THE NEW HAMPSHIRE RETIREMENT SYSTEM:
A LOOK BACKWARD AND FORWARD

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**Executive Summary**

Despite good-faith efforts, the funded ratio for the New Hampshire Retirement System (NHRS) is lower today than it was in 2007 and is below the national average. Much of the decline in the System's funded ratio since 2007 can be attributed to investment losses experienced during the financial crisis in 2008-2009. However, since 2009 – despite benefit modifications, stronger than average investment returns, and a strong commitment to paying the full Annual Required Contribution (ARC) – the funded ratio for the System has improved only slightly and the dollar amount of the unfunded liability has grown.

Although NHRS is currently one of the worst-funded plans in the nation, costs are low in comparison to the national average. The NHRS is a relatively small retirement system, so liabilities relative to payrolls are small compared to the average plan. Additionally, state and local government employers do not contribute much toward the normal cost, which is the amount needed to fund the additional benefits earned each year. As such, the majority of the relatively modest pension costs for New Hampshire governments stem from the existing unfunded liability.

*What Has Driven UAAL Growth since 2007?*

Since 2007, NHRS' Unfunded Actuarial Accrued Liability (UAAL) has grown by about $2.7 billion. A basic comparative analysis found that NHRS currently uses more conservative actuarial assumptions than its peers and has achieved better returns. The plan's assumed return of 7.25 percent is among the lowest in the *Public Plans Database* (PPD), and the mortality assumptions used by NHRS are based on the most current mortality table produced by the Society of Actuaries, RP-2014. NHRS investment performance exceeded the average return for large state and local plans in 2007 through 2017. Ignoring investment performance during the 2008-2009 crisis, NHRS has for the most part achieved its 7.25-percent assumed return. A detailed historical analysis revealed three key components driving UAAL growth since 2007: 1) investment losses during the financial crisis; 2) NHRS' method for amortizing its unfunded liability; and 3) reductions in the assumed return in the wake of the 2008-2009 crisis (as well as periodic adjustments to other actuarial assumptions).

Poor investment performance has accounted for $700 million of the UAAL growth since 2007 – nearly $650 million of it during 2008 and 2009 (see Figure 1). The method for amortizing unfunded liabilities currently used by the System is a level-percent-of-pay method that backloads costs and, depending on the amortization period, allows the UAAL to grow in early years. The backloaded nature of this amortization method added another $700 million to the unfunded liability. Additionally, a level-percent-of-pay method can result in unexpected contribution shortfalls if actual payroll growth is less than the assumed payroll growth used to calculate amortization payments.[1] For NHRS, an additional $300 million in unfunded liabilities is due to differences between the assumed and actual levels of payroll growth. Finally, $1.6 billion in unfunded liabilities are associated with the NHRS' gradual reduction in its assumed return in the wake of the financial crisis, as well as regular periodic adjustments to other actuarial assumptions.

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[1]See Appendix I for a brief analysis on the impact of payroll growth.

Figure 1. *Sources of Change to NHRS' UAAL from 2007-2016, in Billions*
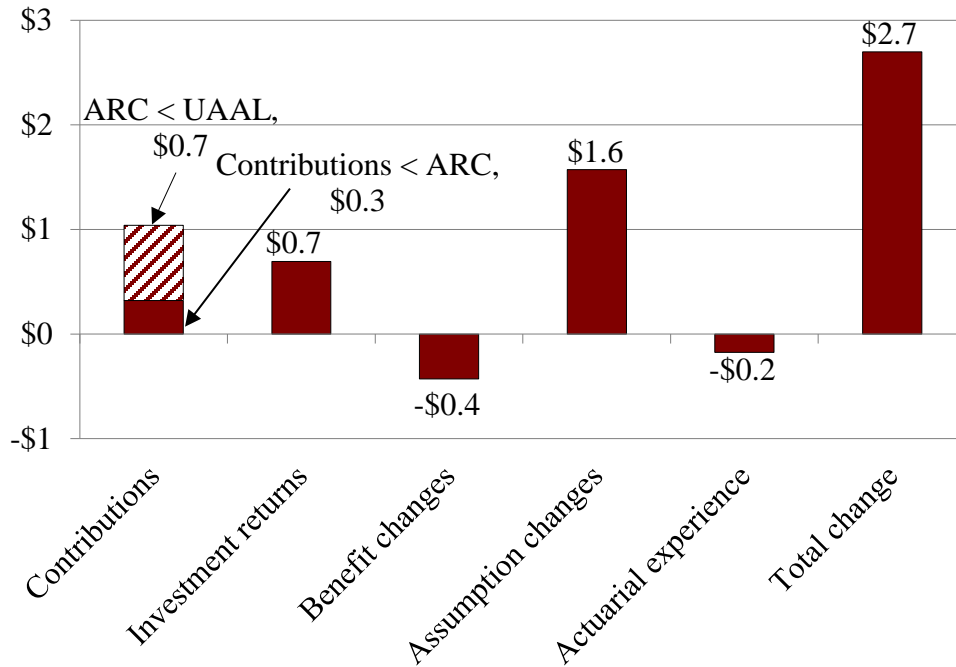


*Source:* Authors' calculations from NHRS actuarial valuations (AVs) (2007-2016).

*Looking Forward*

Again, the main source of NHRS pension costs is the amortization of the unfunded liability. Under current law, the UAAL is scheduled to be paid off by 2039, with dollar costs expected to rise steadily, in step with expected payroll growth, over that period. If all actuarial assumptions are met, and the System achieves its assumed return, employers' pension costs will rise from $350 million in 2016 to nearly $800 million by 2039 (mostly due to the backloaded schedule for amortizing the UAAL). If the plan were to shift from a level-percent-of-pay amortization to a level-dollar approach, costs would rise to about $500 million and increase slowly to $600 million by 2039.

Importantly, the projections are sensitive to key factors such as actual future payroll growth and investment returns. If payroll growth is lower than assumed (for example, no payroll growth versus expected growth of around 3 percent), the improvement in funding is more backloaded and costs would rise more than expected, to almost $900 million in 2039 instead of $800 million.

Further, if investment returns are even 1 percent less than NHRS has assumed (6.25-percent rather than the 7.25-percent assumed return), costs for the System could balloon to over $1 billion by 2039 regardless of the method of funding. On the other hand, if returns are higher than expected (8.25 percent rather the assumed return of 7.25 percent), the ARC rises modestly from $350 million in 2016 to about $470 million in 2029, before declining to $140 million by 2039.

*How Have Other States Addressed Their Pension Challenges?*

To place NHRS in the broader context of the public pension landscape, the analysis looked at the experience of three other state-administered plans: the Maine State Employees and Teachers Retirement Plan (Maine SETP), the Alabama Employees Retirement System (Alabama ERS), and the Vermont State Teachers Retirement System (Vermont TRS). While each plan's experience is unique, general themes emerged.

First, similar to NHRS, all three plans had significant investment losses during the 2008-2009 crisis. In response, the plans adjusted their assumed returns by either lowering the long-term rate or experimenting with separate assumptions for short- and long-term returns. For all three plans plans, investment performance since 2010 roughly equaled or exceeded their assumed returns, but the impact of the strong investment performance on funded status was dampened due to the continued phase-in of the dramatic 2008 and 2009 investment losses in the actuarial value of assets.

Second, for two of the three plans reviewed, contributions since the crisis have not been enough to keep unfunded liabilities from growing due to the level-percent-of-payroll amortization method used and a relatively long amortization period. Maine SETP was the only plan making contributions large enough to prevent annual growth in UAAL. Although Maine SETP used a level-percent-pay method for amortizing unfunded liabilities, its amortization period for newly created unfunded liabilities has been sufficiently short to ensure that annual contributions had a meaningful impact on unfunded liabilities each year.[2] The remaining two plans analyzed, including NHRS, all used amortization methods that allowed the dollar amount of the UAAL to grow.

Finally, the financial crisis spurred a wave of benefit modifications. Benefit reductions for current members immediately improved the funded ratio. Changes that focused on benefits for new hires had little impact on existing funded ratios (although the modifications will improve the trajectory of liabilities going forward).

*Conclusions and Recommendations*

Since 2007, backloaded amortization schedules and investment returns below the assumed return (mostly during the financial crisis) added to the unfunded liability for NHRS and increased costs. However, because NHRS is a relatively small retirement system and employers do not contribute much toward the normal cost for ongoing employee benefits earned each year, total employer contributions to the System are relatively modest in comparison to the national average. Given the relative affordability of current pension costs, the report suggests two changes to NHRS that would likely increase costs today but would reduce the risk that poor investment returns and/or a backloaded funding policy could significantly increase costs or reduce the funded ratio down the road.

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[2] Maine SETP is scheduled to pay off its 1998 unfunded liability by 2028 and has historically amortized newly created unfunded liabilities over 10 years. On November 7, 2017, Maine passed a law extending the amortization period for new unfunded liabilities from 10 to 20 years. This will delay the plan's progress towards full funding.

The first change would be to shift to a level-dollar amortization of the unfunded liability. Although such a shift would increase near-term costs, it would improve funding more quickly and limit the risk of unintended contribution shortfalls resulting from lower-than-expected payroll growth. Additionally, if the assumed investment return is achieved each year, the UAAL would decrease annually in dollar terms. A more rapid reduction of the UAAL may be increasingly desirable for the state and local governments that pay into NHRS, given that new GASB standards require unfunded liabilities to be reported on government balance sheets.[3]

The second change would be to switch from a single long-term assumed return to using different rates for short and long-term return expectations. In the wake of the financial crisis, 10 large plans did so.[4] Three plans use short- and mid-term rates that automatically adjust to align recent investment experience with long-term expectations.[5] For example, if past performance exceeded expectations, expectations for future returns would be reduced such that the average return over the past and future periods match long-term expectations. Interestingly, by 2016, seven of the 10 plans had shifted back to a single long-term rate; higher-than-expected returns in the wake of the financial crisis resulted in lower return expectations and increased contribution requirements. This last fact highlights an important – and desirable – feature of explicitly setting short and long-term return expectations: it often asks plans to put aside more money during times of higher-than-expected returns to protect against the risk of lower-than-expected-returns in the future if the overall performance reverts to long-term expectations.

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[3]While the new GASB 67 and 68 accounting standards are not meant to be funding standards, they do require that governments who participate in cost-sharing multiemployer plans report their proportion of the plan's unfunded liabilities on their balance sheet. This new reporting requirement may incentivize participating governments to adopt funding methods that focus on extinguishing unfunded liabilities more quickly.

[4]Alabama ERS (2012-2016), Alabama TRS (2012-2016), Georgia Teachers (2010-2016), Minnesota Police and Fire (2012-2014), Minnesota Public Employees (2012-2014), Minnesota State Employees (2012-2014), Minnesota Teachers (2012-2016), St. Paul Teachers (2012-2014), Vermont SERS (2011-2015), and Vermont Teachers (2011-2014).

[5]Alabama ERS (2012-2016), Alabama TRS (2012-2016), and Georgia Teachers (2010-2016).

**Introduction**

The State of New Hampshire has one primary retirement system: the New Hampshire Retirement System (NHRS).  The System, a unit of state government overseen by a Board of Trustees, covers nearly all public sector workers in the State.  Despite good-faith efforts to fund the System,[6] the funded ratio for NHRS dropped from 86 percent in 2001 to 60 percent in 2005.[7]  In 2007, as the funded status of NHRS improved to 67 percent on the back of strong market performance, the State Legislature mandated a retirement review commission to study the System's long-term viability.  The Commission's report cited several flaws, some of which were corrected in legislation.  Below are the two most significant flaws highlighted by the report and the legislated corrections:

1) In 1991, NHRS adopted the Open Group Aggregate funding methodology.  The method inflated the funding level, which lowered employer contribution rates for an extended period.  In 2007, just prior to the Commission, House Bill 653 was passed requiring the use of the more commonly accepted Entry Age Normal method.

2) Cost-of-living adjustments (COLAs) and the retiree Medical Subsidy were funded through a special account into which "excess earnings" were deposited.  From 1990-2000, this transfer totaled more than $900 million from the pension fund into the special account.  A 2008 law – HB 1645 – transferred a large portion of the funds in the special account back to the pension fund.  A one-time COLA was provided in FY 2009 and three variously-structured Temporary Supplemental Allowances were also adopted.[8]  Additionally, the dollar amount of the existing medical subsidy benefit was frozen.

NHRS' funded status dropped dramatically during the financial crisis and, despite the HB 653 and HB 1645 modifications, the 60 percent funded ratio since 2009 puts the System near the bottom fifth of major pension plans.  While the funded ratio has been flat, the required contributions to the plan have risen steadily as the dollar amount of the unfunded liability has grown.  This report will identify and measure factors that have undermined these efforts to improve the funded ratio of NHRS and control costs.  Based on the results, the report will recommend changes to ensure the System's long-term viability.

This report has five parts. The first is an overview of New Hampshire's current pension status and comparisons to other states.  The second part includes a historical review and analysis of factors that have contributed to the increase in NHRS' unfunded liability since 2007.  The third section provides a projection of NHRS funding out to 2039 (the statutory full funding date for NHRS), showing the impact that key factors – the realized return, actual payroll growth, and the amortization strategy – has on NHRS' path to extinguishing its unfunded liability.  The fourth

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[6] Except in 2008 and 2009, NHRS has received the full ARC each year since 2001.  The 2008 and 2009 contribution shortfall was due to a technical IRS compliance issue involving funding of the Medical Subsidy provided by NHRS, not an intentional economic decision.  The shortfall is being amortized through future employer rates beginning in fiscal year 2010.

[7] Prior to 2007, the funded ratio for NHRS was calculated using the projected unit credit method.  In 2007, NHRS adopted the entry age normal method to calculate its funded ratio.

[8] The commission recommended a guaranteed COLA to be pre-funded through increased employee contributions, but the recommendation was not adopted.

section contains case studies highlighting the experiences of three state-run pension plans that faced similar challenges to NHRS coming out of the financial crisis. The final section concludes with a synopsis of results and recommendations for the NHRS.

**Part I: How does New Hampshire Compare to Others?**

*The funded status for NHRS lags the national average but is showing slight improvement.*

While the national average continued to fall in the wake of the financial crisis, NHRS improved slightly, from 58 percent funded in 2009 to 60 percent today (see Figure 2). As a result, from 2009 to 2016, NHRS improved its rank from 19th worst-funded to 36th out of the 170 plans in the *Public Plans Database* (PPD) covering 95 percent of all members and assets in U.S. state and local pension plans.

Figure 2. *Funded Ratio of NHRS Compared to the National Average, 2001-2016*
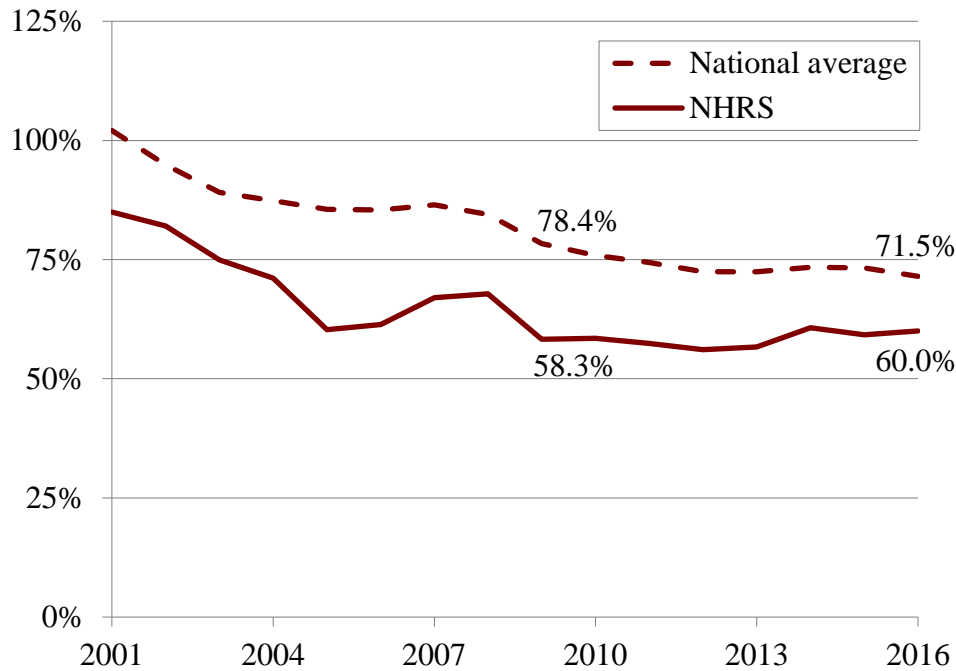


Note: Funded ratio calculated using projected unit credit method prior to 2007 and entry age normal afterward. *Sources:* Authors' calculations from NHRS 2015 AV; and PPD (2001-2016).

*NHRS is relatively inexpensive for state and local governments in New Hampshire.*

Although NHRS worse funded than the average plan, its unfunded liability costs are comparable to the national average. This is because the size of NHRS relative to the the State government is smaller than average. To show how this works, Figure 3 presents the funded status of its accrued liabilities relative to covered payroll in 2015 and for the nation as a whole. For NHRS, total accrued liabilities are only 4.8 times covered payroll – the national average is 6.8. So, while the System may have a lower funded ratio than the average plan, the size of its *unfunded* liabilities relative to payroll is close to the national average.

Figure 3. *Accrued Liabilities Relative to Payroll for NHRS and National Average, 2015*
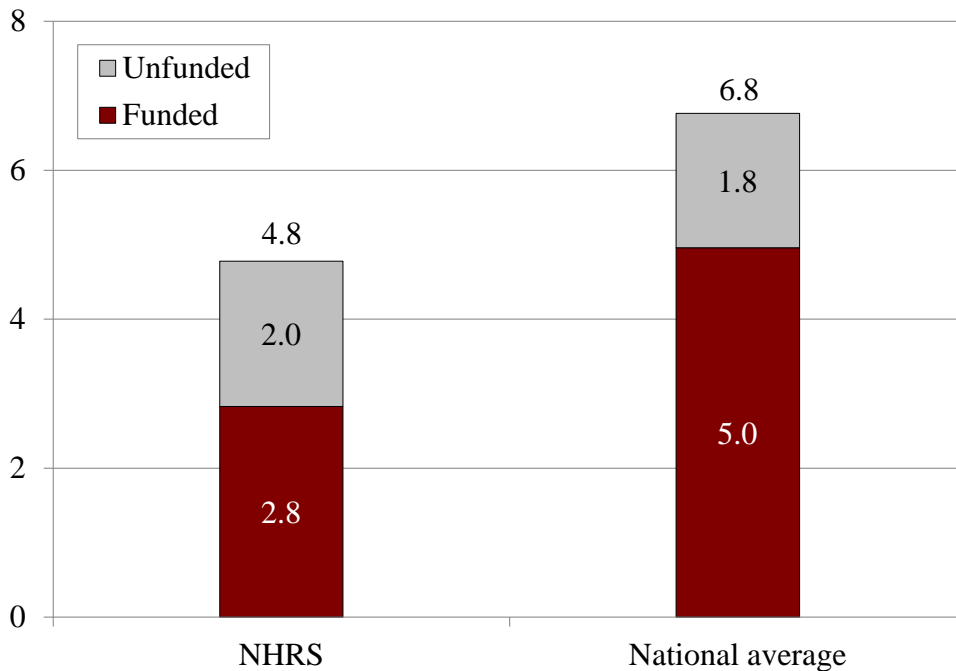


*Sources:* Authors' calculations from 2015 NHRS AV; and PPD (2001-2016).

Because NHRS' unfunded liability relative to payroll is roughly on par with the national average, its unfunded liability costs are very near the average too (see Figure 4). Additionally, state and local governments participating in NHRS are asked to contribute very little to the normal cost for ongoing pension benefits – only 2.7 percent compared to a 5.9 percent national average. Because the NH governments pay relatively little toward newly accruing benefits, and the NHRS has about average UAAL costs, the total government contributions to NHRS are currently about 15 percent of payroll compared to an 18 percent national average.

Figure 4. *Employer's Actuarial Costs as a Percentage of Payroll for NHRS Compared to the National Average, 2015*
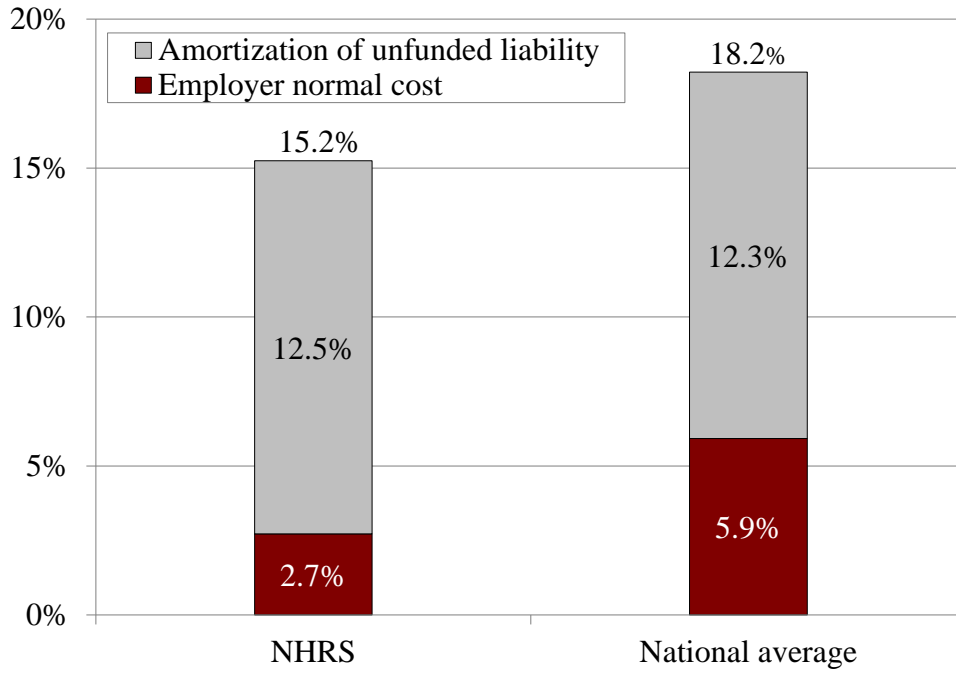


*Sources:* Authors' calculations from 2015 NHRS AV; and PPD (2001-2016).

