FINAL REPORT ON CONNECTICUT'S STATE EMPLOYEES RETIREMENT SYSTEM AND TEACHERS' RETIREMENT SYSTEM

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I. Executive Summary

A. The Challenge

The State of Connecticut administers six retirement systems. The two largest are the State Employees Retirement System (SERS), and the Teachers' Retirement System (TRS). Over the past decade, in spite of a concerted effort to fund by the State,[1] the funded status for both these systems declined by about 20 percentage points and, as of 2014, stood at 42 percent for SERS and 59 percent for TRS – among the lowest in the nation. The total unfunded actuarial accrued liability (UAAL) for the two systems combined was $25.7 billion – $14.9 billion for SERS and $10.8 billion for TRS. As a result, in 2014, the State paid $1.8 billion to amortize the unfunded liability in both plans compared to about $400 million for benefits earned by current employees. And the State faces scheduled increases in amortization payments in order to fully extinguish the unfunded liability by 2032, as required under the current plan.

The State has requested an assessment of both SERS and TRS to:

a) identify factors that have led to today's unfunded liability;
b) project the systems' finances going forward under the current plan; and
c) present alternatives to shore up the systems' finances and improve budget flexibility.

B. Factors Driving Current Unfunded Liabilities

Three factors underlie the current unfunded liability of SERS and TRS: 1) legacy costs from benefits promised before the systems were pre-funded; 2) inadequate contributions once the State decided to pre-fund; and 3) low investment returns relative to the assumed return since 2000. For SERS, poor actuarial experience (particularly retirement patterns) relative to expectations also played a role.

Legacy Costs

Both systems have promised benefits to their members since 1939. But the benefits provided by SERS and TRS were not pre-funded until 1971 and 1982, respectively. Until then, benefits were paid each year from the State's general revenues. The many years of unfunded benefits accrued over that period saddled both systems with unfunded liabilities that today account for nearly $9.3 billion of the combined $26 billion unfunded liability. The remaining portion of the unfunded liability comes from funding shortfalls – due to inadequate contributions, low investment returns relative to expectations, and negative actuarial experience – after the start dates.

[1] Since 2001, the State has paid, on average, 90 percent of the annual required contribution (ARC) for SERS. For TRS, the State issued $2 billion in pension obligation bonds in 2008 and has paid 100 percent of the ARC since then. Prior to that, TRS funding was inconsistent; the State paid more than 80 percent of the ARC from 2001 to 2003, close to 70 percent in 2004 and 2005, and essentially 100 percent in 2006 and 2007.

Inadequate Contributions

Paying down the unfunded liability has two components: 1) calculating an appropriate amortization payment that keeps the UAAL from growing each year; and 2) making the full annual required contribution (ARC) payment. Connecticut has fallen short in both areas. Prior to 2000, SERS' calculated its amortization payments using a "level-dollar" approach that, if paid, would reduce the UAAL each year. But a lax statutory funding plan and multiple union agreements led the State to underpay for many years. From 2000 onward, the amortization payment was calculated using a "level-percent-of-payroll" approach that, even if paid, allows the UAAL to grow for many years before declining. So, while the State paid more of its required contribution after 2000 (State Employees Bargaining Agent Coalition agreements continued to allow for contributions below the ARC), the contributions were inadequate due to the choice of amortization method.

Unlike SERS, TRS has always used the less effective level-percent-of-payroll approach to calculate amortization payments. Additionally, a lax statutory funding schedule allowed TRS to underpay until 1992. Even after 1992, TRS continued to underpay – setting an unofficial policy of paying only 85 percent of the required contribution. The use of level-percent-of-payroll has added a combined $6.3 billion in unfunded liabilities to SERS and TRS ($2.3 billion and $4.0 billion respectively), while underpayment of the required contribution, however calculated, has added a combined $4.7 billion in unfunded liabilities to SERS and TRS ($3.2 billion and $1.5 billion respectively).

Actual Investment Returns Less than the Assumed Return

The impact of investment returns on plan finances depends on two factors: 1) the assumed return for the plan; and 2) the actual return. Achieving actual returns that are greater than what is assumed lowers the UAAL. Conversely, if actual returns are below what is assumed, it adds to unfunded liabilities. Prior to 2000, the actual investment return for both systems was much higher than each system's assumed return. In fact, from 1985-2000, the difference between each system's actual investment return and their assumed return *decreased* unfunded liabilities by a combined $5.4 billion (-$1.9 billion for SERS and -$3.5 billion for TRS). Since 2000, however, the returns for SERS and TRS have fallen short of their expected return, averaging only 5.6 percent annually compared to an assumed return of 8.5 percent for TRS and 8 percent for SERS (reduced from 8.5 to 8.25 percent in 2008 and then to 8 percent in 2012). From 2000-2014, the difference between each system's actual investment return and its assumed return has added a combined $8.9 billion in unfunded liability ($3.2 billion for SERS and $5.7 billion for TRS).

For SERS, Actuarial Experience

Actuarial experience has accounted for $4.1 billion in unfunded liabilities for SERS since 1985. Data from 2009 forward suggest that retirement patterns have been the primary source of poor actuarial experience. One reason may be the ad-hoc early retirement incentive programs (ERIPs) introduced in 1989, 1992, 1997, 2003, and 2009. These programs directly impact the retirement patterns of members and likely cause dramatic deviations from the existing actuarial assumptions for retirement. Overall, we estimate that at least $1.5 billion, or just over a third, of the $4.1

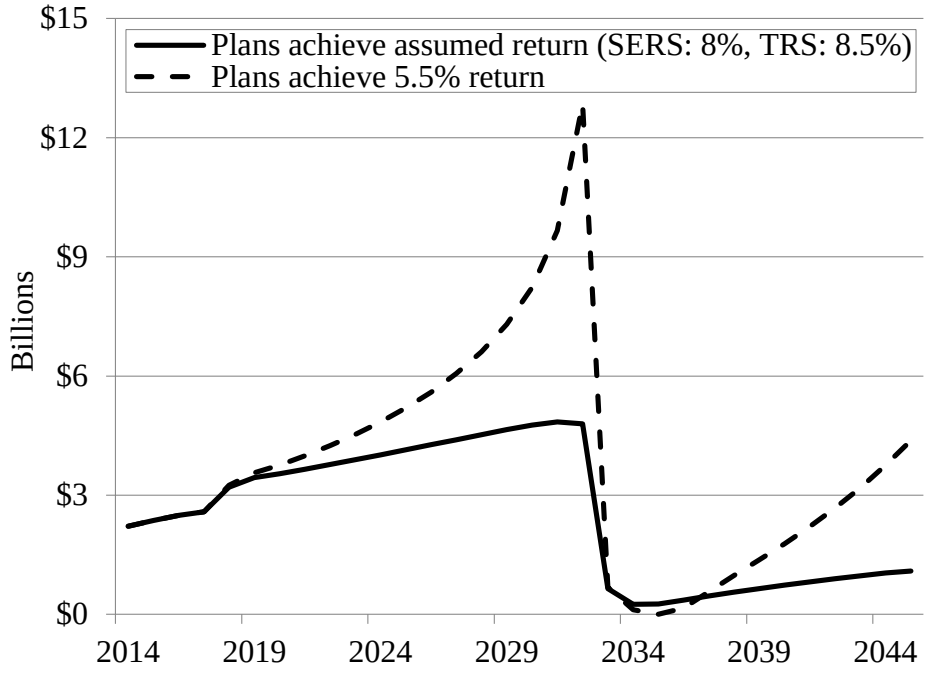
billion is directly due to the ad-hoc ERIPs (read: deviations in retirement patterns). The remaining portion comes from deviations in other assumptions such as mortality, turnover, and salary growth, and likely includes some residual impacts of the ERIPs.

C. Projections of SERS' and TRS' Finances

The main source of pension costs for the State going forward is the amortization of the unfunded liability of SERS and TRS. Currently, payment by the State to amortize the UAAL is about $1.8 billion, while the normal cost – the amount to fund benefits being earned by workers today – is only $400 million. In fact, when compared to similar plans across the nation, the normal cost for both SERS and TRS is below average as a percent of employee payroll. And, for SERS, the normal costs are expected to decline further as Tier III members with lower benefits replace current Tier II and IIA members.

Under the current plan, the UAAL for SERS and TRS is scheduled to be paid off by 2032, with costs expected to rise precipitously over the next 17 years as a result of scheduled increases due to the back-loaded amortization of the UAAL. If all actuarial assumptions are met, and the systems achieve their assumed returns, total costs for the two systems will rise steadily from $2 billion in 2014 to nearly $5 billion by 2032. The investment experience over the next 17 years is critical to the projection of costs. If, instead of realizing the assumed returns, the systems' investment experience is similar to the past decade, total annual costs for the two systems could balloon to $13 billion in order to be fully funded by 2032 (see Figure 1).

Figure 1. *Projected ARC for SERS and TRS Combined under the Current Plan, 2014-2045*



Source: CRR calculations based on various actuarial valuations for Connecticut SERS and TRS.

D. Alternatives to SERS' and TRS' Current Funding Methods

The future costs of SERS and TRS hinge on the same elements that have defined their pasts: addressing the unfunded liability, ensuring adequate contributions, and achieving their expected investment returns. Four key adjustments can help.

Shift to Level-Dollar Amortization of Unfunded Liabilities

The level-dollar approach front-loads payments compared to level-percent-of-payroll, but improves funded levels more quickly and is often easier for budgeting because payments stay fixed in dollar terms. Compared to a level-percent method, using a level-dollar amortization from 2014-2032 would reduce nominal contributions by 3.4 billion ($2.1 billion more over the first 9 years, but $5.5 billion less over the last 9 years). Even in the event of consistently poor returns, using a level-dollar method would reduce total nominal contributions by $3.2 billion over the 18-year funding period.

Replace 2032 Full-Funding Date with a Reasonable Rolling Amortization Period

While the 2032 full-funding date has the attractive quality of providing clear end point, it can also invite dramatic cost volatility if the system experiences any shocks as it approaches 2032 because the State must make up for those shocks over such a short period.

An open period delays full funding, but allows for easier management of unfunded liability costs by maintaining a set number of years over which any shocks (new unfunded liabilities) must be amortized.

Lower the Long-Term Assumed Investment Return

By lowering the assumed return, which also serves as the discount rate, the State will have to contribute more, but the pension systems are less likely to accrue unfunded liabilities due to returns that are below the assumed rate. A quick rule of thumb for the impact of a change in discount rate is that a 1-percent change causes a 12-percent change in the accrued liability and a 22-percent change in the normal cost. Using this rule of thumb, lowering the assumed return by half a percent would increase the employer contributions over the next few years to both SERS and TRS by a combined $225 million annually.

Separately Finance Liabilities for Members Hired before Pre-funding

Separately financing the liabilities associated with members hired prior to pre-funding recognizes the fact that benefits for members hired prior to pre-funding have been consistently underfunded (even after pre-funding started) while benefits for those hired after prefunding have been relatively well funded.

The two main policy arguments for separately financing the liabilities are intergenerational equity and the perception of benefit costs for current employees. First is intergenerational equity. The majority of members hired prior to pre-funding are now retirees. The unfunded liabilities associated with them were accumulated over multiple generations and the services these members provide are no longer being enjoyed by current generation because the members

are now retired. As such, it is not fair, from an intergenerational equity standpoint, to place the entire burden of funding the remaining benefits for these members on a single generation (as under the current plan). A longer time horizon for amortizing these benefits that spreads the costs over multiple generations would be more appropriate. The second argument is the undue burden that the cost of these benefits places on current employees. Today, the unfunded liability for members hired prior to prefunding represent a combined $21.1 billion of SERS' and TRS' combined $25.7 billion unfunded liability, while members hired after prefunding represent only $4.6 billion. Combining the pension costs for members hired prior to pre-funding with those for members hired afterward skews the perception of pension benefits for current employees by misrepresenting the pension cost of current employees to the taxpayer.

E. Conclusion

Both SERS and TRS face rising pension costs over the next 18 years if they continue with their current plan to fully fund the systems by 2032. The majority of these costs are a result of the relatively short time period over which each System has chosen to pay down its large UAAL. The UAAL is a product of nearly 40 years of unfunded benefit promises made prior to pre-funding in the 1970s and 1980s, as well as funding shortfalls after the systems started to pre-fund – namely inadequate contributions and investment returns (since 2000) falling short of assumptions. This report identifies four adjustments to the current funding plan both to address the costs associated with the years of unfunded benefits, and to prevent future funding shortfalls.

To address the costs associated with years of unfunded benefits:

- separately finance – over a long time horizon – the liabilities associated with members hired prior to the pre-funding.

To prevent funding shortfalls for ongoing benefits:

- shift to level-dollar amortization of unfunded liabilities;
- replace 2032 full-funding date with a reasonable rolling amortization period; and
- lower the long-term assumed investment return.

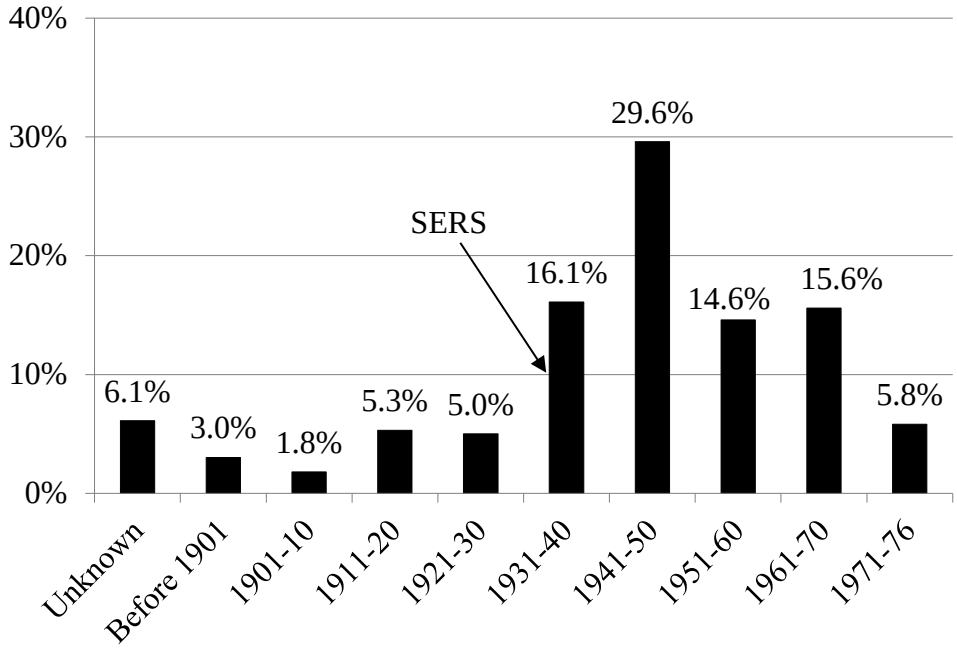
Implementing these changes will more fairly distribute the costs associated with unfunded benefits and better secure ongoing benefits for current employees.

II. Connecticut State Employees Retirement System (SERS)

A. A Brief History of SERS' Funding

SERS has been providing retirement benefits to its members since at least 1939 – longer than most state and local retirement systems in the United States (See Figure 2).

Figure 2. *Percentage of State and Local Plans Established or Significantly Restructured, by Date*

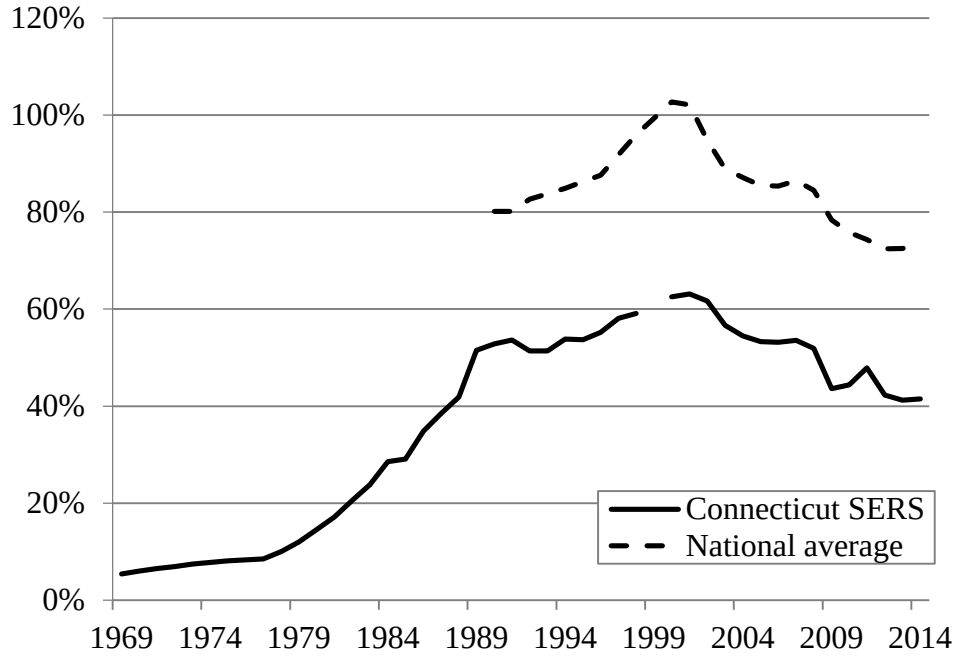


Sources: Various actuarial valuations for Connecticut SERS; CRR calculations based on PENDAT (1990-2000); and *Public Plans Database* (2001-2014).

With the passage of Public Act No. 666 in 1971, the State shifted from its long-standing practice of "funding" benefits on a pay-go basis to pre-funding retirement benefits actuarially (i.e. putting aside enough money in a trust each year while an employee is working in order to fund the payment of the employee's retirement benefits).

Figure 3 shows the funded status for SERS since its first actuarial valuation performed on December 30, 1969 and provides, for comparison purposes, the average funded ratio for all state and local plans from 1990 forward (data prior to 1990 were not available).

Figure 3. *Funded Ratio of Connecticut SERS Compared to the National Average, 1969-2014*



Note: Funded ratios for 1970-1971, 1973-1977, and 1979-82 were not available for SERS. CRR estimates these data points using a straight line approximation between actual data provided in 1969, 1972, 1978, and 1983. The year 2000 was estimated by taking the average of data in 1999 and 2001.
Sources: Various actuarial valuations for Connecticut SERS; CRR calculations based on PENDAT (1990-2000); and *Public Plans Database* (2001-2014).

Because benefits were financed on a pay-go basis prior to 1971, the system was essentially not funded in 1969 (a small amount of assets had been accumulated through employee contributions). At that point, SERS was 0 percent funded and had an unfunded liability of $712 million, equaling 284 percent of SERS' payroll. After 20 years of funding by the State, SERS entered the 1990s with a funded ratio of only 52 percent – well below the national average. And, its UAAL was about $2.7 billion – equal to 147 percent of payroll, compared to a national average of 56 percent. While SERS' funded ratio has remained below the national average over the whole period, it has shared a similar pattern, rising during the stock market boom from 1990-2000, and then declining through two financial downturns since 2000. Today, the unfunded liability of SERS stands at $15 billion, representing 428 percent of SERS' payroll compared to the national average of 185 percent.

B. Factors Driving Current Unfunded Liabilities in SERS

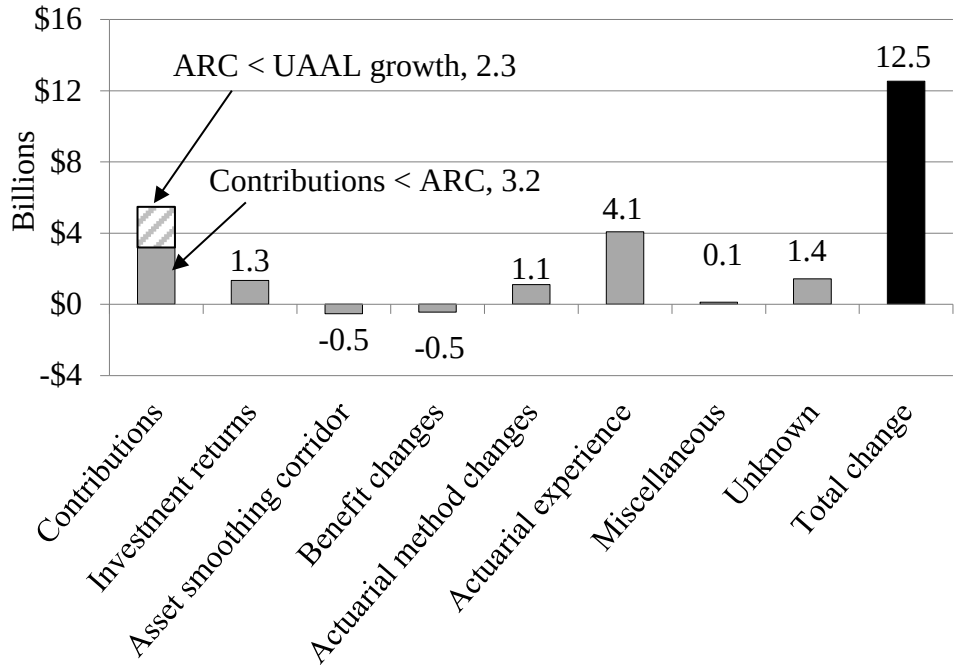
Four factors are behind SERS' current underfunding: 1) legacy costs due to benefits promised before SERS was pre-funded; 2) a history of inadequate contributions once the State decided to pre-fund; 3) low investment returns relative to expectations since 2000; and 4) poor actuarial experience, relative to expectations. Each factor will be discussed in detail below. Dollar amounts have not been adjusted for inflation.

Legacy Costs

A large portion of SERS' current unfunded liability stems from the many years of benefits promised without pre-funding. The burden of those unfunded benefits still lingers in the current finances of SERS, accounting for about $5.2 billion or about 35 percent of SERS' $14.9-billion unfunded liability.[2]

Because detailed data on SERS' unfunded liability from 1970-1985 are not available, the assessment of SERS' underfunding focuses on the change in the unfunded liability from 1985-present (see Figure 4). [3]

Figure 4. *Sources of Change to SERS' UAAL, 1985-2014*



Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

Since 1985, SERS' UAAL has grown by $12.5 billion – from an initial value of $2.5 billion to today's value of $15 billion. As the figure shows, the two largest contributors to the growth in the UAAL have been inadequate contributions and an adverse actuarial experience, including various Early Retirement Incentive Programs (ERIPs). However, other elements have also been significant, namely investment returns.[4]

[2] The total remaining liability for those hired prior to 1971 is estimated to be about $4.8 billion. Assuming that all liabilities are only 48 percent funded (the 2014 funded ratio of SERS), the unfunded liability for those hired prior to 1971 is equal to $2.5 billion.

[3] See the Appendix for the methodology of the UAAL analysis.

[4] See the Appendix for a detailed timeline of all the factors that have contributed to annual changes in the UAAL since 1985.

