investments typically made through private funds (“hedge funds”) that generally invest in listed assets such as stocks, bonds, and commodities, via strategies that are expected to have little correlation with public markets. These investments primarily derive their return from active manager skill as opposed to market directionality.

7.2.1 Strategic Asset Allocation in Practice

Based on risk modeling and the investment consultant's forecast, the strategic asset allocation has reduced the expected severity of sharp downturns in the trust fund due to negative future market events such as the 2009 financial crisis, especially if any downward trend in public markets is limited to a year or two in duration.

8. Regulatory Compliance

There are no regulatory compliance issues with the changes under consideration. Some changes require a change in Maine law or administrative rule, which are anticipated to proceed successfully.

9. Application to Other Retirement Income Spaces

The changes in process for the PLD Consolidated Retirement Plan could likely be successful in many other statewide or multiple-employer public defined benefit retirement plans. While these plan modifications may require legislative or other local regulatory body approval, they are based on sound analysis and are in the best interest of the member, that is, protecting their retirement benefit over the long term.

MainePERS' experience with these changes is that majority of members and employers that understand these changes have been thoroughly thought through and are being made in light of the current economic and shifting demographic environments. Most understand and appreciate that MainePERS has made accommodations for employers and members without sacrificing the security of the plan or plan benefits. If the same principles are adopted within other public entities considering similar changes, the change process should be successful.

Appendix A: Existing PLD Consolidated Retirement Plan Structure Before Changes

	EMPLOYEE CONTRIBUTION RATE	NORMAL RETIREMENT AGE (NRA) AND/OR YEARS OF SERVICE REQUIRED TO BE ELIGIBLE TO RETIRE	HOW SERVICE RETIREMENT BENEFIT IS CALCULATED	INCLUDES COLA?	NOTES
REGULAR PLANS					
AC	Through 6/30/2014: 6.5% 7/1/2014-6/30/2015: 7.0% 7/1/2015-6/30/2016: 7.5% 7/1/2016 and after 8.0%	First membership on/before June 30, 2014: Age 60 or 25 years of service** First membership on/after July 1, 2014: Age 65 or 25 years of service**	1/50 (2.0%) of AFC for each year of service 1/50 (2.0%) of AFC for each year of service	Yes	<ul style="list-style-type: none"> If you retire before age 60, benefit is reduced approximately 2 1/4% for each year you are younger than age 60 If you retire before age 65, benefit is reduced 6% for each year you are younger than age 65
AN	Same as Plan AC	Same as Plan AC	Same as Plan AC	No	Same as Plan AC
BC	Through 6/30/2014: 3% 7/1/2014-6/30/2015: 3.5% 7/1/2015-6/30/2016: 4%	First membership on/before June 30, 2014: Age 60 or 25 years of service** First membership on/after July 1, 2014: Age 65 or 25 years of service**	1/100 (1.0%) of AFC for each year of service 1/100 (1.0%) of AFC for each year of service	Yes	<ul style="list-style-type: none"> If you retire before age 60, benefit is reduced approximately 2 1/4% for each year you are younger than age 60 Available only to those districts that have Social Security coverage under a Section 218 agreement If you retire before age 65, benefit is reduced 6% for each year you are younger than age 65 Available only to those districts that have Social Security coverage under a Section 218 agreement
SPECIAL PLANS					
#1C	Through 6/30/2014: 6.5% 7/1/2014-6/30/2015: 7.0% 7/1/2015-6/30/2016: 7.5%	20 years of service	1/2 (50%) of AFC plus 2.0% of AFC for each year of service beyond 20 years*	Yes	<ul style="list-style-type: none"> Purchased military time may be used to meet service requirement to be eligible to retire only if (1) the same plan was in effect in your PLD before Consolidation and (2) your PLD elected to allow the use of this time to meet this requirement Purchased military time used as service beyond what is needed to be eligible to retire adds 2.0% of AFC per additional year of service to benefit
#1N	Same as Plan #1C	Same as Plan #1C	Same as Plan #1C	No	Same as Plan #1C
#2C	Through 6/30/2014: 6.5% 7/1/2014-6/30/2015: 7.0% 7/1/2015-6/30/2016: 7.5% 7/1/2016 and after 8.0%	25 years of service	1/2 (50%) of AFC plus 2.0% of AFC for each year of service beyond 25 years	Yes	<ul style="list-style-type: none"> Purchased military time used as service beyond what is needed to be eligible to retire adds 2.0% of AFC per additional year of service to benefit
#2N	Same as Plan #2C	Same as Plan #2C	Same as Plan #2C	No	Same as Plan #2C
#3C	Through 6/30/2014: 8% 7/1/2014-6/30/2015: 8.5% 7/1/2015-6/30/2016: 9.0%	25 years of service	2/3 (66.67%) of AFC plus 2.0% of AFC for each year of service beyond 25 years*	Yes	<ul style="list-style-type: none"> Available only for firefighters, police officers, sheriffs, full-time deputy sheriffs and certain county corrections employees Purchased military time can be used to meet service requirement to be eligible to retire Purchased military time used as service beyond what is needed to be eligible to retire adds 2.0% of AFC per additional year of service to benefit
#3N	Same as Plan #3C	Same as Plan #3C	Same as Plan #3C	No	Same as Plan #3C
#4C	Through 6/30/2014: 7.5% 7/1/2014-6/30/2015: 8.0% 7/1/2015-6/30/2016: 8.5%	Age 55 with 25 years of service	1/50 (2%) of AFC for each year of service	Yes	<ul style="list-style-type: none"> Available only for firefighters, police officers, sheriffs, full-time deputy sheriffs and certain county corrections employees Purchased military time can be used to meet service requirement to be eligible to retire If you retire before age 55, benefit is reduced for each year you are younger than age 55 Approximately 2 1/4% if membership under the plan began on/before 6/30/2014 6% if membership under the plan began on/after 7/1/2014
#4N	Same as Plan #4C	Same as Plan #4C	Same as Plan #4C	No	Same as Plan #4C