New Hampshire's pension costs, even as a percent of the own-source revenue generated by state and local governments, are also well below the national average (see Figure 5).

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Figure 5. *Pension Costs as a Percentage of Own-Source Revenue, 2001-2015*
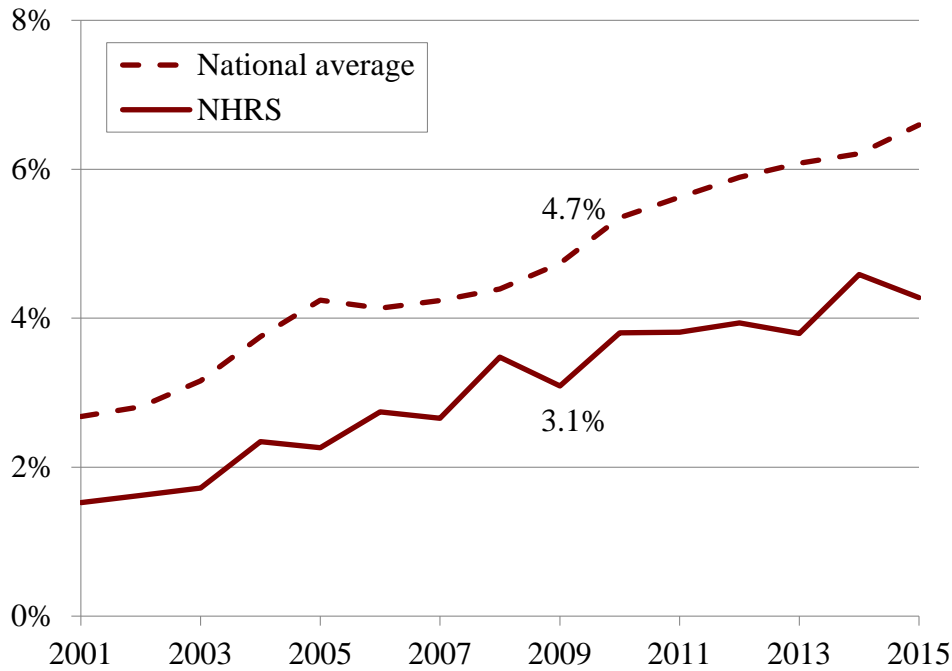


*Sources:* Authors' calculations from PPD (2001-2016); and U.S. Census Bureau (2001-2016).

*Member benefits are comparatively modest.*

The benefits provided by NHRS are relatively modest. Figure 6 shows that in terms of the total normal cost as a percent of payroll (a proxy for benefit generosity), NHRS is below the national average. This difference is partly due to the fact that most public pension plans provide regular COLA benefits.

Figure 6. *Total Normal Cost as a Percentage of Payroll, 2015*
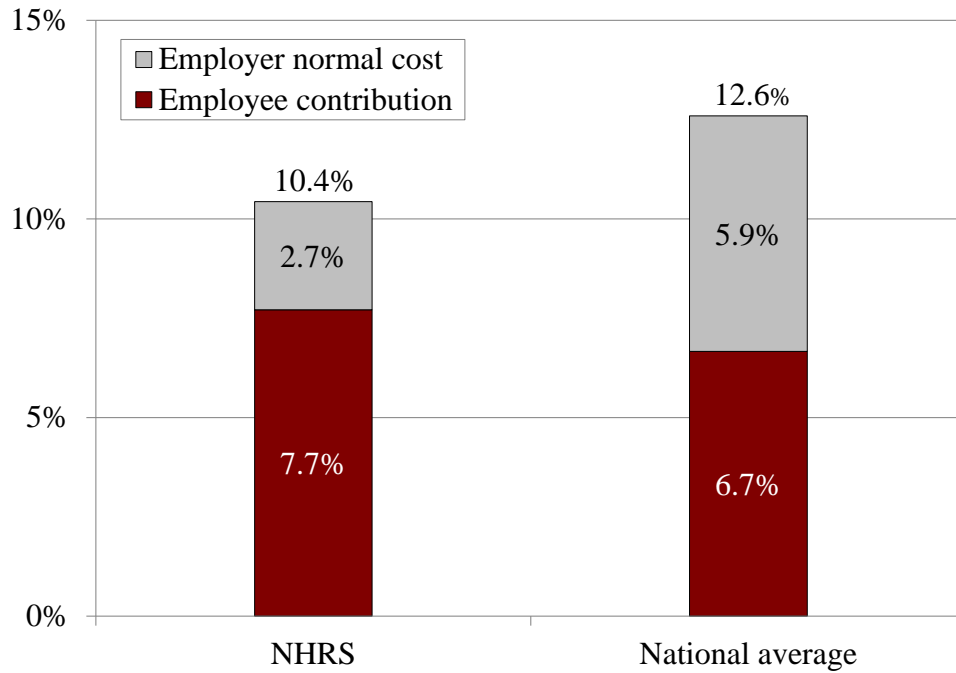
*Assumptions used by NHRS are more conservative than most public plans.*

This section compares NHRS to other large retirement systems in terms of two important actuarial assumptions: the assumed return and mortality.[9]

*Assumed Return.* Figure 7 shows the NHRS assumed return compared to the national average from 2001 through 2015. NHRS has steadily reduced its assumed return from 9 percent in 2001 to 7.25 percent as of 2016. This is below the national average of about 7.5 percent.

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[9] Workforce assumptions such as turnover, salary growth, and retirement are not included because they mostly reflect the specific HR policies for each government and the specific provisions of the pension system, making comparisons across plans are less useful.

Figure 7. *Assumed Return for NHRS Compared to the National Average, 2001-2016*
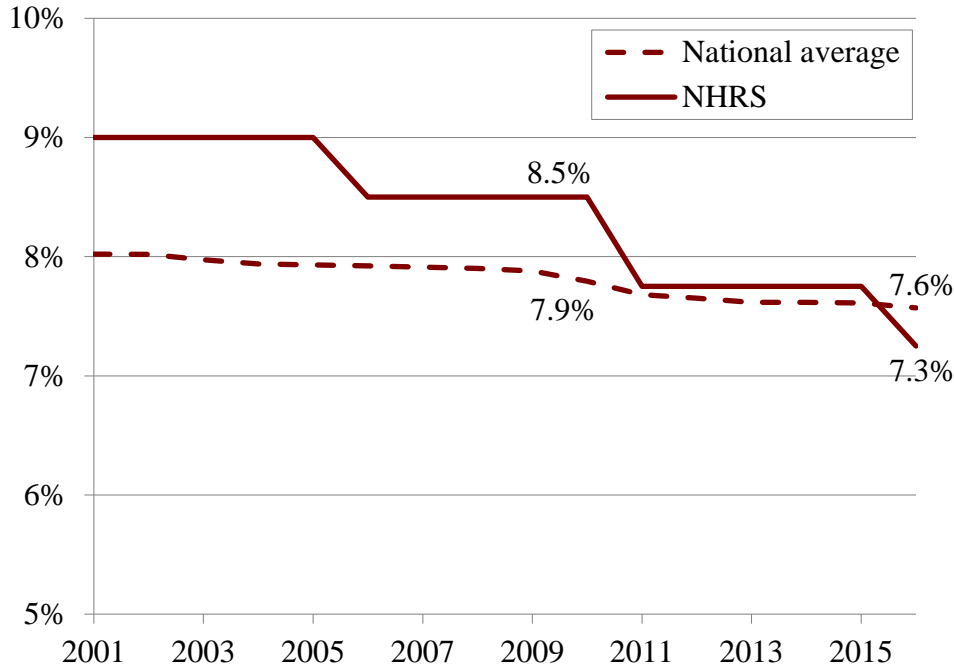


*Sources:* Authors' calculations from various NHRS AVs; and PPD (2001-2016).

The decision to reduce the long-term assumed return involves a relatively straightforward trade-off: larger contributions into the System to make up for lower expected returns on assets. However, the change also decreases the likelihood of greater amortization payments in the future to pay down unfunded liabilities that arise due to investment performance that is below the assumed return. Conversely, increasing the assumed return means paying less upfront, but it increases the likelihood of having to pay more to make up for unfunded liabilities that accrue if investment experience falls short of expectations.

*Mortality.* As of 2016, half of the plans in the PPD used the RP-2000 as their base mortality table. A third of the plans – NHRS among them – use the most recent RP-2014 table (see Figure 8). The remaining 16 percent use either older mortality tables or tables generated directly from their own mortality experience.

Figure 8. *Mortality Tables Used by Large State and Local Pension Plans, 2016*
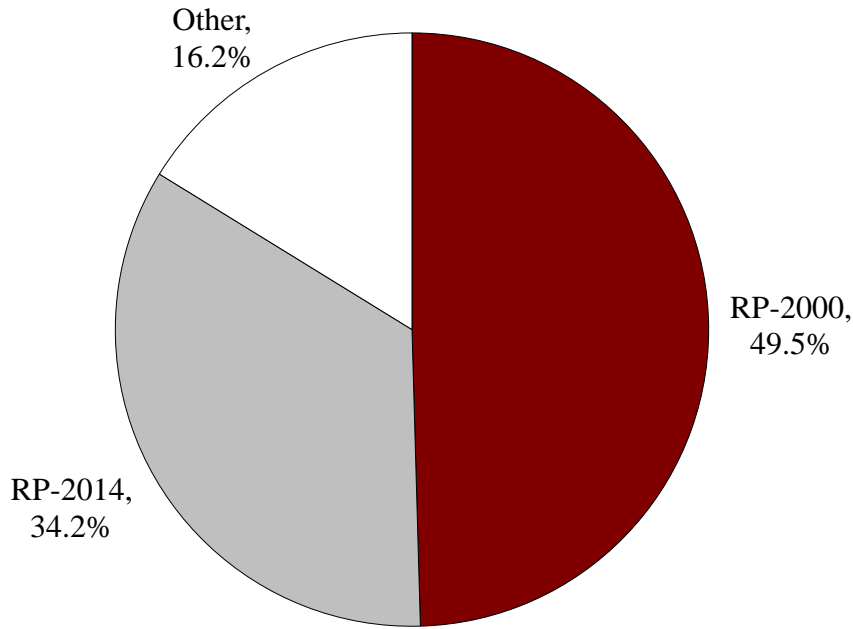
But the base mortality table is only a starting point for actuaries. They make a variety of adjustments to align the tables with their plan members' expected mortality.  Perhaps the most important is the use of mortality improvement scales to specify the pace at which longevity improves each year.  Actuaries have two approaches to applying the improvement scale: "static" and "generational."  Generally, the static method projects mortality improvements up to a fixed point in the relatively near future.  The generational method goes further, fully incorporating *all* anticipated future improvements in longevity.  Interestingly, while state and local plans primarily use a static approach, they have gradually moved toward a generational method (see Figure 9). Today, NHRS is one of 35 public plans in the PPD that are currently using the generational method to fully account for the potential impact of future mortality improvements.

Figure 9. *Number of Large State and Local Plans Using Generational Scaling, 2007-2016*
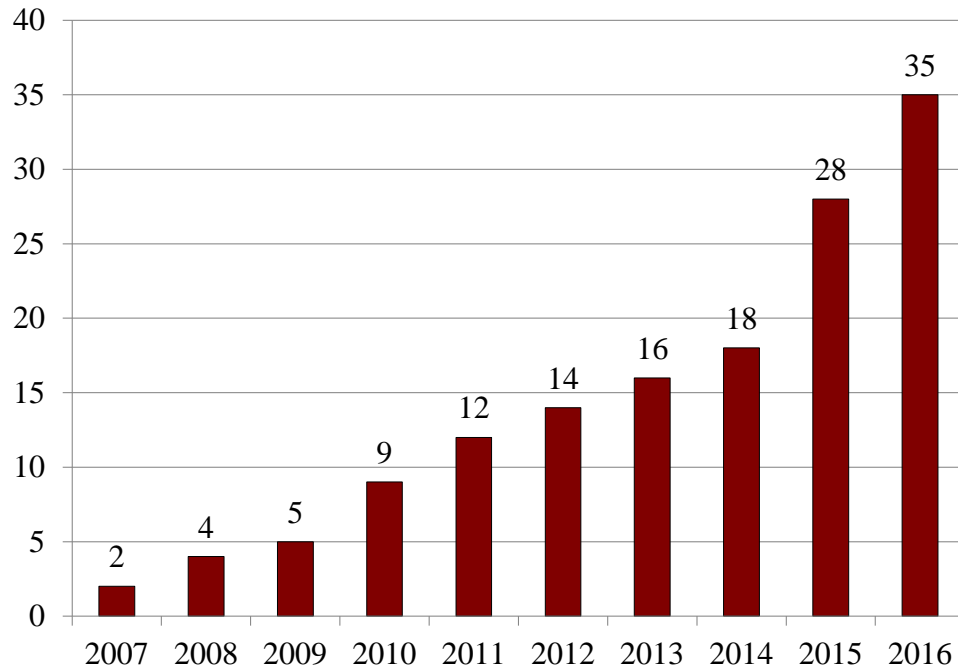


*Source:* Authors' calculations from various plan AVs.

*Level percent amortization of UAAL is common but often inadequate.*

Pension funding has two discrete components. The first is the normal cost – technically the actuarial method for spreading the costs of retirement benefits across an employee's working career. The second component of pension funding are payments to amortize unfunded liabilities – an additional cost that must be paid when past contributions to cover the normal cost end up falling short of what is needed.

*Normal Cost.* When an employee enters the workforce, the pension actuaries estimate the expected lifetime benefit for the employee based on the plan's own assumptions for employee turnover, salary growth, retirement, and mortality. To calculate the annual normal cost, the actuary spreads the total value of the lifetime benefits across an employee's working career. Each year an employee works, he or she accrues a portion of their total lifetime benefit based on how the actuary has spread the value of lifetime benefits over the expected career. The annual accrual is the normal cost. The sum of past normal costs is the total accrued benefit for the employee (or liability for NHRS). The most common method for calculating the normal cost – and that used by the NHRS – is the entry age normal method (see Figure 10).

Figure 10. *Normal Cost Methods for Large State and Local Pension Plans, 2016*
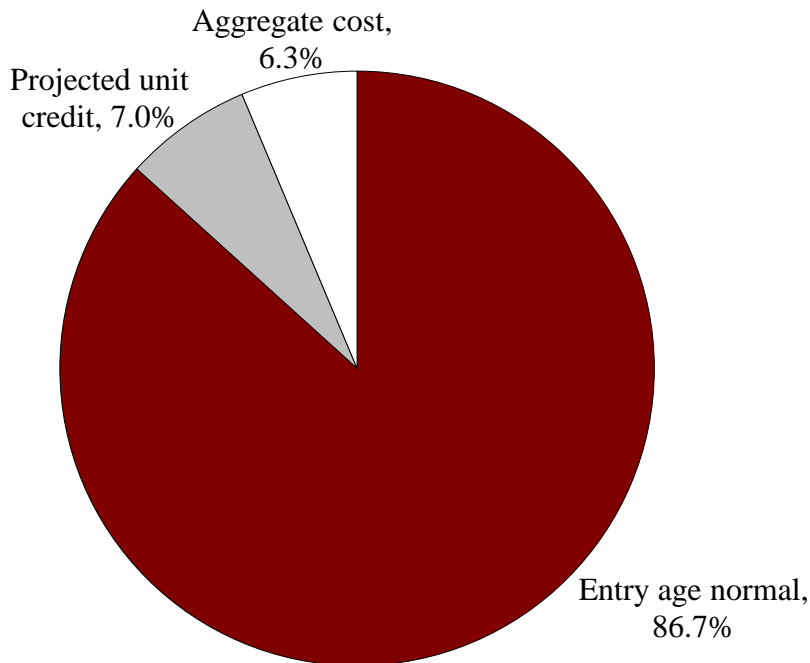


*Source:* PPD (2016).

*Amortization of UAAL.* Two-thirds of major state and local plans, including NHRS, use a level-percentage-of-payroll method to amortize unfunded liabilities. In theory, this allows for easier budgeting, as payments are expected to remain a relatively stable share of payrolls. But this method also backloads amortization payments so that smaller dollar payments are scheduled in the initial years (often allowing the UAAL to grow in dollar terms) and larger dollar payments later. Currently, based on the projection in the 2015 actuarial valuation for NHRS, the UAAL is projected to grow until 2018. From that point forward it is projected to decline and reach zero by 2039.

This level-percent-of-pay approach can also result in ballooning costs in later years if actuarial assumptions (namely investment returns) are not met in the early years when the UAAL is being allowed to grow. The alternative is a level-dollar amortization, which schedules equal dollar payments each year and reduces more of the unfunded liability in the early years. Though less convenient in terms of budgeting, level-dollar amortization better protects against ballooning costs down the road in the event of adverse experience.

Unfortunately, both methods often undermine plans' own efforts to pay off the unfunded liability by using an open amortization that keeps pushing out the slated date for full funding (see Figure 11). This is particularly problematic when using a percentage-of-pay method because contributions remain at the initial low levels indefinitely. Fortunately, NHRS uses a closed amortization period with a statutory full funding date of 2039.

Figure 11. *Amortization Methods for Large State and Local Pension Plans, 2016*
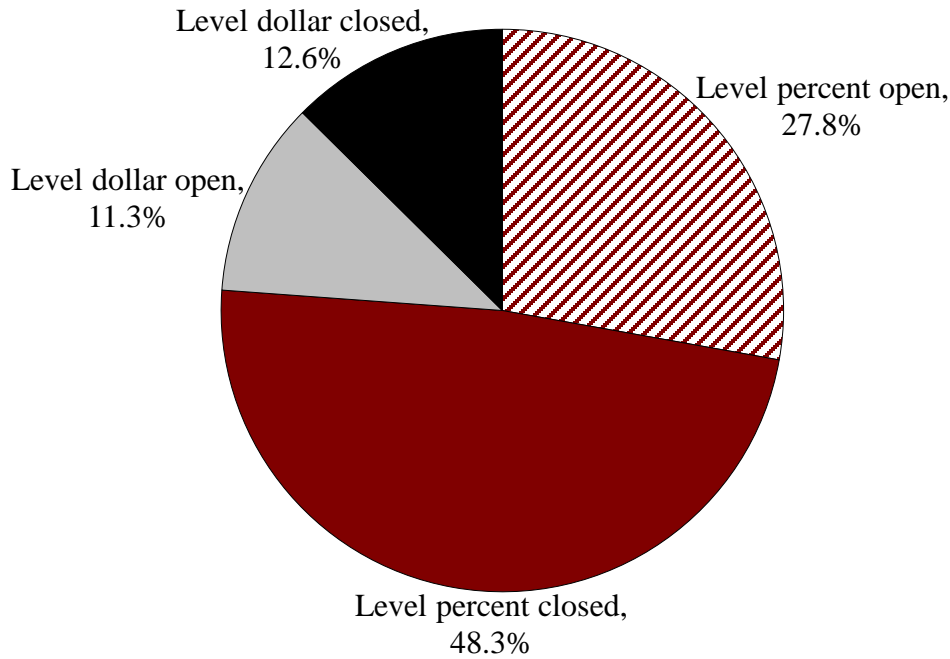


*Source:* PPD (2016).

The payroll growth assumption is important when considering the impact of the level-percent approach. The higher the assumed payroll growth, the more backloaded the payment schedule will be, the greater the increases in the UAAL in the early years of the schedule, and the greater the risk of dramatic increases in payments in future periods in the event of negative actuarial experience. Figure 12 reports the distribution of payroll assumptions used by plans that amortize with a level percent-of-pay approach. Almost half of the plans assume annual payroll growth of between 3.5 percent and 3.9 percent. NHRS currently assumes 3.25 percent payroll growth for employees, police and fire and 3.0 percent for teachers.