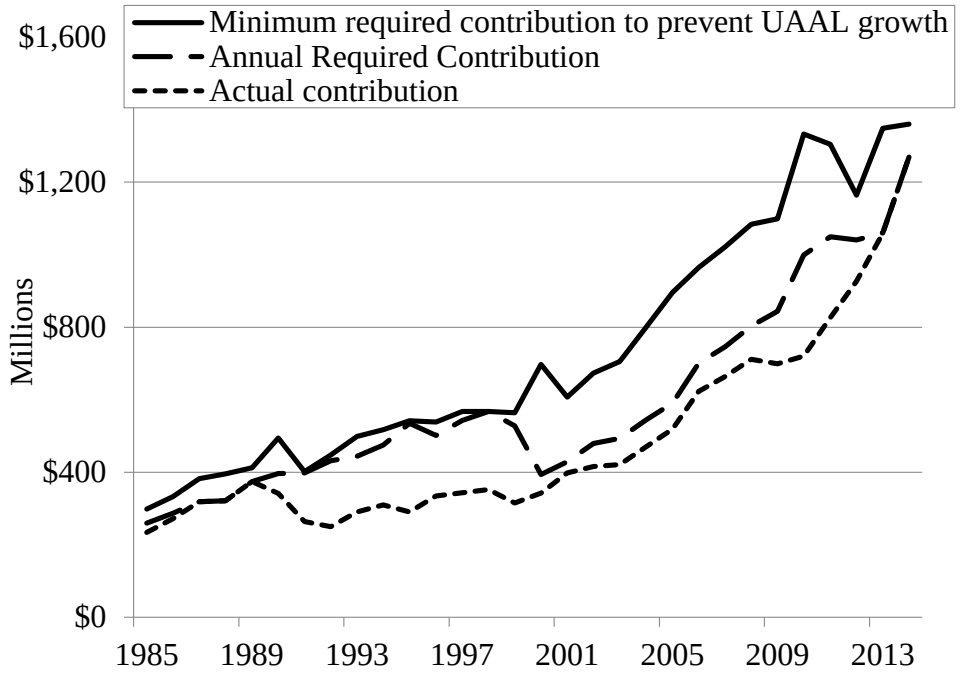
Inadequate Contributions

Paying down the unfunded liability has two components: 1) calculating an amortization payment that keeps the unfunded liability from growing each year; and 2) making the full payment. Connecticut SERS has fallen short in both areas. SERS' underpayment of the ARC began as soon as the State decided to pre-fund. At the outset, State law provided for a ramp-up schedule in the State's funding requirement such that, in 1972, the State was only required to pay 30 percent of the ARC. This percentage was scheduled to gradually increase each year until 1985, when the State would be required to pay the full ARC.

Figure 5 shows the minimum contribution required to prevent UAAL growth, the calculated ARC, and the actual contributions made from 1985-2014. From 1985-2000, SERS used a level-dollar method of amortizing the UAAL and the calculated ARC closely tracked the minimum contribution. And the State paid the full ARC for the first few years, thus limiting UAAL growth. Then, in the 1990s, the State began to underpay, allowing the UAAL grow significantly. Much of the underpayment was sanctioned by agreements between the State and employee unions, known as State Employees Bargaining Agent Coalition (SEBAC) Agreements 1-3. After 2000, SERS switched from a level-dollar method of amortizing the UAAL to a level-percent-of-payroll amortization method. This shift resulted in calculated ARC payments that fell far short of the minimum amount required to prevent the UAAL from growing. And SEBAC Agreements 4 and 5 continued to allow for contributions below the calculated ARC by the State. Since 1985, using the level-percent-of-payroll method to calculate the ARC and contributing less than the ARC have accounted for a combined $5.5 billion in unfunded liabilities ($2.3 billion and $3.2 billion, respectively).[5] Of the $3.2 billion due to contributions below the ARC, about $2 billion were a direct result of SEBAC agreements and other negotiated reductions.

[5] A smaller issue with the calculated ARC is that there is a delay between when the ARC is calculated and when it is scheduled to be paid. Because the calculated contribution is generally not adjusted to account for this difference in timing, contributions are often inadequate to address the unfunded liability that exists when the contribution is made. As a result, from 1985-1999 – even though SERS used the level-dollar approach – the scheduled ARC for each year was often just shy of the minimum required contribution.

Figure 5. *Minimum Contribution to Prevent UAAL Growth, ARC, and Actual Contributions for SERS, 1985-2014*

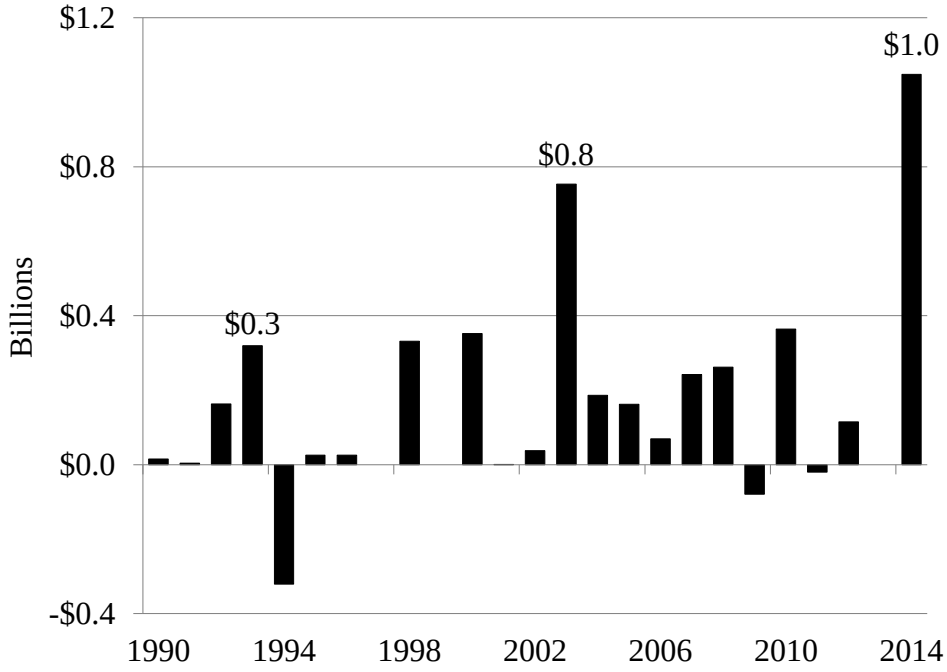


Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

Actuarial Experience

Actuarial experience has accounted for $4.1 billion in unfunded liabilities since 1985. While actuarial assumptions are not expected to precisely match experience in any given year (in some years, actual experience will fall below assumptions; in other years, it will overshoot), they should align over the long term. Figure 6 shows the annual impact of actuarial experience on SERS' UAAL from 1990-2014. In most years, the difference between assumptions and actual experience has resulted in increased liabilities.

Figure 6. *Annual Impact of Actuarial Experience on Unfunded Liabilities for SERS, 1990-2014*



Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

Most plans, including SERS, perform periodic experience studies to test how well assumptions have aligned with experience, and make adjustments if needed. Given these periodic reviews and adjustments, actuarial experience should have only a minimal impact on UAAL growth over time. However, this has not been the case for SERS. One reason may be the ad-hoc ERIPs introduced in 1989, 1992, 1997, 2003, and 2009. These programs directly impact the retirement patterns of members and likely cause dramatic deviations from the existing actuarial assumptions for retirement.

Figure 7 shows the impact that specific types of actuarial experience (turnover, retirement, mortality, or salary growth) have had on SERS' UAAL from 2009-2014. Although detailed data are not available prior to 2009, data from 2009 forward show that, recently, retirement patterns have been the primary source of UAAL growth from actuarial experience, supporting the notion that ERIPs may be a key factor in the poor actuarial experience.

Figure 7. *Impact of Specific Actuarial Assumptions on Unfunded Liabilities for SERS, 2009-2014*

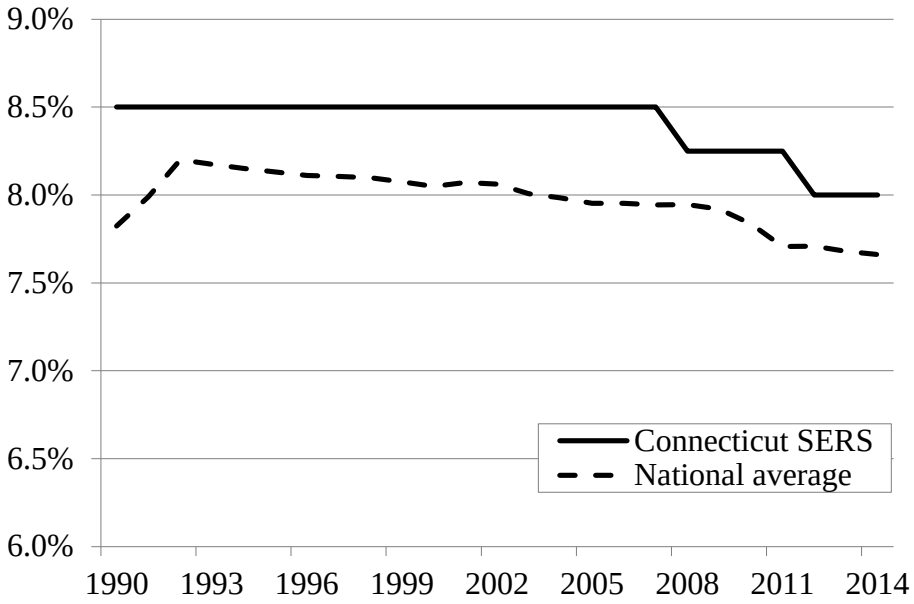
Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

Overall, we estimate that about $1.5 billion, or just over a third, of the $4.1 billion in unfunded liabilities from actuarial experience can be attributed to the ad-hoc ERIPs (i.e., deviations in retirement patterns). The remaining portion comes from deviations in other assumptions such as mortality, turnover, and salary growth.

Investment Returns

The impact of investment returns on the unfunded liability depends on the difference between the system's assumed and actual return. For SERS, this difference has generated $1.3 billion in unfunded liabilities since 1985. Figure 8 shows the SERS' assumed return compared to the national average from 1990-2014. Although SERS has lowered its assumed return from 8.5 to 8 percent in recent years, it still remains nearly 50 basis points above the national average.

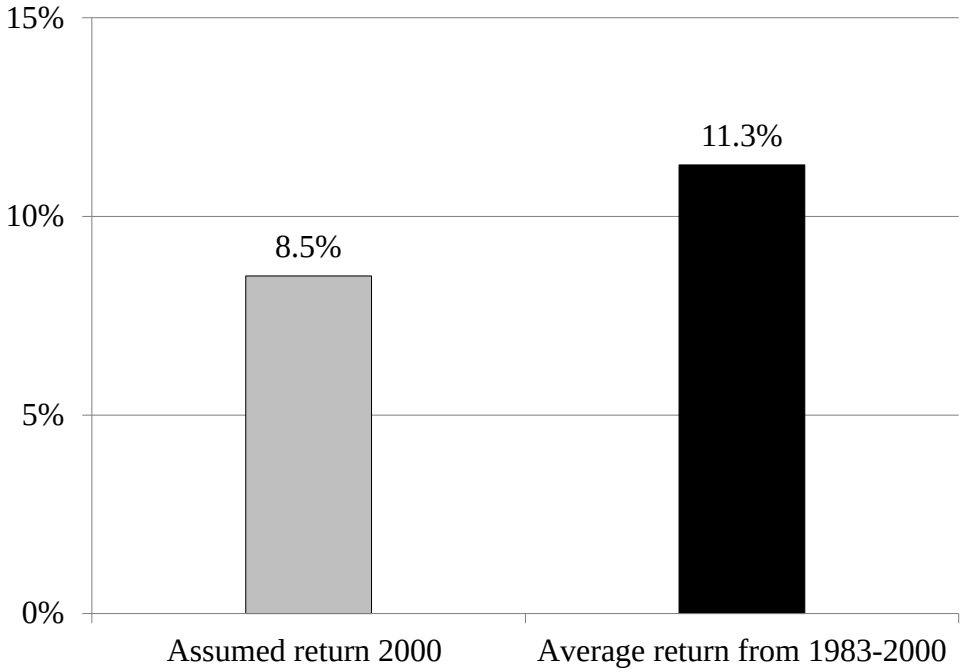
Figure 8. *Assumed Return for SERS Compared to the National Average, 1990-2014*



Sources: Various actuarial valuations for Connecticut SERS; CRR calculations based on PENDAT (1990-2000); and *Public Plans Database* (2001-2014).

The actual returns for SERS were studied over two distinct periods: 1983-2000, which included the stock market boom of the 1990s, and 2001-2014, which included the 2002 market downturn and the 2008-2009 financial crisis. Figure 9a compares the actual and assumed returns for SERS from 1983-2000. Over that period, SERS' actual investment return was almost 3.0 percentage points above its assumed return. As a result, prior to 2000, investment experience *reduced* the unfunded liabilities by $1.9 billion.

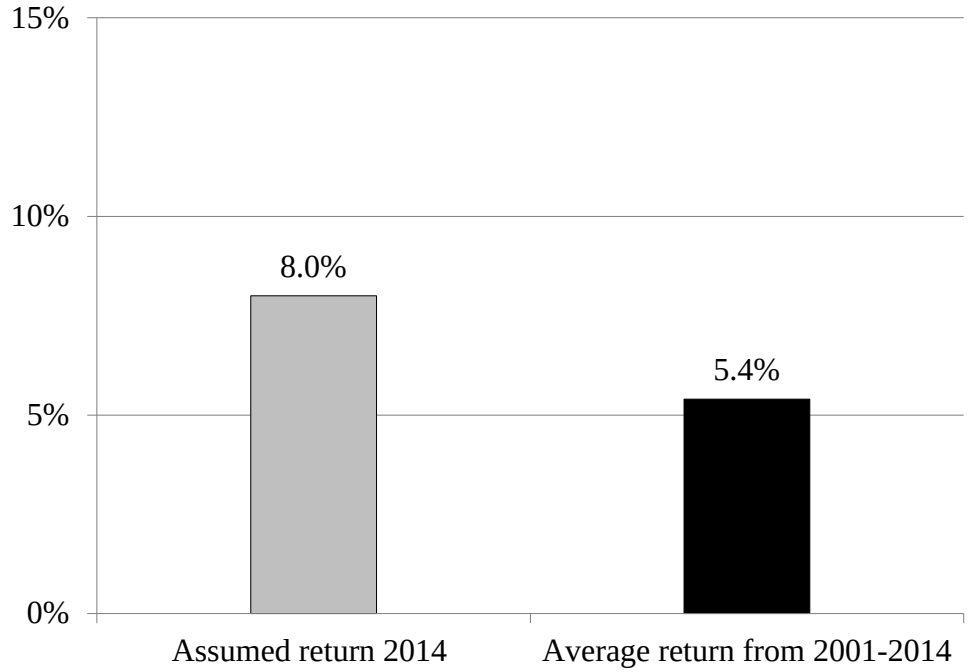
Figure 9a. *Actual and Assumed Investment Return for SERS, 1983-2000*



Sources: CRR calculations based on various actuarial valuations for Connecticut SERS; PENDAT (1990-2000); *Public Plans Database* (2001-2014); and U.S. Census Bureau (1983-2000).

Figure 9b compares the actual and assumed returns for SERS from 2001-2014. Unlike the earlier years, SERS' average return during this period was more than 2.5 percentage points below its assumed return. This investment experience added $3.2 billion in unfunded liabilities.

Figure 9b. *Actual and Assumed Investment Return for SERS, 2001-2014*



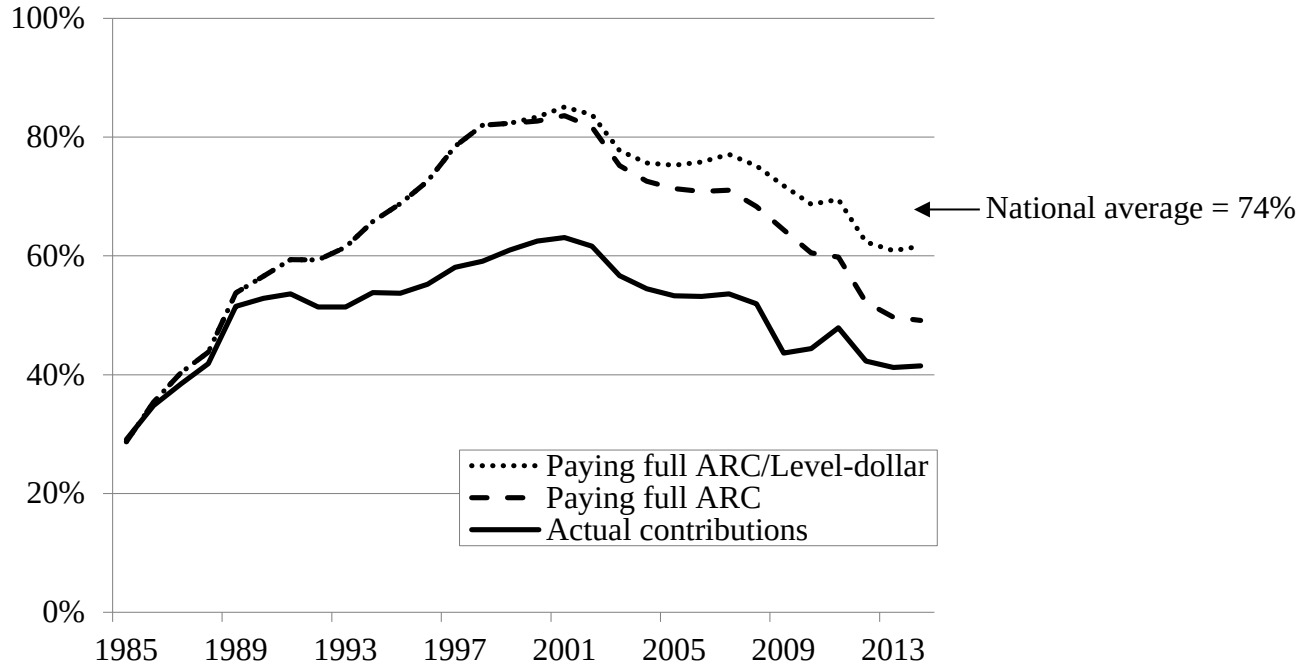
Sources: CRR calculations based on various actuarial valuations for Connecticut SERS; PENDAT (1990-2000); *Public Plans Database* (2001-2014); and U.S. Census Bureau (2001-2014).

C. An Alternate History for SERS: Controllable vs. Uncontrollable Factors

The majority of today's underfunding for SERS stems from the legacy of unfunded benefits, inadequate contributions throughout the State's history of pre-funding, low investment returns relative to the assumed return since 2000, and poor actuarial experience. Some of these factors mentioned above are more controllable than others. Nothing could be done about the initial legacy costs, other than to have had the State pre-fund benefits since SERS' inception. The poor investment and actuarial experience were difficult to fully control. However, calculating the appropriate contribution was definitely within the control of the State, and the State often knowingly underpaid the required contribution.

What would SERS' funded level be today if the plan had: a) fully paid the ARC from 1985-2014; and b) maintained a level-dollar amortization method throughout? To answer this question, we recalculated SERS' funded ratio over time under these two assumptions (see Figure 10).

Figure 10. *SERS' Funded Ratio under Various Funding Regimes, 1985-2014*



Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

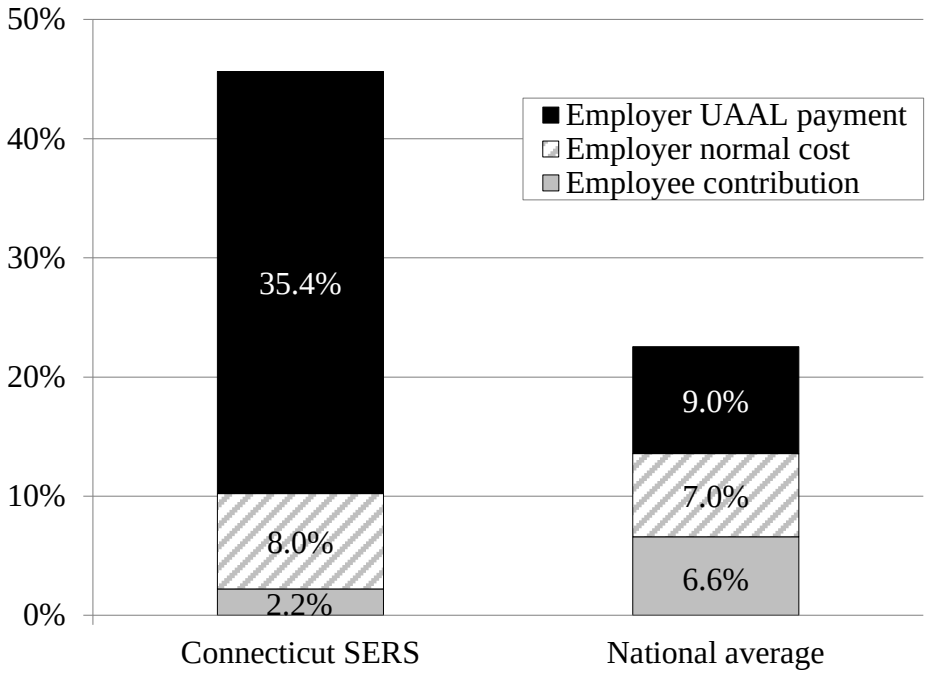
The figure shows that, if SERS had simply paid its full ARC, today's funded ratio would be about 10 percentage points higher. If the plan had also maintained a level-dollar amortization method after 2000, its current funded ratio would be 20 percentage points higher, jumping from 40 to 60 percent. Interestingly, the funded ratio for SERS would be below the national average even if the State contributed adequately, highlighting the importance of legacy costs, investment returns, and actuarial experience.

D. Projections of SERS' Finances

This section will project the funded ratio for SERS and the State's required contributions under the current agreement. Data points underlying the projection figures can be found in the Appendix tables.

The main cost driver for SERS is the unfunded liability from legacy costs and funding shortfalls, not overly generous benefits to members. The total normal cost as a percent of payroll (employee contributions plus employer normal cost) is a good way to compare plan generosity among plans. Figure 11 presents a breakdown of normal costs and amortization payments for SERS compared to the national average for similar plans. The figure shows two things. First, the majority of pension costs for the State is due to the unfunded liability. Second, the cost of benefits provided to current employees (the total normal cost) is actually below average. And, with the reduction in benefits for Tier III members, normal costs are projected to decrease from today's rate of 10.2 percent of payroll to about 9.2 percent of payroll once the Tier III members make up most of the workforce.