*The additional 2% per year is only for service earned after you become a member under the PLD Consolidated Plan, unless this provision was included in your PLD's retirement plan before it entered the PLD Consolidated Plan.

**Date membership under the Plan began.

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Comments on

“Multiple Employer Pension Plan Risk-Sharing Model”

By Jean-Pierre Aubry

A Brief Summary of the Evolving Retirement Landscape for Government Plans

At its core, the basic retirement formula is quite simple: contributions + investment returns = benefits. This basic truism holds whether the retirement vehicle is a defined benefit pension (DB), 401(k), or individual retirement account (IRA). As such, the basic challenge for any system designed to provide financial support in retirement is to manage the possibility that actual values in the equation shift from expectations. Today, investment risk is a primary concern as interest rates have declined and retirement systems have needed to reach for yield to maintain initial retirement goals while limiting contribution increases. Other risks to retirement security—primarily longevity risk—have also increased. Table 1 presents an admittedly simplified view of the investment and longevity risk faced by employers and plan participants in different types of retirement systems.

TABLE 1

Employer and Employee Investment Risk and Longevity Risk, by Plan Type

	Investment Risk		Longevity Risk	
	EMPLOYER	PLAN PARTICIPANT	EMPLOYER	PLAN PARTICIPANT
Defined Benefit				
Final Average Pay (Classic)	High	Low	High	Low
Career Average Pay	High	Low	High	Low
Shared Risk Retirement Plan	Med	Med	Med	Med
Cash Balance	Med	Med	Low	Med
DB/DC Hybrid				
Parallel Hybrid	Med	Med	Med	Med
Stacked Hybrid	Med	Med	Med	Med
Defined Contribution				
Individual (Classic)	Low	High	Low	High
Pooled	Low	Med	Low	Med

The two predominant plan types in the North America are the classic defined benefit (DB) and defined contribution (DC) plan. But other plan types are increasing in popularity among government-run retirement systems (see Table 2). Specifically, the Shared Risk Retirement Plan (SRRP)—for many years the purview of mainly the Netherlands—has emerged as one way to share risks more equitably among plan stakeholders. A key difference between SRRPs and other plan types that share risk (such as cash balance and DB/DC hybrids) is that most SRRPs explicitly recognize risk at the outset of the plan design and prescribe automatic adjustments among various stakeholders to deal with it.