Figure 12. *Payroll Growth Assumptions for Large State and Local Pension Plans, 2016*
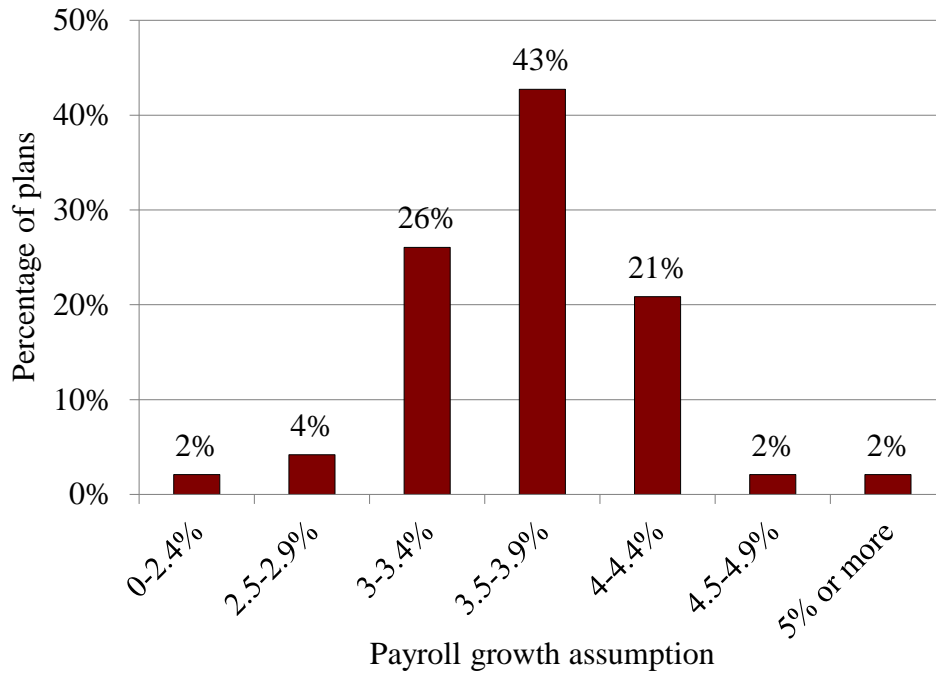


*Source:* PPD (2016).

## Part II: What Has Driven the Increase in NHRS' Unfunded Liability since 2007?

Beginning in 2007, NHRS actuaries began reporting data on the System's current Unfunded Actuarial Accrued Liability (UAAL) and a projection schedule for paying off the UAAL by 2039. Compared to the first schedule produced in 2007, today's UAAL and Annual Required Contribution (ARC) are larger than expected (see Figure 13). Much of this divergence can be attributed to large investment losses during the 2008 and 2009 financial crisis. When compared to the updated projections generated in 2009 (after accounting for the downturn), today's UAAL and ARC are roughly on schedule.

Figure 13. *NHRS' Projection of 2016 UAAL and ARC Compared to Actual, in Millions*
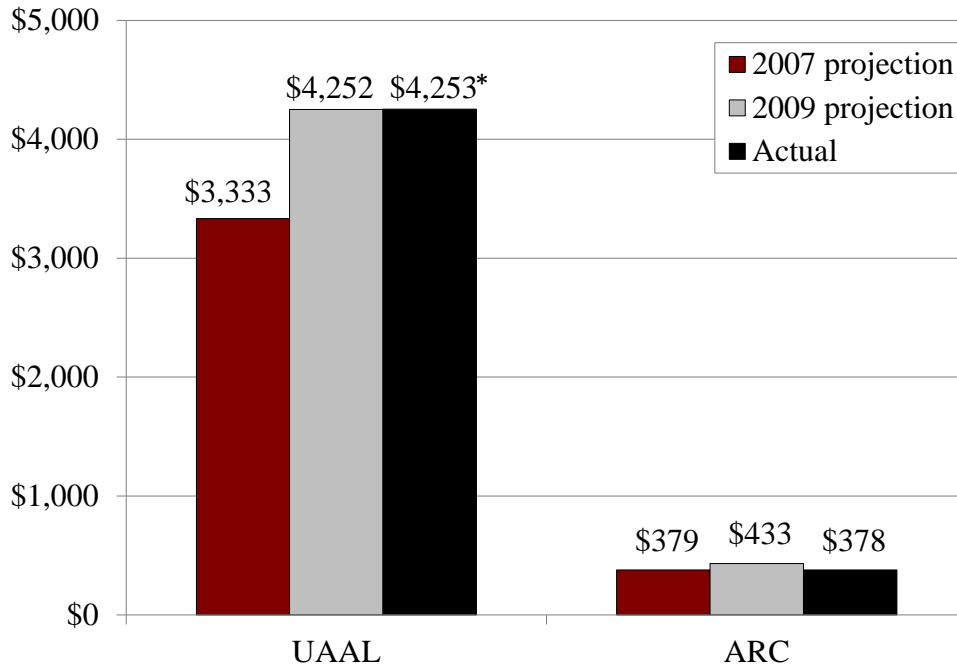


* The actual UAAL reported in the 2016 actuarial valuation is valued using a 7.25 percent assumed return. UAAL projections provided in the 2007 and 2009 valuations use a 7.5-percent assumed return. In order to properly compare today's UAAL to the projected amounts, the reported 2016 UAAL was revalued using 7.5-percent assumed return.
*Source:* NHRS AVs (2007-2016).

While today's UAAL and ARC payments are on par with the actuary's more recent projections, it is important to consider what risks might lay ahead as NHRS strives to achieve full funding by 2039. To answer this question, this part of the analysis takes a closer look at how the UAAL has evolved since 2007. The investigation requires a detailed review of each valuation produced by the NHRS actuaries since 2007 for information to determine the specific factors that have contributed to the growth of the UAAL. The factors include: 1) contributions that backload the amortization of the unfunded liability; 2) benefit changes (i.e., increased age for retirement and a lower accrual factor); and 3) assumption changes (e.g., lowering the assumed investment return or shifts in employee turnover/retirement assumptions), and 4) deviations from actuarial assumptions (e.g., actual returns falling short of the assumed investment return or workers living longer than expected).

Table 1 comes straight from the 2016 NHRS actuarial valuation report and illustrates how this works. First, the expected UAAL in 2016 is estimated by growing the 2015 UAAL by the interest rate, adding to that the newly accrued liability in the form of the normal cost, and then reducing it by the contributions paid. If contributions do not cover interest on the existing unfunded liability and value of the newly accrued benefits, the unfunded liability at this stage is expected to grow. Then, the impact of any legislated changes to benefits and/or changes to actuarial assumptions are applied. Finally, the remaining difference between the expected

UAAL and the actual UAAL is attributed to actuarial experience – the differences between actuarial assumptions and the actual outcomes.

Table 1. *2016 Change in the UAAL for NHRS, from the Plan's Actuarial Valuation*

| Item | |
|---|---|
| (1) Actual UAAL* as of June 30, 2015 | $5,022,875,296 |
| (2) Normal cost from 2015 valuation | 284,098,237 |
| (3) Actual contributions (employer and employee) | 565,431,098 |
| (4) Interest accrual: [(1)+1/2 [(2)-(3)]] x {.0725 for pension} | 353,960,143 |
| (5) Expected UAAL end of year: (1)+(2)-(3)+(4) | 5,095,502,578 |
| (6) Change from legislation | - |
| (7) Change from revised actuarial assumptions | - |
| (8) Expected UAAL after changes: (5)+(6)+(7) | 5,095,502,578 |
| (9) Actual UAAL as of June 30, 2016 | 5,096,799,491 |
| (10) Gain/(loss) for year 2: (8)-(9) | -1,296,913 |
| (11) Gain/(loss) as percent of actuarial accrued liabilities at start of year | -0.00% |

*Source:* NHRS CAFR Schedules and GASB Statement No. 67 Plan Reporting and Accounting Schedules (2016).

The first task is to take the individual changes for each year, categorize them in a consistent fashion, and then move systematically from one year to the next to build a year-over-year catalog of the changes to the UAAL over the period of interest (see Table 2).

Table 2. *Annual Change to NHRS' UAAL, 2007-2016, in Millions*

| FY | Starting UAAL | Projected ARC dollar amount compared to liability growth | Contributions relative to projected ARC dollar amount | Investment return relative to expectations | Benefit changes | Changes to assumptions and methods | Actuarial assumptions relative to expectations | Ending UAAL |
|---|---|---|---|---|---|---|---|---|
| 2007 | – | – | – | – | – | – | – | 2,397.5 |
| 2008 | 2,397.5 | 98.1 | -2.1 | -53.4 | 0.0 | 0.0 | 79.3 | 2,519.3 |
| 2009 | 2,519.3 | 133.5 | -7.0 | 697.2 | 0.0 | 0.0 | 194.7 | 3,537.7 |
| 2010 | 3,537.7 | 145.0 | 4.0 | 106.9 | 0.0 | 0.0 | -73.5 | 3,720.1 |
| 2011 | 3,720.1 | 142.9 | 17.0 | 87.9 | -430.1 | 756.7 | -36.7 | 4,257.7 |
| 2012 | 4,257.7 | 89.2 | 55.9 | 259.6 | 0.0 | 0.0 | -118.6 | 4,543.7 |
| 2013 | 4,543.7 | 88.1 | 74.6 | 36.3 | 0.0 | 0.0 | -104.6 | 4,638.1 |
| 2014 | 4,638.1 | 12.1 | 63.9 | -273.5 | 0.0 | 0.0 | -96.0 | 4,344.6 |
| 2015 | 4,344.6 | -19.3 | 71.3 | -197.6 | 0.0 | 815.0 | 8.9 | 5,022.9 |
| 2016 | 5,022.9 | 30.8 | 41.8 | 30.4 | 0.0 | 0.0 | -29.1 | 5,096.8 |
| Total | | 720.3 | 319.3 | 693.8 | -430.1 | 1,571.7 | -175.5 | |

*Source:* Authors' calculations from NHRS AVs (2008-2016).

Aggregating these detailed year-over-year changes provides insights into the relative impact of each factor on the total change in the UAAL over the period (see Figure 14).

Figure 14. *Sources of Change to NHRS' UAAL from 2007-2016, in Billions*
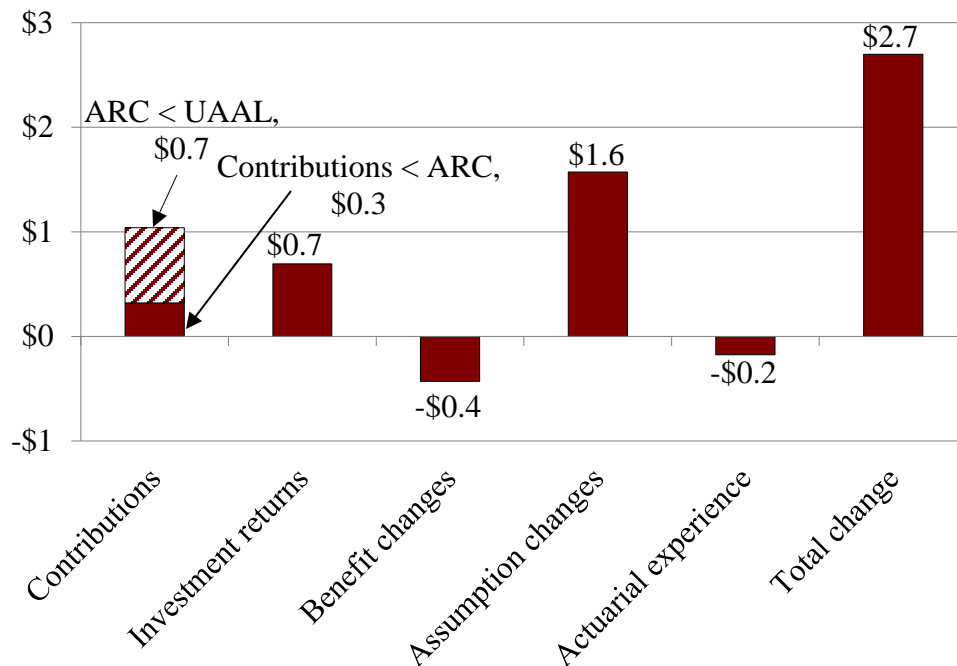


*Source:* Authors' calculations from NHRS AVs (2007-2016).

Based on the data provided in the valuation, an ARC that was insufficient to limit UAAL growth accounted for $1 billion in unfunded liabilities. Investment losses (primarily the losses experienced during financial crisis of 2008 and 2009) accounted for $700 million, and reductions in the assumed rate of return in the wake of the financial crisis accounted for $1.6 billion. Benefit changes in 2011 and favorable actuarial experience decreased the UAAL by $600 million.

*Inadequate Contributions.*

Paying down the unfunded liability has two components: 1) calculating an appropriate amortization payment that prevents the UAAL from growing each year; and 2) making the full ARC payment each year. First, the UAAL amortization schedule that NHRS uses is designed to allow for UAAL growth (in dollar terms) until 2018. As such, it is not surprising to find that $700 million in UAAL growth from 2007 to 2016 can be attributed to amortization payments that are less than the annual UAAL growth. However, it was unexpected that a portion of UAAL growth since 2007 has also come from dollar contributions smaller than the scheduled ARC dollar amounts. The required contributions are set as a percent of expected payroll. However, since 2007, differences between expected and actual payrolls have resulted in contribution amounts that were less than expected and, ultimately, added $300 million to unfunded liabilities.

Combined, a level-percent ARC that is designed to have the UAAL grow and contributions that were less than projected have increased the UAAL about $1 billion since 2007.
*Actual Returns Less than Assumed Returns.*

The impact of investment returns on plan finances depends on the relationship between two factors: 1) the plan's actual return; and 2) the assumed return. Achieving actual returns in excess of what is assumed lowers the UAAL. Conversely, if actual returns are below what is assumed, it adds to unfunded liabilities.

Prior to 2007, NHRS' actual investment return was much lower than the average plan in the PPD. Since major reforms to the investment process in 2007, NHRS investment performance has exceeded most other plans (see Figure 15).

Figure 15. *Actual Annualized Return for NHRS Compared to National Average*
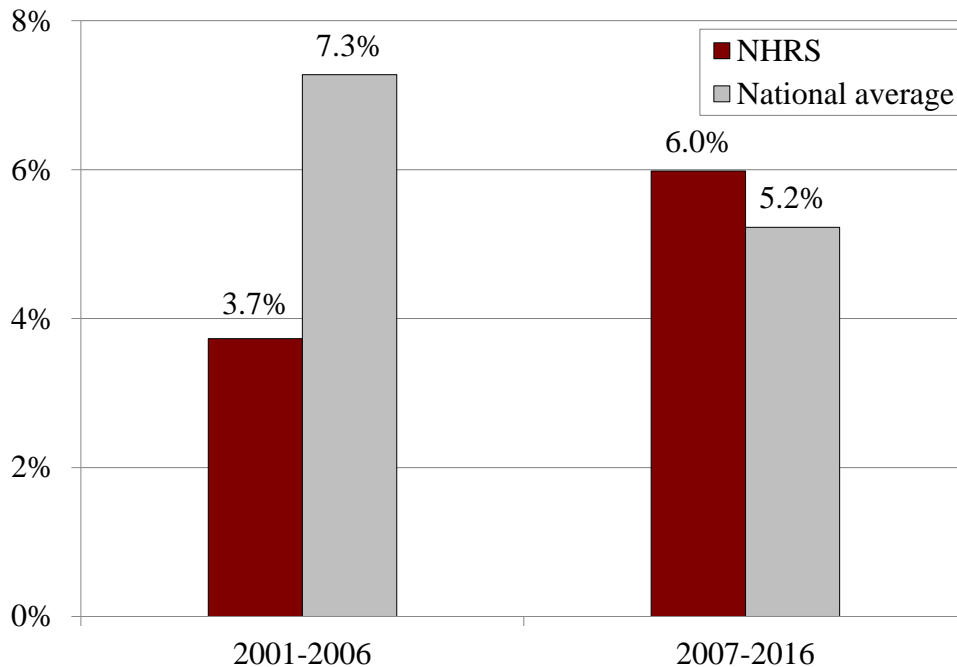


*Source:* Authors' calculations from PPD (2016).

But as stated above, the key to limiting growth in the unfunded liability is the difference between actual and assumed returns. On that front, NHRS' investment performance has varied from year to year. Figure 16 shows the annualized return as of 2017 for contributions made each year since 2007. For example, assets held in 2007 (including the contributions made that year) have earned an annualized 6.6 return as of 2017 – short of the current assumed 7.25 percent return. Similarly, contributions made in 2008 and 2009 have underperformed the assumed return as of 2017. But the majority of contributions made in the wake of the financial crisis have exceeded assumed returns. The point is that even long-term performance exhibits volatility that must be managed.

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Figure 16. *Actual Annualized Return Compared to Assumed Return for NHRS, 2007-2017*
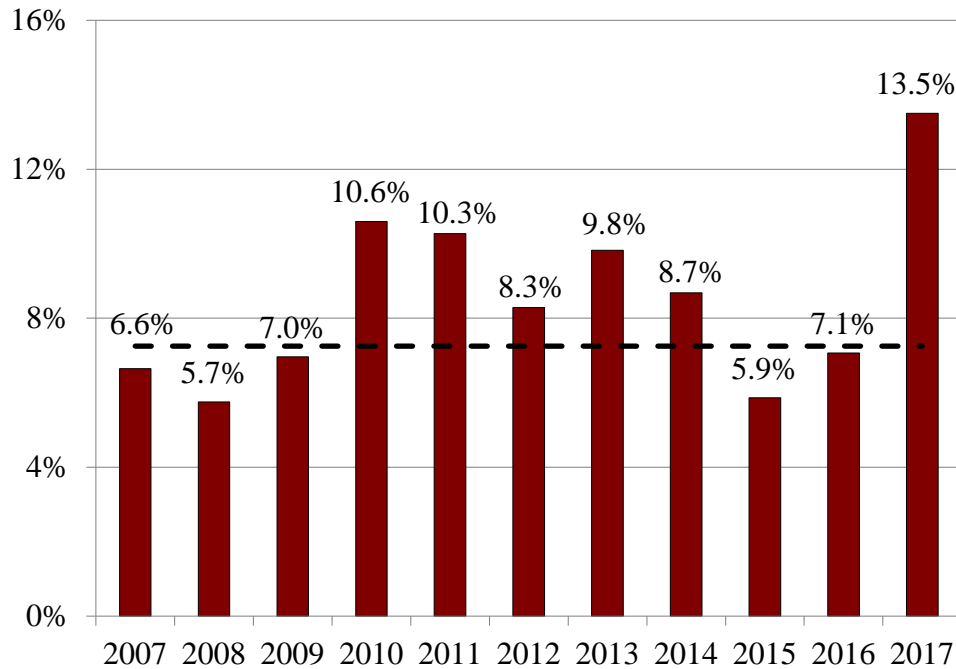


*Source:* Authors' calculations from NHRS AVs and CAFRs (2007-2016).

## Part III: How Can NHRS Better Ensure Improved Funding in the Future?

This section will project NHRS' funded ratio, required contributions, and unfunded liabilities. Importantly, all projections assume that the statutory full funding date of 2039 is maintained. The projections also assume that NHRS maintains its current assumptions for future payroll growth and investment returns.[10]

*Current Funding Regime.*

Under current law, NHRS' unfunded liability is to be paid off by 2039 (a closed period) and the NHRS is using a level-percent-of-payroll amortization method to do so. To provide a sense of how investment returns might impact the NHRS projections, the first set of projections includes scenarios using a realized return equal to the assumed return, and realized returns of 1 percent above and 1 percent below the assumed return. Figures 17 and 18 show the trajectories of the funded ratio and UAAL under current methods in 2017-2039.[11] If the full ARC is paid and NHRS achieves its assumed 7.25 percent return each year (and all other actuarial experience perfectly matches assumptions), the funded ratio steadily increases and the UAAL steadily shrinks until 2039 when it is zero and the plan is fully funded. Under a 6.25-percent return, the

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[10] See Appendix III for projection tables.

[11] These projections assume that the UAAL is fully amortized by 2039 using a level-percent method. The assumed (and realized) payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers. The assumed investment return is 7.25 percent.

funding improvement and UAAL decline would be more backloaded, but full funding is still achieved in 2039 per statute.  On the other hand, if returns are better than expected – say, 8.25 percent – more progress is made in the earlier years.

Figure 17. *Projected Funded Ratio for NHRS at Various Realized Returns, 2016-2039*
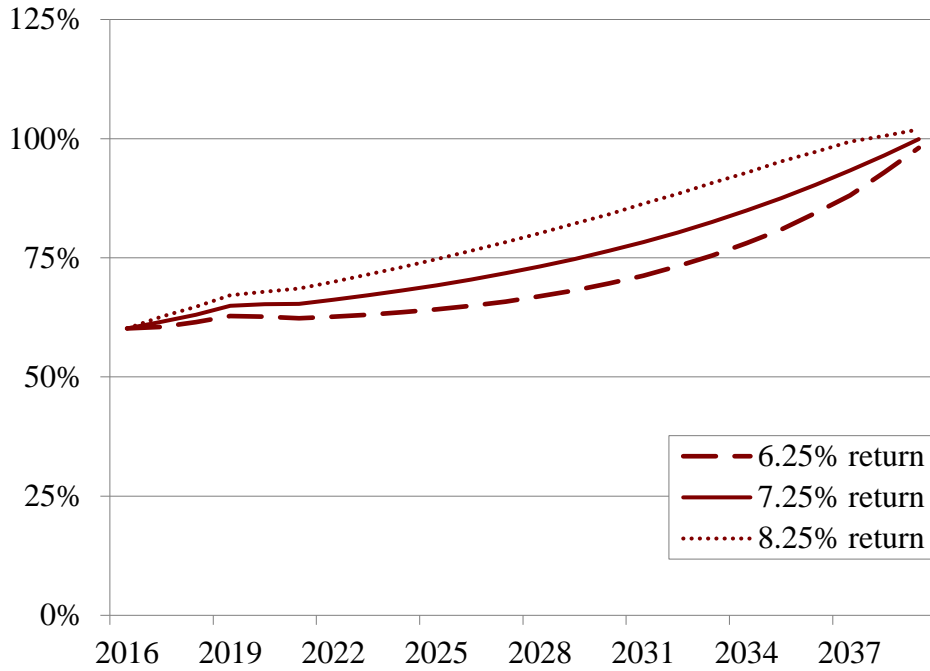


*Source:* Authors' calculations from various NHRS AVs.