Figure 11. 2014 *Actuarial Costs as a Percent of Payroll for SERS Compared to the National Average, by Element*



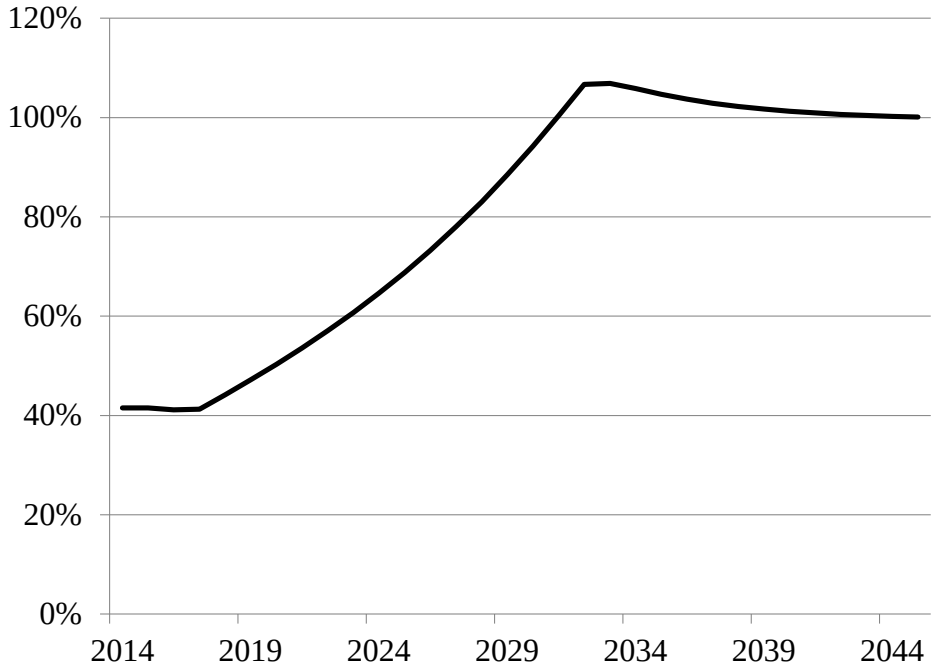
Source: CRR calculations based on 2014 actuarial valuations for Connecticut SERS, projections by the SERS actuary, and *Public Plans Database* (2014).

Two factors determine the annual payments needed to pay down the UAAL. First is the payment schedule (or amortization method): level-dollar payments vs. payments that are a level percent of payroll. Second is the type of amortization period: closed period (setting a fixed date for the plan to be fully funded) or open period (setting a perpetual time horizon for paying down the UAAL). If an open method is chosen, the perpetual time horizon over which to pay down the UAAL is also an important factor. The pros and cons of each are listed below.

- Level-dollar: front-loads payments compared to level-percent-of-payroll, but improves funded levels more quickly and is often easier for budgeting because payments stay fixed in dollar terms.
- Level-percent-of-payroll: back-loads payments compared to level-dollar, as payments increase in step with expected payroll growth. The funded level improves more slowly and budgeting may be tricky as the schedule calls for increasing payments each year.
- Closed period: has the attractive quality of setting a clear date by which the plan will be fully funded. Unfortunately, it can also invite dramatic cost volatility if the system experiences any shocks near the full funding date because the State must make up for those shocks over a short period.
- Open period: perpetually delays full funding, but allows for easier management of unfunded liabilities by maintaining a set number of years over which any shocks (new unfunded liabilities) must be amortized.

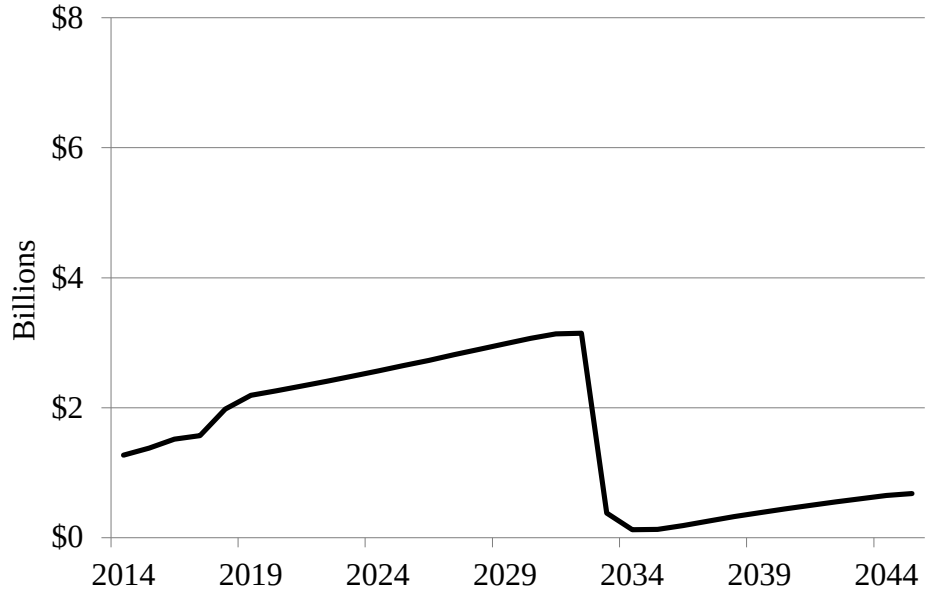
Under the current agreement, SERS' unfunded liability is to be paid off by 2032 (a closed period) using the level-percent-of-payroll amortization method. Figure 12 shows the funded ratio and Figure 13 shows the ARC (normal cost plus amortization payment) under the current agreement from 2014-2045. The projections assume the full ARC is paid each year and SERS achieves its assumed return of 8 percent. The funded ratio climbs each year to full funding by 2032. The ARC, primarily as a result of the amortization method, steadily rises each year from $1.3 billion in 2014 to $3.1 billion in 2032. Once the UAAL is paid off, costs drop precipitously to $380 million in normal cost payments.

Figure 12. *Projected Funded Ratio for SERS under the Current Agreement, 2014-2045*



Source: CRR calculations.

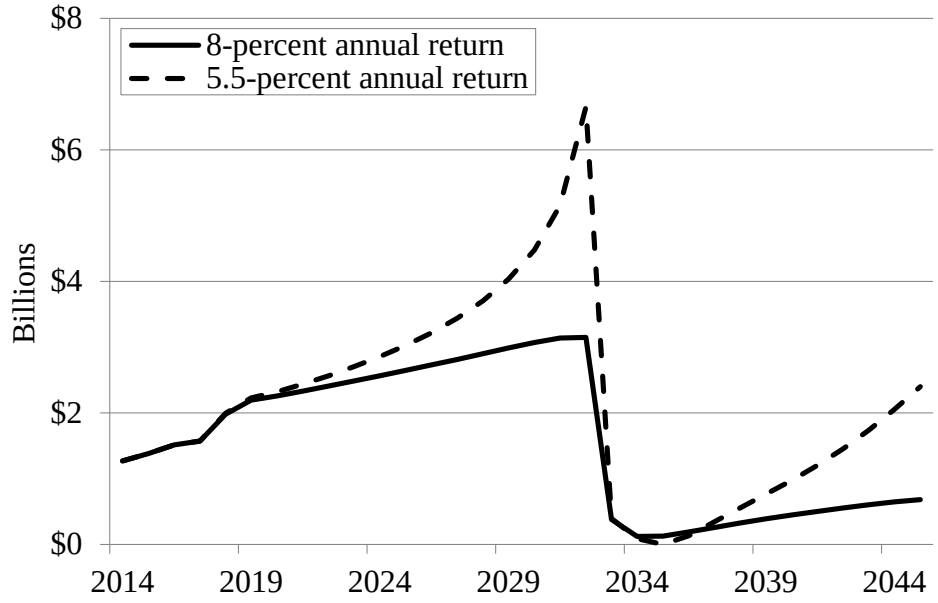
Figure 13. *Projected ARC for SERS under the Current Agreement, 2014-2045*



Source: CRR calculations.

The investment return is critical to the cost projection. If, instead of realizing the assumed return of 8 percent, the investment return for SERS is similar to the past decade, the ARC will rise from $1.3 billion in 2014 to $6.7 billion in 2032 (see Figure 14).

Figure 14. *Projected ARC for SERS under the Current Agreement with a 5.5-Percent Return, 2014-2045*



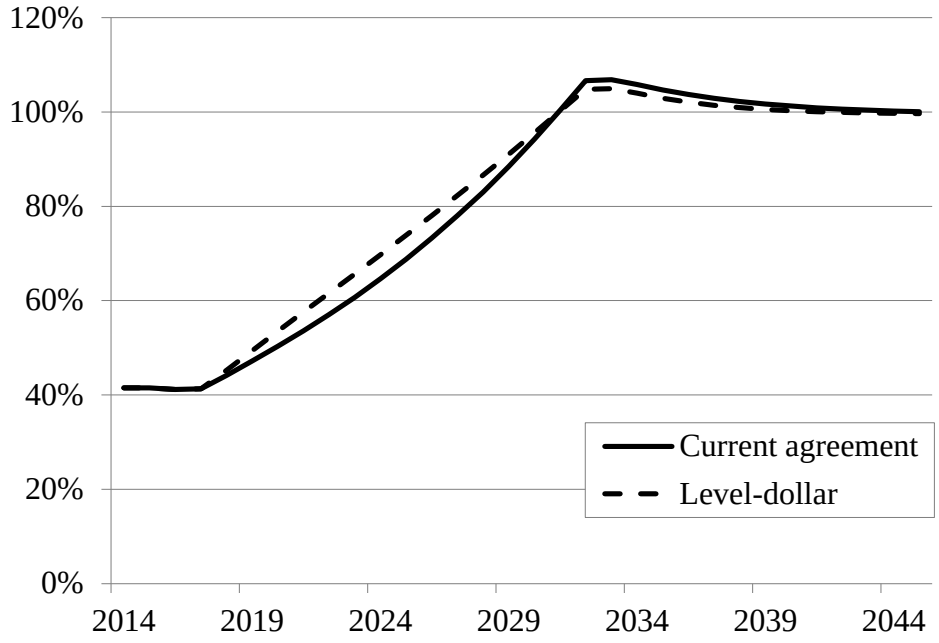
Source: CRR calculations.

F. Alternatives to SERS' Current Funding Methods

Alternative 1. Switch to a Level-Dollar Amortization of the UAAL
To limit the scheduled cost increases that result from using the level-percent-of-payroll method for amortizing the UAAL, one alternative for SERS is to switch back to the level-dollar method, which it used prior to 2000.

Figure 15 shows a projection of SERS' funded ratio under the level-percent-of-payroll and level-dollar amortization methods, maintaining the full funding date of 2032. Due to the backloading of amortization payments, the funded ratio under the level-percent-of-payroll method falls below that of the level-dollar method. However, because the 2032 full funding date is only 18 years away, the path of the funded ratio differs very little between the two methods.

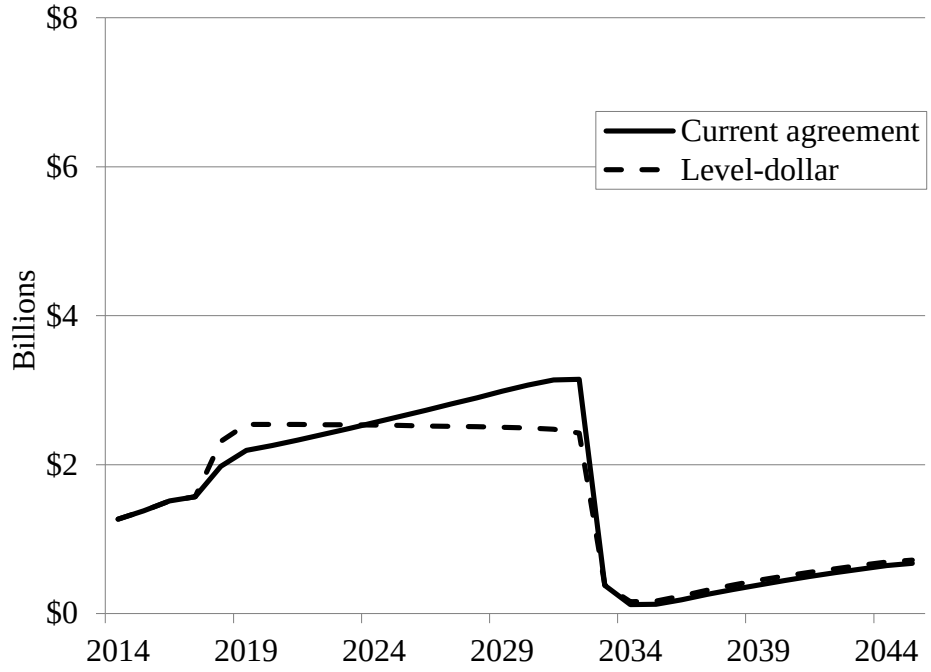
Figure 15. *Projected Funded Ratio for SERS under Alternative Funding Methods, 2014-2045*



Source: CRR calculations.

Unlike the funded ratio, the State's required contributions under a level-percent-of-payroll and level-dollar method have noticeably different trajectories (see Figure 16). Contributions under the level-percent-of-payroll method begin at $2 billion in the early years, but soon exceed the level-dollar payments, ultimately peaking at $3.1 billion in 2032. On the other hand, contributions under the level-dollar method remain relatively steady at just about $2.5 billion annually. In both cases, the State's costs drop dramatically once the plan achieves full funding.

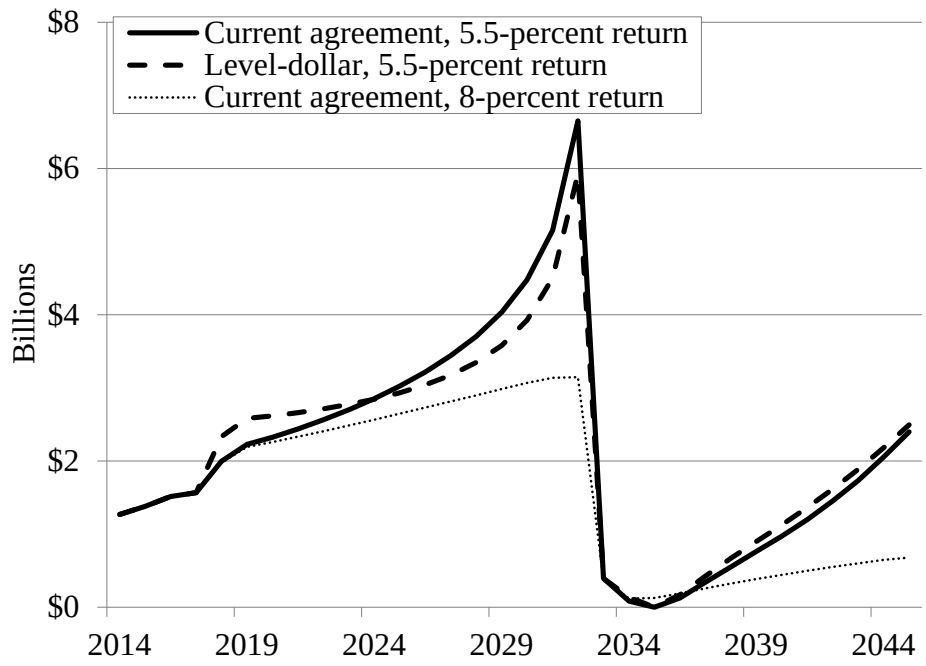
Figure 16. *Projected ARC for SERS under Alternative Funding Methods, 2014-2045*



Source: CRR calculations.

Once again, investment returns are integral to the cost projections. Figure 17 shows employer costs under the two amortization methods with a 5.5-percent return going forward. Under both funding methods, costs could rise to $6-$7 billion before dropping once the plan reaches full funding. For visual comparison, the light line in the figure shows projected costs under the current agreement and under an 8-percent return.

Figure 17. *Projected ARC for SERS under Alternative Funding Methods and a 5.5-Percent Return, 2014-2045*



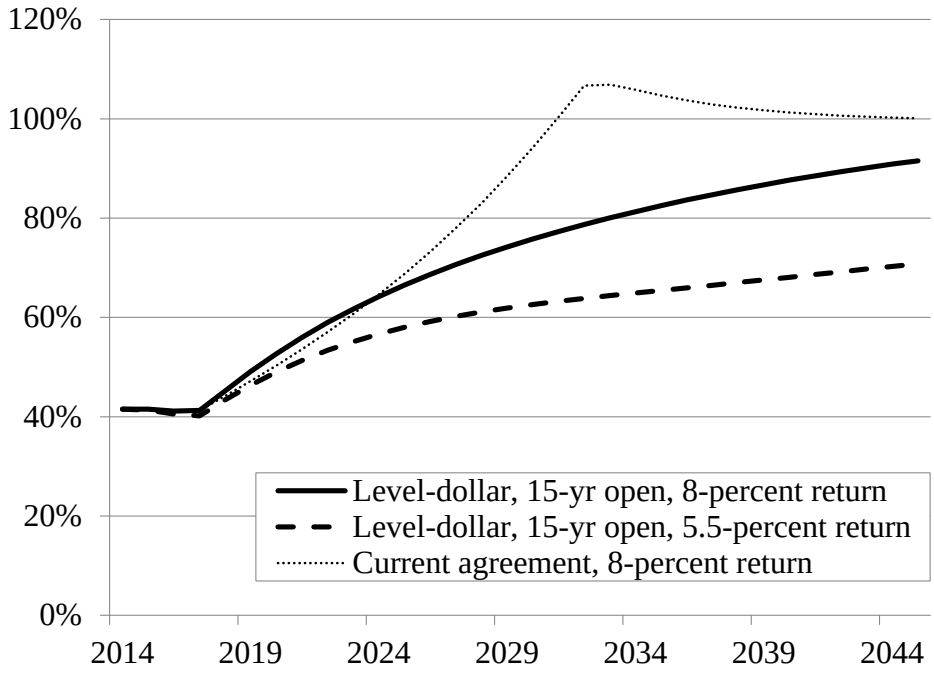
Source: CRR calculations.

Alternative 2. Switch to a Level-Dollar and 15-year Open Amortization of the UAAL

As the above figures show, maintaining the status quo may be quite costly for the State, especially if SERS does not realize its assumed 8-percent return. Switching to a level-dollar method provides little relief, as required contributions rise immediately. Additionally, in terms of budgeting, the precipitous drop in contributions once the plan reaches full funding is not practical. As such, it may be preferable to relax the 2032 full funding date in addition to using the level-dollar approach.

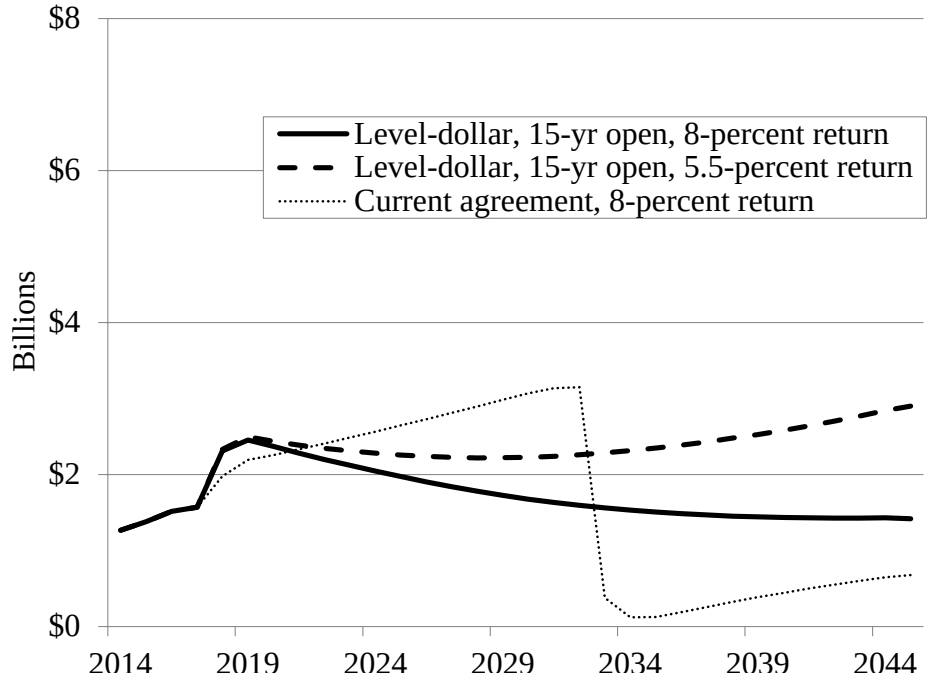
Figures 18 and 19 show the results of this approach under SERS' assumed return – 8 percent – and a 5.5-percent return (similar to the average return since 2000). The actual outcome will likely fall in between. While the 15-year open amortization approach does mitigate costs, it also delays full funding. This delay can be especially meaningful if returns are below expectations.

Figure 18. *Projected Funded Ratio for SERS under Level-Dollar, 15-yr Open Amortization, 2014-2045*



Source: CRR calculations.

Figure 19. *Projected ARC for SERS under Level-Dollar, 15-yr Open Amortization, 2014-2045*



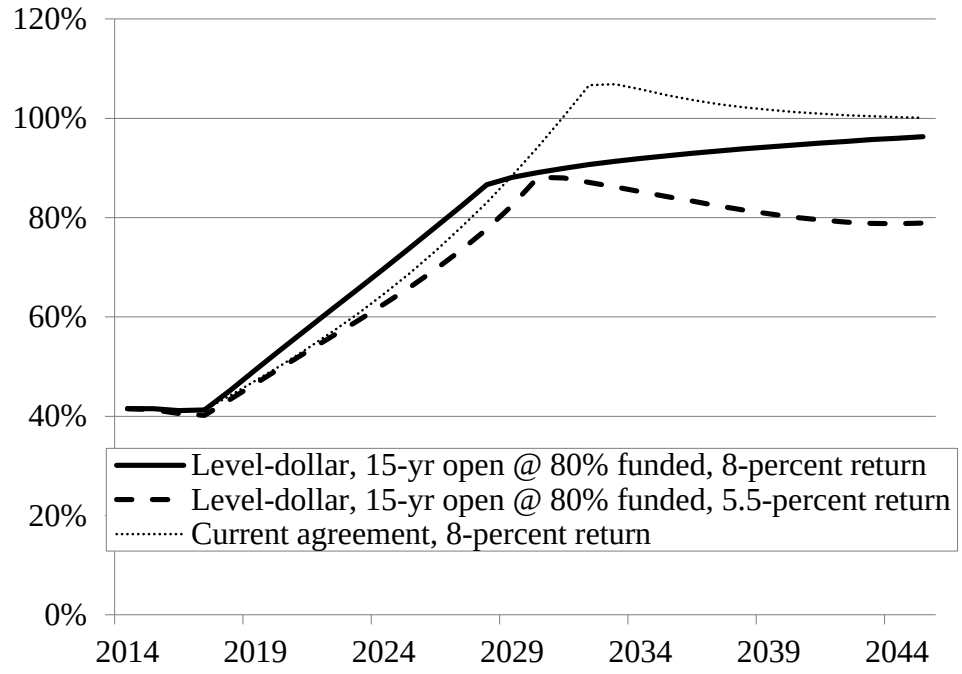
Source: CRR calculations.