TABLE 2

Major Government-Run SRRPs, Cash Balance, and DB/DC Hybrids in the US and Canada

SRRP	CASH BALANCE	DB/DC HYBRID
Arizona PSPRS	Kentucky RS	Georgia GSEPS
Arizona SRS	Nebraska County ERS	Indiana PRS
California PERS	Nebraska State ERS	Michigan Public Schools
Houston Firefighters	Texas County and District RS	Oregon PERS
Houston Municipal	Texas Municipal RS	Pennsylvania PSERS
Houston Police		Pennsylvania SERS
MainePERS PLD		Rhode Island ERS
New Brunswick		Tennessee RS
Ontario Teachers		Utah RS
Wisconsin RS		Virginia RS

The Shared Risk Plan for the Maine Public Employees Retirement System (MainePERS) Participating Local Districts Consolidated Retirement Plan (PLD Consolidated Retirement Plan)

In 1994, the MainePERS PLD Consolidated Retirement Plan was formed as a classic DB plan. As a relatively young plan with little in initial unfunded liabilities, MainePERS was able to implement a comparatively stringent method for managing unfunded liabilities—allowing only 15-year amortization of actuarial gains and losses (and extending it to 20 years in 2015). Most plans—which were older and saddled with larger legacy debts—allowed at least 20-year amortization and more often 30-year. During most of the 1990s and early 2000s actuarial gains and losses were relatively small and MainePERS’s stringent amortization methods served the plan well—keeping it well funded and limiting intergenerational transfers. However, the investment losses of 2009 and the specter of persistent actuarial investment losses afterward introduced new strains on the existing system. Rather than stay with the classic DB model and perhaps adjust their amortization methods (as some plans did during the crisis), MainePERS took a novel approach to managing employer costs by shifting to an SRRP model that explicitly involved employees and retirees in the management of actuarial gains and losses.

To be successful and sustainable, MainePERS must allocate plan risks and benefits among various stakeholder groups in a way that is perceived as “fair” by each group. Currently, the PLD Consolidated Retirement Plan follows a common SRRP approach by managing the brunt of plan risk through variable employee and employer contribution rates that automatically adjust to remain a constant share of the total contribution rate, with any residual risk placed on retirees through limiting COLAs. This approach to risk sharing stems from standard perceptions regarding which stakeholders can most easily bear the risk—with employers being arguably the most able, then employees, and finally retirees (many retired members of the PLD Consolidated Retirement Plan are not covered by Social Security).

While the PLD’s risk-sharing approach is reasonable, it may not always be seen as fair by the various stakeholder groups. For example, a significant portion of actuarial gains and losses are associated with retirees and managing those risks through employee contribution rates before retiree COLAs is not unequivocally “fair” to active employees.¹ One could imagine an SRRP that separately amortizes retirees’ actuarial gains and losses by adjusting COLA first and then through contributions. Additionally, because active employees often have many years over which to spread the cost of retirement benefits,

¹ If the cost of increased employer contributions is passed on to employees through lower employee compensation or lack of raises (as most economists believe), employees also share in the plan risk that is managed through changes to employer contribution rates.

they might prefer to spread the costs of active employees' actuarial gains and losses over the average expected work life. Finally, some of the distributional consequences of a classic DB plan remain in the system. For example, because retirement benefits under the PLD Consolidated Retirement Plan are still based on final average pay, workers who spend the first 10 years of their careers in public service get much less from the system than those who spend the last 10 years of their career. Basing retirement benefits on career average inflation-indexed wages would correct some of the lingering effects of a classic DB that tend to short-change younger (and/or shorter-term) workers.²