Figure 18. *Projected UAAL for NHRS at Various Realized Returns, 2016-2039, in Billions*
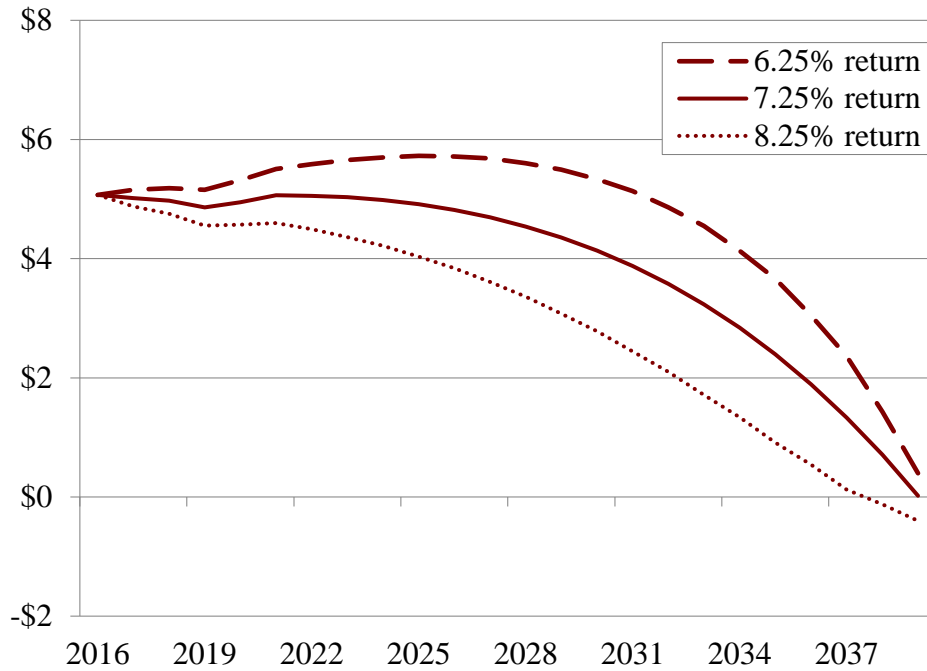


*Source:* Authors' calculations from various NHRS AVs.

Figure 19 shows the ARC over the same period, 2017-2039.[12]  Unlike the funded ratio and UAAL charts, the investment return is critical to the ARC projection.  Under the 7.25-percent return scenario, the ARC steadily rises each year from just under $350 million in 2016 to about $800 million in 2039, primarily as a result of the backloaded amortization method.  However, if investment returns over the projection period are 1 percent lower than assumed (6.25 percent versus 7.25 percent), the ARC rises from $350 million in 2016 to $1.4 billion in 2039. Of course, if returns are higher than expected (8.25 percent rather the assumed return of 7.25 percent), the ARC rises modestly from $350 million in 2016 to about $470 million in 2029, before declining to about $140 million by 2039.

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[12] This projection assumes that the UAAL is fully amortized by 2039 using a level-percent method.  The assumed (and realized) payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers.  The assumed investment return is 7.25 percent.

Figure 19. *Projected ARC for NHRS at Various Realized Returns, 2016-2039, in Billions*



*Source:* Authors' calculations from various NHRS AVs.

To test the sensitivity of these projected outcomes to differences between actual and assumed payroll growth, a second set of projections presented below assume that actual payroll growth equals the assumed growth or equals zero. Figure 20 shows that lower-than-assumed payroll growth negatively impacts the path to full funding and the decline in the UAAL.[13] The impact on the funding trajectory from lower-than-expected payroll growth is moderated by the fact that each biennial valuation increases amortization payments to account for lower-than-expected-payrolls. In terms of the impact that low payroll growth has on total employer contributions, incremental increases in amortization payments are partially offset by the fact that lower-than-expected payroll means lower-than-expected growth in new liabilities and lower normal cost.[14]

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[13] The projections in Figures 20, 21, and 22 assume that the UAAL is fully amortized by 2039 using a level-percent method. The assumed payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers. The assumed (and realized) investment return is 7.25 percent.

[14] See Appendix I for a brief analysis on the impact of payroll growth.

Figure 20. *Funded Ratio for NHRS at Various Payroll Growth Levels, 2016-2039*
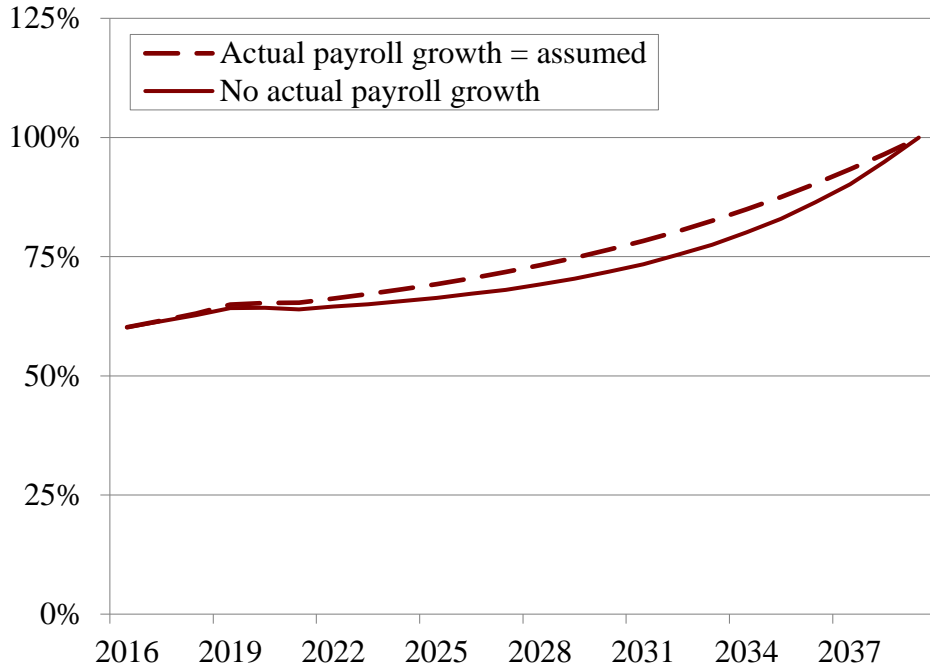


*Source:* Authors' calculations from various NHRS AVs.

Figure 21. *Projected UAAL for NHRS at Various Payroll Growth Levels, 2016-2039, in Billions*
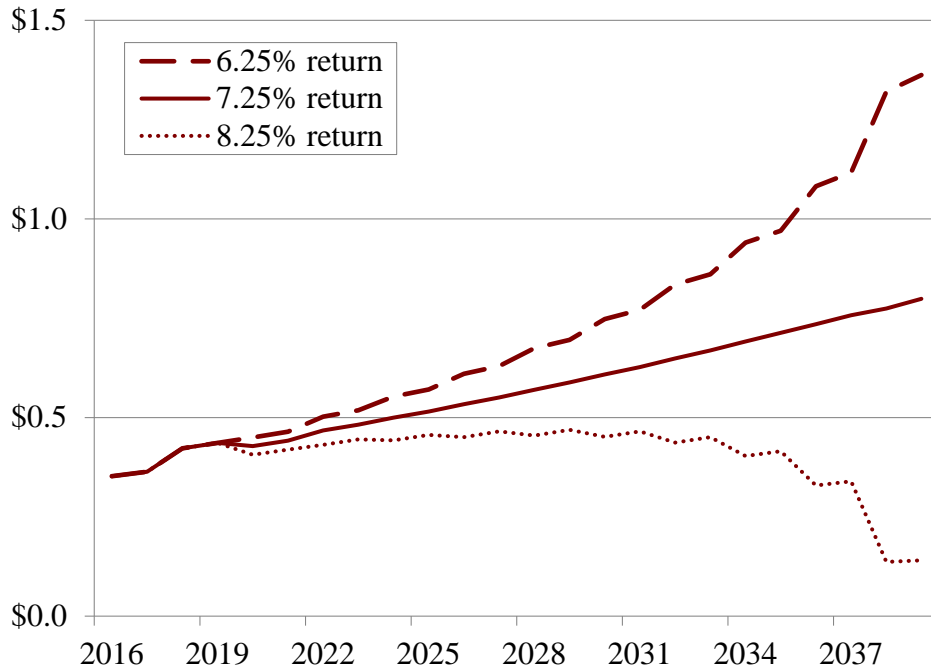


*Source:* Authors' calculations from various NHRS AVs.

Figure 22. *Projected ARC for NHRS at Various Payroll Growth Levels, 2016-2039, in Billions*
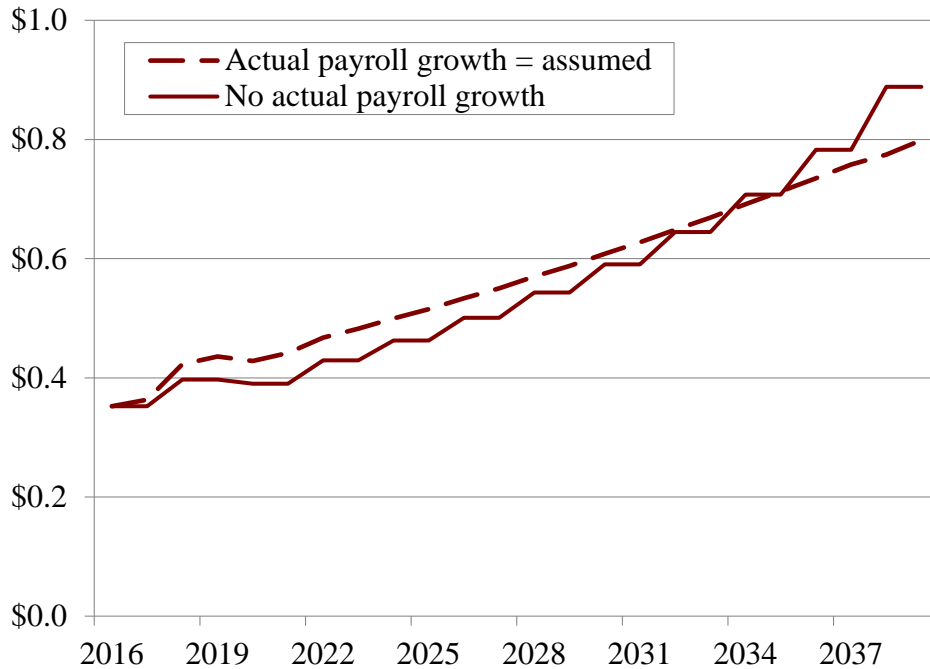


*Source:* Authors' calculations from various NHRS AVs.

*Alternative Funding Method - a Level-Dollar Amortization of the UAAL.*

To limit scheduled increases in the dollar contributions resulting from the level-percent-of-payroll method, one alternative is to switch NHRS to level-dollar amortization of the UAAL. Figures 23 and 24 show projections of the funded ratio and UAAL under both the level-percent-of-payroll and level-dollar amortization methods, maintaining the full funding date of 2039 and an assumed 7.25 percent return.[15]  The funded ratio under the level-percent-of-pay method falls below that of the level-dollar method, because the level-percent-of-payroll method backloads amortization payments.  Conversely, the funding ratio improves more quickly under a level-dollar amortization method compared to level-percent-of-payroll.

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[15] These projections assume that the UAAL is fully amortized by 2039.  The assumed (and realized) payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers.  The assumed (and realized) investment return is 7.25 percent.

Figure 23. *Projected Funded Ratio for NHRS under Alternative Funding Methods, 2016-2039*
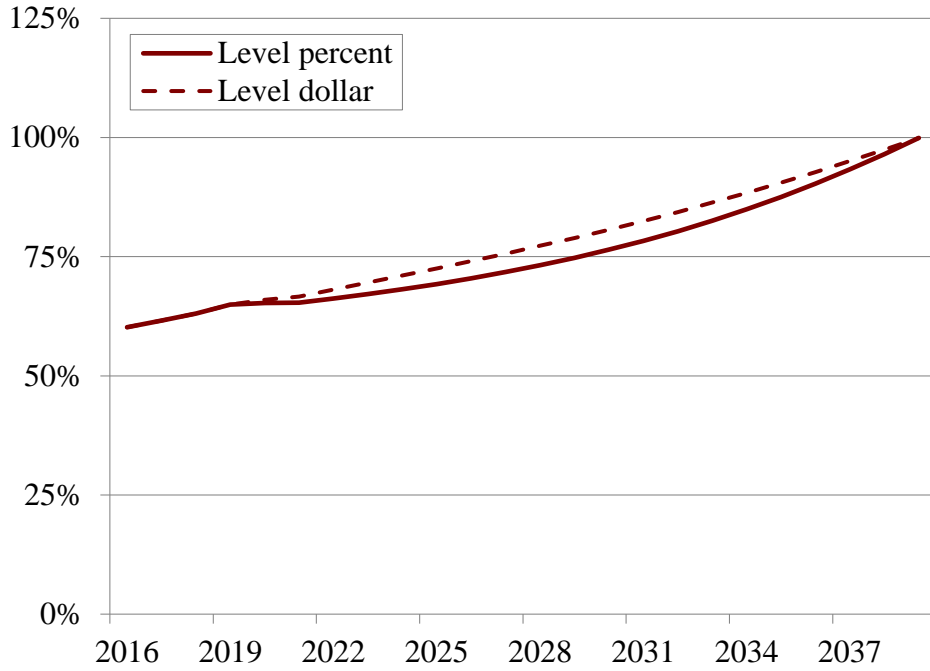
Figure 24. *Projected UAAL for NHRS under Alternative Funding Methods, 2016-2039, in Billions*
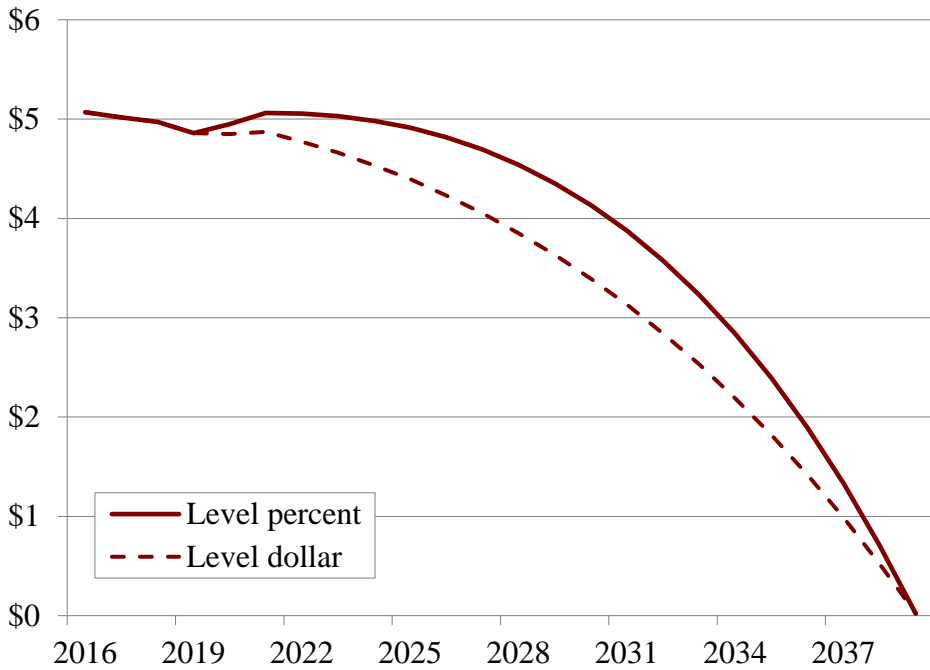
In addition to different trajectories for the funded ratio and UAAL, contributions under level-percent-of-pay and level-dollar methods also have very different trajectories (see Figure 25).[16] While contributions under the level-dollar method are greater than those under the level-percent-of-payroll method in the early years, level-dollar contributions increase much more slowly, peaking at $600 million in 2039.[17] On the other hand, while contributions under the level-percent-of-payroll method are lower in the early years, they eventually exceed level-dollar payments; the percent-of-payroll contributions peak in 2039 at $800 million.

Figure 25. *Projected ARC for NHRS under Alternative Funding Methods, 2016-2039, in Billions*
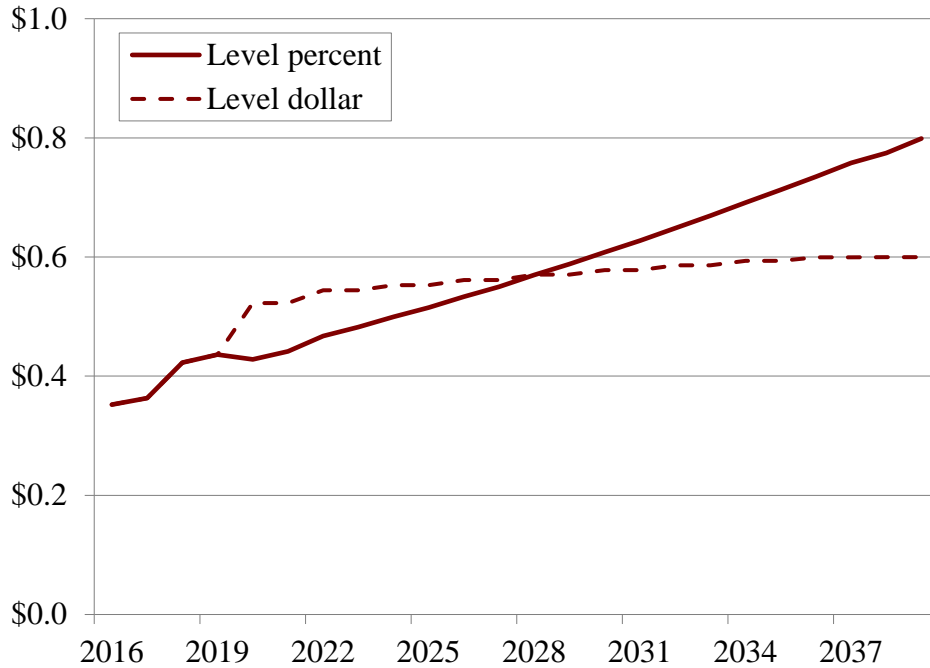


*Source:* Authors' calculations from various NHRS AVs.

Again, because returns are critical to cost projections, Figure 26 shows employer costs under a level-percent-of-pay and percent-of-payroll method, both with a 6.25-percent realized return over the projection period.[18] Under either funding method, annual costs could rise above $1 billion by 2039.

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[16] This projection assumes that the UAAL is fully amortized by 2039. The assumed (and realized) payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers. The assumed (and realized) return is 7.25 percent.

[17] The ARC has two components - the normal cost and amortization payments. While the method for amortizing the UAAL is level dollar, the normal cost is based on entry age normal and rises each year with payroll. As a result, the the ARC rises slightly due to increasing normal costs even though a level-dollar amortization approach is used.

[18] This projection assumes that theUAAL is fully amortized by 2039. The assumed (and realized) payroll growth is 3.25 percent for employees, police and fire, and 3.0 percent for teachers. The assumed return is 7.25 percent.

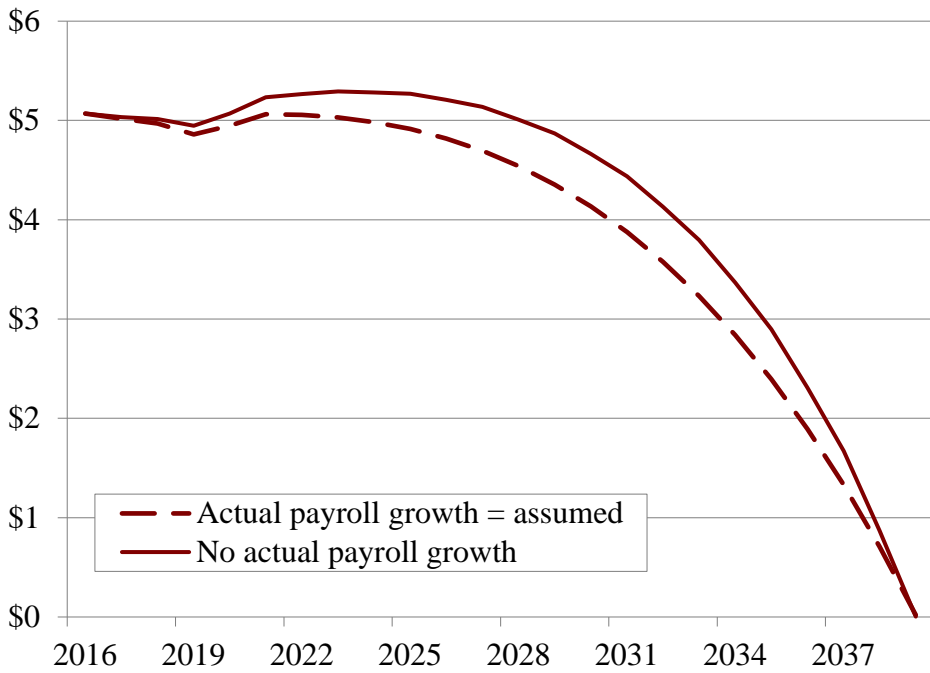Figure 26. *Projected ARC for NHRS under Alternative Funding Methods and a 6.25-Percent Return, 2016-2039, in Billions*
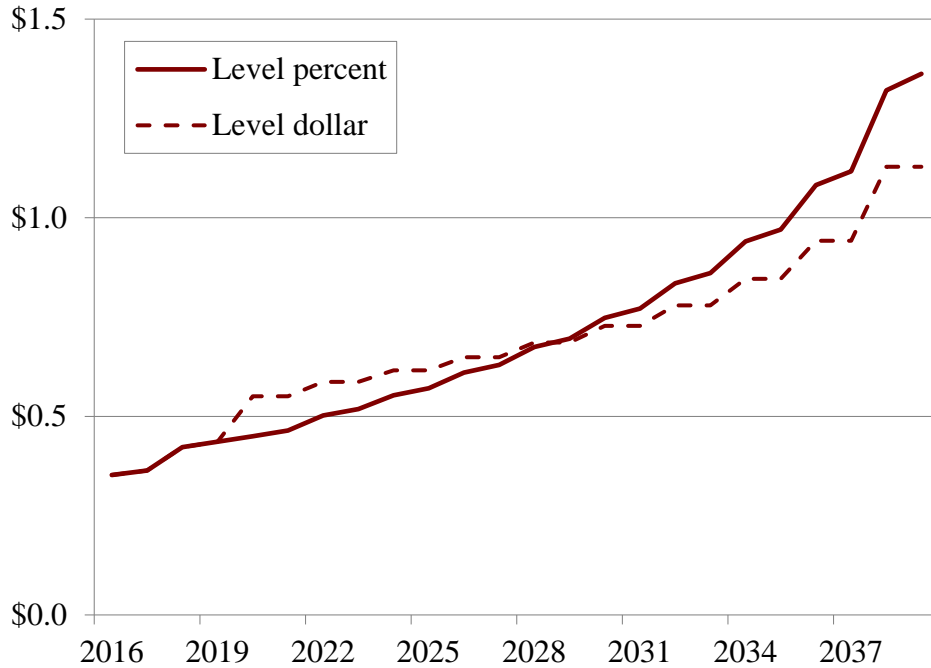


*Source:* Authors' calculations from various NHRS AVs.