Alternative 3. Relax 2032 Full-funding Date When 80 Percent Funded

Whether under a level dollar or level-percent amortization, the 2032 full-funding date presents real risks to the State of dramatic contribution rate volatility as the date approaches. Yet, shifting to a 15-year open amortization significantly delays funding improvements. One other approach is to maintain the 2032 goal until the plan reaches a lower funding threshold deemed to be adequate. At that point, relaxing the full-funding date may provide contribution rate relief, while not greatly risking the plan's fiscal health.

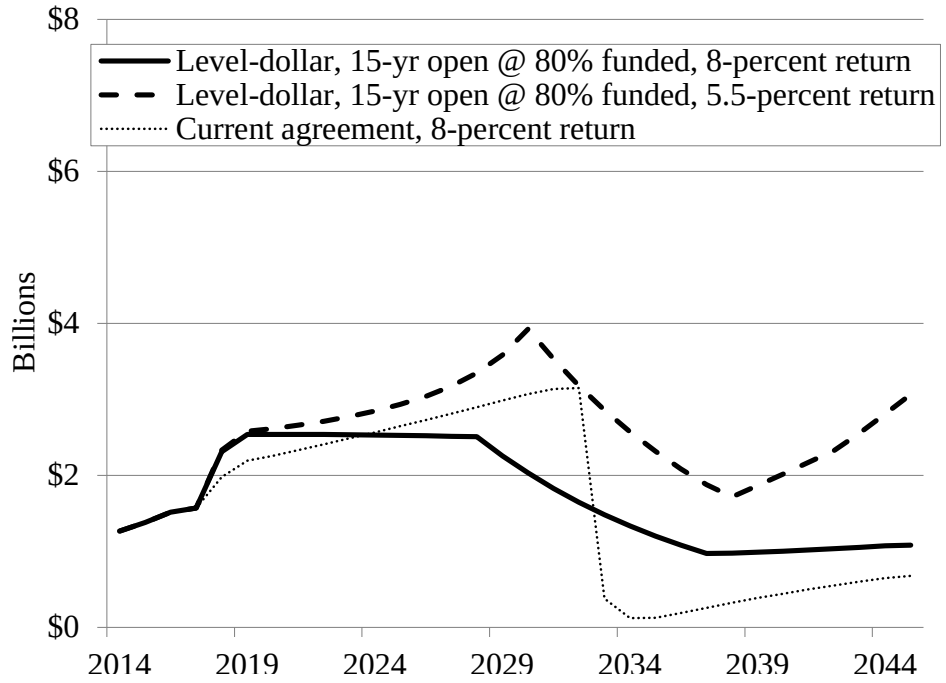
Figures 20 and 21 (below) show the funded ratio and State required contributions under a level-dollar amortization approach that maintains the 2032 full-funding date until SERS is 80-percent funded and then shifts to an open 15-year amortization. As the figure shows, under both the 8-percent and 5.5-percent return scenarios, funding improves quickly in the early years under the 2032 full-funding date and, when the plan shifts to an open amortization, contribution pressure is reduced, while maintaining reasonable funding.

Figure 20. *Projected Funded Ratio for SERS under Level-Dollar and 15-yr Open Amortization at 80-percent Funded, 2014-2045*



Source: CRR calculations.

Figure 21. *Projected ARC for SERS under Level-Dollar and 15-yr Open Amortization at 80-percent Funded, 2014-2045*

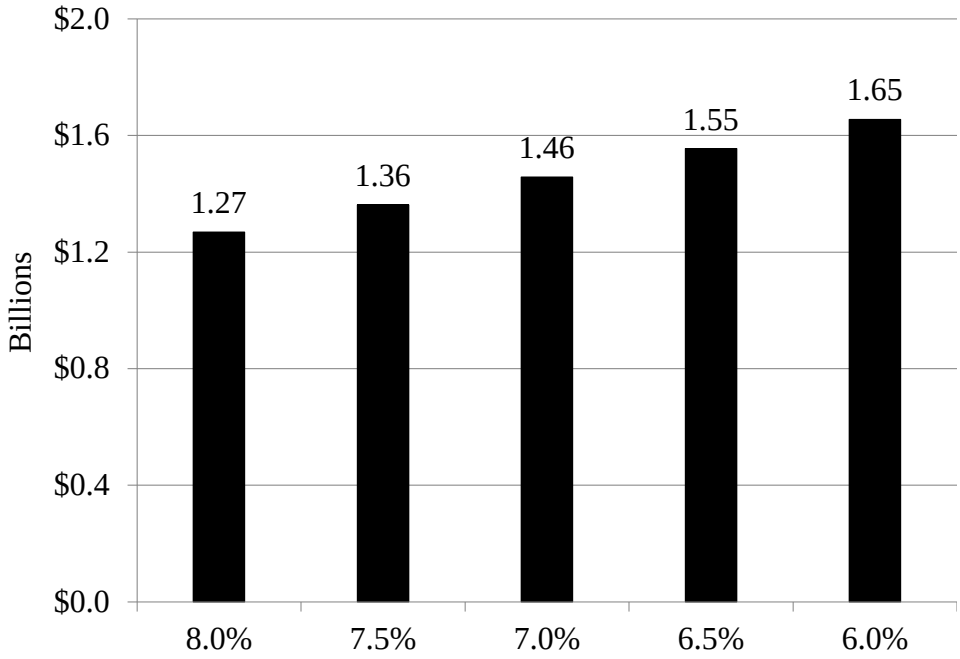


Source: CRR calculations.

Lowering the Discount Rate/Long-Term Assumed Return

The decision to change the long-term assumed return involves a clear trade-off. Reducing the assumed return means paying more into the system (to make up for lower expected returns). But, it also lowers the likelihood of paying amortization payments in the future for unfunded liabilities that arise due to investment performance that is below the assumed return. Conversely, increasing the assumed return means paying less up front, but it increases the likelihood of having to pay more to make up for unfunded liabilities that accrue if investment experience falls short. Figure 22 shows the impact of various discount rates on the 2014 ARC for SERS. It reflects the change in up-front costs from discount rate changes, but does not include the change in the likelihood of paying UAAL payments down the road if returns do not meet expectations.

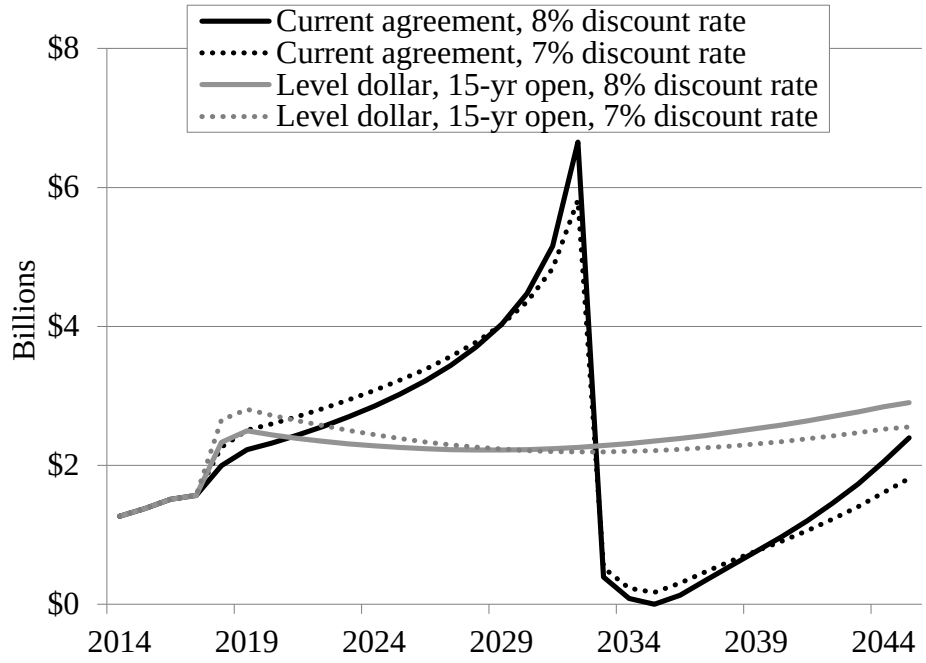
Figure 22. *2014 ARC for SERS under Various Discount Rates/Long-term Assumed Returns*



Source: CRR calculations.

Figure 23 shows the trajectory of costs for SERS under an 8-percent and 7-percent assumed return, given an actual return of 5.5 percent. The figure illustrates the trade-off described above. When compared to the 8-percent assumed return, the 7-percent assumed return requires greater contributions in the early years and less in the later years.

Figure 23. *Projected ARC for SERS under Various Discount Rates and a 5.5-percent Return, 2014-2045*



Source: CRR calculations.

Separately Finance Liabilities for Tier 1 Members

When considering alternatives for addressing SERS unfunded liability going forward, the separate financing of legacy costs, particularly for unfunded Tier 1 benefits, should be considered. As stated above, Tier 1 benefits were totally unfunded prior to 1971 and only partially funded from 1971-1985. However, accurately apportioning the *current* unfunded liability to each tier requires a detailed account of how each Tier has been funded over time. A tier-specific funding history is difficult to determine as all pension assets and contributions are commingled in a single retirement trust to finance benefit payments to *all* members, not individual tiers. Getting some sense of each Tier's individual funded status requires recreating the funding history for SERS as if each Tier were separately funded, with assets held in its own trust.[6] As shown in Table 1, the majority of SERS current unfunded liabilities are, in fact, for Tier 1, while the more recent Tiers are relatively well funded.

[6] We estimate annual liabilities and benefit payments for Tier I assuming a straight-line growth in liabilities and annual benefit payments from the SERS total levels (all Tier 1) in 1983 to the 2014 levels specifically for Tier 1 provided by the SERS administrators and actuaries. For Tier 1 employer normal cost contributions, we use the annual employer normal costs reported in the actuarial valuation. Tier 1 employee contributions are based on the reported payroll for each tier in the actuarial valuation and the member contribution rate. Investment returns for Tier 1 are assumed to be equal to the returns experienced by SERS as a whole. We back into the assets, liabilities, and unfunded liabilities for the remaining Tiers by subtracting Tier 1 estimates from the totals for SERS liabilities, assets, unfunded liabilities, and contributions reported in the annual valuations. Tier 1's amortization payment is proportional to SERS total amortization payment based on the proportion of the UAAL that Tier 1 represents two years prior.

Table 1. *2014 Assets, Liabilities, Unfunded Liabilities, and Funded Ratio for SERS, by Tier*

Tier	Assets (billions)	Liabilities (billions)	Unfunded liabilities (billions)	Funded ratio
Tier I	$3.7	$14.4	$10.7	25.4%
Tiers II, IIA, III	6.9	11.1	4.2	62.4
Total	10.6	25.5	14.9	41.5

Source: CRR calculations based on data from SERS Actuary and Connecticut SERS 2014 Valuation.

Today, the majority of Tier 1 members are retired, and nearly 85 percent of Tier 1 liabilities are for retirees (see Table 2). Thus, the current unfunded liability is primarily the product of benefit promises made to existing retirees (Tier 1) that were never properly funded. In contrast, benefits for most current employees (Tier II, IIA, and III) have been relatively well funded as they have accrued.

Table 2. *2014 Membership and Liabilities for SERS, by Tier*

Tier	Actives	Retirees	Active liability (billions)	Retiree liability (billions)
Tier I	2,281	29,214	$1.3	$13.1
Tiers II, IIA, III	47,695	16,589	6.1	5.0
Total	49,976	45,803	7.4	18.1

Source: CRR calculations based on data from SERS Actuary and Connecticut SERS 2014 Valuation.

Separately financing the liabilities associated with Tier 1 members recognizes the historical difference in the funding of benefits for Tier 1 members when compared to other Tiers. Benefits for Tier I members have been consistently underfunded (even after pre-funding began), and today are only 25 percent funded. Benefits for members of Tiers II, IIA, and III have been more dutifully funded, and today are about 62 percent funded.

The two main policy arguments for separately financing Tier 1 liabilities are intergenerational equity and the perception of costs for current employees. First is intergenerational equity. The unfunded liability for Tier 1 has been accumulated over multiple generations, and the services provided by those members are no longer being enjoyed by current generations because most Tier 1 members are now retired. As such, it is not fair to place the entire burden of funding the remaining Tier 1 benefits on a single generation (as under the current agreement). A longer time horizon for amortizing Tier 1 liabilities that better spreads the costs over multiple generations would be more appropriate. The second argument is that the cost of Tier 1 benefits place an undue burden on current employees. The funded status of benefits for more recent Tiers is estimated to be about 62 percent. And the cost of ongoing benefits for these Tiers is only about 10 percent of payroll, below the national average. In contrast, the funded status of Tier 1 benefits is only about 25 percent and Tier 1 retirees receive more generous benefits than those in more recent Tiers. Separating the financing of Tier 1 benefits from other Tiers allows for a more

accurate accounting of pension costs for current employees, while clearly defining the costs attributable to a closed system that, for the most part, services retired state employees.

F. Conclusion

SERS faces rapidly rising pension costs over the next 18 years if it continues with its current plan to fully fund the system by 2032. The majority of these costs are a result of the relatively short time period over which SERS has chosen to pay down its large UAAL. SERS' UAAL is mainly the result of underfunding benefits for Tier 1 members, those hired prior to pre-funding. Although unfunded liabilities occurred after the system started to pre-fund – due to inadequate contributions, investment returns (since 2000) less than assumptions, and poor actuarial experience – benefits earned by members of the more recent tiers (Tiers II, IIA, and III) have been relatively well funded. This report identifies four adjustments to the current funding plan both to address the large costs associated with underfunded Tier 1 benefits, and to prevent future funding shortfalls for the more recent Tiers II, IIA, and III.

To address the costs associated with underfunded Tier 1 benefits:

- separately finance – over a long time horizon – the liabilities for Tier 1 members.

To prevent funding shortfalls for ongoing benefits:

- shift to level-dollar amortization of unfunded liabilities;
- replace 2032 full-funding date with a reasonable rolling amortization period; and
- lower the long-term assumed investment return

Implementing these changes will more fairly distribute the costs associated with underfunded Tier 1 benefits and better secure ongoing benefits for current employees.

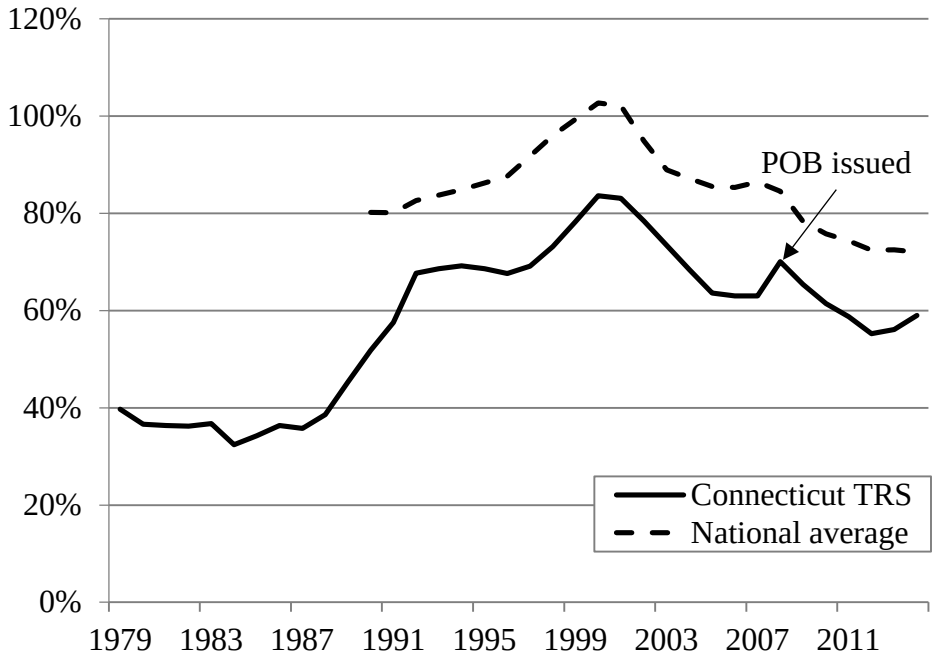
III. Connecticut Teachers' Retirement System (TRS)

A. A Brief History of TRS' Funding

Like SERS, TRS has been providing retirement benefits to its members since at least 1939 – longer than most state and local retirement systems in the United States. And, also like SERS, for much of TRS' history, benefits were paid as they came due, through annual appropriations by the State.

In 1979, the Legislature established an actuarial funding program (Public Act 79-436). Figure 24 shows the funded status for TRS from its first actuarial valuation performed as of July 1, 1979 through 2014 and provides, for comparison purposes, the national average funded ratio for state and local plans since 1990 (data prior to 1990 were not available).

Figure 24. *Funded Ratio of Connecticut TRS Compared to the National Average, 1979-2014*



Note: Beginning in 1992, TRS valuations have been performed biennially in even-numbered years (e.g., 1992, 1994, 1996). Data for odd-numbered years are estimated by taking the average of the year before and after.
Sources: Various actuarial valuations for Connecticut TRS; PENDAT (1990-2000); and *Public Plans Database* (2001-2014).

At the outset, TRS was 40-percent funded (due in large part to the accumulation of employee contributions) and had a $1.5 billion unfunded liability (equaling 234 percent of TRS' payroll). After about 10 years of pre-funding by the State, TRS entered the 1990s with a funded ratio of only about 50 percent – well below the national average. And its UAAL was still 238 percent of payroll (compared to a national average of 56 percent). While TRS' funded ratio has remained below the national average since 1990, it shares a similar pattern, rising due to strong market performance from 1990-2000, and then declining as a result of two financial downturns since

2000. Today, the unfunded liability of TRS stands at $11 billion, equaling 282 percent of TRS' payroll compared to the national average of 185 percent.

B. Factors Driving Current Unfunded Liabilities in TRS

Three factors are behind the current unfunded liability of TRS: 1) legacy costs due to benefits promised before TRS was pre-funded; 2) a history of inadequate contributions once the State decided to pre-fund; and 3) investment returns less than expectations since 2000. Each factor will be discussed in detail below. Dollar amounts have not been adjusted for inflation.

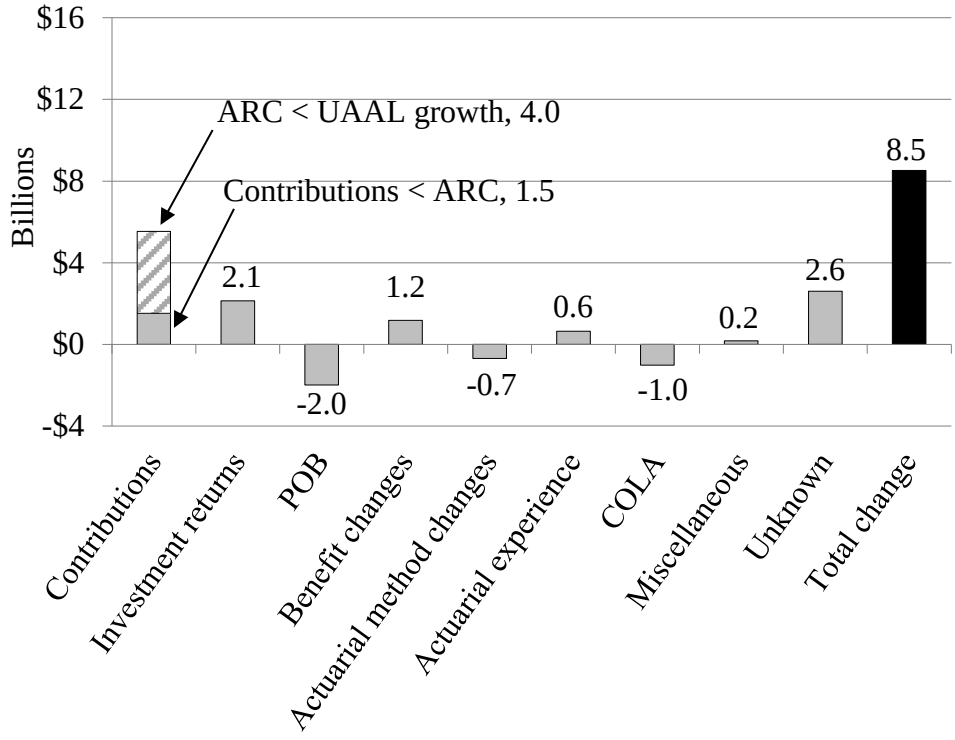
Legacy Costs

A large portion of TRS' current unfunded liability stems from the many years of benefits promised without pre-funding. Retirement benefits earned by employees prior to 1979 were completely unfunded by the State (although partially pre-funded through employee contributions). When the State decided to pre-fund benefits, it was immediately presented with a $1.5 billion unfunded liability for benefits earned by employees during the pay-go years. The burden of those unfunded benefits still lingers in the current finances of TRS, accounting for $4.1 billion, or about 38 percent, of TRS' $10.8-billion unfunded liability.

In addition to the initial legacy costs, other factors have also played a role in today's unfunded liability. Because detailed data on TRS' unfunded liability are not available from 1979-1982, this assessment of TRS' underfunding focuses primarily on the change in the unfunded liability from 1983-present (see Figure 25).[7]

[7] See the Appendix for a detailed account of the annual changes to the UAAL since 1985.

Figure 25. *Sources of Change to UAAL for TRS, 1983-2014, in Billions*



Source: CRR calculations based on various actuarial valuations for Connecticut TRS.

Since 1983, the UAAL has grown by $8.5 billion – from an initial value of $2.5 billion to today's value of $11 billion.[8] As Figure 28 shows, the two largest identifiable contributors to the growth in the UAAL have been inadequate contributions and low investment returns relative to the assumed return. Other elements, such as actuarial experience, benefit changes, and changes to assumptions and methods have had marginal and essentially offsetting impacts. The Pension Obligation Bond (POB) issued by the State in 2008 – discussed below – lowered the UAAL by $2 billion, but simultaneously increased the State's overall indebtedness by $2 billion.

