

## SPECIAL COMMENT

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# US State and Local Government Pensions Lose Ground Despite Meeting Return Targets

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US state and local government pension plans are benefiting from favorable investment performance as the equity market recovery from the severe 2008-09 crisis continues. For many plans, this development has been achieved with riskier asset allocations, yet has not prevented a large expansion of unfunded liabilities. These attributes worsen budgetary strain at many sponsoring governments, magnified by the aging demographics of government workers and pension beneficiaries.

This report analyzes the 25 largest public defined benefit pension systems in terms of assets under unified management, primarily from 2004 to 2013. These 25 systems cover a large share of US state and local government beneficiaries, managing roughly 40% of the \$5.29 trillion in total assets across US public-sector pensions.<sup>1</sup> We observe the following trends.

- » **Asset growth in public-sector pension plans has not kept pace with liabilities, despite long-term investment meeting plan expectations.** Compound average returns from 2004-13 were 7.45% across these systems, broadly meeting current return targets and discount rates. Yet, Moody's adjusted unfunded liabilities tripled from 2004-12 to just under \$2 trillion. This rise underscores the difficulty of recovering from double-digit asset declines experienced in 2008-09, as well as the broad inadequacy of sponsor contributions.
- Strong investment performance in 2013 and 2014, combined with benefit reforms and moderating wages, has begun to ease the rate of unfunded liability growth for some plans, but a large funding gap persists for many plans.
- » **Demographic trends exacerbate the challenges of unfunded liabilities and asset risk.** The combination of aging plan demographics and the slow paydown of large unfunded liabilities effectively transfers costs incurred by a previous generation, growing the burden on sponsoring governments. The large scale of asset buildup necessary to cover aging beneficiaries magnifies the downside implications of sharp market declines for government budgets. An enhanced recognition of the need for pension reform, however, would likely emerge for at least some governments faced with such future budget stress.
- » **Through their pension funds, US municipal budgets are exposed to increasing levels of asset volatility and market performance risk.** Unlike corporates, public pensions have opted for riskier investments through a high allocation to equities and alternatives. The resulting exposure to asset volatility increases the risk of sharp asset declines and consequent upward pressure on budgets to increase pension funding sharply.

<sup>1</sup> Towers Watson, *Global Pension Assets 2014*; Moody's Investors Service calculations.

## Long-term investment returns have met plan expectations, yet asset growth did not keep pace with liabilities

Over the past decade, the compound average growth rate (CAGR) for the investment returns of the 25 largest US public pension plans has been reasonably robust despite variable, poor performance during the Great Recession. The CAGR over the period<sup>2</sup> fiscal year 2004 to fiscal year 2013 averaged 7.45%, which is close to the average 7.65% rate-of-return goal these plans currently assume. While the plans have come close to meeting internal expectations, they have essentially paced the market—the CAGR for the S&P 500 for the fiscal 2004-13 period was about 7.21%<sup>3</sup> (see Exhibit 1).