**Part IV: How Have Other States Addressed Their Pension Challenges?**

To place NHRS in the broader context of the public pension landscape, this section examines three other state-administered plans: the Maine State Employees and Teachers Retirement Plan (Maine SETP), the Alabama Employees' Retirement System (Alabama ERS), and the Vermont State Teachers Retirement System (Vermont TRS). Similar to NHRS, significant investment losses during the 2008-2009 crisis hurt the funded status of all three plans. All the plans have also taken corrective action, including reductions to their assumed rates of return and some degree of benefit cuts.

Yet their post-financial crisis funding trajectories have not been uniform (see Figure 27). Maine SETP is the only plan that has been able to recover to its pre-crisis funding levels. And while the funding of NHRS and Alabama ERS has stabilized in recent years, the funded status of Vermont TRS has continued to decline. The following sections take a closer look at each plan's narrative, and presents key takeaways from the three plans' collective experience.[19]

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[19] For a more detailed discussion on individual plans see Appendix II.

Figure 27. *Funded Ratio for NHRS, Maine SETP, Alabama ERS, and Vermont TRS, 2007-2016*
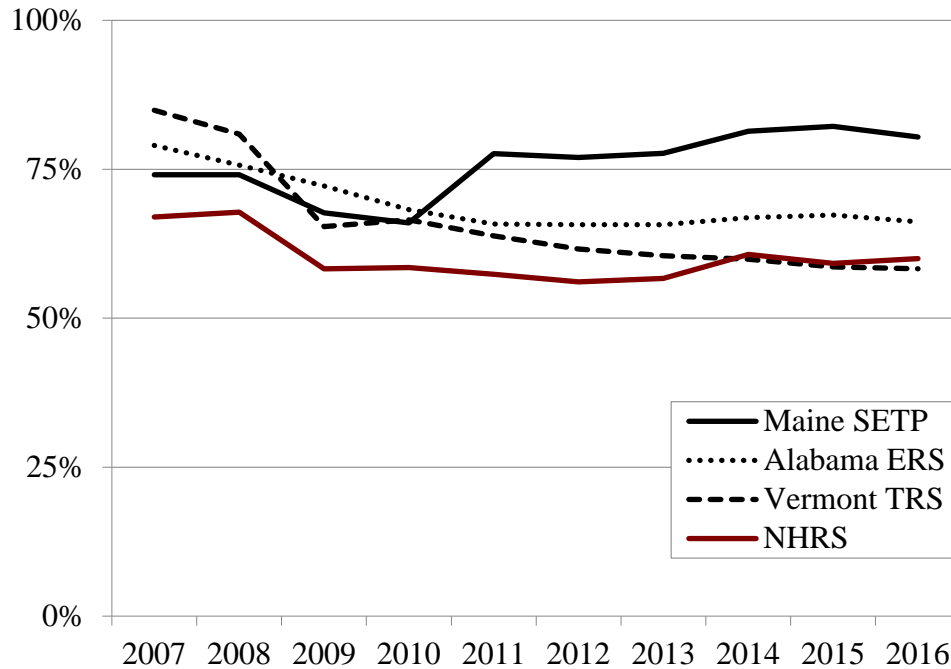


*Source*: PPD (2007-2016).

*Case Studies in Brief: Maine, Alabama, and Vermont*

*Maine State Employees and Teachers Retirement Plan.*

Maine SETP is a state-administered plan – in the same region as NHRS – that has been able to improve its funding since the financial crisis. During the crisis, the plan's funded ratio dropped from 74.1 percent to 66.0 percent and costs rose from a historical average of around 17 percent of payroll to about 23 percent. Yet Maine SETP's funded ratio since 2009 has increased to 80.4 percent. While – like NHRS – Maine SETP has a consistent history of paying its full ARC, the key elements that have improved its funding trajectory since the crisis are the modifications made to current employee benefits and rigorous funding methods.

The primary driver of Maine SETP's recovery has been the benefit reductions made after the crisis. Following the drop in its funded ratio in 2009, Maine SETP reduced COLAs for current employees and made changes to the core benefits of non-vested employees and new hires; these changes will improve long-term solvency and impact the trajectory of future liability growth but have no immediate impact on unfunded liability. The changes to current employee COLAs, however, immediately lowered the plan's UAAL, dramatically increased the funded status – from 66.0 to 77.6 percent – and reduced costs to around 15 percent of payroll.

Since then, the Maine SETP's funding improvement has primarily come from its method for amortizing unfunded liabilities. Like NHRS, Maine SETP uses a level-percent-of-payroll amortization. This approach results in smaller amortization payments in earlier years and larger

payments in later years, because contributions are expected to grow in step with an increasing payroll base. While a level-percent-of-payroll method backloads UAAL payments, Maine SETP reduced the backloading by using a relatively short amortization period. The system's funding policy has set a full-funding date of 2028 for the UAAL that existed as of 1998, and – until recently – 10-year amortization periods for any UAAL generated after 1998. As such, the resulting ARC payments, although based on a level-percent methodology, have still been large enough to meaningfully reduce the unfunded liability each year. On November 7, 2017, Maine SETP's amortization period for new gains/losses changed from 10 to 20 years. This change will delay its funding improvement going forward.

*Alabama Employees' Retirement System.*

Alabama ERS is a state-administered plan that, similar to NHRS, has seen relatively little progress in its funded status in the wake of the financial crisis, despite consistently paying 100 percent of its annual required contribution. The impact of the crisis on the funded ratio of Alabama ERS was limited from 2012 forward, however, due to the plan's resetting of actuarial assets to market assets, which allowed the plan to shed the burden of smoothing in 2009's steep investment losses. And yet, Alabama ERS has been unable to make progress, primarily due to its poor funding regime. The plan made changes to employee benefits, but there was no immediate impact on funding because the changes applied to new hires only. In addition to its lagged funding, Alabama ERS is a useful plan to examine for another reason: its experimentation with an alternative approach to investment return assumptions in the wake of the crisis.

Up until 2012, Alabama ERS used a level-percent-of-pay method with a 30-year open amortization period. A long amortization period coupled with low initial payments under a level-percent method can result in the UAAL dollar amount growing in the early years of the funding schedule – a phenomenon called negative amortization. Further, an open amortization period means that the full-funding date is delayed for another year so that the plan is always at the beginning of its funding schedule when contributions remain at low levels. This allows the UAAL to grow. Starting in 2012, Alabama ERS adopted a layered amortization approach, which sets a new fixed full-funding date for the new unfunded liabilities that arise each year (a new layer of UAAL). However, each new layer of UAAL is amortized using a level-percent method over a 30-year period. This approach results in negative amortization for nearly half of the 30-year period before the UAAL actually starts declining. As such, even under this new method, annual required contributions have been insufficient to prevent growth in the dollar amount of the UAAL.

In the wake of the financial crisis, Alabama ERS switched from an 8-percent long-term assumption for investment returns to an approach that automatically set future return expectations to align its recent actual returns with ultimate long-term assumptions. For example, immediately after the financial crisis, Alabama ERS' future return expectations were automatically set higher than its ultimate long-term expected return so that the recent lower returns plus the higher future returns would result in an overall return that was equal to the plan's ultimate long-term expected return. Conversely, in 2015, after a period of above-average returns, the assumed returns were set lower than their ultimate long-term expectations, so that the overall return would equal the plan's ultimate long-term expected return. The lower future

expectations translated to increased required contributions.  In 2016, the plan shifted to a flat return rate of 7.875 percent – and then 7.75 percent from 2017 forward – which was higher than what would have been projected under the method, and as a result, shrank liabilities.

*Vermont State Teachers Retirement System.*

Vermont TRS is a state-administered plan – also geographically close to NHRS – whose funding has continued to decline since the financial crisis, despite paying 100 percent of its annual required contribution (ARC).  Similar to NHRS, Vermont TRS used an aggregate cost method to fund and a frozen initial liability method to report liabilities until 2006 (when it switched to entry age normal for funding and reporting liabilities).  Vermont TRS has been unable to gain footing primarily due to the funding methodology and to experimentation with an alternative approach to its investment return assumption.  Modifications to employee benefits in 2010 had only a modest impact on plan funding, because the changes primarily applied to non-vested members and new hires.

Until 2006, Vermont TRS used an aggregate cost method to determine the ARC and a frozen entry age method to report its funded ratio.  This method made it difficult to accurately assess the plan's funding position each year.  As a result, in 2006, after the switch to an entry age normal method for funding and reporting, the unfunded liability increased and the plan's funded ratio declined.  In its transition to entry age, Vermont TRS also extended its 13-year amortization to a 30-year period.  Because Vermont TRS uses a level-percent-of-pay method, the longer amortization period resulted in low initial payments that can cause negative amortization.  While Vermont TRS has adhered to its 30-year closed schedule, the lower payments are currently insufficient to make meaningful progress in paying down the UAAL.

In 2012, in response to the results of a five-year experience study, Vermont TRS experimented with the use of a select-and-ultimate assumed return.  This approach required the plan to maintain separate short- and long-term return expectations.  Vermont TRS set lower return expectations in the short-term but higher expectations for the long-term, based on the plan's target asset allocation.  Interestingly, the plan annually reset the return schedule so that its assumed return always reflected the low short-term returns expectations, which increased the UAAL each year.  The plan switched back to a single rate of 7.95 percent in 2015.  While it is not clear why the plan returned to its old method, the 2010 experience study indicated that shifting to a select-and-ultimate approach increased costs when they first made the transition.

*Key Takeaways*

The main takeaway from the case studies is that four key factors explain the plans' funding trajectories. Two of the factors – investment performance and funding practices – affect actuarial assets, and the other two – changes to actuarial assumptions and methods, and benefit modifications – affect liabilities.

*Investment returns.*  While all plans experienced heavy investment losses in 2008 and 2009, the investment performance of all three plans since 2010 – and NHRS – has roughly equaled or exceeded each of their assumed returns over the period (see Table 3).

Table 3. *Comparison between Average Assumed and Actual Return Performance, 2010-2016*

|  | Actual return | Assumed return |
| --- | --- | --- |
| Maine SETP | 8.9% | 7.2% |
| Alabama ERS | 9.3 | 8.0 |
| Vermont TRS | 8.2 | 8.3 |
| New Hampshire RS | 10.2 | 7.8 |
| National average | 9.5 | 7.6 |

Note: Average actual returns represent the geometric mean.
*Source*: Authors' calculation from PPD (2010-2016).

And yet – with the exception of Maine SETP – the strong investment performance has not improved funding to the degree one would expect. One explanation lies in the impact of asset smoothing on plan funding.[20] Because all four plans incorporate some asset smoothing when calculating actuarial assets, the 2008-2009 investment losses were not recognized immediately and were phased-in over a three- to five-year period. This phase-in of such significant losses limited the growth in actuarial assets between 2009 and 2014, dampening improvements to the funded status. For Alabama ERS, the lingering impact of the financial crisis on funding stopped in 2012 due to resetting actuarial assets to market assets.

*Funding and Contributions.*

Funding progress in all plans has not been uniform, despite the fact that all plans have paid 100 percent of their ARCs since 2007 under a level-percent-of-pay method. Since 2011, Maine SETP was the only plan with contributions sufficient to prevent annual UAAL growth. In general, using a level-percent method backloads amortization payments so that smaller payments are scheduled in the initial years and larger payments later. The backloaded funding progress of the level-percent method leaves the plan more vulnerable to declining finances in the near-term and ballooning costs down the road to make up for it – specifically in the event of poor investment performance. The alternative is a level-dollar amortization method that schedules equal dollar payments each year and reduces more of the unfunded liability in the early years.

One way to combat the backloaded nature of level-percent amortization is to shorten the amortization period. Although Maine SETP uses a level-percent method, it uses a shorter amortization period than all three plans and most other public pension plans. Currently, Maine SETP has a 2028 full-funding date for the UAAL that existed as of 1998 and uses 10-year periods for any UAALs generated after that point.[21] In comparison, both NHRS and Vermont TRS had 23 years remaining as of 2016. And while Alabama ERS resembles Maine SETP in its amortization of new UAALs in layers, its 30-year amortization periods have limited its funding progress.

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[20] Growth in actuarial assets lagged growth in market assets between 2010 and 2016 for all four plans.
[21] On November 7, 2017, Mainers voted the amortization period for new gains/losses was changed from 10 to 20 years.

*Actuarial Assumptions.*

Like most public pension plans' response to the financial crisis, all four plans compared here adjusted their assumed returns (see Table 4). The investment return assumption has two key components – the real rate of return and price inflation. Generally, the two tend to move in step, though not always. To understand the impact of return assumptions on plan finances, the focus should be on the real rate of return, which is the return expected above inflation. While reductions in return assumptions set a plan up for expected long-term solvency – bolstering plans in the event of poor future performance – the immediate impact on a plan is a larger liability.

Table 4. *Nominal Return, Inflation, and Real Return Assumption by Plan, 2007-2016*

| NHRS | | | | Alabama ERS | | | |
|---|---|---|---|---|---|---|---|
| | Nominal | Inflation | Real | | Nominal | Inflation | Real |
| 2007 | 8.5% | 3.5% | 5.0% | 2007 | 8.0% | 4.5% | 3.5% |
| 2008 | 8.5 | 3.5 | 5.0 | 2008 | 8.0 | 4.5 | 3.5 |
| 2009 | 8.5 | 3.5 | 5.0 | 2009 | 8.0 | 4.5 | 3.5 |
| 2010 | 8.5 | 3.5 | 5.0 | 2010 | 8.0 | 4.5 | 3.5 |
| 2011 | 7.75 | 3.0 | 4.75 | 2011 | 8.0 | 3.0 | 5.0 |
| 2012 | 7.75 | 3.0 | 4.75 | 2012 | Ultimate- 8.0 | 3.0 | 5.0 |
| 2013 | 7.75 | 3.0 | 4.75 | 2013 | Ultimate- 8.0 | 3.0 | 5.0 |
| 2014 | 7.75 | 3.0 | 4.75 | 2014 | Ultimate- 8.0 | 3.0 | 5.0 |
| 2015 | 7.75 | 3.0 | 4.75 | 2015 | Ultimate- 8.0 | 3.0 | 5.0 |
| 2016 | 7.25 | 2.5 | 4.75 | 2016 | 7.875 | 2.875 | 5.0 |
| Maine SETP | | | | Vermont TRS | | | |
| 2007 | 7.75% | 4.5% | 3.25% | 2007 | 8.25% | 3.0% | 5.25% |
| 2008 | 7.75 | 4.5 | 3.25 | 2008 | 8.25 | 3.0 | 5.25 |
| 2009 | 7.75 | 4.5 | 3.25 | 2009 | 8.25 | 3.0 | 5.25 |
| 2010 | 7.75 | 4.5 | 3.25 | 2010 | 8.25 | 3.0 | 5.25 |
| 2011 | 7.25 | 3.5 | 3.75 | 2011 | 8.25 | 3.0 | 5.25 |
| 2012 | 7.25 | 3.5 | 3.75 | 2012 | Select-and-ultimate | 3.0 | |
| 2013 | 7.25 | 3.5 | 3.75 | 2013 | Select-and-ultimate | 3.0 | |
| 2014 | 7.125 | 3.5 | 3.625 | 2014 | Select-and-ultimate | 3.0 | |
| 2015 | 7.125 | 3.5 | 3.625 | 2015 | 7.95 | 3.0 | 4.95 |
| 2016 | 6.875 | 2.75 | 4.125 | 2016 | 7.95 | 3.0 | 4.95 |

*Source*: Authors' calculations from various plan AVs and CAFRs.

*Employee Benefits.*

In the wake of the financial crisis, all four plans modified employee benefits in order to improve long-term plan solvency. However, the plans differed in the types of benefit reductions and the impact they had on liabilities. Lower benefits for new hires reduce the costs of a plan in the

long-term – as do increases to current member contributions – but these changes have no impact on existing liabilities or funded ratios.  Immediate changes to the funded ratio occur only if modifications are made to benefit provisions for current employees.

The benefit modifications made by NHRS and Vermont TRS are similar in that they reduced the maximum allowable pension benefit that could be promised for all members, but reduced benefits the most for non-vested current employees and new hires.  Alabama ERS made significant reductions to core benefit provisions, but only for new employees entering the system.  Again, while changes to benefits for new hires or non-vested members improve the long-term solvency of a plan, they have a limited impact on the funded ratio in the short-term.  Maine SETP significantly lowered benefits for current members, and saw a significant jump in funded ratio in result of an immediate reduction in liabilities.

*Looking Forward*

The case studies show that the financial crisis spurred a wave of rapid reductions in plans' investment return assumptions and benefits.  This wave has probably passed and, as a result, liability growth should steady.  In addition, actuarial assets should grow more in step with future market returns, now that the dramatic losses experienced in the financial crisis have been smoothed out.  Moving forward, the key for making meaningful progress in plan funding is paying an adequate ARC.

The plans examined have all done a good job of paying their ARCs.  Unfortunately, these payments are often not enough to make meaningful reductions in UAAL.  While the use of a level-dollar amortization approach is most effective at paying down the unfunded liability quickly, the plans' experiences demonstrate that not all level-percent models are alike.  For plans that rely on a level-percent method, the shorter the amortization period the better.  First, a shorter amortization period means larger payments in the earlier years so that real progress can be made on reducing the UAAL in the short-term – and sooner.  Second, a shorter amortization reduces the risk of experiencing a shock that disrupts the schedule of required payments.  Because a level-percent method backloads costs, in the event of a shock, the scheduled increases in required contributions for later years would grow even larger, often reaching unacceptable levels for governments.

In sum, Maine SETP experienced dramatic improvement in its funding due primarily to benefit reductions for current employees, which in turn, significantly reduced its existing liabilities.  Yet modifications to current employee benefits is not feasible for most plans due to already low benefit levels, human resource concerns, or legal constraints.  For this reason, an adjustment to the amortization method is one of the remaining tools plans have at their disposal to make meaningful funding progress.  Applying a more stringent amortization method – ideally, the use of a level-dollar approach, or, at minimum, amortizing over a shorter period using level-percent – will help plans make faster progress towards full funding.

**Part V: Conclusion and Recommendations.**

Since 2007, NHRS' funded ratio has lagged the national average and, despite good-faith efforts to fund the System, is lower today than it was in 2007. Much of this decline can be attributed to investment losses during the financial crisis in 2008 and 2009. However, since 2009 – despite benefit modifications, stronger-than-average returns, and a strong commitment to funding the full ARC – the System's funded ratio has improved only slightly and the unfunded liability has grown by $2.7 billion.

An analysis of NHRS since 2007 uncovered two important factors in its unfunded liability growth: investment returns and the method for amortizing unfunded liability. Since 2007, poor investment performance has accounted for $700 million of the $2.7 billion unfunded liability growth ($650 million during 2008 and 2009). While the System's 7.25-percent assumed return is among the lowest in the country, returns earned on recent contributions into the System have, more often than not, fallen short of that mark. In terms of amortizing the unfunded liability, the level-percent-of-pay method used by NHRS is designed to allow unfunded liabilities to grow until 2018 (after which UAAL declines). As such, some portion of the growth in unfunded liabilities since 2007 is to be expected. However, what was not expected was the additional growth of the unfunded liability due to inadequate contributions resulting from contribution rates being applied to lower-than-expected payroll growth. Since 2007, the level-percent-of-pay method has accounted for an additional $700 million in unfunded liabilities and inadequate contributions have accounted for $300 million.

The case study analysis found that the financial crisis spurred a lot of change in the public pension landscape, notably a wave of reductions in investment return assumptions and benefit cuts. Likely, the wave of reforms has passed, and, as a result, liability growth should steady for public plans going forward. In addition, actuarial assets should grow more in step with market returns, now that the dramatic losses in the financial crisis have been smoothed out. Moving forward, the key for NHRS is paying an adequate ARC.