Inadequate Contributions

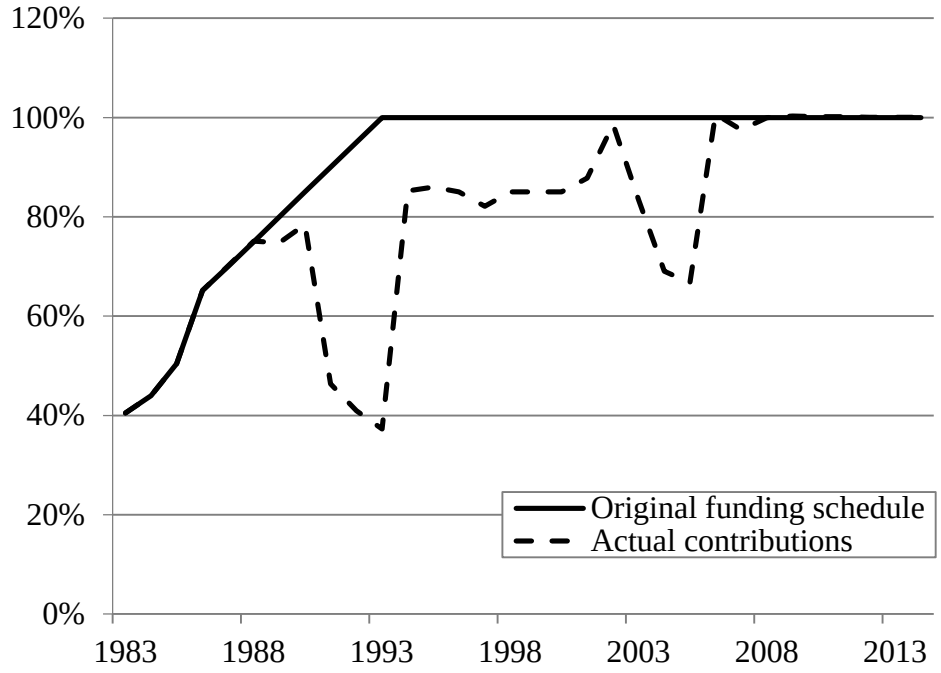
Paying down the unfunded liability has two components: 1) calculating an amortization payment that keeps the unfunded liability from growing each year; and 2) making the full payment. Connecticut TRS has fallen short in both areas. Similar to SERS, TRS' underpayment of the ARC began as soon as the State decided to pre-fund. At the outset, State law provided for a ramp-up schedule in the State's funding requirement. In 1979, the State was only required to pay 35 percent of the ARC. This percentage was scheduled to gradually increase until 1993, when the State would be required to pay the full ARC.

Figure 26 shows the actual payments relative to the scheduled percent of ARC from 1983-2014. While the State has made good on its obligation to pay the ARC in recent years, TRS (like

[8] See the Appendix for the methodology of the UAAL analysis.

SERS) has not been as disciplined historically. Even during the ramp-up period prior to 1993, the State often did not meet the lower scheduled payments. Since 1985, underpayment has added $1.5 billion in unfunded liabilities (see the solid grey area of the contributions bar in Figure 25).

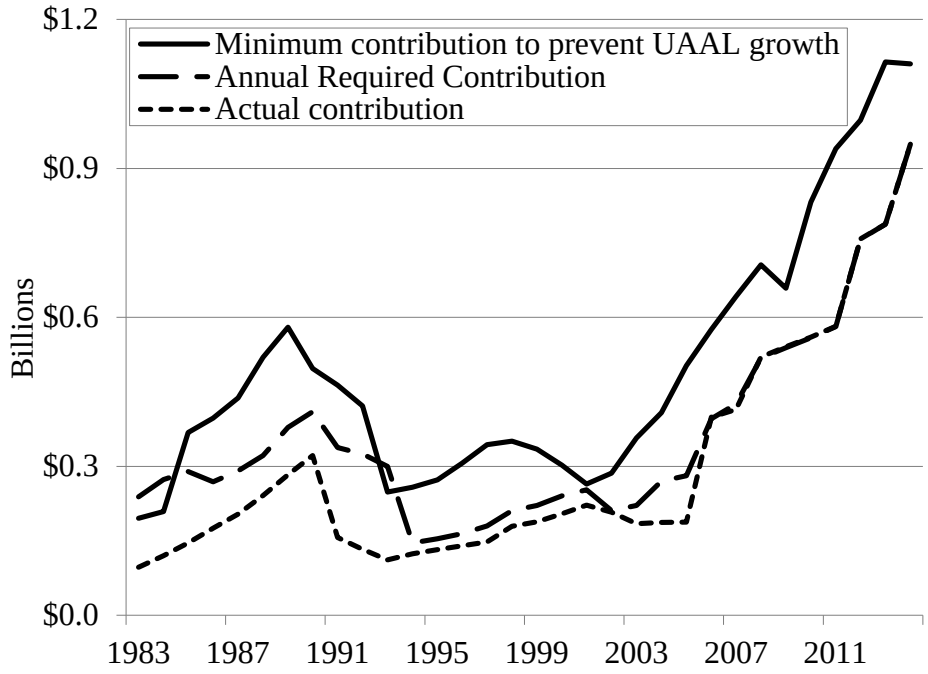
Figure 26. *Percent of Annual Required Contributions Paid for TRS, 1983-2014*



Source: CRR calculations based on various actuarial valuations for Connecticut TRS.

Figure 27 shows the minimum contribution required to prevent growth in the UAAL, compared to the calculated ARC and the actual contributions made from 1983-2014.

Figure 27. *Minimum Contribution to Prevent UAAL Growth, ARC, and Actual Contribution for TRS, 1983-2014*



Source: CRR calculations based on various actuarial valuations for Connecticut TRS.

Since the State began pre-funding TRS, the level-percent-of-payroll method has been used to calculate the UAAL amortization payment. As discussed earlier, this method backloads payments and, when coupled with a long amortization period, results in payments that are too low to keep the UAAL from growing during the early years of the period. From 1979-1992, TRS annually reset its 40-year horizon. In 1992, TRS set the amortization date to 2032. As a result, even if the State had paid the ARC in most years – which it did not – payments would not have been enough to slow the growth of the UAAL. Since 1985, the use of the level-percent-of-payroll method to calculate the amortization component of the ARC has added $4.0 billion in unfunded liabilities (see the hatched grey area of the contributions bar in Figure 25).[9] In combination with the $1.5 billion in unfunded liabilities from underpayment of the ARC, the total unfunded liabilities due to inadequate contributions for TRS are $5.5 billion.

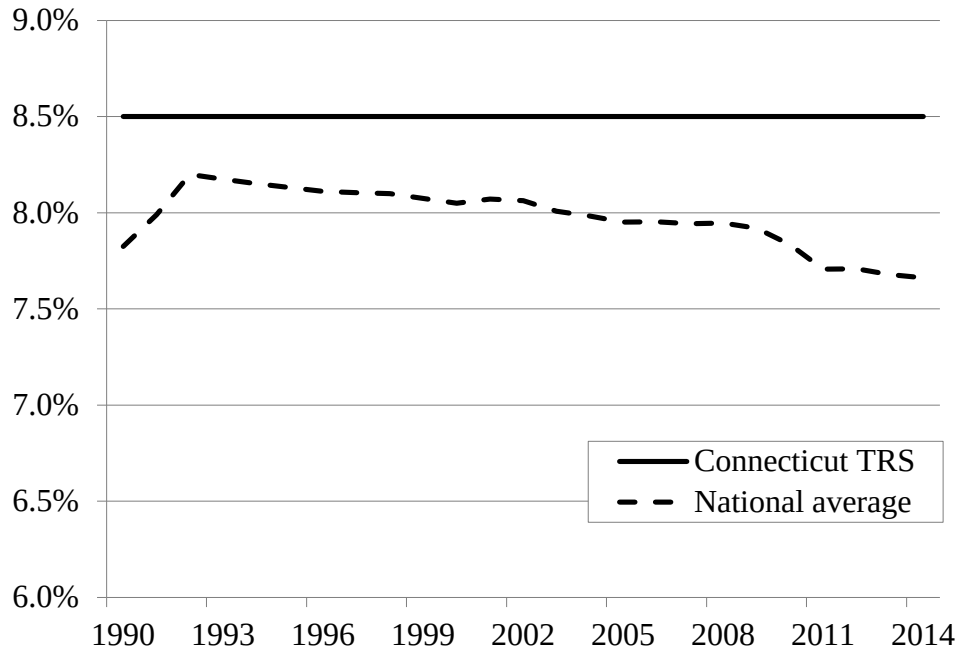
Investment Returns

The impact of investment returns on the unfunded liability depends on the difference between the system's assumed return and actual return. For TRS, this difference has added $2.7 billion in unfunded liabilities since 1985. Figure 28 shows the TRS' assumed return compared to the national average from 1990-2014. Like SERS, TRS' assumed return has been, and continues to

[9] A smaller issue with the calculated ARC is that there is a delay between when the ARC is calculated and when it is scheduled to be paid. As a result, the amortization payment scheduled for each year is generally based on the UAAL from two or three years prior. This situation often results in contributions that are inadequate for the current year's unfunded liability.

be, high compared to the national average. However, unlike SERS, TRS has not lowered its assumed return in the wake of the financial crisis. This reluctance to lower the return assumption is difficult to understand given that, since at least 2000, the assets of TRS and SERS have both been held within Connecticut's Combined Investment Fund and have had nearly identical asset allocations.

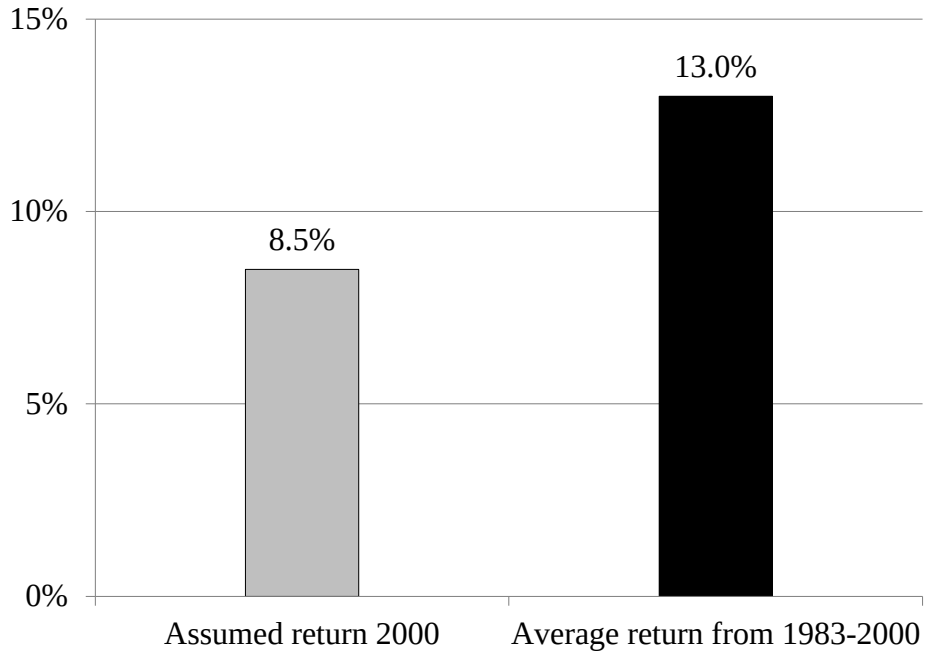
Figure 28. *Assumed Return for TRS Compared to the National Average, 1990-2014*



Sources: Various actuarial valuations for Connecticut TRS; PENDAT (1990-2000); and *Public Plans Database* (2001-2014).

Figure 29a compares the actual and assumed return for TRS from 1983-2000. Over that period, TRS' investment return was 4.5 percentage points above its assumed return. As a result, investment experience from 1985-2000 *reduced* unfunded liabilities by $3.5 billion.

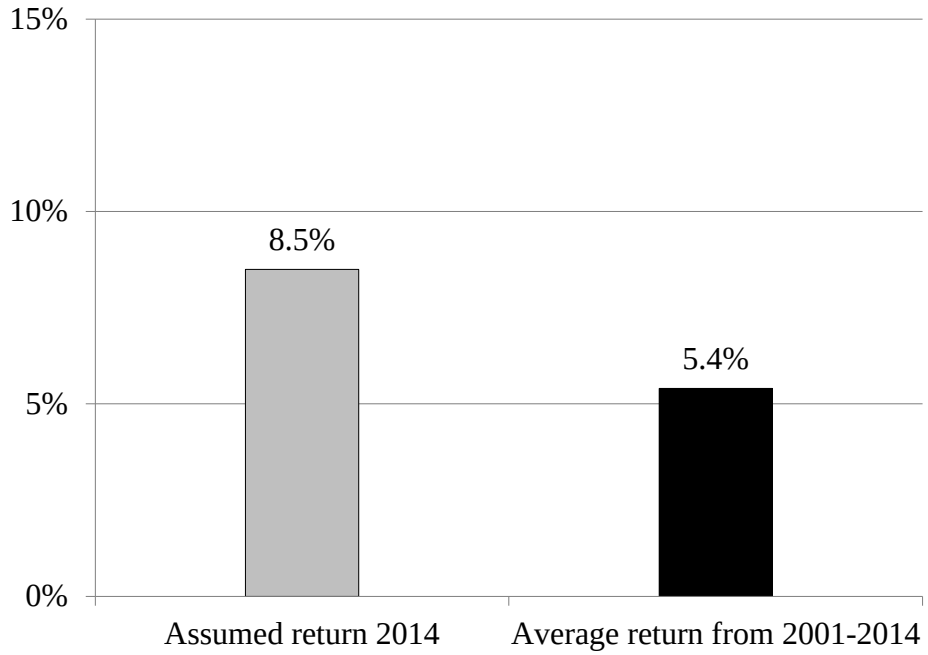
Figure 29a. *Actual and Assumed Investment Return for TRS, 1983-2000*



Sources: Various actuarial valuations for Connecticut TRS; and U.S Census Bureau (1983-2000).

Figure 29b compares the actual and assumed returns for TRS from 2001-2014. Unlike the prior years, TRS' investment experience during this period was more than 3.0 percentage points below its assumed return. As a result, investment experience has added $5.7 billion in unfunded liabilities since 2000.

Figure 29b. *Actual and Assumed Investment Return for TRS, 2001-2014*



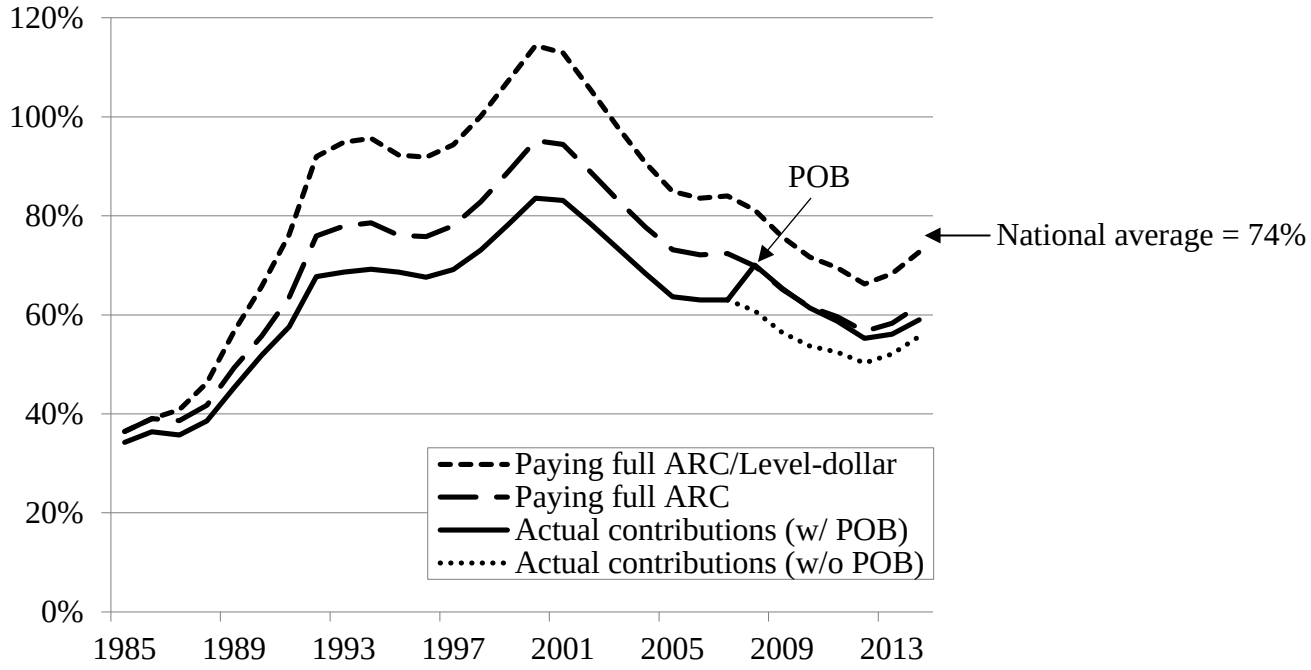
Sources: Various actuarial valuations for Connecticut TRS; and U.S Census Bureau (2001-2014).

C. An Alternate History for TRS: Controllable vs. Uncontrollable Factors

Like SERS, the majority of TRS' current underfunding stems from the legacy of unfunded benefits, inadequate contributions throughout the State's history of pre-funding, and low investment returns relative to the assumed return since 2000. Some of these factors are more controllable than others. Nothing could be done about the initial legacy costs, other than to have had the State pre-fund benefits since TRS' inception. The impact of the low returns could have been mitigated by lowering the assumed return, but actual investment performance is extremely difficult to predict. However, contributions (and how they were calculated) were definitely within the control of the State, and the State often knowingly underpaid.

What would TRS' funded level be today if the plan had: a) fully paid the ARC from 1985-2014; and b) used a level-dollar amortization method throughout? To answer this question, we recalculate TRS' funded ratio over time under these two assumptions (see Figure 30).

Figure 30. *TRS Funded Ratio under Various Funding Regimes, 1985-2014*



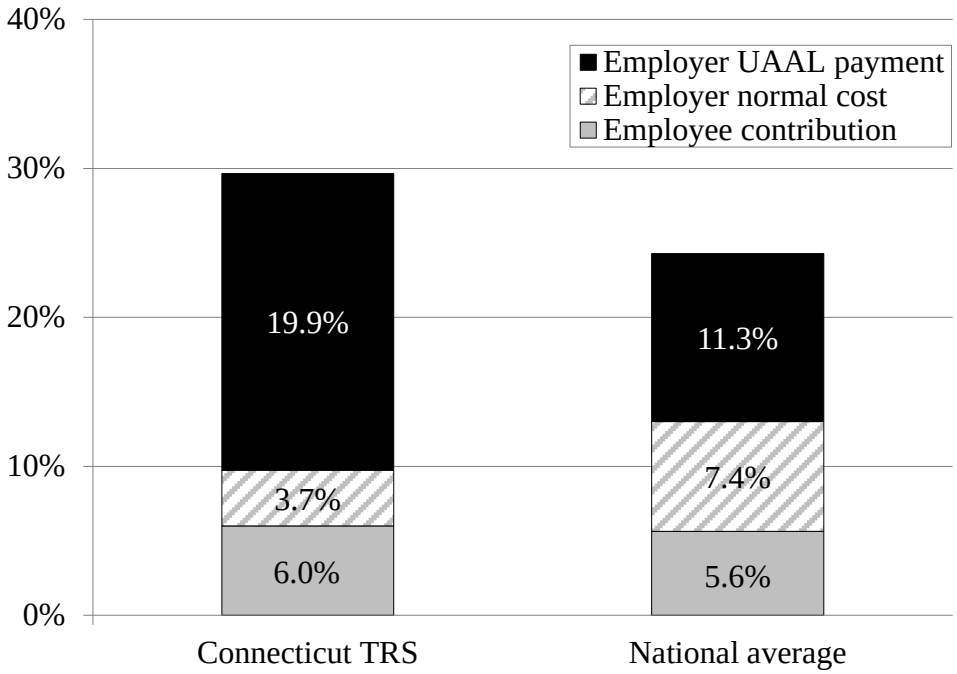
Source: CRR calculations based on various actuarial valuations for Connecticut TRS.

If TRS had simply paid its full ARC, its funded ratio would be slightly better than it is today (and it would not have had to issue a POB to reach that level). But, if the plan had also used a level-dollar amortization method throughout, its current funded ratio would have improved to 71 percent – just below the national average.

D. Projections of TRS' Finances

This section projects the funded ratio for TRS and the State's required contributions under current law. Like SERS, the main driver of contributions to TRS is the unfunded liability from legacy costs and funding shortfalls, not overly generous benefits. The total normal cost as a percent of payroll (employee contributions plus employer normal cost) is a good way to compare plan generosity among plans. Figure 31 shows that benefits provided to members of TRS actually fall below that of Teachers' plans elsewhere, and that the State pays very little compared to the national average. The lion's share of costs to the State is due to the unfunded liability.

Figure 31. 2014 *Actuarial Costs as a Percent of Payroll for TRS Compared to the National Average, by Element*

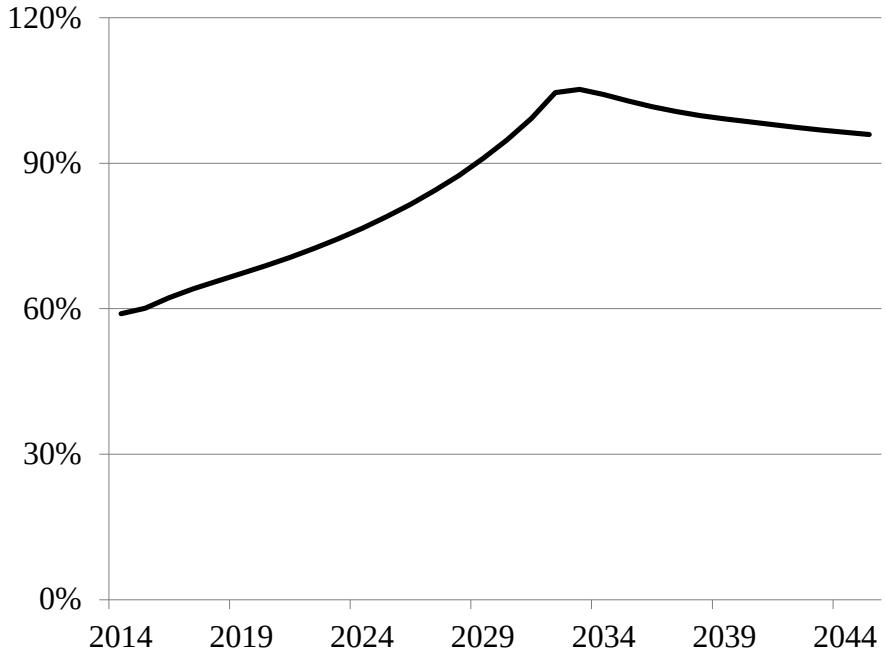


Sources: CRR calculations based on various actuarial valuations for Connecticut TRS; and *Public Plans Database* (2014).

Under current law, TRS' unfunded liability is to be paid off by 2032 (a closed period) using the level-percent-of-payroll amortization method.[10] Figure 32 shows the funded ratio and Figure 33 shows the ARC (normal cost plus amortization payment) under current law from 2014-2045. If the State pays the full ARC, TRS achieves its assumed return of 8.5 percent each year, and actuarial experience perfectly matches assumptions, the figures show full funding is achieved by 2032. Over the same period, the ARC – primarily as a result of the back-loaded amortization method – steadily rises each year from just under $1 billion in 2014 to $1.7 billion in 2032. Once the UAAL is paid off, the required contribution drops precipitously to about $150 million to cover TRS' normal cost.