## EXHIBIT 1

### Compound Average Returns Have Often Exceeded Rate-of-Return Goals

		Investment Returns vs. Target			
Plan	Fiscal Year	CAGR (%)			Assumed Rate of Return
		10 yr	5 yr	3 yr	
California Public Employees' Retirement System (CalPERS)	30-Jun	6.99%	3.50%	11.31%	7.50%
California State Teachers' Retirement System (CalSTRS)	30-Jun	7.52%	3.71%	12.56%	7.50%
New York State and Local Employee Retirement System (NYSLERS)	31-Mar	8.67%	4.42%	10.25%	7.50%
Florida State Retirement System (FL)	30-Jun	7.45%	5.04%	11.47%	7.75%
Teacher Retirement System of Texas (TX TRS)	31-Aug	7.17%	5.44%	10.65%	8.00%
New York City Retirement Systems (NYCRS)	30-Jun	-	5.50%	11.88%	7.00%
New York State Teachers' Retirement System (NY TRS)	30-Jun	7.50%	5.12%	12.92%	8.00%
Ohio Public Employees Retirement System (OPERS)	31-Dec	7.14%	12.31%	9.33%	8.00%
New Jersey Division of Pensions and Benefits (NJ)	30-Jun	7.39%	5.62%	10.59%	7.90%
North Carolina Retirement Systems (NC)	30-Jun	6.58%	4.97%	9.87%	7.25%
State Teachers Retirement System of Ohio (OSTERS)	30-Jun	-	4.60%	12.56%	7.75%
Washington State Investment Board (WA)	30-Jun	8.32%	3.81%	11.34%	7.90%
Virginia Retirement System (VA)	30-Jun	7.58%	3.98%	10.53%	7.00%
Oregon Public Employees Retirement Fund (OR)	30-Jun	8.34%	4.95%	11.88%	7.75%
Teachers Retirement System of Georgia (GA TRS)	30-Jun	6.55%	6.27%	11.96%	7.50%
Massachusetts Pension Reserves Investment Trust (PRIM)	30-Jun	8.09%	3.41%	11.26%	8.00%
PA Public School Employees' Retirement System (PPSERS)	30-Jun	7.72%	2.50%	10.36%	7.50%
University of California Retirement System (UCal)	30-Jun	6.68%	4.69%	11.17%	7.50%
Michigan State Employees' Retirement System (MSERS)	30-Sep	7.43%	6.82%	10.82%	8.00%
Colorado Public Employees' Retirement Association (CO)	31-Dec	7.70%	12.22%	9.97%	8.00%
Maryland State Retirement and Pension System (MD)	30-Jun	6.62%	3.97%	10.02%	7.70%
Los Angeles County Employees Retirement System (LACo)	30-Jun	7.70%	4.19%	10.42%	7.50%
Tennessee Consolidated Retirement System (TN)	30-Jun	6.16%	5.33%	11.56%	7.50%
Wisconsin Department of Employee Trust Fund (WI)	30-Jun	7.77%	5.22%	11.42%	7.20%
Minnesota State Board of Investment (MN)	1-Jul	8.18%	6.17%	12.97%	8.00%
Average CAGR Across Plans		7.45%	5.35%	11.16%	
Average Annual Return Across Plans		8.17%	6.32%	11.42%	

Sources: Top 25 plan CAFRS; Moody's Investors Service calculations

Investment returns improved after plunging steeply during the recession. In fiscal years 2008 and 2009, the plans, on average, sustained a cumulative decline in assets of 21.67%. Investment returns began to rebound in the second half of 2009, and have stayed strong since, although not without some

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<sup>2</sup> 10-year data is not available for two of the 25 plans.

<sup>3</sup> Moody's calculations

volatility. The CAGR was weaker than expectations for the five year period 2009-13, and only two plans exceeded their recent targets. Notably, this time period captures the end of the sharp market downturn. For the three years ended fiscal 2013, all 25 plans had growth rates exceeding their current rate of return goals by a considerable margin, primarily due to the strength of recent equity performance. While these returns are stronger than expectations, they lagged the S&P 500 CAGR for this period, which was 18.6%.

In terms of a simple average annual return, however, all plans performed better by a margin of about 0.75%- to 1.0% for the 10- and five-year CAGR, and of 0.25% over three years. This reflects the basic difficulty of recovering overall asset position after suffering double-digit losses—the annual return may be strong, but the incremental gain is small relative to pre-downturn levels because the investment base has shrunk. As of 2012, asset valuations for half of the largest 25 plans were still below their peak 2008 levels, despite improved investment returns.

Despite the robust investment returns since 2004, annual growth in *unfunded* pension liabilities has outstripped these returns by nearly 2.4 times, with a compound annual growth of 17.7% for 2004-12. This growth is due to inadequate pension contributions, stemming from a variety of actuarial and funding practices, as well as the sheer growth of pension liabilities as benefit accruals accelerate with the passage of time, salary increases and additional years of service.

### Contribution practices and actuarial techniques hinder asset growth

Employer and employee contributions are the bedrock of any defined benefit pension plan. They establish the base of assets that investments help to expand. Contributions typically have two components. First, they furnish the annual increment of accrued liabilities earned by participants—the normal cost. Second, employer contributions amortize any shortfalls in funded status that may arise, such as those caused by financial market declines.