Looking forward, projections of NHRS' ARC, UAAL, and funded status show the potential impact that poor investment returns, lower than expected payroll, and the funding strategy have on the path to full funding. Importantly, in all these future scenarios, the System is ensured of being fully funded by 2039. However, if investment returns are only slightly less than expected, costs would increase substantially and the improvement in funded status delayed until the later years. In practice, the slow funding progress and continual increase in costs could also jeopardize the political will to stick to the amortization schedule.

The NHRS is a relatively small retirement system and employers do not contribute much toward the ongoing employee benefits earned each year in normal costs. As a result, total employer contributions to the System are relatively modest in comparison to the national average, with the majority of the cost aimed at paying down the existing unfunded liability. Given the relative affordability of current pension costs, the two recommendations explained below would require increasing costs today in order to limit the risk that poor investment returns and a backloaded amortization plan lead to dramatic increases in future costs and/or a flagging funded ratio down the road.

*Shift to Level-Dollar Amortization*

NHRS currently uses a level-percentage-of-payroll method to amortize its unfunded liabilities. This method holds contribution levels as a percentage of government payroll, a strategy generally consistent with public sector budgeting objectives. However, this method results in smaller amortization payments in earlier years and larger payments later, based on an assumption that payrolls will increase each year. Coupled with the 20- to 30-year amortization periods used by many plans, level-percent-of-pay often allows the unfunded liability to grow in the early years of the amortization – a phenomenon called negative amortization. Additionally, contributions may be inadequate due to differences between assumed and actual payroll growth each year. An alternative approach used by some plans is a level-dollar amortization method that schedules equal dollar payments each year – for any given amortization period – and reduces the unfunded liability more quickly than level percent of pay.[22]

Although a shift to level dollar would increase near-term costs, it would have multiple benefits.[23] First, contributions should decline over time as a percent of payroll. Second, the funded ratio under a level-dollar approach would improve more quickly than under a level-percent-of-pay approach. Finally, if the assumed investment return is achieved each year, the UAAL should decrease annually in dollar terms, which may be increasingly desirable given that new GASB standards require unfunded liabilities to be reported on government balance sheets.

*Shift from a Single Long-Term Assumed Rate of Return to using Separate Rates for Short and Long-Term Return Expectations.*

The second recommendation is to switch from using a single long-term assumed return to using different rates for short and long-term return expectations. Ten plans have done so in the wake of the financial crisis. Three plans used a particularly novel approach in which future expectations automatically adjust to align recent investment experience with long-term expectations. For example, if past performance exceeded expectations, future return assumptions would be reduced so that average returns over the past and future periods equal the long-term expectations. Interestingly, seven of the ten plans had shifted back to a single long-term rate by 2016; higher-than-expected returns in the wake of the financial crisis resulted in lower return expectations and increased their required contributions. This last fact highlights an important – and desirable – feature of explicitly setting short and long-term return expectations: it often asks plans to put aside more money during times of higher-than-expected returns to protect against the risk of lower-than-expected-returns in the future if the overall performance reverts to long-term expectations.

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[22] As the amortization period shortens, the difference in funding progress between the level-percent-of-pay and level-dollar method becomes less pronounced.

[23] The projections provided in the 2015 actuarial valuations for NHRS show the annual employer cost under a level dollar amortization to be about $460 million compared to $350 million under level-percent-of-pay.

## Appendix I – Payroll Growth

Since the financial crisis, aggregate payroll growth for NHRS (and state and local governments more generally) has slowed dramatically relative to historical averages (see Figure A1). For a public employee pension plan that links contribution payments directly to payrolls, the slow growth could result in unintentional underfunding if the payroll growth falls short of expectations.

Figure A1. *NHRS Covered Payroll, 2001-2016, in Billions*
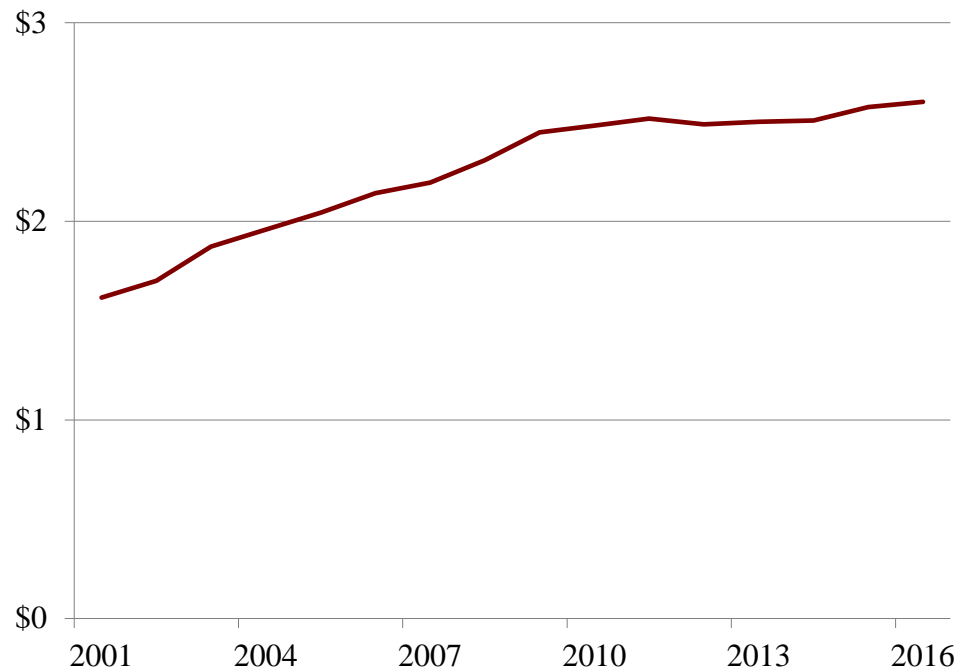


*Source:* Authors' calculations from NHRS AVs and CAFRs (2001-2016).

To better understand how payroll growth impacts a plan's funded status and costs, it helps to conceptually separate pension funding into its two components: 1) existing accrued liabilities that reflect the value of benefits already promised based on past work and salary; and 2) future liabilities that accrue each year as employees work longer, increase their salaries, and increase the benefits they are promised. Currently, NHRS has set aside enough assets to cover 60 percent of existing accrued liabilities, leaving about $2.7 billion unfunded. This gap will be met through regular amortization payments deposited into the fund until 2039. Additionally, each year, normal cost contributions are made to fund the new liabilities that accrue as employees work longer and earn higher benefits on their rising salaries.

In terms of funding newly accrued liabilities, differences between expected and actual payroll growth should not lead to additional unfunded liabilities. The accrual of future liabilities is linked to the salary earned each year. Lower-than-expected salary growth results in lower-than-expected normal cost contributions, but also lower-than-expected liabilities. As such, lower payroll growth does not result in underfunding of newly accrued liabilities.

However, existing accrued liabilities – in contrast to newly accrued liabilities – are less sensitive to differences between expected and actual payroll. This is because a large portion of accrued liabilities are for retired employees. And, the accrued liability for active employees is based on past service, so expectations of their future salaries have little impact.[24] So, lower-than-expected payroll growth will result in lower amortization payments, but not lower (unfunded) accrued liabilities. As such, incorrect payroll assumptions can have a meaningful impact on how quickly unfunded liabilities are diminished.

Figure A2 presents actual and projected annual payroll growth for NHRS. The projections – provided by Gabriel, Roeder, Smith & Company (GRS) and based on the assumption that the total number of active members remains constant in the future – show that annual payroll growth is expected to remain under the assumed payroll growth until 2039 (at which point the UAAL will have been paid off).

Figure A2. *Actual and Projected Payroll Growth for NHRS, 2016-2039*
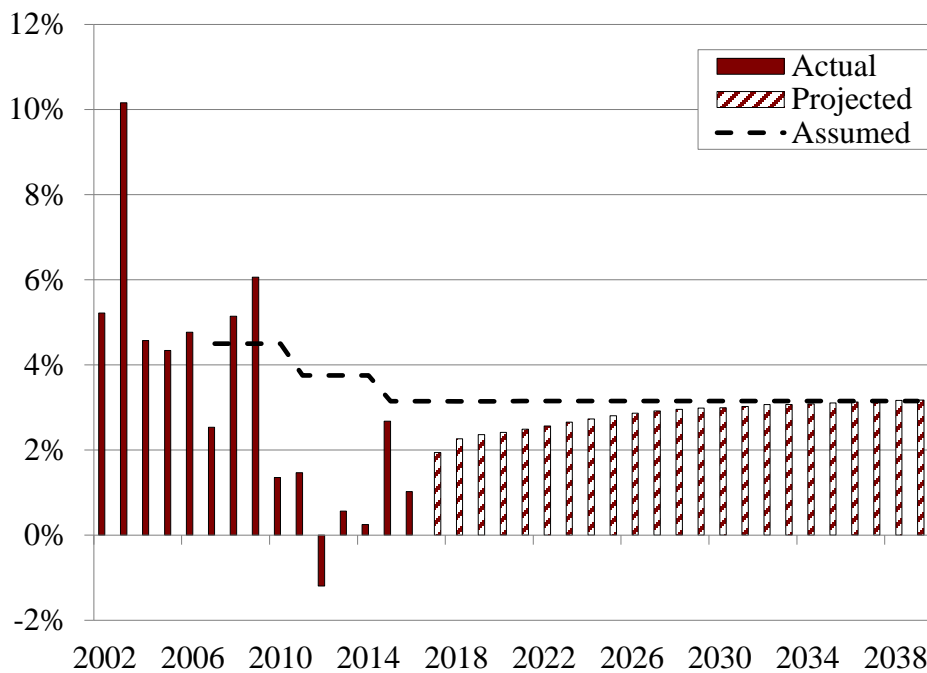


Note: The projection assumes that active member population for employees, police and fire remains constant. For teachers, the active member population is assumed to decline by 0.25 percent per year. The new entrant profile is determined by the current active population with 3-8 years of service.
*Sources:* Authors' calculations from NHRS AVs and CAFRs (2001-2016); and GRS projections 2017-2039).

If payroll growth does indeed lag expectations, this differential could result in a consistently underfunded UAAL. Fortunately, in the event this occurs, NHRS will not be left underfunded in

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[24] Accrued liabilities for most public plans are based on a projected benefit obligation (PBO) approach that incorporates future expected salaries of existing employees. As such, under a PBO liability, lower-than-expected payroll growth that stems from slow salary growth for existing plan members will have some impact on the accrued liability. However, if lower-than-expected payroll growth is due mostly to a decrease in the number of new hires each year, then the accrued liability will not be impacted.

2039 (or face a sharp increase in cost in the final years of the schedule) because the required contributions set in each biennial valuation will adjusted to account for lower-than-expected payrolls. But, as a result, the required contributions will rise more steeply than anticipated and improvements to the UAAL and funded ratio will be more backloaded.

## Appendix II – Case Studies: Maine, Alabama, and Vermont

### Maine State Employees and Teachers Retirement Plan

The Maine Public Employees Retirement System administers seven retirement plans, including the State Employees and Teachers Plan (SETP), a multiple-employer cost sharing plan. All state employee and public school teachers are legally required to become members when hired. As of 2016, Maine SETP held $10.5 billion in assets and covered 39,942 active members – one-third teachers. School districts are responsible for making normal cost contributions on behalf of their teachers, while the State makes payments to amortize the unfunded liability (UAAL) plus the normal cost component for state employee members.[25] Plan members are not covered by Social Security.

Between 2001 and 2016, Maine SETP increased its funded ratio from 73.1 to 80.4 percent (see Figure A3). Despite poor investment performance in 2008 and 2009 – dropping the funded ratio from 74.1 to 66.0 percent – Maine SETP has managed to reroute its funding trajectory. The key elements correcting this are the modifications made to current employee benefits in 2010 and rigorous funding methods. The following sections give a brief overview of the significant events that contributed to Maine SETP's overall growth since 2001, with a focus on its recovery in the wake of the crisis.

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[25] Prior to the introduction of the special funding situation in 2013, the State paid both the normal cost and UAAL contributions on behalf of all state employee and teacher members.

Figure A3. *Funded Ratio for Maine State Employees and Teachers Plan, 2001-2016*
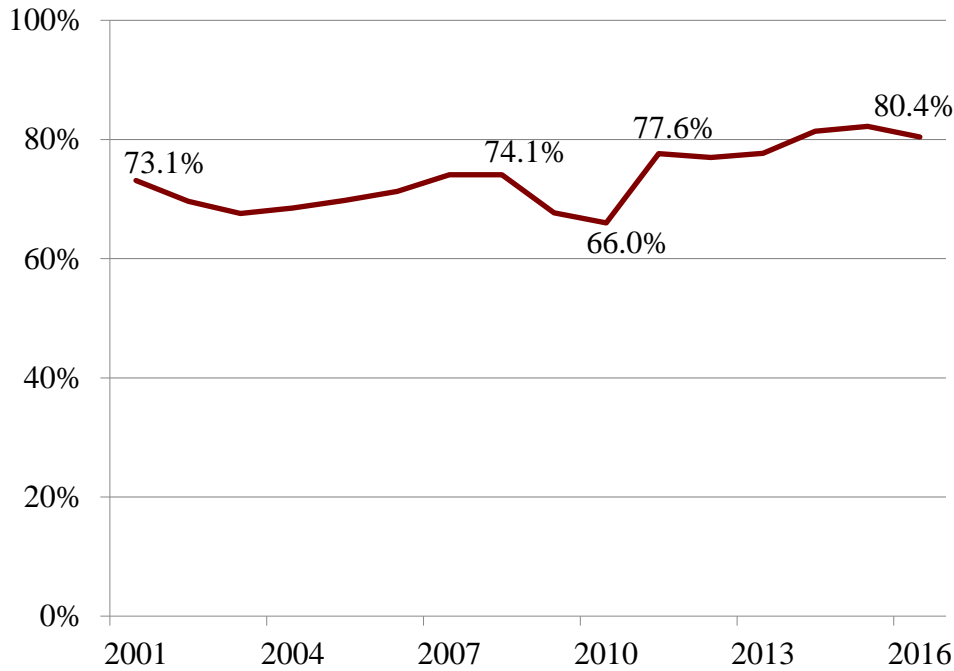
*Investment Returns and Actuarial Assumptions*

Like most plans, Maine SETP experienced large losses during the financial crisis, losing 11.3 percent compared to an average loss of 12.6 percent. The investment losses reduced the funded ratio from 74.1 to 66.0 percent. Since 2010, the plan's investment performance has lagged the nation – earning 8.9 percent compared to the national average of 9.5 percent.

The overall impact of investment performance depends greatly on the plan's return expectations. Maine SETP has adjusted its return expectations many times over the past 15 years, from 8.0 percent in 2001 to a rate of 6.875 percent in 2016. Alongside adjustments to the assumed return, the plan has made multiple modifications to other workforce and demographic assumptions (such as turnover, retirement, disability, mortality, and salary growth) and the COLA (see Table A1).

Table A1. *Actuarial Assumptions for Maine State Employees and Teachers Plan, 2001-2016*

| Year | Investment Return | Price inflation | Wage inflation | COLA |
|------|------|------|------|------|
| 2001 | 8.0% | 5.0% | 5.5% | 4.0% |
| 2002 | 8.0 | 5.0 | 5.5 | 4.0 |
| 2003 | 8.0 | 5.0 | 5.5 | 4.0 |
| 2004 | 8.0 | 5.0 | 5.5 | 4.0 |
| 2005 | 8.0 | 5.0 | 5.5 | 4.0 |
| 2006 | 7.75 | 4.5 | 4.75 | 3.75 |
| 2007 | 7.75 | 4.5 | 4.75 | 3.75 |
| 2008 | 7.75 | 4.5 | 4.75 | 3.75 |
| 2009 | 7.75 | 4.5 | 4.75 | 3.75 |
| 2010 | 7.75 | 4.5 | 4.75 | 3.75 |
| 2011 | 7.25 | 3.5 | 1.5 [a] | 2.55 [b] |
| 2012 | 7.25 | 3.5 | 1.5 | 2.55 |
| 2013 | 7.25 | 3.5 | 3.5 | 2.55 |
| 2014 | 7.125 | 3.5 | 3.5 | 2.55 |
| 2015 | 7.125 | 3.5 | 3.5 | 2.55 |
| 2016 | 6.875 | 2.75 | 2.75 | 2.2 |

[a] Wage inflation was temporarily set to 1.5 percent for FY 2011 and FY 2012.
[b] No cost-of-living-adjustments were made between 2011 and 2014.
*Source*: Maine SETP plan AVs and CAFRs.

*Benefit Modifications*

The primary driver behind Maine SETP's recovery are benefit changes made in the wake of the crisis. Following the drop in funded ratio in 2009, Maine SETP enacted benefit reform that was first reflected in the 2011 valuation. The reforms increased the retirement age from 60 to 65 for non-vested members (those with less than 5 years of service) and new hires. The plan also suspended the COLA until 2014, lowered the cap on COLAs from 4 percent to 3 percent, and restricted the COLA base to the first $20,000 of annual benefits – for all members. While the changes to the retirement age for non-vested members and new hires improved the long-term solvency of the plan, they had no immediate impact on unfunded liability. However, the changes to the COLA for current plan members immediately reduced the plan's UAAL, dramatically increased the funded status from 66.0 to 77.6 percent, and reduced costs from 23 percent to around 15 percent of payroll.

*Funding*

Maine SETP's incremental funding progress since 2001 – and its accelerated progress since 2011 – can be primarily attributed to its method for amortizing unfunded liabilities. In addition to

consistently paying its Annual Required Contribution (ARC) since 2001, Maine SETP uses a level-percent-of-pay approach to calculate required fund payments, structured around short, layered amortization periods. Generally speaking, a level-percent approach results in smaller amortization payments in earlier years and larger payments in later years because contributions are expected to grow in step with an increasing payroll base. Maine SETP was able to reduce the backloading of UAAL payments resulting from its level-percent method by using a relatively short amortization period.

The System's funding policy sets a full-funding date of 2028 for the UAAL that existed as of 1998, and – until recently – 10-year amortization periods for any UAAL generated after 1998. As such, the resulting ARC payments, although based on a level-percent methodology, have still been enough to meaningfully reduce the unfunded liability each year. On November 7, 2017, the amortization period for new gains/losses changed from 10 to 20 years. Once incorporated into the plan's funding policy, this change will delay its funding improvement going forward.

**Alabama Employees' Retirement System**

The Alabama Employees' Retirement System (Alabama ERS) is an agent, multiple-employer, cost-sharing pension plan administered by the State of Alabama. Established in 1945, the Alabama ERS is one of two main defined benefit plans in the Retirement System of Alabama. The plan provides benefits for state employees, state police, and, on an elective basis, all cities, counties, towns, and quasi-governmental organizations. As of 2016, the plan held $11.1 billion in assets and covered 84,814 active members. Plan members are also covered by Social Security.

Between 2001 and 2016, Alabama ERS' funded ratio decreased from 100.2 percent to 66.2 percent (see Figure A4). Despite consistently paying 100 percent of its annual required contribution, the plan's funded ratio steadily declined between 2001 and 2011 and has seen relatively little improvement since. The impact of the financial crisis on the plan's funded status was limited from 2012 forward because the plan reset actuarial assets to market-value assets – shedding the burden of smoothing-in its 2009 investment losses. And yet Alabama ERS has been unable to make meaningful funding progress, primarily due to its poor funding regime. While the plan trimmed employee benefits, there was no immediate impact on funding because the changes applied to new hires only. The following sections give an overview of the significant events that contributed to the decline of Alabama ERS' funded ratio since 2001, with a focus on its inability to make meaningful progress post-crisis.

Figure A4. *Funded Ratio for Alabama Employees' Retirement System, 2001-2016*
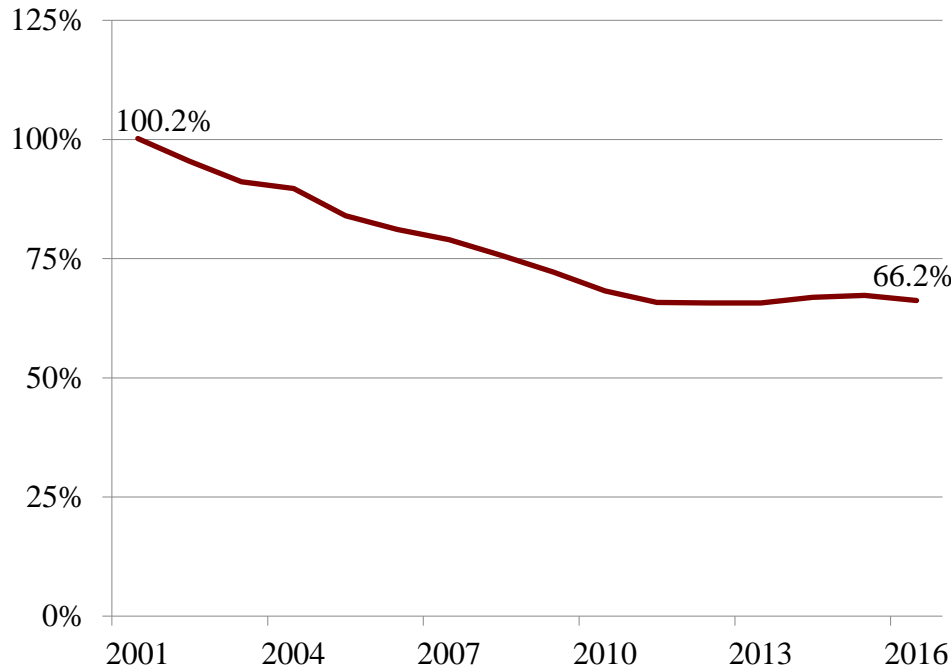
*Investment Returns and Actuarial Assumptions*

Since 2008, Alabama ERS' investment performance has been on par with the national average – equal to negative 12.7 percent during the 2008-2009 crisis and 9.3 percent since 2010. Like most plans, the large losses experienced during the crisis have contributed to its inability to make meaningful funding improvements.