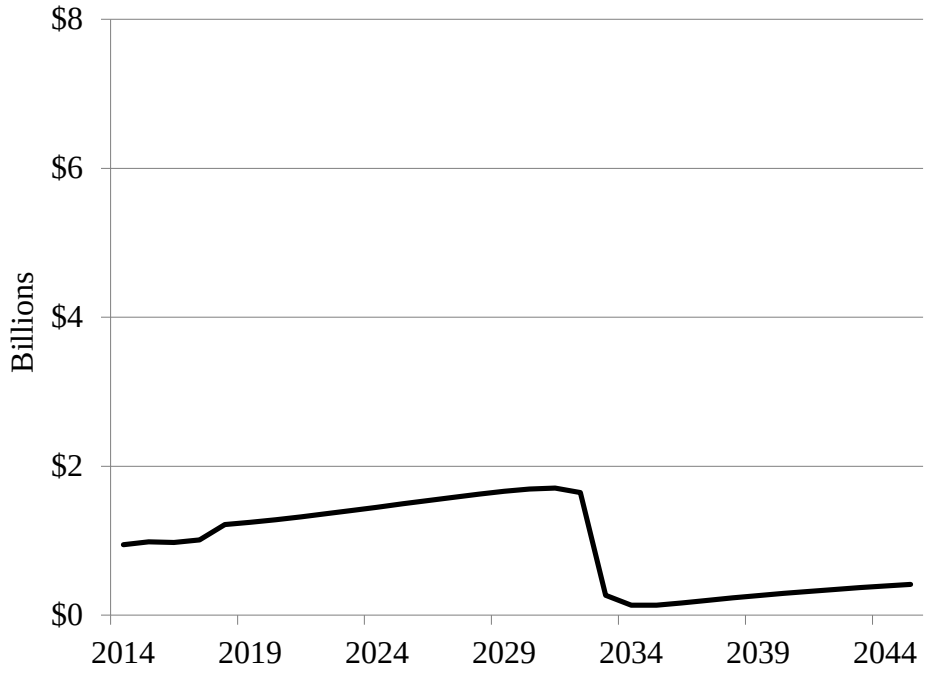
[10] A small portion of the TRS's UAAL is being separately amortized over a longer period. This portion is primarily the result of benefit changes over time.

Figure 32. *Projected Funded Ratio for TRS under Current Law, 2014-2045*



Source: CRR calculations.

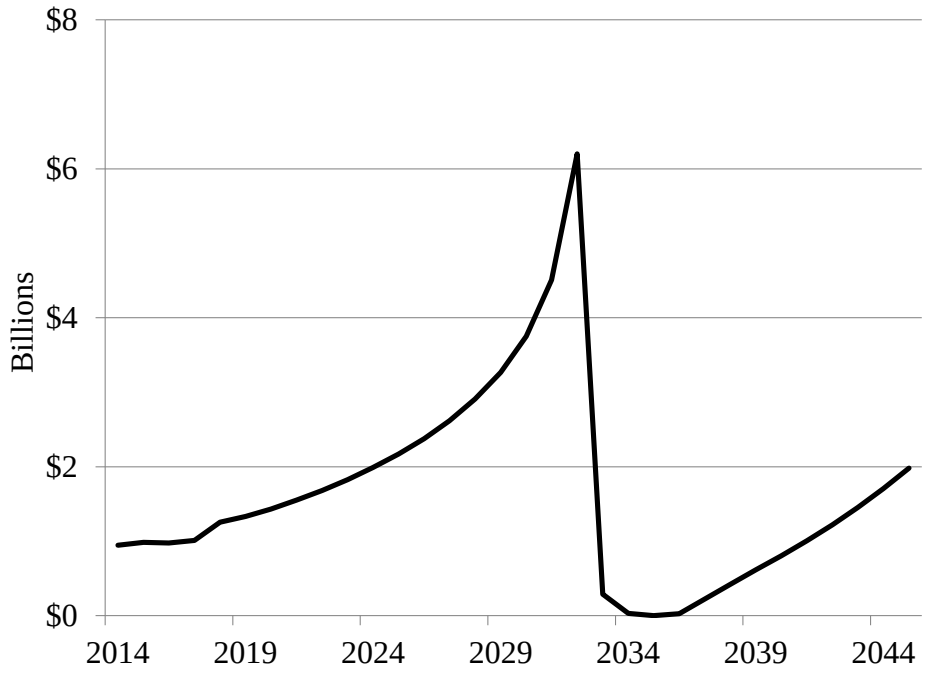
Figure 33. *Projected ARC for TRS under Current Law, 2014-2045*



Source: CRR calculations.

The assumption that TRS achieves its assumed return is critical to the cost projection. Figure 34 shows the ARC if the investment returns over the projection period are similar to the past decade – 5.5 percent – rather than TRS' assumed return of 8.5 percent. In that case, the ARC rises from $1 billion in 2014 to $6 billion in 2032. Again, required contributions drop precipitously after the TRS achieves full funding.

Figure 34. *Projected ARC for TRS under Current Law, and a 5.5-Percent Return, 2014-2045*



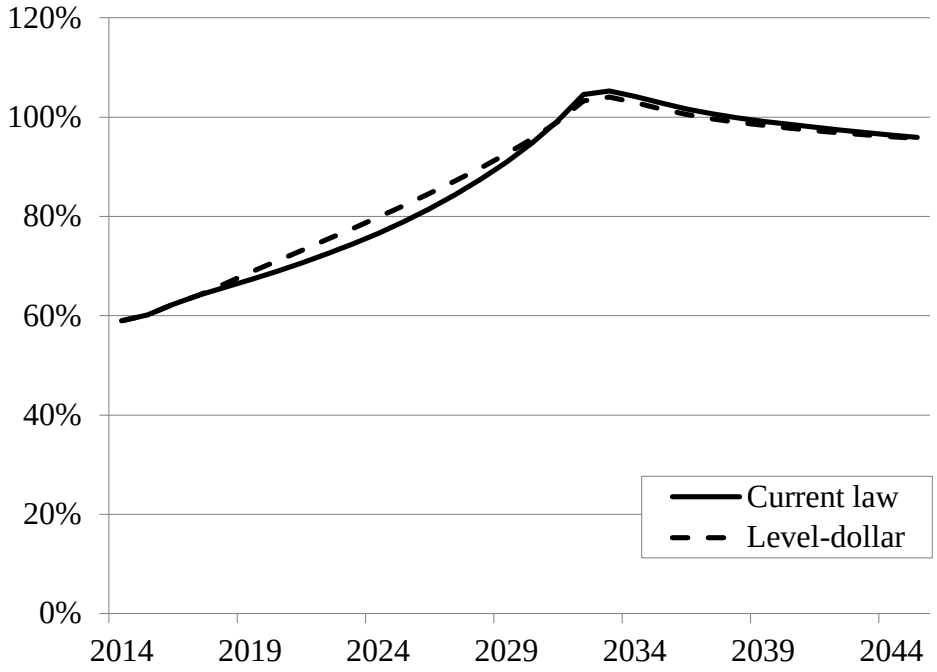
Source: CRR calculations.

E. Alternatives to TRS' Current Funding Methods

Alternative 1. Switch to a Level-Dollar Amortization of the UAAL

To limit the scheduled increases in cost resulting from the level-percent-of-payroll method, one alternative for TRS is to switch to level-dollar amortization of the UAAL. Figure 35 shows a projection of TRS' funded ratio under the two methods, maintaining the full funding date of 2032. Due to the backloading of amortization payments, the funded ratio under the level-percent-of-payroll method falls below that of the level-dollar method. However, because the 2032 full funding date is only 18 years away, the path of the funded ratio differs very little between the two methods.

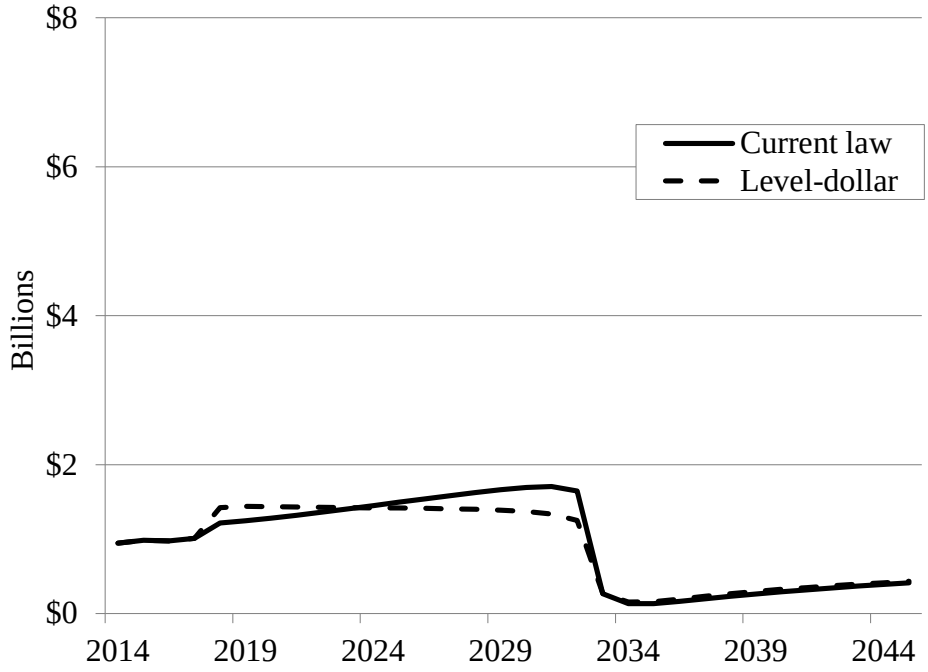
Figure 35. *Projected Funded Ratio for TRS under Alternative Funding Methods, 2014-2045*



Source: CRR calculations.

In contrast to the funded ratio, the contributions under the two amortization methods have very different trajectories (see Figure 36). While contributions under the level-dollar method are greater than those under the level-percent-of-payroll method in the early years, they stay relatively flat throughout at about $1.3 billion. On the other hand, contributions under the level-percent-of-payroll method eventually exceed the level-dollar payments, peaking at $1.7 billion in 2032. In both cases, State contributions drop precipitously to the TRS normal cost once the system reaches full funding.

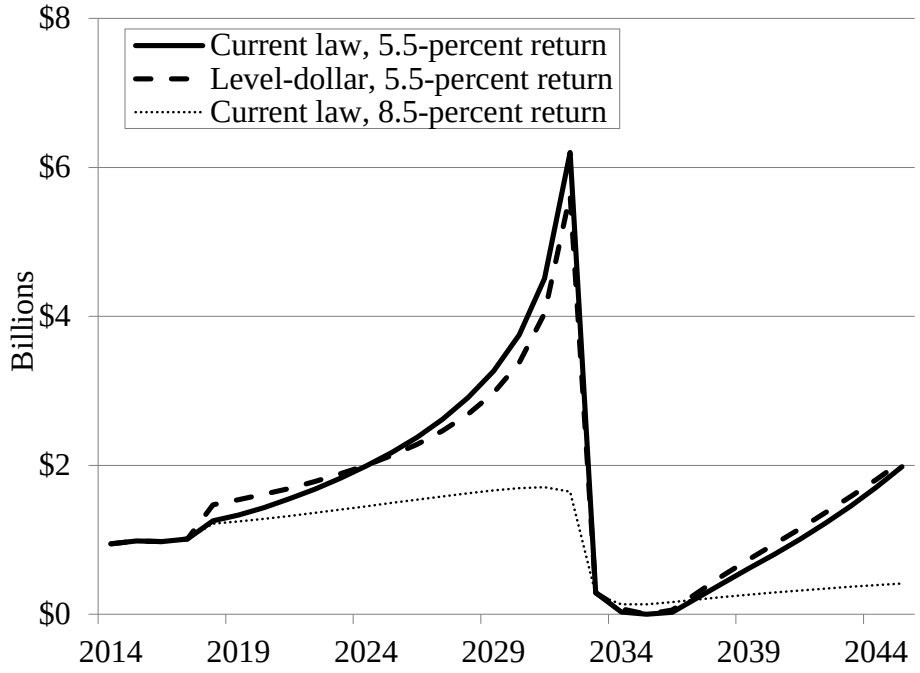
Figure 36. *Projected ARC for TRS under Alternative Funding Methods, 2014-2045*



Source: CRR calculations.

Again, because returns are critical to the projection of costs, Figure 37 shows employer costs under the two methods with a 5.5-percent return over the projection period. Under both methods, costs could rise to almost $6.2 billion before dropping to about $150 million in normal costs once the UAAL is paid off. For visual comparison, the light line in the figure shows the projected cost under current law and under an 8.5-percent return.

Figure 37. *Projected ARC for TRS under Alternative Funding Methods and a 5.5-Percent Return, 2014-2045*



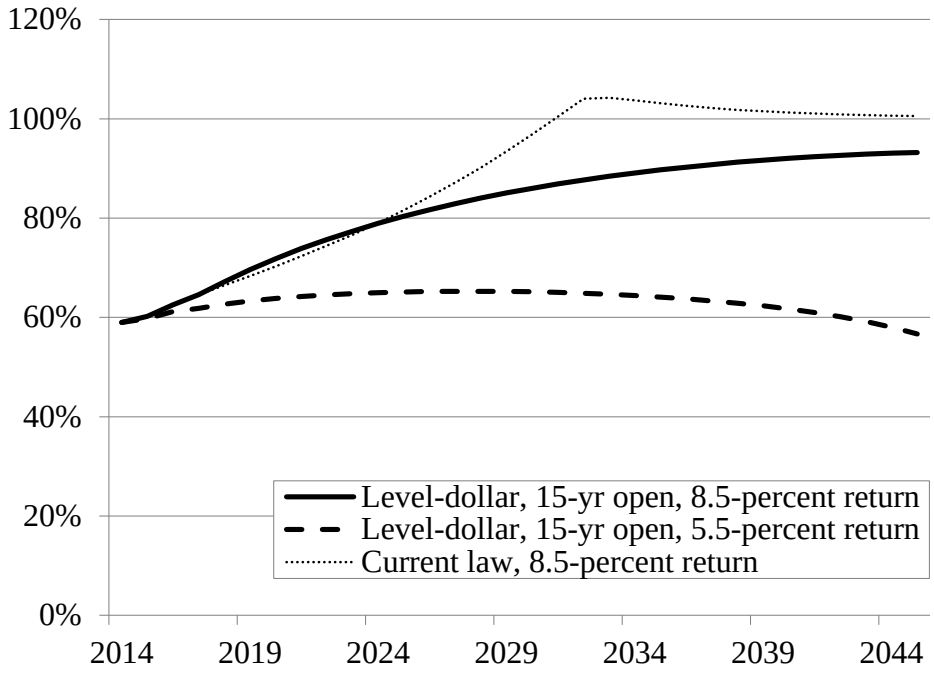
Source: CRR calculations.

Alternative 2. Switch to a Level-Dollar and 15-year Open Amortization of the UAAL

As the above figures show, maintaining the status quo may be quite costly for the State, especially if TRS does not realize its assumed return of 8.5 percent. Switching to a level-dollar method provides little relief. Additionally, in terms of budgeting, the precipitous drop in contributions once the plan reaches full funding is not practical. As such, it may be preferable to switch to a level-dollar amortization of the UAAL and employ a 15-year open period for amortization, allowing for more manageable contributions by the State while ensuring TRS remains well funded (if not fully funded).

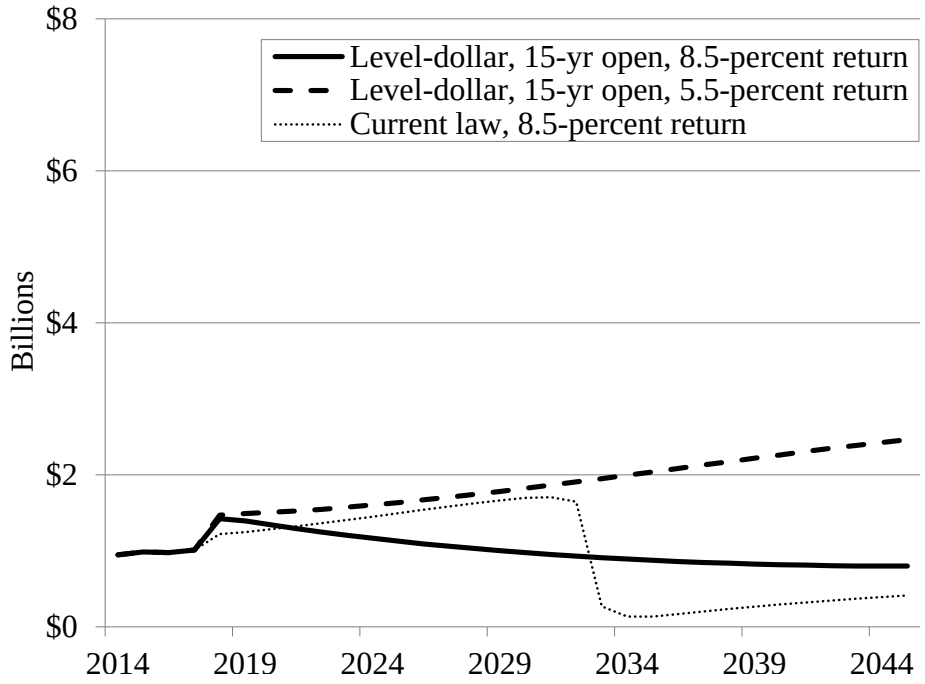
Figures 38 and 39 show the results of this approach under TRS' assumed return – 8.5 percent – and a 5.5-percent return (similar to the average return since 2000). The actual outcome will likely fall in between. While the 15-year open amortization approach does mitigate costs, it also delays full funding. This delay can be especially meaningful when returns are below expectations.

Figure 38. *Projected Funded Ratio for TRS under Level-Dollar, 15-year Open Amortization, 2014-2045*



Source: CRR calculations.

Figure 39. *Projected ARC for TRS under Level-Dollar, 15-year Open Amortization, 2014-2045*



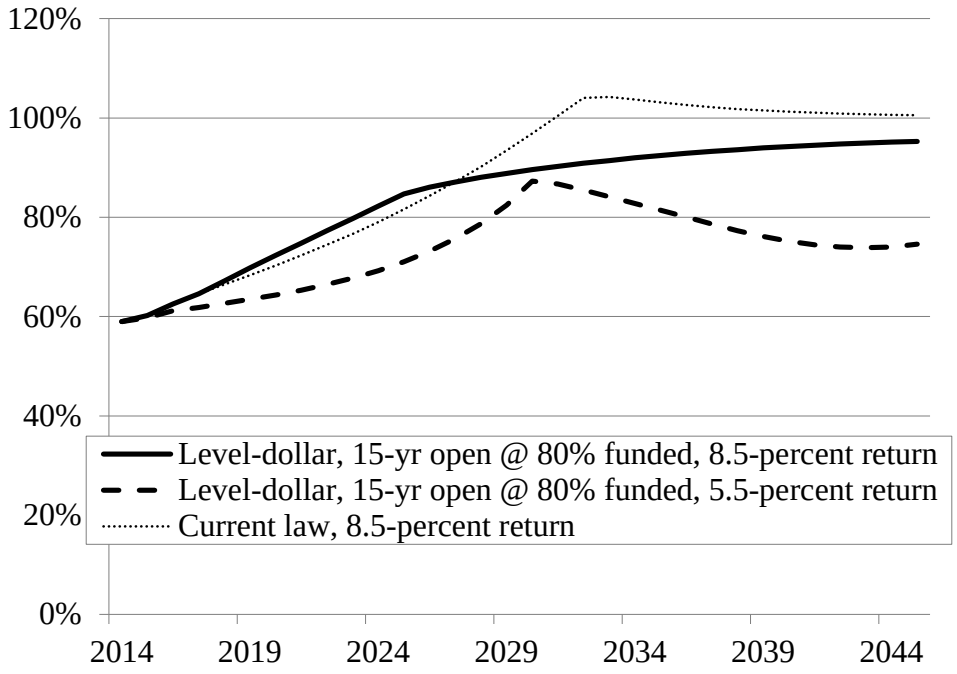
Source: CRR calculations.

Alternative 3. Relax 2032 Full-funding Date When 80 Percent Funded

Whether under the level-dollar or level-percent approach, the 2032 full-funding date presents real risks to the State of dramatic contribution rate volatility as the date approaches. Yet, shifting to a 15-year open amortization significantly delays funding improvements. One other approach, is to maintain the 2032 full-funding goal until the plan reaches a lower funding threshold deemed to be adequate. At that point, relaxing the full-funding date may provide contribution rate relief, while not greatly risking the plan's fiscal health.

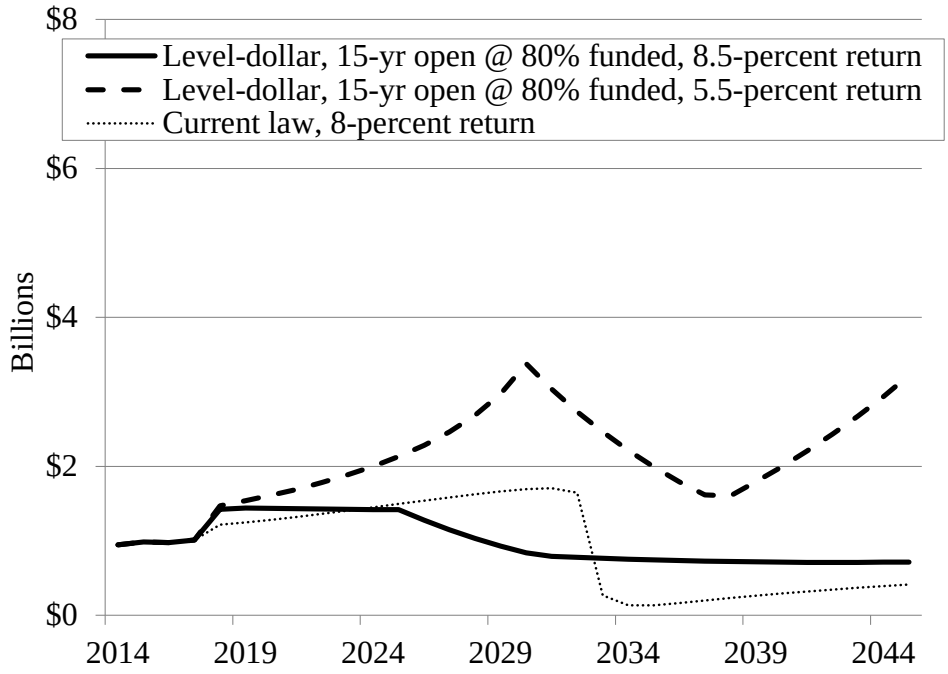
Figures 40 and 41 show the funded ratio and State required contributions under a level-dollar amortization approach that maintains the 2032 full-funding date until TRS is 80-percent funded and then shifts to an open 15-year amortization. As the figure shows, under both the 8-percent and 5.5-percent return scenarios, funding improves quickly in the early years under the 2032 full-funding date and, when the plan shifts to an open amortization, contribution pressure is reduced, while maintaining reasonable funding.