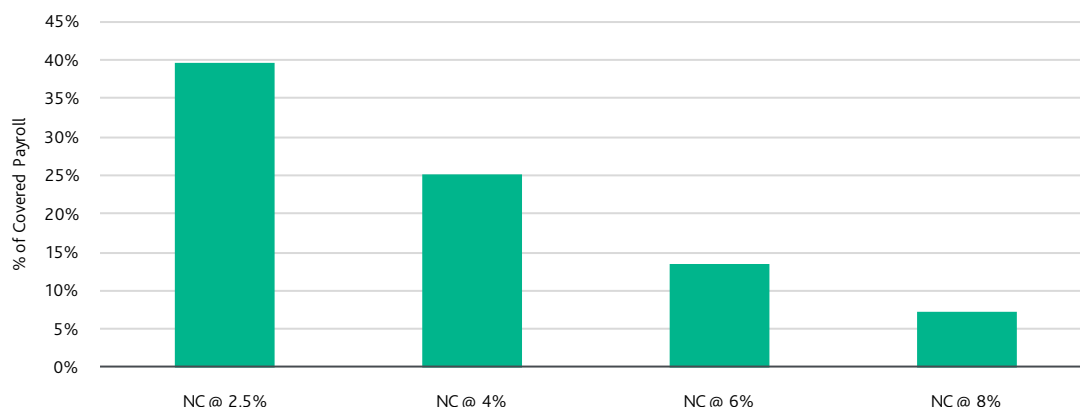
Contributions can and do vary in size from year to year. For example, they accounted for 60% of total plan income in 2012, but only 22% in 2010.<sup>4</sup>

The Governmental Accounting Standards Board (GASB) pension accounting and disclosure regime emphasizes investment returns over annual contributions; the resulting funding disincentive is at the core of the public-sector pension asset-liability gap. Unlike Financial Accounting Standards Board (FASB) corporate accounting rules, GASB has allowed pension liabilities to be valued using the assumed investment rate of return as the discount rate. As a result, a common practice has been to use a relatively high discount rate that mathematically understates plan liabilities and amortization needs relative to other approaches, such as those supported by financial economists.

Higher discount rates also drive down a pension plan's normal costs, reinforcing a dependence on investment returns over annual funding from regular contributions. For example, the normal cost for a hypothetical 40-year career employee would be nearly 40% of annual payroll at a 2.5% discount rate, but shrinks to 7% of payroll for the same pension benefits assuming an 8% discount rate (see Exhibit 2).

<sup>4</sup> US Census Bureau, 2012 Annual Survey of Public Pensions: State- and Locally-Administered Defined Benefit Data and Historical Survey Data

EXHIBIT 2

**High Discount Rates Push Down Normal Costs (NC)**

Source: Moody's Investors Service

Assumptions: Entry Age Normal cost method, 2% COLA benefit, retirement at age 65, death at age 85, 2% benefit with 5-year final average salary, 3% annual salary increases

Only one of the 25 largest plans—the Wisconsin Retirement System (WRS), administered by the Department of Employee Trust Funds—has adopted an approach closer to corporate pension valuation. At 7.2%, not only is the WRS target rate of return the lowest amongst the 25 plans, but the plan uses separate discount rates for retired (5.0%) and active employees (7.2%), with a resulting single-equivalent discount rate of 5.5%.<sup>5</sup> At 5.5%, WRS's valuation of its pension liabilities is mathematically closer to Moody's valuation using our adjusted approach<sup>6</sup> than are other plans, given current market conditions. The approach also makes WRS less dependent on investment returns and thus less exposed to investment underperformance than its peers, reducing risk.

Wisconsin's practice is rare. In addition to using liberal assumptions, state and local governments will also commonly pay less than the annual required contribution (ARC). In fact, many multi-employer cost-sharing plans consistently collect less than the ARC in aggregate from participating state and local government employers. Examples among the largest plans in this report include CalSTRS, OSTRS and PPSERS. Hundreds of entities participating in these plans have thus been exposed to the risks associated with actuarial contribution shortfalls, despite having made their required contributions in contractual and/or statutory terms.

Some governments, such as the State of New Jersey (A1 negative), simply took contribution 'holidays' during the Great Recession, and then in more recent years skipped payments or artificially reduced them. Many other plans extended their asset-smoothing periods to stretch out the recognition of poor asset performance; CalPERS, for example, went from three years to 15 years in 2005. The State of New York (Aa1 stable) currently allows local governments to amortize cost-sharing plan pension payments for several years as a budgetary relief measure. Regardless of the specific deferral mechanism, the budgetary consequence is generally akin to borrowing at a compound interest rate equivalent to the assumed rate of investment return to support current government operations.

<sup>5</sup> Wisconsin Employees Retirement System CAFR.