In the wake of the financial crisis, Alabama ERS switched from an 8-percent long-term return assumption to an approach that adjusts future expectations in a way that aligns recent returns with the plan's ultimate long-term assumption. This ultimate long-term assumption was equal to the plan's expected return over a 30-year period – 8 percent. Each year, the plan automatically adjusts its future return expectations such that actual returns over the past 7 years combined with the future return expectation over the next 23 years would equal the 30-year long-term expectation of 8 percent.

In 2012 and 2013, after a period of lower-than-expected returns during the financial crisis, Alabama ERS' future expected returns were 9.68 and 8.37 percent – greater than its ultimate 8-percent assumption. The higher return expectations resulted in lower required contributions. However, in 2014 and 2015, after a few years of above-average returns in the wake of the crisis, future expectations were set to 7.42 and 7.73 percent – lower than the ultimate long-term return. The lower return expecations resulted in increased required contributions. Finally, in 2016, the plan shifted to a single long-term rate of 7.875 percent, with a plan to reduce the rate to 7.75 percent in 2017 (see Table A2). Both these single rates are higher than what would have been

projected under the automatically adjusting method. As such, the shift back to a single rate lowered liabilities and reduced costs for Alabama ERS.

Table A2. *Actuarial Assumptions for Alabama ERS, 2001-2016*

| Year | Ultimate investment return | Future expectation | Price inflation | Wage inflation |
|---|---|---|---|---|
| 2001 | 8.0% | | 4.5% | 4.5% |
| 2002 | 8.0 | | 4.5 | 4.5 |
| 2003 | 8.0 | | 4.5 | 4.5 |
| 2004 | 8.0 | | 4.5 | 4.5 |
| 2005 | 8.0 | | 4.5 | 4.5 |
| 2006 | 8.0 | | 4.5 | 4.5 |
| 2007 | 8.0 | | 4.5 | 4.5 |
| 2008 | 8.0 | | 4.5 | 4.5 |
| 2009 | 8.0 | | 4.5 | 4.5 |
| 2010 | 8.0 | | 4.5 | 4.5 |
| 2011 | 8.0 | | 3.0 | 3.25 |
| 2012 | Ultimate- 8.0 | 9.68% | 3.0 | 3.25 |
| 2013 | Ultimate- 8.0 | 8.37 | 3.0 | 3.25 |
| 2014 | Ultimate- 8.0 | 7.42 | 3.0 | 3.25 |
| 2015 | Ultimate- 8.0 | 7.73 | 3.0 | 3.25 |
| 2016[a] | 7.875 | | 2.875 | 3.125 |

[a] From 2017 forward, the investment return assumption will be lowered from from 7.875 to 7.75 percent, price inflation from 2.875 to 2.75 percent, and wage inflation from 3.125 to 3.0 percent.
Note: Table excludes COLA assumption because no future ad hoc COLA's are assumed.
*Source*: Alabama ERS AVs and CAFRs.

*Benefit Modifications*

In 2013, Alabama ERS reduced benefits for employees hired on or after January 1, 2013 (Tier 2). There was no immediate impact on funding because the changes applied to new hires only. The changes increased retirement eligibility provisions, reduced the benefit multiplier, and extended the period used to calculate final average salaries for Tier 2 employees. While these changes flattened the trajectory of future liability growth, there was no immediate impact on the unfunded liability because the changes did not impact current employee benefits.

*Funding*

The main factor impeding the progress is Alabama ERS' method for amortizing unfunded liabilities. Between 2001 and 2012, the plan used a level-percent-of-pay method with a 30-year open amortization period. This method results in smaller amortization payments in earlier years

and larger payments in later years, because contributions are expected to grow in step with an increasing payroll base.  When coupled with a long amortization period, the low initial payments can cause the dollar amount of the UAAL to grow in the early years of the funding schedule – a phenomenon called negative amortization.  Further, an open amortization period means that the full-funding date is pushed out each year so that the plan is always at the beginning of its funding schedule when contributions remain at low levels and the UAAL is allowed to grow.

From 2012 forward, Alabama ERS adopted a layered amortization approach – which sets a fixed full-funding date for new unfunded liabilities that arise each year, layering the UAAL.  However, each new layer is amortized using the level-percent-of-pay method over a 30-year period.  This results in negative amortization for nearly half of the 30-year period, before the UAAL actually starts declining.  As such, even under this new method, annual required contributions have been insufficient to prevent growth in the dollar amount of the UAAL.

**Vermont State Teachers Retirement System**

The Vermont State Teachers Retirement System (Vermont TRS) is a multiple-employer, cost-sharing pension plan administered by the State of Vermont.  Established in 1947, Vermont TRS is one of three main defined benefit plans in the Vermont Retirement System.  As of 2016 the plan held $1.7 billion in assets, covered 9,919 active teachers, and paid benefits to 8,106 service retirees.  Plan members are also covered by Social Security.

Between 2001 and 2016, Vermont TRS' funded ratio decreased from 89.0 to 58.3 percent (see Figure A5).  Vermont TRS has been unable to gain footing primarily due to its funding methodology and experimentation with an alternative approach to its investment return assumption.  Modifications to employee benefits in 2010 had only a modest impact on plan funding, because the changes primarily applied to non-vested members and new hires.  The following sections give a brief overview of the significant events contributing to Vermont TRS' decline since 2001, with an emphasis on the plan's experience in the wake of the crisis.

Figure A5. *Funded Ratio for Vermont State Teachers Retirement System, 2001-2016*
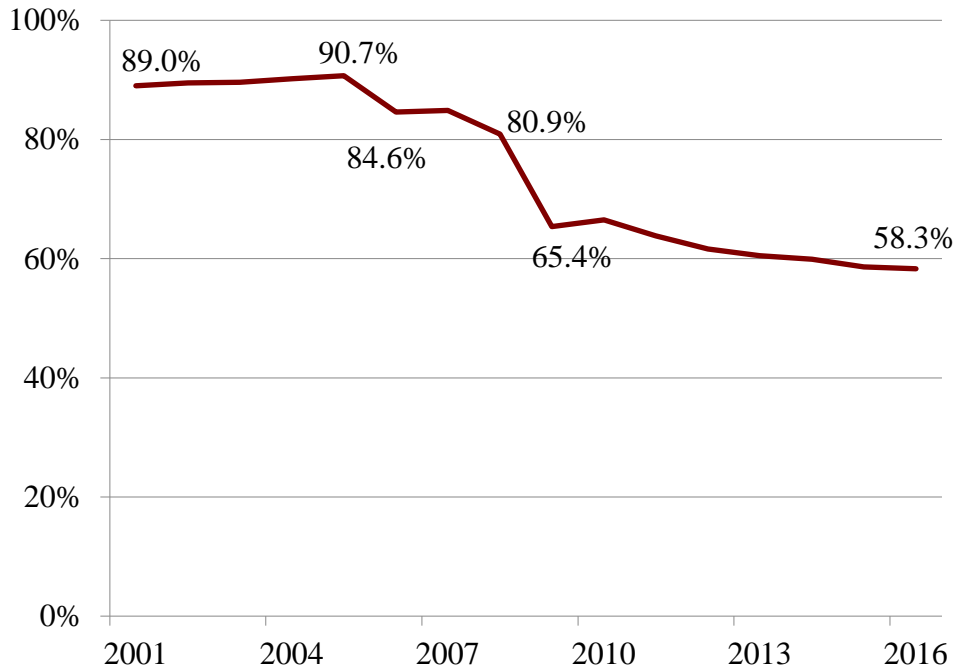
*Investment Returns and Actuarial Assumptions*

A significant factor in the decline in funding has been its investment performance. Like most plans, Vermont TRS experienced large losses during the crisis (13.5 percent compared to an average loss of 12.6 percent nationally). The investment losses increased the UAAL in 2008 and reduced the funded ratio from 80.9 to 65.4 percent. Since 2010, the plan's investment performance has lagged the national average – earning 8.2 percent compared to a 9.5 percent national average.

The overall impact of investment performance depends greatly on the return expectations of the plan. Since 2001, Vermont TRS has adjusted its long-term return assumption several times. In 2012, based on the results of a five-year experience study, Vermont TRS experimented with the use of what is called a select-and-ultimate assumed return. This approach required the plan to maintain separate short- and long-term return expectations. Vermont TRS set lower return expectations in the short-term with higher expectations for the long-term, based on the plan's target asset allocation (see Table A3). Interestingly, the plan annually reset the return schedule so that its assumed return always reflected the low short-term returns expectations, which increased the UAAL each year. The plan switched back to a single rate of 7.95 percent in 2015. While it is not explicitly clear why the plan returned to its old method, the 2010 experience study indicated that shifting to a select-and-ultimate approach increased costs.

Table A3. *Select-and-Ultimate Investment Return Assumption for Vermont State Teachers Retirement System*

| Year | Rate | Year | Rate |
|------|------|------|------|
| Year 1 | 6.25% | Year 10 | 8.50% |
| Year 2 | 6.75 | Year 11 | 8.50 |
| Year 3 | 7.00 | Year 12 | 8.50 |
| Year 4 | 7.50 | Year 13 | 8.50 |
| Year 5 | 7.75 | Year 14 | 8.50 |
| Year 6 | 8.25 | Year 15 | 8.50 |
| Year 7 | 8.25 | Year 16 | 8.75 |
| Year 8 | 8.25 | Year 17+ | 9.00 |
| Year 9 | 8.50 | | |

*Source:* Vermont TRS AV (2011).

Alongside adjustments to the assumed return, the plan has made multiple modifications to other workforce and demographic assumptions (such as turnover, retirement, disability, mortality, and salary growth) and the COLA (see Table A4).

Table A4. *Actuarial Assumptions for Vermont State Teachers Retirement System, 2001-2016*

| Year | Investment return | Price inflation | COLA |
|------|-------------------|-----------------|----------|
| 2001 | 8.5% | 3.0% | 4.0/2.0% |
| 2002 | 8.5 | 3.0 | 4.0/2.0 |
| 2003 | 8.0 | 3.0 | 3.0/1.5 |
| 2004 | 8.0 | 3.0 | 3.0/1.5 |
| 2005 | 8.0 | 3.0 | 3.0/1.5 |
| 2006 | 8.25 | 3.0 | 3.0/1.5 |
| 2007 | 8.25 | 3.0 | 3.0/1.5 |
| 2008 | 8.25 | 3.0 | 3.0/1.5 |
| 2009 | 8.25 | 3.0 | 3.0/1.5 |
| 2010 | 8.25 | 3.0 | 3.0/1.5 |
| 2011 | 8.25 | 3.0 | 3.0/1.5 |
| 2012 | Select-and-ultimate | 3.0 | 3.0/1.5 |
| 2013 | Select-and-ultimate | 3.0 | 3.0/1.5 |
| 2014 | Select-and-ultimate | 3.0 | 3.0/1.5 |
| 2015 | 7.95 | 3.0 | 3.0/1.5 |
| 2016 | 7.95 | 3.0 | 3.0/1.5 |

Note: Plan uses separate COLA assumptions for Group A and Group C employees (Group A/Group C). Group A includes employees hired prior to 1981 who elected to remain in Group A.  Group C includes all other employees. The wage inflation assumption is omitted as it is not stated explicitly in plan valuations.
*Source*: Vermont TRS AVs and CAFRs.

*Benefit Modifications*

In 2010, following a dramatic decline in the funded ratio, Vermont TRS made changes to both its current and new employee benefits, which had only a modest impact on reducing the unfunded liability. Specifically, the plan reduced the maximum allowable benefit promised to all members and changed normal retirement eligibility, early retirement reductions, and the benefit factor for non-vested members with less than 5 years of service.[26]  These modifications contributed to a slight increase in the funded ratio in 2010.

*Funding*

Prior to 2006, Vermont TRS used a frozen entry-age normal actuarial cost method for funding. The frozen entry-age normal method is generally used by plans that fund using the aggregate cost method, which does not incorporate an accrued liability concept.  Plans that use the aggregate cost method periodically calculate an accrued liability at a specific point in time ("frozen") using the entry age normal method.  Comparing the frozen liability to actuarial assets

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[26] Vermont TRS also made increases to member contributions in 2010 and 2014, which will reduce costs in the long-term, but has no immediate impact on outstanding liabilities.

results in a UAAL that can be amortized over a set period. After calculating the UAAL and setting an amortization schedule, the plan continues to use the aggregate cost method to fund the plan going forward (plus the additional payments set by the amortization schedule).

While the frozen entry-age method may be reasonable for funding, its reliance on intermittent calculations of the unfunded liability makes it difficult to accurately assess a plan's funding position at any given moment. When Vermont TRS eventually switched to an entry-age normal method in 2006, the funded status dropped from 90.7 percent to 84.6 percent and the unfunded liability increased.[27] Vermont TRS was able to mitigate the cost of the larger UAAL by extending the amortization period from approximately 13 years to 30 years, allowing more time to pay down the increased UAAL. Since the shift in funding method in 2007, the plan has paid its annual required contribution (ARC) each year.

Despite paying its ARC since 2007 and passing benefit changes in 2010, the funded status for Vermont TRS was only 58.3 percent as of 2016. The low funded ratio can be partly attributed to the financial crisis, when the plan's funded status dropped from 80.9 to 65.4 percent. But even since that time, the plan's funded status has continued to decline despite relatively strong investment returns. One reason is the plan's use of a level-percent-of-pay amortization method, which backloads amortization payments so that smaller payments are scheduled in the initial years and larger payments later. The alternative is a level-dollar amortization method that schedules equal dollar payments each year and reduces more of the unfunded liability in the early years. The slower funding progress when using the level-percent-of-pay method leaves the plan more vulnerable to declining finances in the near term and ballooning costs down the road – specifically in the event of poor investment performance.

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[27] Isolating the impact of shifting to an Entry Age Method reduces the 2006 funded ratio from 90.7 to 81.9 percent. The increase in investment return assumption offset this decline by reducing the unfunded liability by $56.4 million. When combined with other miscellaneous gains/losses the changes net out to a funded ratio of 84.6 percent.

## Appendix III – NHRS Projections

Table A5. *Level-Percent-of-Pay Amortization, Payroll Growth Equals Assumed, 6.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 7,908.7 | 13,066.0 | 5,157.3 | 206.9 | 66.4 | 297.0 | 363.4 | 2,683.3 | 802.2 | 13.5% | 60.5% |
| 2018 | 8,281.9 | 13,466.2 | 5,184.3 | 213.4 | 75.5 | 347.2 | 422.7 | 2,767.7 | 843.2 | 15.3% | 61.5% |
| 2019 | 8,701.3 | 13,858.6 | 5,157.3 | 220.2 | 77.8 | 358.1 | 436.0 | 2,854.9 | 886.3 | 15.3% | 62.8% |
| 2020 | 8,926.5 | 14,240.6 | 5,314.1 | 217.9 | 75.4 | 374.7 | 450.0 | 2,944.7 | 930.1 | 15.3% | 62.7% |
| 2021 | 9,106.0 | 14,611.0 | 5,505.0 | 224.9 | 75.1 | 389.0 | 464.2 | 3,037.5 | 973.6 | 15.3% | 62.3% |
| 2022 | 9,383.0 | 14,969.3 | 5,586.3 | 232.1 | 75.2 | 427.3 | 502.5 | 3,133.1 | 1,015.4 | 16.0% | 62.7% |
| 2023 | 9,659.8 | 15,316.8 | 5,657.0 | 239.6 | 75.4 | 442.9 | 518.3 | 3,231.7 | 1,055.5 | 16.0% | 63.1% |
| 2024 | 9,957.3 | 15,655.1 | 5,697.8 | 247.4 | 75.8 | 477.2 | 553.0 | 3,333.5 | 1,094.6 | 16.6% | 63.6% |
| 2025 | 10,259.4 | 15,984.8 | 5,725.4 | 255.4 | 76.3 | 494.0 | 570.4 | 3,438.4 | 1,133.5 | 16.6% | 64.2% |
| 2026 | 10,593.4 | 16,305.8 | 5,712.4 | 263.7 | 77.0 | 532.9 | 609.9 | 3,546.7 | 1,168.6 | 17.2% | 65.0% |
| 2027 | 10,942.5 | 16,622.2 | 5,679.7 | 272.3 | 78.0 | 551.1 | 629.1 | 3,658.4 | 1,201.9 | 17.2% | 65.8% |
| 2028 | 11,337.0 | 16,935.7 | 5,598.7 | 281.0 | 78.7 | 595.7 | 674.4 | 3,773.6 | 1,233.3 | 17.9% | 66.9% |
| 2029 | 11,754.9 | 17,248.7 | 5,493.7 | 290.1 | 79.9 | 615.8 | 695.7 | 3,892.5 | 1,264.7 | 17.9% | 68.1% |
| 2030 | 12,230.9 | 17,561.9 | 5,331.0 | 299.4 | 81.2 | 666.7 | 747.9 | 4,015.1 | 1,295.4 | 18.6% | 69.6% |
| 2031 | 12,741.1 | 17,875.8 | 5,134.7 | 309.0 | 82.7 | 688.7 | 771.4 | 4,141.5 | 1,324.2 | 18.6% | 71.3% |
| 2032 | 13,330.6 | 18,192.5 | 4,861.9 | 318.9 | 84.1 | 750.4 | 834.5 | 4,272.0 | 1,351.4 | 19.5% | 73.3% |
| 2033 | 13,968.6 | 18,515.3 | 4,546.7 | 329.1 | 85.7 | 775.1 | 860.8 | 4,406.5 | 1,376.9 | 19.5% | 75.4% |
| 2034 | 14,715.1 | 18,846.4 | 4,131.3 | 339.6 | 87.6 | 853.1 | 940.7 | 4,545.3 | 1,401.0 | 20.7% | 78.1% |
| 2035 | 15,527.0 | 19,188.1 | 3,661.1 | 350.4 | 89.4 | 880.9 | 970.4 | 4,688.5 | 1,423.6 | 20.7% | 80.9% |
| 2036 | 16,495.0 | 19,542.4 | 3,047.4 | 361.6 | 91.5 | 990.9 | 1,082.4 | 4,836.2 | 1,444.9 | 22.4% | 84.4% |
| 2037 | 17,549.3 | 19,913.6 | 2,364.3 | 373.1 | 93.7 | 1,022.8 | 1,116.5 | 4,988.6 | 1,466.0 | 22.4% | 88.1% |
| 2038 | 18,871.8 | 20,301.8 | 1,430.0 | 385.0 | 95.8 | 1,224.8 | 1,320.6 | 5,145.8 | 1,486.4 | 25.7% | 93.0% |
| 2039 | 20,312.5 | 20,711.1 | 398.5 | 397.2 | 98.2 | 1,264.0 | 1,362.2 | 5,307.9 | 1,506.5 | 25.7% | 98.1% |

Table A6. *Level-Percent-of-Pay Amortization, Payroll Growth Equals Assumed, 7.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 8,048.7 | 13,066.0 | 5,017.3 | 206.9 | 66.4 | 297.0 | 363.4 | 2,683.3 | 802.2 | 13.5% | 61.6% |
| 2018 | 8,495.9 | 13,466.2 | 4,970.4 | 213.4 | 75.5 | 347.2 | 422.7 | 2,767.7 | 843.2 | 15.3% | 63.1% |
| 2019 | 8,997.9 | 13,858.6 | 4,860.7 | 220.2 | 77.8 | 358.1 | 436.0 | 2,854.9 | 886.3 | 15.3% | 64.9% |
| 2020 | 9,292.6 | 14,240.6 | 4,948.0 | 217.9 | 75.4 | 353.0 | 428.3 | 2,944.7 | 930.1 | 14.5% | 65.3% |
| 2021 | 9,549.1 | 14,611.0 | 5,061.9 | 224.9 | 75.1 | 366.6 | 441.8 | 3,037.5 | 973.6 | 14.5% | 65.4% |
| 2022 | 9,914.2 | 14,969.3 | 5,055.1 | 232.1 | 75.2 | 392.4 | 467.6 | 3,133.1 | 1,015.4 | 14.9% | 66.2% |
| 2023 | 10,287.3 | 15,316.8 | 5,029.5 | 239.6 | 75.4 | 406.9 | 482.3 | 3,231.7 | 1,055.5 | 14.9% | 67.2% |
| 2024 | 10,672.7 | 15,655.1 | 4,982.4 | 247.4 | 75.8 | 423.6 | 499.4 | 3,333.5 | 1,094.6 | 15.0% | 68.2% |
| 2025 | 11,070.3 | 15,984.8 | 4,914.5 | 255.4 | 76.3 | 438.8 | 515.1 | 3,438.4 | 1,133.5 | 15.0% | 69.3% |
| 2026 | 11,488.0 | 16,305.8 | 4,817.8 | 263.7 | 77.0 | 456.5 | 533.5 | 3,546.7 | 1,168.6 | 15.0% | 70.5% |
| 2027 | 11,927.8 | 16,622.2 | 4,694.4 | 272.3 | 78.0 | 472.3 | 550.3 | 3,658.4 | 1,201.9 | 15.0% | 71.8% |
| 2028 | 12,396.5 | 16,935.7 | 4,539.2 | 281.0 | 78.7 | 491.3 | 570.0 | 3,773.6 | 1,233.3 | 15.1% | 73.2% |
| 2029 | 12,894.5 | 17,248.7 | 4,354.2 | 290.1 | 79.9 | 508.1 | 588.0 | 3,892.5 | 1,264.7 | 15.1% | 74.8% |
| 2030 | 13,427.4 | 17,561.9 | 4,134.5 | 299.4 | 81.2 | 526.9 | 608.1 | 4,015.1 | 1,295.4 | 15.1% | 76.5% |
| 2031 | 13,998.8 | 17,875.8 | 3,877.0 | 309.0 | 82.7 | 544.5 | 627.2 | 4,141.5 | 1,324.2 | 15.1% | 78.3% |
| 2032 | 14,615.9 | 18,192.5 | 3,576.6 | 318.9 | 84.1 | 564.6 | 648.6 | 4,272.0 | 1,351.4 | 15.2% | 80.3% |
| 2033 | 15,283.1 | 18,515.3 | 3,232.2 | 329.1 | 85.7 | 583.4 | 669.0 | 4,406.5 | 1,376.9 | 15.2% | 82.5% |
| 2034 | 16,007.5 | 18,846.4 | 2,838.9 | 339.6 | 87.6 | 603.6 | 691.1 | 4,545.3 | 1,401.0 | 15.2% | 84.9% |
| 2035 | 16,794.7 | 19,188.1 | 2,393.4 | 350.4 | 89.4 | 623.5 | 712.9 | 4,688.5 | 1,423.6 | 15.2% | 87.5% |
| 2036 | 17,651.1 | 19,542.4 | 1,891.4 | 361.6 | 91.5 | 643.1 | 734.6 | 4,836.2 | 1,444.9 | 15.2% | 90.3% |
| 2037 | 18,583.5 | 19,913.6 | 1,330.1 | 373.1 | 93.7 | 664.1 | 757.8 | 4,988.6 | 1,466.0 | 15.2% | 93.3% |
| 2038 | 19,592.0 | 20,301.8 | 709.8 | 385.0 | 95.8 | 678.6 | 774.5 | 5,145.8 | 1,486.4 | 15.1% | 96.5% |
| 2039 | 20,690.8 | 20,711.1 | 20.3 | 397.2 | 98.2 | 700.7 | 798.8 | 5,307.9 | 1,506.5 | 15.1% | 99.9% |