Figure 40. *Projected Funded Ratio for TRS under Level-Dollar and 15-year Open Amortization at 80-percent Funded, 2014-2045*



Source: CRR calculations.

Figure 41. *Projected ARC for TRS under Level-Dollar and 15-year Open Amortization at 80-percent funded, 2014-2045*

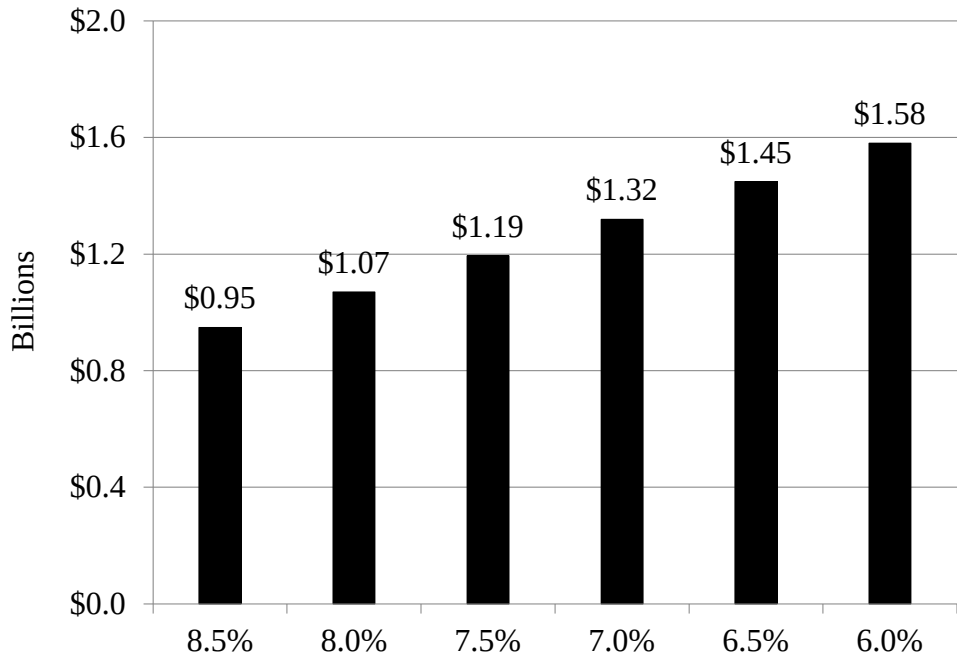


Source: CRR calculations.

Lowering the Discount Rate/Long-Term Assumed Return

The decision to change the long-term assumed return involves a relatively straightforward trade-off. Reducing the assumed return means paying more into the system (to make up for lower expected returns). But, it also lowers the likelihood of paying amortization payments in the future for unfunded liabilities that arise due to investment performance that is below the assumed return. Conversely, increasing the assumed return means paying less up front, but it increases the likelihood of having to pay more to make up for unfunded liabilities that accrue if investment experience falls short. Figure 42 shows the impact of various discount rates on the 2014 ARC for TRS. It reflects the change in up-front costs from discount rate changes, but does not include the change in the likelihood of paying UAAL payments down the road if returns do not meet expectations.

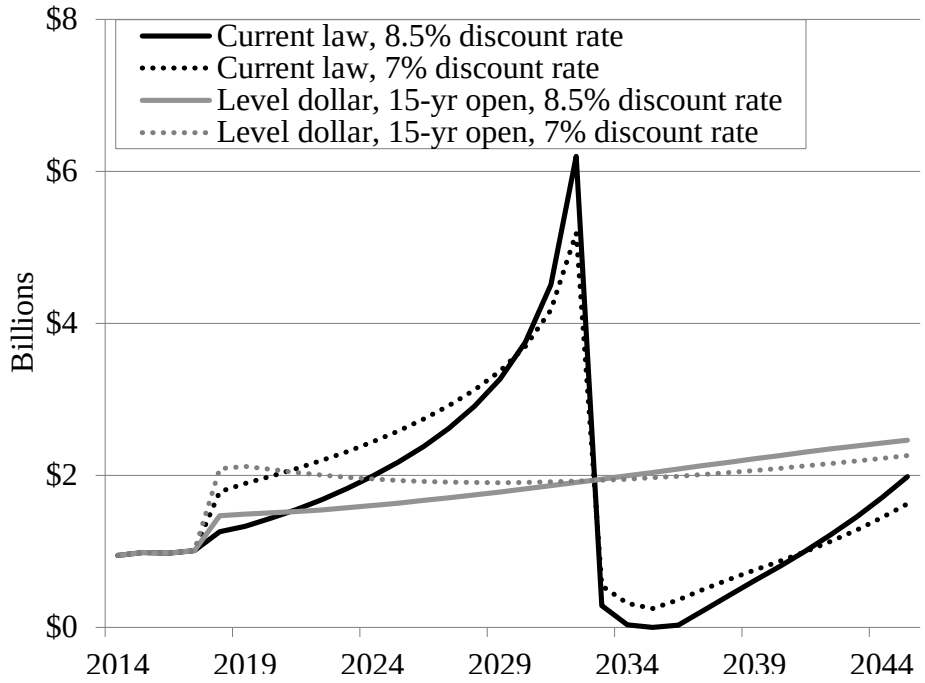
Figure 42. *2014 ARC for TRS under Various Discount Rates/Long-term Assumed Returns*



Source: CRR calculations.

Figure 43 shows the trajectory of costs for SERS under an 8.5-percent and 7-percent assumed return, given an actual return of 5.5 percent. The figure clearly illustrates the trade-off described above. When compared to the 8.5-percent assumed return, the 7-percent assumed return requires more contributions in the early years and less in the later years.

Figure 43. *Projected ARC for TRS under Various Discount Rates and a 5.5-percent Return, 2014-2045*



Source: CRR calculations.

Separately Finance Liabilities for Members Hired before 1979.

When considering alternatives for addressing TRS' unfunded liability going forward, the separate financing of liabilities associated with TRS members hired prior to pre-funding should be considered. As stated above, TRS benefits were totally unfunded by the State prior to 1979 and only partially funded from 1979-1993. However, accurately apportioning the *current* unfunded liability to members hired prior to 1979 requires recreating the funding history for TRS as if benefits for those hired prior to 1979 were separately funded with their own trust.[11] As the results in Table 3 show, if you do this the majority of TRS' current unfunded liabilities are, in fact, associated with those hired prior to 1979, while the benefits for more recently hired members are almost fully funded.

[11] We estimate annual liabilities, benefit payments, and payroll for members hired prior to 1979 by assuming a straight-line growth in liabilities and annual benefit payments from the TRS total levels in 1979 to the 2014 levels specifically for those hired prior to 1979 that are provided by the TRS administrators and actuaries. The total normal cost contributions for pre-1979 members is based on the reported payroll and the total entry age normal cost rate calculated in 1979 (with periodic adjustments made for changes in the discount rate). Investment returns are assumed to be equal to the returns experienced by TRS as a whole. We back into the assets, liabilities, and unfunded liabilities for those hired after 1979 by subtracting the pre-1979 estimates from the totals for TRS liabilities, assets, unfunded liabilities, and contributions reported in the annual valuations. The amortization payment to pre-1979 members is proportional to TRS' total amortization payment based on the proportion of the UAAL that pre-1979 members represent two years prior.

Table 3. *2014 Assets, Liabilities, Unfunded Liabilities, and Funded Ratio for TRS, by Employee Group*

Employee Group	Assets (billions)	Liabilities (billions)	Unfunded liabilities (billions)	Funded ratio
Hired prior to 1979	$5.7	$16.1	$10.4	35.3%
Hired after 1979	9.8	10.2	.4	96.0
Total	15.5	26.3	10.8	59.0

Source: CRR calculations based on data from TRS Actuary and Connecticut TRS 2014 Valuation.

Today, the majority members hired prior to 1979 are retired, and nearly 90 percent of liabilities for members hired prior to 1979 are for retirees (see Table 4). Thus, the current unfunded liability for TRS is primarily the product of benefit promises made to existing retirees that were never properly funded. In contrast, benefits for members hired after 1979 have been almost fully funded as they have accrued.

Table 4. *2014 Membership and Liabilities for TRS, by Employee Group*

Employee Group	Actives	Retirees	Active liability (billions)	Retiree liability (billions)
Hired prior to 1979	2,978	28,197	$1.7	$14.4
Hired after 1979	48,455	17,644	7.9	2.3
Total	51,433	45,841	9.6	16.7

Source: CRR calculations based on data from TRS Actuary and Connecticut TRS 2014 Valuation.

Separately financing the liabilities associated with members hired before 1979 recognizes the dramatic difference in funding for the two groups. Benefits for those hired prior to 1979 have been consistently underfunded (even after pre-funding began), and today are 35 percent funded. In contrast, benefits for those hired after 1979 are currently almost 100 percent funded

The two main policy arguments for separating the liabilities are intergenerational equity and the perception of costs for current employees. First is intergenerational equity. The liability for members hired prior to 1979 has been accumulated over multiple generations, and the services provided by those members are no longer being enjoyed by current generations because most members are retired. As such, it is not fair to place the entire burden of funding the remaining benefits for this group on a single generation (as under current law). A longer time horizon for amortizing these unfunded benefits that better spreads the costs over multiple generations would be more appropriate. The second argument is that the cost of benefits for members hired prior to 1979 place an undue burden on current employees. The unfunded liability for members hired after 1979 is estimated to be only about $400 million. In contrast, unfunded liability for members hired prior to 1979 is $10.4 billion. Combining the cost of the unfunded liabilities for members hired prior to 1979 with that of those hired afterward skews the perception of benefits offered to current teachers by misrepresenting the pension costs for current employees to the taxpayer.

F. TRS' Pension Obligation Bond

Connecticut issued a $2 billion POB in 2008 to fund TRS, shifting a portion of its pension costs into bond payments. The bond matures in 2032, precisely the same date that TRS is scheduled to extinguish its unfunded liability.

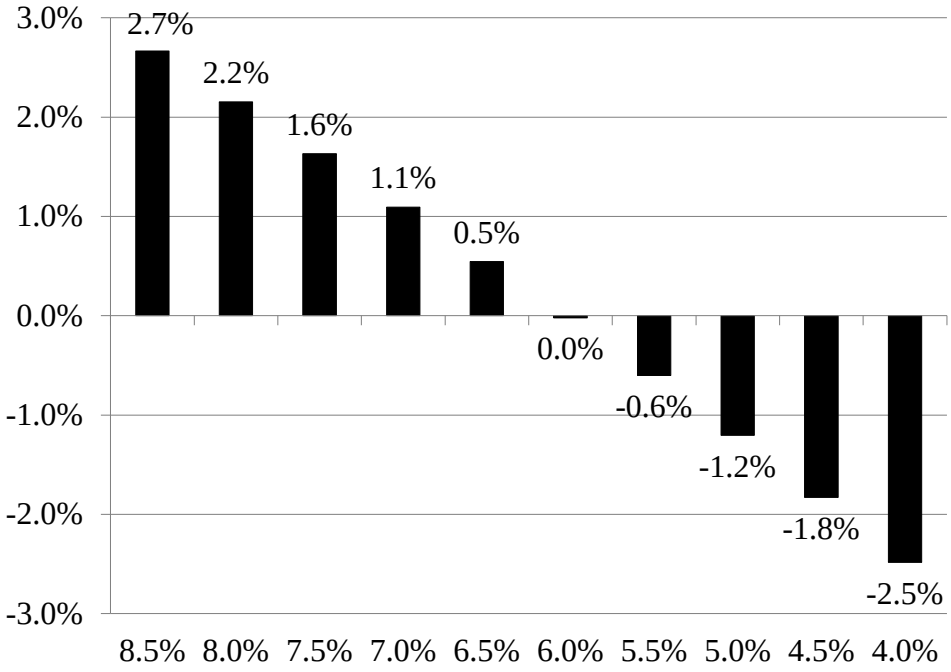
POBs raise issues in terms of investment risk and required payments. In terms of investment risk, if the average return earned on the invested bond proceeds is greater than the interest payments, the bond can be a net gain to the government's finances. Otherwise, it will be a loss. Investment risk aside, a POB restructures pension payments for the plan sponsor. Borrowed funds immediately improve the plan's funded ratio and lower annual pension costs. This decrease is offset by the POB's annual interest payments and the repayment of principal.

POB Investment Risk

In order to assess the extent to which the POB has met the State's expectations, we calculate the internal rate of return (IRR) on the bond. The assumption is that the proceeds from the bond are invested in accordance with the allocation of TRS' assets. Beginning with fiscal year 2009, we calculate the growth of the invested bond proceeds for that year, then subtract the interest (using the stated coupon rate) and principal payments for that year to get a new beginning balance for the following year, and this process is repeated until the date of the assessment. At the date of assessment, we compare the ending balance with the initial proceeds to calculate an IRR.

Using this approach, we find that the TRS POB has returned, on average, negative 30 basis points a year since 2008. To extend this analysis over the full life of the bond, we use a distribution of possible returns from 2014-2032. The results, shown in Figure 44, highlight the variability in possible investment performance of the POB over its lifetime.

Figure 44. *Annualized Return on TRS' POB Proceeds at Various Investment Returns*



Source: CRR calculations.

Projection of Required Payments

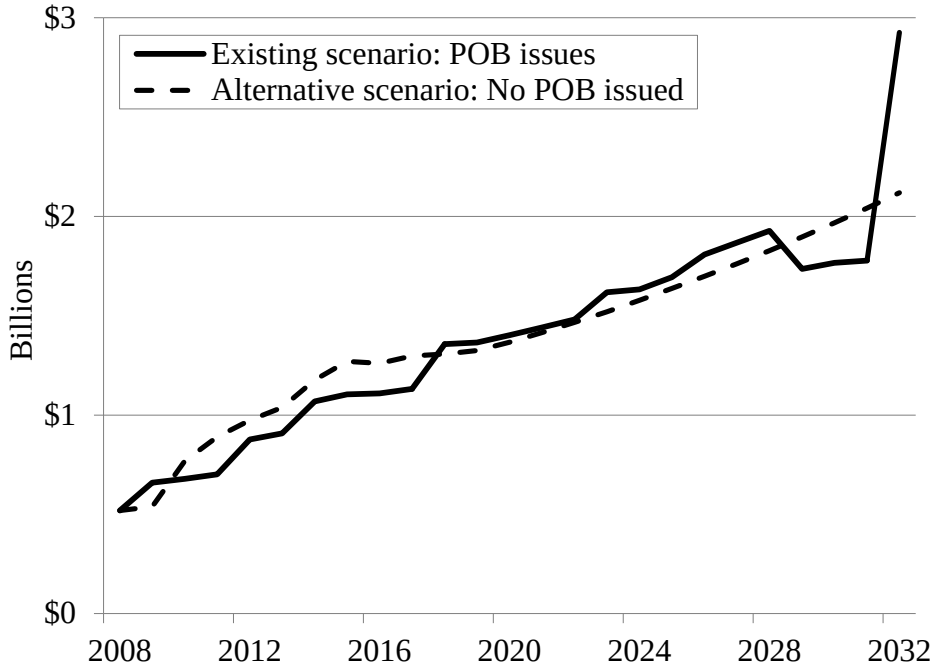
We project the State's overall pension costs (including ARC and POB payments) under two scenarios: 1) the existing arrangement in which the POB was issued in 2008; and 2) assuming the POB had never been issued.

Modeling total State costs under the existing arrangement involves three steps. First, we use actual required pension payments reported for 2008-2014. Second, we project future required pension payments assuming TRS receives 100 percent of the required pension payments and achieves its assumed return of 8.5 percent annually. Third, to get total State costs, we add annual POB interest and principal payments to required pension payments.

The second scenario also has three steps. First, we decrease reported 2008 pension assets by $2 billion to account for the POB never being issued. Second, we project required pension payments from 2008-2014 assuming the State pays the same percent of required payment and TRS achieves the same returns as reported for those years. Third, we project required pension payments from 2014 forward assuming TRS receives 100 percent of the required pension payments and achieves its assumed return of 8.5 percent annually.

Figure 45 shows the State's costs under the two scenarios. In the near-term, State costs under the existing arrangement are less than if the POB had not been issued. However, from 2018 onward, annual costs are greater under the status quo. And, under the status quo, there is a 1.2-billion dollar principal payment in 2032.

Figure 45. *State Costs With and Without POB Issuance, 2008-2032*



Source: CRR calculations.

G. Conclusion

TRS faces rising pension costs over the next 18 years if it continues with its current plan to fully fund the system by 2032. The majority of the costs are a result of the relatively short time period over which TRS has chosen to pay down its large UAAL. TRS' UAAL is mainly the result of underfunding benefits for those hired prior to 1979, when TRS began pre-funding. Although unfunded liabilities occurred after the system started to pre-fund—due to inadequate contributions and investment returns (since 2000) falling short of assumptions—benefits earned by members hired after 1979 have been relatively well funded. This report identifies four adjustments to the current funding plan both to address the large costs associated with underfunded benefits for members hired prior to 1979, and to prevent future funding shortfalls for the employees hired more recently.

To address the costs associated with benefits for those hired prior to 1979:

- Separately finance—over a long time horizon—the liabilities for members hired prior to 1979.

To prevent funding shortfalls for ongoing benefits:

- Shift to level-dollar amortization of unfunded liabilities
- Replace 2032 full-funding date with a reasonable rolling amortization period
- Lower the long-term assumed investment return

Implementing these changes will more fairly distribute the costs associated with benefits for members hired prior to 1979 and better secure ongoing benefits for employees hired more recently.

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V. Appendix

A. Analysis of the UAAL

i. Methodology

In most years, the actuarial valuations for SERS and TRS include data on the Unfunded Actuarial Accrued Liability (UAAL), the change in the UAAL, and some information on the factors that led to the change. These factors include: 1) investment returns relative to the assumed return; 2) contributions; 3) deviations from actuarial assumptions (e.g. workers living longer than expected); 4) benefit changes; and 5) assumption changes (e.g. long-run investment returns). As an example, Tables A1 and A2, copied from the Connecticut SERS 2014 valuation, report both the overall change in the UAAL for fiscal years 2013 and 2014 and detail the individual factors that led to that change. In Table A1, the expected UAAL for 2013 (item 5) is equal to the 2012 UAAL and interest on the UAAL, plus the normal cost and interest on the normal cost, minus contributions and interest on the contributions. The expected UAAL for 2014 follows the same methodology. If contributions (and interest) do not cover the interest on the UAAL plus normal cost (and interest), the unfunded liability will grow. The unfunded liability will also grow or decline as a result of a host of other factors listed in Table A2.

Table A1. *Change in the UAAL for Connecticut from 2012-2014, in Millions*

(1) UAAL as of June 30, 2012	$13,273.8
(2) Total normal cost from 2012 valuation	315.5
(3) Actual employer and employee contributions	(1,228.0)
(4) Interest accrual: [[(1) +(2)] x .08] - [(3) x .0392]	1,039.0
(5) Expected UAAL as of June 30, 2013: (1) + (2) – (3) + (4)	13,400.3
(6) Total normal cost for 2013 fiscal year	323.5
(7) Actual employer and employee contributions	(1,419.9)
(8) Interest accrual: [[(5) + (6)] x .08] - [(7) x .0392]	1,042.2
(9) Expected UAAL as of June 30, 2014: (5) + (6) - (7) + (8)	13,346.1
(10) Plan changes	193.4
(11) Expected UAAL as of June 30, 2014: (9) + (10)	13,539.5
(12) Actual UAAL as of June 30, 2014	14,920.8
(13) Gain/(loss): (11) – (12) (See Schedule H)	(1,381.3)

Source: Connecticut SERS 2014 actuarial valuation.

Table A2. *Details on the Actuarial Gain/(Loss) for Unfunded Liability*

Schedule H: Analysis of Financial Experience
Gains & Losses in Accrued Liabilities Resulting from Difference
Between Assumed Experience & Actual Experience, in Millions of Dollars

Type of activity	Gain/loss for two-year period ending 6/30/2014
Age & service retirements. If members retire at older ages, there is a gain. If younger ages, a loss.	$(286.9)
Disability retirements. If disability claims are less than assumed, there is a gain. If more claims, a loss.	(31.2)
Death-in service benefits. If survivor claims are less than assumed, there is a gain. If more claims, a loss.	(17.3)
Withdrawal from employment. If more liabilities are released by withdrawals than assumed, there is a gain. If fewer liabilities are released, a loss.	(29.3)
Pay increases. If there are smaller pay increases than assumed, there is a gain. If greater increases, a loss.	(231.3)
New members. Additional unfunded accrued liability will produce a loss.	(310.2)
Net change on Tier III-Hybrid transfers. Includes $205.0 million in liabilities offset by $154.9 million in asset transfers.	(50.1)
Investment income. If there is a greater investment income than assumed, there is a gain. If less income, a loss.	(333.3)
Death after retirement. If retirees live longer than assumed, there is a loss. If not as long, a gain.	(65.3)
Other. Miscellaneous gains and losses resulting from changes in valuation software, data adjustments, timing of financial transactions, etc.	(26.4)
Gain (or loss) during year from financial experience.	(1,381.3)
Non-recurring items. Adjustments for plan amendments, assumption changes, or method changes.	(193.4)
Composite gain (or loss) during year.	(1,574.7)

Source: 2014 Connecticut SERS Actuarial Valuation.