SRRPs provide a promising way forward for retirement systems seeking a better way to share risk, but the PLD Consolidated Retirement Plan has yet to be fully field-tested and managing expectations of the various stakeholders can be tricky. Recent adjustments made by the Netherlands SRRP—opting to delay benefit cuts after initially announcing the need for benefit cuts following years of contribution increases—show that following through on agreed-upon protocols can be difficult.³ Although the actuarial models of the PLD system show steady contribution rates and funded ratios as evidence of success, the various stakeholder groups may one day chafe under MainePERS's current approach that increases contribution rates (which might lower take-home pay or future raises) before adjusting COLAs—especially active employees who would rather not bear the costs of retirees' actuarial losses. If the rationale for—and benefits of—sharing risk among the various stakeholder groups is not well articulated and repeatedly communicated, acceptance of the adjustments may falter precisely when the plan needs it the most. Fortunately, MainePERS administrators have made major efforts to educate and inform various stakeholder groups about the new plan design. To ensure the PLD Consolidated Retirement Plan remains viable, they must continue such efforts going forward.

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² Employee contribution rates for the Los Angeles County Employees Retirement Association (LACERA) increase with an employee's age of entry to offset some of the distributional differences related to an employee's time served in public service.

³ Reuters. Oct. 13, 2019. "Going Dutch? Low interest rates rattle 'world's best' pension system." Reuters. Nov. 19, 2019. "Netherlands spares pensioners cuts in 2020 as funds rebuild ratios."

Authors' Response to Comments by Jean-Pierre Aubry

By Sandy Matheson and Gene Kalwarski

The Consolidated Participating Local District Retirement Plan (PLD Plan) is a multiple-employer cost-sharing defined benefit retirement plan. MainePERS (Public Employees Retirement System) administers this plan available to more than 600 local Maine governments.

Defined benefit plan risk has often been viewed as the employers' because they bear the market risk, but risk also exists for members and retirees. The employer's risk has taken on new importance over the last 20 years as interest rates have declined and a shift to equities in the plan portfolio has created greater contribution volatility. Employers have begun sharing their risk with employees and retirees by lowering or eliminating cost-of-living adjustments (COLAs) and with future employees by reducing future benefits.

Repeated market slowdowns or downturns can therefore continuously and permanently decrease the value of the defined plan benefits while increasing their cost.

One of the distinguishing features of the PLD Plan is that employers join this plan voluntarily and can also leave at any time. They join and stay in the PLD Plan because they value the benefit it provides their employees and the value it brings to their recruitment and retention efforts. Employees also value the retirement benefit they earn.

The PLD Plan changes were developed within the framework of maintaining the value of the benefit so that both employers and members would continue to value it for the cost. This meant changing the way risk is distributed in a traditional model to a way where all participants accept risk proportionately.

Proportionate risk distribution is situational. Because this plan is optional for employers, they can leave the plan when the costs are too high. A significant number of employer departures opens up the possibility that the plan might no longer be able to pay benefits down the road.

Given this framework, risk was redistributed in a way that countered each party's greatest fear. Employers know there is a maximum amount they will owe and can plan for that during financial downturns or disasters without uncertainty. Employees also have a maximum amount. In exchange, they will not have any benefit reductions and will share in the market recovery through reduced rates. Retirees share in the risk with temporary COLA reductions, maybe even for an extended time if the downturn is severe or prolonged. But their COLA cap will not be reduced to lower the employer's cost.

Mr. Aubry's points are valid. There is no perfect alignment of risk. Perfect alignment may be impossible to achieve because each market downturn, recovery, prolonged slowdown, or prolonged bull market is different. We found that creating known ranges of certainty within which employer and employee costs and retiree COLAs can change while protecting the core lifetime benefit enabled our membership to accept these changes.

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