Table A7. *Level-Percent-of-Pay Amortization, Payroll Growth Equals Assumed, 8.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 8,189.8 | 13,066.0 | 4,876.2 | 206.9 | 66.4 | 297.0 | 363.4 | 2,683.3 | 802.2 | 13.5% | 62.7% |
| 2018 | 8,713.6 | 13,466.2 | 4,752.6 | 213.4 | 75.5 | 347.2 | 422.7 | 2,767.7 | 843.2 | 15.3% | 64.7% |
| 2019 | 9,302.6 | 13,858.6 | 4,555.9 | 220.2 | 77.8 | 358.1 | 436.0 | 2,854.9 | 886.3 | 15.3% | 67.1% |
| 2020 | 9,672.3 | 14,240.6 | 4,568.3 | 217.9 | 75.4 | 330.6 | 406.0 | 2,944.7 | 930.1 | 13.8% | 67.9% |
| 2021 | 10,013.1 | 14,611.0 | 4,597.9 | 224.9 | 75.1 | 343.6 | 418.8 | 3,037.5 | 973.6 | 13.8% | 68.5% |
| 2022 | 10,475.2 | 14,969.3 | 4,494.1 | 232.1 | 75.2 | 356.0 | 431.2 | 3,133.1 | 1,015.4 | 13.8% | 70.0% |
| 2023 | 10,955.9 | 15,316.8 | 4,360.9 | 239.6 | 75.4 | 369.3 | 444.7 | 3,231.7 | 1,055.5 | 13.8% | 71.5% |
| 2024 | 11,441.6 | 15,655.1 | 4,213.6 | 247.4 | 75.8 | 366.5 | 442.3 | 3,333.5 | 1,094.6 | 13.3% | 73.1% |
| 2025 | 11,949.8 | 15,984.8 | 4,035.0 | 255.4 | 76.3 | 379.9 | 456.2 | 3,438.4 | 1,133.5 | 13.3% | 74.8% |
| 2026 | 12,466.6 | 16,305.8 | 3,839.2 | 263.7 | 77.0 | 373.7 | 450.7 | 3,546.7 | 1,168.6 | 12.7% | 76.5% |
| 2027 | 13,015.2 | 16,622.2 | 3,606.9 | 272.3 | 78.0 | 386.9 | 464.9 | 3,658.4 | 1,201.9 | 12.7% | 78.3% |
| 2028 | 13,575.4 | 16,935.7 | 3,360.3 | 281.0 | 78.7 | 376.1 | 454.8 | 3,773.6 | 1,233.3 | 12.1% | 80.2% |
| 2029 | 14,173.5 | 17,248.7 | 3,075.2 | 290.1 | 79.9 | 389.2 | 469.1 | 3,892.5 | 1,264.7 | 12.1% | 82.2% |
| 2030 | 14,780.4 | 17,561.9 | 2,781.5 | 299.4 | 81.2 | 370.0 | 451.2 | 4,015.1 | 1,295.4 | 11.2% | 84.2% |
| 2031 | 15,432.2 | 17,875.8 | 2,443.6 | 309.0 | 82.7 | 382.7 | 465.4 | 4,141.5 | 1,324.2 | 11.2% | 86.3% |
| 2032 | 16,090.3 | 18,192.5 | 2,102.2 | 318.9 | 84.1 | 352.7 | 436.8 | 4,272.0 | 1,351.4 | 10.2% | 88.4% |
| 2033 | 16,801.4 | 18,515.3 | 1,713.9 | 329.1 | 85.7 | 364.8 | 450.5 | 4,406.5 | 1,376.9 | 10.2% | 90.7% |
| 2034 | 17,507.6 | 18,846.4 | 1,338.8 | 339.6 | 87.6 | 315.3 | 402.9 | 4,545.3 | 1,401.0 | 8.9% | 92.9% |
| 2035 | 18,273.2 | 19,188.1 | 914.9 | 350.4 | 89.4 | 326.1 | 415.5 | 4,688.5 | 1,423.6 | 8.9% | 95.2% |
| 2036 | 19,001.8 | 19,542.4 | 540.6 | 361.6 | 91.5 | 237.6 | 329.1 | 4,836.2 | 1,444.9 | 6.8% | 97.2% |
| 2037 | 19,791.6 | 19,913.6 | 122.0 | 373.1 | 93.7 | 245.8 | 339.4 | 4,988.6 | 1,466.0 | 6.8% | 99.4% |
| 2038 | 20,427.0 | 20,301.8 | -125.1 | 385.0 | 95.8 | 40.7 | 136.5 | 5,145.8 | 1,486.4 | 2.7% | 100.6% |
| 2039 | 21,111.6 | 20,711.1 | -400.6 | 397.2 | 98.2 | 42.6 | 140.8 | 5,307.9 | 1,506.5 | 2.7% | 101.9% |

Table A8. *Level-Percent-of-Pay Amortization, No Payroll Growth, 7.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 8,031.6 | 13,064.1 | 5,032.5 | 200.6 | 64.3 | 288.0 | 352.3 | 2,601.4 | 801.3 | 13.5% | 61.5% |
| 2018 | 8,440.7 | 13,454.6 | 5,014.0 | 200.6 | 70.9 | 326.4 | 397.3 | 2,601.4 | 840.6 | 15.3% | 62.7% |
| 2019 | 8,883.2 | 13,829.3 | 4,946.2 | 200.6 | 70.9 | 326.4 | 397.3 | 2,601.4 | 881.6 | 15.3% | 64.2% |
| 2020 | 9,116.2 | 14,185.4 | 5,069.2 | 197.7 | 62.5 | 327.7 | 390.1 | 2,601.4 | 923.1 | 15.0% | 64.3% |
| 2021 | 9,287.6 | 14,521.0 | 5,233.4 | 197.6 | 60.2 | 329.9 | 390.1 | 2,601.4 | 964.4 | 15.0% | 64.0% |
| 2022 | 9,569.9 | 14,834.5 | 5,264.6 | 197.5 | 58.1 | 371.1 | 429.2 | 2,601.4 | 1,004.1 | 16.5% | 64.5% |
| 2023 | 9,833.7 | 15,126.1 | 5,292.4 | 197.4 | 56.2 | 373.0 | 429.2 | 2,601.4 | 1,041.7 | 16.5% | 65.0% |
| 2024 | 10,113.8 | 15,396.7 | 5,282.9 | 197.4 | 54.5 | 408.1 | 462.6 | 2,601.4 | 1,077.8 | 17.8% | 65.7% |
| 2025 | 10,377.3 | 15,645.8 | 5,268.5 | 197.4 | 52.9 | 409.7 | 462.6 | 2,601.4 | 1,113.4 | 17.8% | 66.3% |
| 2026 | 10,664.8 | 15,872.2 | 5,207.4 | 197.4 | 51.4 | 449.2 | 500.6 | 2,601.4 | 1,146.5 | 19.2% | 67.2% |
| 2027 | 10,941.4 | 16,077.2 | 5,135.8 | 197.3 | 50.2 | 450.4 | 500.6 | 2,601.4 | 1,177.2 | 19.2% | 68.1% |
| 2028 | 11,252.7 | 16,261.2 | 5,008.6 | 197.3 | 48.8 | 494.4 | 543.2 | 2,601.4 | 1,205.5 | 20.9% | 69.2% |
| 2029 | 11,557.5 | 16,425.5 | 4,867.9 | 197.2 | 47.7 | 495.5 | 543.2 | 2,601.4 | 1,233.5 | 20.9% | 70.4% |
| 2030 | 11,906.0 | 16,569.5 | 4,663.5 | 197.1 | 46.7 | 544.0 | 590.7 | 2,601.4 | 1,260.1 | 22.7% | 71.9% |
| 2031 | 12,254.7 | 16,692.1 | 4,437.4 | 197.0 | 45.9 | 544.7 | 590.7 | 2,601.4 | 1,284.2 | 22.7% | 73.4% |
| 2032 | 12,662.2 | 16,793.2 | 4,131.0 | 196.9 | 45.1 | 599.9 | 644.9 | 2,601.4 | 1,306.0 | 24.8% | 75.4% |
| 2033 | 13,078.5 | 16,875.0 | 3,796.5 | 196.9 | 44.3 | 600.6 | 644.9 | 2,601.4 | 1,325.9 | 24.8% | 77.5% |
| 2034 | 13,571.2 | 16,937.7 | 3,366.6 | 196.7 | 43.8 | 663.5 | 707.3 | 2,601.4 | 1,343.7 | 27.2% | 80.1% |
| 2035 | 14,083.5 | 16,981.9 | 2,898.4 | 196.6 | 43.3 | 664.1 | 707.3 | 2,601.4 | 1,359.0 | 27.2% | 82.9% |
| 2036 | 14,697.7 | 17,006.7 | 2,309.0 | 196.5 | 42.9 | 740.0 | 782.9 | 2,601.4 | 1,372.0 | 30.1% | 86.4% |
| 2037 | 15,344.2 | 17,015.7 | 1,671.5 | 196.4 | 42.5 | 740.4 | 782.9 | 2,601.4 | 1,383.7 | 30.1% | 90.2% |
| 2038 | 16,136.8 | 17,006.6 | 869.8 | 196.3 | 42.2 | 846.2 | 888.4 | 2,601.4 | 1,393.4 | 34.1% | 94.9% |
| 2039 | 16,978.4 | 16,982.4 | 3.9 | 196.3 | 41.9 | 846.4 | 888.4 | 2,601.4 | 1,401.4 | 34.1% | 100.0% |

Table A9. *Level Dollar Amortization, Payroll Growth Equals Assumed, 7.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 8,048.7 | 13,066.0 | 5,017.3 | 206.9 | 66.4 | 297.0 | 363.4 | 2,683.3 | 802.2 | 13.5% | 61.6% |
| 2018 | 8,495.9 | 13,466.2 | 4,970.4 | 213.4 | 75.5 | 347.2 | 422.7 | 2,767.7 | 843.2 | 15.3% | 63.1% |
| 2019 | 8,997.9 | 13,858.6 | 4,860.7 | 220.2 | 77.8 | 358.1 | 436.0 | 2,854.9 | 886.3 | 15.3% | 64.9% |
| 2020 | 9,390.5 | 14,240.6 | 4,850.1 | 217.9 | 75.4 | 447.4 | 522.8 | 2,944.7 | 930.1 | 17.8% | 65.9% |
| 2021 | 9,738.0 | 14,611.0 | 4,873.0 | 224.9 | 75.1 | 447.7 | 522.8 | 3,037.5 | 973.6 | 17.2% | 66.6% |
| 2022 | 10,196.4 | 14,969.3 | 4,773.0 | 232.1 | 75.2 | 469.1 | 544.3 | 3,133.1 | 1,015.4 | 17.4% | 68.1% |
| 2023 | 10,654.1 | 15,316.8 | 4,662.7 | 239.6 | 75.4 | 468.9 | 544.3 | 3,231.7 | 1,055.5 | 16.8% | 69.6% |
| 2024 | 11,121.6 | 15,655.1 | 4,533.5 | 247.4 | 75.8 | 477.1 | 552.9 | 3,333.5 | 1,094.6 | 16.6% | 71.0% |
| 2025 | 11,590.9 | 15,984.8 | 4,394.0 | 255.4 | 76.3 | 476.6 | 552.9 | 3,438.4 | 1,133.5 | 16.1% | 72.5% |
| 2026 | 12,075.4 | 16,305.8 | 4,230.4 | 263.7 | 77.0 | 484.6 | 561.6 | 3,546.7 | 1,168.6 | 15.8% | 74.1% |
| 2027 | 12,569.5 | 16,622.2 | 4,052.7 | 272.3 | 78.0 | 483.6 | 561.6 | 3,658.4 | 1,201.9 | 15.4% | 75.6% |
| 2028 | 13,085.0 | 16,935.7 | 3,850.6 | 281.0 | 78.7 | 491.6 | 570.4 | 3,773.6 | 1,233.3 | 15.1% | 77.3% |
| 2029 | 13,614.8 | 17,248.7 | 3,633.9 | 290.1 | 79.9 | 490.5 | 570.4 | 3,892.5 | 1,264.7 | 14.7% | 78.9% |
| 2030 | 14,168.8 | 17,561.9 | 3,393.1 | 299.4 | 81.2 | 497.0 | 578.2 | 4,015.1 | 1,295.4 | 14.4% | 80.7% |
| 2031 | 14,743.2 | 17,875.8 | 3,132.6 | 309.0 | 82.7 | 495.5 | 578.2 | 4,141.5 | 1,324.2 | 14.0% | 82.5% |
| 2032 | 15,349.4 | 18,192.5 | 2,843.1 | 318.9 | 84.1 | 502.0 | 586.0 | 4,272.0 | 1,351.4 | 13.7% | 84.4% |
| 2033 | 15,983.8 | 18,515.3 | 2,531.5 | 329.1 | 85.7 | 500.4 | 586.0 | 4,406.5 | 1,376.9 | 13.3% | 86.3% |
| 2034 | 16,657.7 | 18,846.4 | 2,188.7 | 339.6 | 87.6 | 505.8 | 593.4 | 4,545.3 | 1,401.0 | 13.1% | 88.4% |
| 2035 | 17,368.3 | 19,188.1 | 1,819.8 | 350.4 | 89.4 | 504.0 | 593.4 | 4,688.5 | 1,423.6 | 12.7% | 90.5% |
| 2036 | 18,126.0 | 19,542.4 | 1,416.5 | 361.6 | 91.5 | 507.8 | 599.3 | 4,836.2 | 1,444.9 | 12.4% | 92.8% |
| 2037 | 18,928.7 | 19,913.6 | 984.9 | 373.1 | 93.7 | 505.7 | 599.3 | 4,988.6 | 1,466.0 | 12.0% | 95.1% |
| 2038 | 19,781.2 | 20,301.8 | 520.6 | 385.0 | 95.8 | 503.9 | 599.8 | 5,145.8 | 1,486.4 | 11.7% | 97.4% |
| 2039 | 20,687.3 | 20,711.1 | 23.7 | 397.2 | 98.2 | 501.6 | 599.8 | 5,307.9 | 1,506.5 | 11.3% | 99.9% |

Table A10. *Level Dollar Amortization, Payroll Growth Equals Assumed, 6.25-percent Investment Return, in Millions*

| FY | Actuarial assets | Actuarial liabilities | UAAL | Employee contribution | Employer normal cost | UAAL payment | Employer ARC | Payroll | Benefits | ARC/ payroll | Funded ratio |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2016 | $7,663.4 | $12,732.9 | $5,069.4 | $200.6 | $64.3 | $288.0 | $352.3 | $2,601.4 | $838.6 | 13.5% | 60.2% |
| 2017 | 7,908.7 | 13,066.0 | 5,157.3 | 206.9 | 66.4 | 297.0 | 363.4 | 2,683.3 | 802.2 | 13.5% | 60.5% |
| 2018 | 8,281.9 | 13,466.2 | 5,184.3 | 213.4 | 75.5 | 347.2 | 422.7 | 2,767.7 | 843.2 | 15.3% | 61.5% |
| 2019 | 8,701.3 | 13,858.6 | 5,157.3 | 220.2 | 77.8 | 358.1 | 436.0 | 2,854.9 | 886.3 | 15.3% | 62.8% |
| 2020 | 9,030.2 | 14,240.6 | 5,210.4 | 217.9 | 75.4 | 475.1 | 550.4 | 2,944.7 | 930.1 | 18.7% | 63.4% |
| 2021 | 9,305.3 | 14,611.0 | 5,305.7 | 224.9 | 75.1 | 475.3 | 550.4 | 3,037.5 | 973.6 | 18.1% | 63.7% |
| 2022 | 9,682.1 | 14,969.3 | 5,287.2 | 232.1 | 75.2 | 511.5 | 586.7 | 3,133.1 | 1,015.4 | 18.7% | 64.7% |
| 2023 | 10,048.8 | 15,316.8 | 5,268.0 | 239.6 | 75.4 | 511.3 | 586.7 | 3,231.7 | 1,055.5 | 18.2% | 65.6% |
| 2024 | 10,436.2 | 15,655.1 | 5,218.9 | 247.4 | 75.8 | 540.1 | 615.9 | 3,333.5 | 1,094.6 | 18.5% | 66.7% |
| 2025 | 10,815.9 | 15,984.8 | 5,168.9 | 255.4 | 76.3 | 539.5 | 615.9 | 3,438.4 | 1,133.5 | 17.9% | 67.7% |
| 2026 | 11,225.2 | 16,305.8 | 5,080.6 | 263.7 | 77.0 | 571.5 | 648.5 | 3,546.7 | 1,168.6 | 18.3% | 68.8% |
| 2027 | 11,634.4 | 16,622.2 | 4,987.8 | 272.3 | 78.0 | 570.6 | 648.5 | 3,658.4 | 1,201.9 | 17.7% | 70.0% |
| 2028 | 12,084.0 | 16,935.7 | 4,851.6 | 281.0 | 78.7 | 606.9 | 685.6 | 3,773.6 | 1,233.3 | 18.2% | 71.4% |
| 2029 | 12,538.6 | 17,248.7 | 4,710.1 | 290.1 | 79.9 | 605.7 | 685.6 | 3,892.5 | 1,264.7 | 17.6% | 72.7% |
| 2030 | 13,043.1 | 17,561.9 | 4,518.8 | 299.4 | 81.2 | 646.7 | 727.9 | 4,015.1 | 1,295.4 | 18.1% | 74.3% |
| 2031 | 13,559.2 | 17,875.8 | 4,316.6 | 309.0 | 82.7 | 645.2 | 727.9 | 4,141.5 | 1,324.2 | 17.6% | 75.9% |
| 2032 | 14,142.9 | 18,192.5 | 4,049.6 | 318.9 | 84.1 | 695.4 | 779.5 | 4,272.0 | 1,351.4 | 18.2% | 77.7% |
| 2033 | 14,747.4 | 18,515.3 | 3,767.8 | 329.1 | 85.7 | 693.8 | 779.5 | 4,406.5 | 1,376.9 | 17.7% | 79.7% |
| 2034 | 15,444.3 | 18,846.4 | 3,402.1 | 339.6 | 87.6 | 758.3 | 845.9 | 4,545.3 | 1,401.0 | 18.6% | 81.9% |
| 2035 | 16,172.7 | 19,188.1 | 3,015.4 | 350.4 | 89.4 | 756.5 | 845.9 | 4,688.5 | 1,423.6 | 18.0% | 84.3% |
| 2036 | 17,035.6 | 19,542.4 | 2,506.8 | 361.6 | 91.5 | 850.7 | 942.2 | 4,836.2 | 1,444.9 | 19.5% | 87.2% |
| 2037 | 17,942.9 | 19,913.6 | 1,970.7 | 373.1 | 93.7 | 848.6 | 942.2 | 4,988.6 | 1,466.0 | 18.9% | 90.1% |
| 2038 | 19,090.3 | 20,301.8 | 1,211.5 | 385.0 | 95.8 | 1,032.4 | 1,128.3 | 5,145.8 | 1,486.4 | 21.9% | 94.0% |
| 2039 | 20,301.9 | 20,711.1 | 409.2 | 397.2 | 98.2 | 1,030.1 | 1,128.3 | 5,307.9 | 1,506.5 | 21.3% | 98.0% |