<sup>6</sup> [Adjustments to US State and Local Government Reported Pension Data](#); April 17, 2013

Beyond deliberate asset smoothing and contribution shortfalls, state and local governments commonly use several additional actuarial techniques that defer contribution requirements and stymie asset accumulation. GASB 27 allows for lengthy and back-loaded payment schedules that reduce near-term contributions and produce years of payments amounting to less than full interest on the unfunded liability—in other words, negative amortization. This practice can extend an unfunded position for years, even when “full payments” are made and *plan experience matches expectations, such as in a cooperative investment environment*.

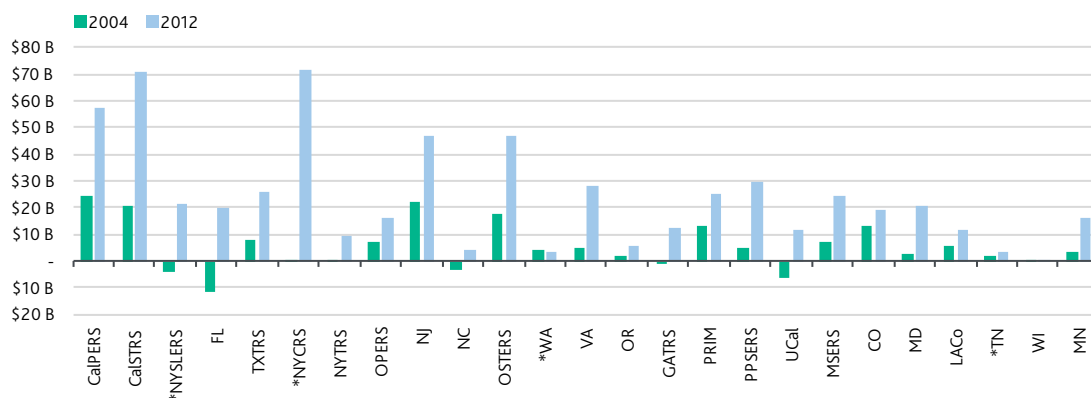
### Meanwhile, pension liabilities grow rapidly

Asset returns will vary from year to year, and contributions can be subject to holidays, smoothing, or statutory caps. Meanwhile, the top-line accrued pension liability in a defined benefit plan will grow with normal cost and the time value of money, whether assets increase or not.

The challenge for state and local government credit is not just that pension liabilities increased in 2004-13, but that the increase rapidly outpaced asset growth. As a result, *unfunded liabilities* grew substantially. This growth is clear on both an as-reported basis and using Moody's adjustments. As-reported aggregate unfunded liabilities across the 25 systems more than quadrupled between 2004 and 2012, rising to \$601 billion from \$139 billion in this period (see Exhibit 3).

EXHIBIT 3

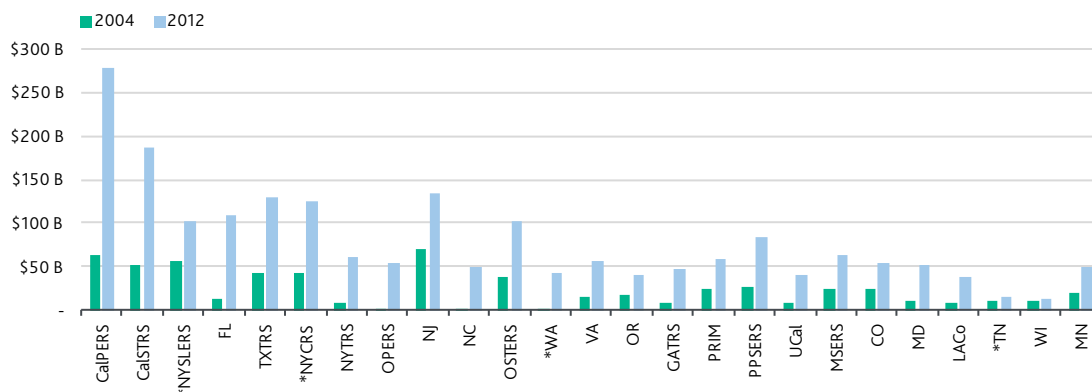
#### As-Reported Unfunded Actuarial Accrued Liability Has Quadrupled



Sources: Top 25 plan CAFRS, Moody's Investors Service calculations  
Notes: TN: 2005-2011; NYSLERS 2005; WA: 2007; NYCRS 2011

Moody's approach of using market-based discount rates to adjust unfunded liabilities increases their magnitude substantially under current market conditions. Using Moody's adjustments, which capture both the top-line liability growth and the material decline in interest rates, the aggregate underfunding across the 25 systems more than tripled in the years 2004 -12, rising to \$1,994 billion from \$608 billion (see Exhibit 4).