The challenge is to take the factors listed in these tables for each year, categorize them in a useful fashion, and combine the annual data over time to highlight the factors that have played a role in the development of the current UAAL. Tables A3 and A4 show the results of this process for SERS and TRS, respectively. For 2013 and 2014, the majority of items listed in the Schedule H were classified as actuarial experience. The two exceptions were: “investment income” and “non-recurring items.” These were classified as: “investment returns” and “benefit changes,” respectively.

ii. Analysis of SERS' Unfunded Liability

Table A3. *Annual Change in the UAAL for Connecticut SERS by Source, 1985-2014, in Millions of Dollars*

Year	Starting UAAL	Contributions vs. ARC	ARC vs. UAAL growth	Investment returns	Early retirement program	Benefit changes	Changes to assumptions and methods	Actuarial experience	Other	Unknown	Ending UAAL
1985	$2,392	$25	$9	$64	$0	$0	$0	$0	$0	$175	$2,665
1986	2,665	14	16	-72	0	0	0	0	0	20	2,643
1987	2,643	15	20	-85	0	0	0	0	0	306	2,900
1988	2,900	0	46	-720	0	0	0	0	0	814	3,039
1989	3,039	0	9	-19	0	0	-678	0	0	109	2,460 [a]
1990	2,460	55	69	-15	0	0	0	15	67	0	2,652 [b]
1991	2,652	134	-30	32	12	0	0	-8	-17	0	2,775
1992	2,775	181	-17	41	74	0	0	152	37	0	3,243 [c]
1993	3,243	153	21	-11	12	0	-233	308	0	0	3,494 [d, *]
1994	3,494	164	7	41	0	0	0	-321	0	0	3,385 [d]
1995	3,385	245	-29	3	0	0	0	26	0	0	3,629 [c, d]
1996	3,629	166	2	-92	0	0	0	26	0	0	3,731 [d]
1997	3,731	199	-11	-257	322	0	0	0	0	-282	3,702 [e]
1998	3,702	215	-36	-291	0	0	0	331	0	0	3,923 [e, f]
1999 [i]	3,923	212	-2	-508	0	0	0	0	0	495	4,119
2000	4,119	51	260	-230	0	0	470	352	0	-705	4,316 [*]
2001	4,316	54	132	-36	0	0	0	1	0	0	4,467
2002	4,467	64	144	201	0	-2	0	38	1	0	4,912
2003	4,912	72	161	267	492	0	0	-230	0	492	6,165 [b]
2004	6,165	74	208	140	0	0	116	186	0	0	6,890 [*]
2005	6,890	72	253	93	0	0	0	162	0	0	7,470
2006	7,470	78	208	40	0	0	0	69	13	0	7,879
2007	7,879	82	214	-114	0	0	0	242	0	0	8,303

-continued-

Table A4. *Annual Change in the UAAL for Connecticut SERS by Source, 1985-2014, in Millions* (cont'd)

Year	Starting UAAL	Contributions vs. ARC	ARC vs. UAAL growth	Investment returns [l]	Early retirement program	Benefit changes	Changes to assumptions and methods	Actuarial experience	Other	Unknown	Ending UAAL
2008	$8,303	$91	$213	$165	$0	$0	$212	$262	$7	$0	$9,253 [g,*]
2009 [j]	9,253	144	184	1,714	554	0	0	0	0	0	9,581 [b]
2010	11,295	278	-67	-211	0	0	0	-146	0	0	11,295
2011	11,705	224	187	-447	0	-644	0	-20	0	0	11,705
2012	11,004	114	55	773	0	0	1,213	115	0	0	11,004 [h,*]
2013 [k]	13,274	2	125	463	0	0	0	0	0	0	13,274
2014	13,863	0	-54	-129	0	193	0	1,048	0	0	14,921
Total		3,179	2,296	800	1,466	-452	1,099	2,608	108	1,424	

[a] Shift from EAN to PUC.
[b] 1989 Early Retirement Program.
[c] February 1992 SEBAC Agreement II: Re-amortized 1989 Early Retirement Program and 1992 Early Retirement Incentive Program (ERIP) over 40 years, to begin in 1994-1995 fiscal year. Reduced state's contribution to fund past service liability by $215 million for the 1991-92 fiscal year.
[d] June 1992 SEBAC Agreement III: Set statutory contributions towards the UAAL for fiscal year 1992-93 at $92.7 million; 1993-94 at $121.3 million; 1994-95 at $130.5 million; and 1995-96 at $138.4 million.
[e] May 1995 SEBAC Agreement IV: Set statutory contributions towards the UAAL for fiscal year 1996-97 at $152 million; and 1997-98 at $164.15 million.
[f] February 1997 SEBAC Agreement V: Decreased Tier II vesting from 10 years to 5 years.
[g] Reduced discount rate from 8.5 to 8.25.
[h] Reduced discount rate from 8.25 to 8.00.
[i] No Actuarial Valuation was performed for 1999. Change in the UAAL is estimated.
[j] No detailed data on the change in the UAAL are available for 2009. Data is estimated.
[k] No detailed data on the change in the UAAL are available for 2013. Data is estimated.
[l] Includes both the actuarial smoothing and the corridor method that limits the actuarial assets to +/- 20% of market assets.
[*] Experience study.
Source: CRR calculations based on various actuarial valuations for Connecticut SERS.

iii. Analysis of TRS' Unfunded Liability

Table A5. *Annual Change in the UAAL for Connecticut TRS from 1983-2014, by Source, in Millions*

Year	Beginning UAAL	Contributions vs. ARC	ARC vs. UAAL growth	Investment returns	POB	Benefit changes	Assumptions and methods	Actuarial experience	COLA	Miscellaneous	Unknown	Ending UAAL
1983	$2,284	$139	$-40	$0	$0	$28	$0	$0	$0	$0	$0	$2,411
1984	2,411	149	-60	-33	0	0	762	0	0	0	33	3,261
1985	3,261	136	87	-42	0	0	0	59	-11	10	0	3,500
1986	3,500	85	138	-159	0	0	0	0	0	0	255	3,819
1987	3,819	77	158	-155	0	2	0	0	0	0	713	4,612
1988	4,612	68	210	-103	0	0	0	0	0	0	1	4,788
1989	4,788	60	192	-134	0	0	-1,202	0	0	0	639	4,343 [a]
1990	4,343	71	98	-132	0	0	0	0	0	0	-420	3,961 [b]
1991	3,961	173	136	-65	0	0	0	0	0	0	-745	3,461
1992	3,461	177	108	-53	0	0	0	0	-1,384	0	122	2,430 [c]
1993	2,430	182	-48	-86	0	0	0	0	0	0	36	2,514 [d]
1994	2,514	16	113	-25	0	0	0	0	0	0	2	2,621
1995	2,621	15	123	-243	0	0	-161	0	0	0	617	2,971 [e]
1996	2,971	19	141	-162	0	0	0	0	0	0	411	3,380 [f]
1997	3,380	26	164	-326	0	0	0	0	0	0	229	3,473
1998	3,473	24	140	-588	0	0	0	0	0	0	200	3,249
1999	3,249	25	113	-596	0	0	0	0	0	0	-27	2,765
2000	2,765	27	62	-633	0	0	0	0	0	0	-31	2,192
2001	2,192	21	12	-84	0	0	0	0	0	0	278	2,419
2002	2,419	-6	76	559	0	0	0	0	0	0	245	3,293 [g]
2004	3,293	120	222	1,753	0	0	0	-166	0	0	2	5,224
2006	5,224	91	332	458	0	0	0	818	0	0	0	6,922 [h]
2008	6,922	9	50	-494	-2,000	1,151	0	188	705	0	0	6,530
2009	6,530	-25	119	1,054	0	0	0	81	-46	163	4	7,881 [i]

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Table A5. *Annual Change in the UAAL for Connecticut TRS from 1983-2014, by Source, in Millions* (cont'd)

Year	Beginning UAAL	Contributions vs. ARC	ARC vs. UAAL growth	Investment returns	POB	Benefit changes	Assumptions and methods	Actuarial experience	COLA	Miscellaneous	Unknown	Ending UAAL
2010	$7,881	$-25	$273	$1,069	$0	$0	$0	$50	$-190	$0	$7	$9,066
2011	9,066	-26	358	1,000	0	0	-89	-307	-183	0	0	9,819 [j]
2012	9,819	-33	240	888	0	0	0	26	180	0	7	11,127
2013	11,127	-34	327	-175	0	0	0	106	-28	0	7	11,331
2014	11,331	-41	162	-373	0	0	0	-217	-66	0	6	10,803
Total		1,523	4,006	2,121	-2,000	1,180	-691	637	-1,023	173	2,592	

[a] Impact of changed discount rate from 8 to 8.5 percent on liability.
[b] Impact of changed discount rate from 8 to 8.5 percent on normal cost.
[c] Impact of COLA Amendment PA.92.205 on reported liability.
[d] Impact of COLA Amendment PA.92.205 on normal cost.
[e] Shift to 5-year smoothing of actuarial assets in 1996, recalculates 1995 assets under 5-year smoothing.
[f] Change in Assumptions from 89-94 Experience Study. Shifted to 5-year smoothing of actuarial assets.
[g] Change in Assumptions from 1996-2001 Experience Study.
[h] Change in Assumptions from 2001-2005 Experience Study.
[i] There was an increase in the UAAL of $163.4 million due to the transition from the prior actuarial firm. This is primarily due to a difference in the allocation of liabilities between normal cost and accrued liability.
[j] Change in Assumptions from 2005-2010 Experience Study. Shift to 5-year smoothing of actuarial assets.
Source: CRR calculations based on various actuarial valuations for Connecticut TRS.

B. Projections of Plan Funded Ratios and State Contributions

Table A6. *SERS Funded Ratio under the Current Agreement and Alternative Funding Methods*

	8% return			6.5% return			5.5% return		
Year	Current agreement	Level-dollar	Level-dollar, 15-yr open	Current agreement	Level-dollar	Level-dollar, 15-yr open	Current agreement	Level-dollar	Level-dollar, 15-yr open
2014	41.5%	41.5%	41.5%	41.5%	41.5%	41.5%	41.5%	41.5%	41.5%
2015	41.5	41.5	41.5	41.4	41.4	41.4	41.3	41.3	41.3
2016	41.1	41.1	41.1	40.8	40.8	40.8	40.6	40.6	40.6
2017	41.3	41.3	41.3	40.6	40.6	40.6	40.2	40.2	40.2
2018	44.2	45.2	45.2	43.0	44.1	44.1	42.3	43.4	43.4
2019	47.2	49.4	49.1	45.5	47.7	47.5	44.4	46.6	46.4
2020	50.3	53.5	52.7	48.1	51.3	50.5	46.6	49.8	49.0
2021	53.6	57.6	56.0	50.8	54.8	53.1	49.0	53.0	51.3
2022	57.1	61.6	59.0	53.7	58.2	55.5	51.6	56.1	53.4
2023	60.7	65.7	61.7	56.8	61.7	57.6	54.4	59.3	55.1
2024	64.6	69.7	64.2	60.2	65.3	59.5	57.5	62.6	56.7
2025	68.8	73.9	66.5	63.9	69.0	61.2	61.0	66.0	58.0
2026	73.2	78.0	68.7	68.0	72.7	62.7	64.9	69.6	59.2
2027	78.0	82.3	70.7	72.5	76.7	64.1	69.3	73.4	60.2
2028	83.1	86.6	72.5	77.5	81.0	65.3	74.3	77.7	61.1
2029	88.5	91.1	74.2	83.2	85.6	66.4	80.1	82.5	61.9
2030	94.3	95.6	75.8	89.7	90.8	67.4	87.0	88.1	62.6
2031	100.4	100.2	77.3	97.3	96.9	68.3	95.5	95.1	63.2
2032	106.7	104.8	78.7	107.2	105.1	69.2	107.5	105.3	63.8
2033	106.9	105.0	80.1	109.4	107.4	70.0	111.1	109.0	64.4
2034	105.8	104.0	81.3	106.8	104.9	70.8	107.5	105.5	64.9
2035	104.7	103.0	82.5	103.6	101.8	71.5	103.1	101.1	65.4
2036	103.7	102.1	83.7	100.8	99.1	72.2	99.1	97.2	66.0
2037	102.9	101.4	84.7	98.5	97.0	72.9	95.7	94.1	66.5
2038	102.3	100.9	85.8	96.6	95.3	73.6	93.0	91.5	67.0
2039	101.7	100.6	86.7	95.0	93.8	74.2	90.5	89.3	67.5
2040	101.3	100.3	87.7	93.5	92.6	74.8	88.4	87.5	68.1
2041	100.9	100.1	88.5	92.2	91.6	75.5	86.6	86.0	68.6
2042	100.6	99.9	89.4	91.2	90.8	76.1	85.2	84.9	69.2
2043	100.4	99.8	90.1	90.3	90.2	76.7	84.2	84.2	69.7
2044	100.2	99.7	90.9	89.7	89.9	77.3	83.7	83.9	70.3
2045	100.1	99.7	91.6	89.4	89.9	77.8	83.6	84.0	70.8

Source: CRR calculations.

Table A7. *State Contributions to SERS under the Current Agreement and Alternative Funding Methods, in Millions*

	8% return			6.5% return			5.5% return		
Year	Current agreement	Level-dollar	Level-dollar, 15-yr open	Current agreement	Level-dollar	Level-dollar, 15-yr open	Current agreement	Level-dollar	Level-dollar, 15-yr open
2014	$1,269	$1,269	$1,269	$1,269	$1,269	$1,269	$1,269	$1,269	$1,269
2015	1,379	1,379	1,379	1,379	1,379	1,379	1,379	1,379	1,379
2016	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514	1,514
2017	1,569	1,569	1,569	1,569	1,569	1,569	1,569	1,569	1,569
2018	1,979	2,313	2,313	1,988	2,324	2,324	1,995	2,332	2,332
2019	2,193	2,539	2,456	2,214	2,564	2,481	2,228	2,581	2,497
2020	2,258	2,541	2,369	2,297	2,586	2,411	2,322	2,616	2,438
2021	2,332	2,540	2,282	2,396	2,613	2,347	2,438	2,661	2,389
2022	2,409	2,538	2,200	2,504	2,645	2,289	2,565	2,713	2,347
2023	2,487	2,535	2,121	2,619	2,682	2,237	2,703	2,774	2,311
2024	2,566	2,531	2,045	2,743	2,725	2,190	2,854	2,847	2,280
2025	2,647	2,526	1,973	2,880	2,778	2,148	3,024	2,934	2,257
2026	2,730	2,521	1,905	3,032	2,844	2,112	3,216	3,041	2,239
2027	2,814	2,516	1,841	3,203	2,926	2,081	3,438	3,174	2,226
2028	2,899	2,509	1,781	3,402	3,033	2,056	3,703	3,347	2,220
2029	2,986	2,503	1,727	3,645	3,180	2,037	4,034	3,582	2,221
2030	3,069	2,494	1,677	3,956	3,395	2,025	4,476	3,924	2,228
2031	3,139	2,478	1,633	4,415	3,758	2,018	5,156	4,503	2,241
2032	3,148	2,426	1,595	5,371	4,638	2,018	6,652	5,918	2,261
2033	379	383	1,561	395	395	2,023	395	395	2,286
2034	121	159	1,532	97	144	2,033	84	135	2,315
2035	126	168	1,506	26	49	2,047	0	0	2,349
2036	188	236	1,485	153	194	2,066	129	170	2,388
2037	258	313	1,468	313	383	2,090	342	425	2,431
2038	324	384	1,454	468	562	2,117	553	672	2,478
2039	386	447	1,443	611	726	2,148	762	899	2,528
2040	444	504	1,435	753	885	2,183	973	1,127	2,583
2041	499	556	1,430	902	1,051	2,222	1,202	1,365	2,642
2042	551	604	1,428	1,065	1,228	2,264	1,455	1,617	2,705
2043	600	649	1,429	1,245	1,419	2,310	1,735	1,887	2,772
2044	648	692	1,431	1,446	1,628	2,359	2,051	2,182	2,843
2045	678	718	1,420	1,658	1,846	2,397	2,397	2,495	2,903

Source: CRR calculations.

Table A8. *TRS Funded Ratio under Current Law Alternative Funding Methods*

	8.5% return			6.5% return			5.5% return		
Year	Current law	Level-dollar	Level-dollar, 15-yr open	Current law	Level-dollar	Level-dollar, 15-yr open	Current law	Level-dollar	Level-dollar, 15-yr open
2014	59.0%	59.0%	59.0%	59.0%	59.0%	59.0%	59.0%	59.0%	59.0%
2015	60.2	60.2	60.2	59.9	59.9	59.9	59.8	59.8	59.8
2016	62.5	62.5	62.5	61.6	61.6	61.6	61.2	61.2	61.2
2017	64.6	64.6	64.6	62.7	62.7	62.7	61.8	61.8	61.8
2018	66.5	67.2	67.2	63.4	64.1	64.1	61.9	62.6	62.6
2019	68.4	69.8	69.6	64.0	65.5	65.4	62.0	63.5	63.3
2020	70.3	72.3	71.8	64.8	66.9	66.4	62.2	64.4	63.8
2021	72.3	74.8	73.9	65.7	68.3	67.3	62.6	65.3	64.2
2022	74.4	77.3	75.7	66.8	69.8	68.0	63.3	66.4	64.5
2023	76.7	79.8	77.4	68.2	71.5	68.7	64.3	67.7	64.8
2024	79.1	82.2	79.0	69.8	73.2	69.3	65.7	69.3	65.0
2025	81.6	84.7	80.4	71.8	75.2	69.8	67.5	71.0	65.1
2026	84.3	87.3	81.7	74.1	77.4	70.2	69.8	73.1	65.2
2027	87.2	89.8	82.9	76.9	79.9	70.5	72.6	75.7	65.3
2028	90.2	92.4	84.0	80.3	82.8	70.8	76.2	78.7	65.3
2029	93.4	95.0	85.1	84.4	86.2	71.1	80.7	82.5	65.2
2030	96.9	97.7	86.0	89.5	90.3	71.2	86.4	87.3	65.1
2031	100.5	100.4	86.9	96.1	95.8	71.3	94.3	93.9	65.0
2032	104.1	102.9	87.7	105.9	104.2	71.4	106.6	104.7	64.9
2033	104.2	103.0	88.4	109.2	107.5	71.4	111.4	109.5	64.7
2034	103.7	102.5	89.1	106.4	104.8	71.3	107.6	105.7	64.4
2035	103.1	102.0	89.7	103.0	101.3	71.2	102.8	100.9	64.1
2036	102.6	101.5	90.3	99.7	98.0	71.1	98.2	96.3	63.7
2037	102.2	101.2	90.8	96.9	95.4	70.9	94.2	92.6	63.3
2038	101.8	100.9	91.2	94.5	93.2	70.6	90.8	89.4	62.9
2039	101.5	100.7	91.7	92.3	91.2	70.3	87.6	86.4	62.3
2040	101.3	100.5	92.0	90.2	89.3	69.8	84.7	83.8	61.7
2041	101.1	100.4	92.4	88.3	87.6	69.3	81.9	81.4	61.0
2042	100.9	100.3	92.6	86.6	86.1	68.7	79.5	79.3	60.1
2043	100.8	100.2	92.9	85.0	84.8	68.0	77.4	77.5	59.2
2044	100.7	100.2	93.1	83.8	83.9	67.1	75.7	76.2	58.0
2045	100.6	100.1	93.2	82.9	83.2	66.1	74.5	75.3	56.6

Source: CRR calculations.

Table A9. *State Contributions to TRS under Current Law and Alternative Funding Methods, in Millions*

	8.5% return			6.5% return			5.5% return		
Year	Current law	Level-dollar	Level-dollar, 15-yr open	Current law	Level-dollar	Level-dollar, 15-yr open	Current law	Level-dollar	Level-dollar, 15-yr open
2014	$949	$949	$949	$949	$949	$949	$949	$949	$949
2015	984	984	984	984	984	984	984	984	984
2016	976	976	976	976	976	976	976	976	976
2017	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012	1,012
2018	1,219	1,425	1,425	1,245	1,455	1,455	1,258	1,470	1,470
2019	1,247	1,440	1,395	1,304	1,507	1,460	1,331	1,540	1,491
2020	1,283	1,436	1,343	1,385	1,554	1,452	1,434	1,611	1,505
2021	1,322	1,431	1,293	1,477	1,607	1,449	1,551	1,692	1,524
2022	1,363	1,427	1,246	1,580	1,669	1,450	1,682	1,783	1,547
2023	1,406	1,424	1,204	1,694	1,739	1,456	1,828	1,886	1,574
2024	1,450	1,421	1,164	1,820	1,819	1,466	1,990	2,001	1,604
2025	1,494	1,418	1,127	1,962	1,911	1,478	2,172	2,133	1,636
2026	1,539	1,414	1,093	2,121	2,017	1,492	2,379	2,285	1,670
2027	1,583	1,408	1,060	2,305	2,143	1,509	2,620	2,465	1,705
2028	1,625	1,400	1,030	2,522	2,299	1,528	2,908	2,687	1,743
2029	1,664	1,389	1,002	2,790	2,500	1,549	3,268	2,973	1,782
2030	1,695	1,371	976	3,145	2,783	1,572	3,754	3,377	1,822
2031	1,707	1,338	952	3,688	3,246	1,596	4,509	4,042	1,864
2032	1,645	1,250	930	4,872	4,350	1,623	6,200	5,635	1,906
2033	269	270	910	288	288	1,650	288	288	1,950
2034	135	158	892	61	96	1,679	33	73	1,994
2035	136	161	876	0	0	1,709	0	0	2,039
2036	166	195	861	66	93	1,740	28	56	2,084
2037	201	232	848	214	272	1,771	223	292	2,129
2038	234	268	836	360	445	1,804	422	527	2,174
2039	265	299	826	500	599	1,836	614	737	2,219
2040	293	326	818	637	747	1,869	804	942	2,263
2041	320	351	811	782	899	1,902	1,006	1,149	2,306
2042	345	374	806	939	1,056	1,934	1,221	1,361	2,348
2043	369	395	802	1,110	1,220	1,966	1,453	1,581	2,389
2044	392	416	799	1,299	1,395	1,997	1,706	1,811	2,427
2045	414	436	798	1,508	1,582	2,027	1,983	2,054	2,464

Source: CRR calculations.

C. Assumptions and Methods for Projections of Finances

i. Connecticut SERS

- Benefit growth rate: Actuarial Projection, ~ 2.5 percent annually
- Payroll growth rate: Actuarial Projection, ~ 4 percent annually
- Discount rate/long-term assumed return: 8 percent
- Total normal cost rate: 10.2 → 9.2 percent-of-payroll
- Employee contribution rate: Actuarial Projection, 2.2 → 3.0 percent, percent-of-payroll
- Actuarial asset smoothing method: 5-year smoothing
- Percent of ARC paid: 100 percent
- UAAL amortization methods
    - *Current Agreement.*
        - Level-percent-of-payroll, closed (2032)
    - *Alternative 1.*
        - Level-dollar, closed (2032)
    - *Alternative 2.*
        - Level-dollar, open (15-year period)
    - *Alternative 3.*
        - Level-dollar, closed amortization (2032) until plan is 80-percent funded. Then, open (15-year period) amortization of UAAL.

ii. Connecticut TRS

- Benefit growth rate: 3.75 percent
- Payroll growth rate: 3.75 percent
- Discount rate/long-term assumed return: 8.5 percent
- Total normal cost rate: 9.73 percent-of-payroll
- Employee contribution rate: 6 percent-of-payroll
- Percent of ARC paid: 100 percent
- Actuarial asset smoothing method: 5-year smoothing
- UAAL amortization methods
    - *Current Law.*
        - Level-percent-of-payroll, closed (2032)
    - *Alternative 1.*
        - Level-dollar, closed (2032)
    - *Alternative 2.*
        - Level-dollar, open (15-year period)
    - *Alternative 3.*
        - Level-dollar, closed amortization (2032) until plan is 80-percent funded. Then, open (15-year period) amortization of UAAL.