EXHIBIT 4

**Moody's Adjusted Net Pension Liability Has Tripled on a Substantially Higher Base**

Sources: Top 25 plan CAFRS, Moody's Investors Service calculations

Notes: TN: 2005- 2011; NYSLERS 2005; WA; 2007; NYCRS 2011

How significant is this underfunding? In 2004, the aggregate funding ratio for the 25 plans was approximately 71% measured using Moody's adjustments, and 91% as reported. By 2012, these aggregate funded ratios had declined to 49% and 76% respectively.

As we have noted, the growth rate of unfunded liabilities may have since lessened for some plans, with continued strong asset performance and benefit reforms. However, the question remains: Why did the underfunding increase so much from 2004-12, given that the systems were earning close to their currently expected returns, which – serving as the discount rates – were the basis for calculating liabilities and normal costs? What went wrong that state and local governments could neither grow their plan funding nor prevent its decline? Along with the simple deferral of contributions for budgetary reasons, there are several other factors at play, including but not limited to:

- » Asset returns over the period studied have come closer to *current* return assumptions than the assumptions in place at the beginning of the period. In the 2003-04 period, assumed returns averaged 8.00%, or 50 bps higher than the current average return assumption.
- » Reductions in investment returns assumptions have lowered the discount rate. While this assumption change does not alter the projection of benefit payments, it does change their present value, driving actuarial accrued liabilities (AALs) upward. Since any corresponding increase in the unfunded actuarial accrued liability (UAAL) from such a change is generally amortized over a number of years, contribution increases will not immediately close the new assumption-driven gaps that have materialized. Similarly, changes in demographic and economic assumptions, such as mortality, have also driven liability increases. For example, CalSTRS actuaries recommended a discount rate decrease and an increase in life expectancy as part of a 2006-10 actuarial experience analysis, among other changes. The implementation of these assumption changes in 2011 increased the UAAL by \$6.4 billion.<sup>7</sup>
- » Benefit enhancements and other economic experience hastened liability growth. For example, in its 2007 actuarial valuation, TX TRS reported a 14.4% investment return on a market value of assets basis and a 12.5% return on an actuarial asset basis, equivalent to a \$4.1 billion actuarial gain. However, the benefit of strong asset performance in this case was substantially mitigated by

<sup>7</sup> California State Teachers' Retirement System, *Experience Analysis July 1, 2006 – June 30, 2010*. February 7, 2012; *Defined Benefit Program – 2011 Actuarial Valuation*. March 26, 2012.



\$2.5 billion in actuarial losses, stemming from one-time ad hoc COLA payments and larger-than-expected salary increases.<sup>8</sup>

- » The back-loading of costs through techniques such as asset smoothing and lengthy (e.g., 30 year) level-percent-of-pay amortization allowed by GASB suppresses near-term contribution increases, in many cases causing UAALs to rise for years *by design*. Applied to the kinds of actuarial losses described above, increases in plan UAALs have generally been amortized over a number of years, such that contribution increases have not immediately responded to funding gaps, whether caused by changes in assumptions or experience.

Only two plans among the top 25—the Tennessee and Wisconsin systems—have had muted or insignificant growth in unfunded liabilities. This is particularly the case in Wisconsin, which uses a lower discount rate in comparison to other plans.

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### Recent trends are positive, but large asset-liability gaps remain

In the last few years, the growth in unfunded liabilities for some large plans has moderated. First, reported investment returns in 2013 and 2014 have generally been very strong. Second, some plans have experienced restrained liability growth attributable to benefit reform and moderating government payrolls.

Examples of the good investment growth include CalPERS' preliminary returns of 18.4% for fiscal 2014, following 13.2% returns in fiscal 2013. CalSTRS similarly reports 18.7% returns for fiscal 2014, after 13.8% returns in fiscal 2013. The Ohio State Teachers Retirement System (OSTRS) had not only a strong 13.7% return in 2013 but also experienced a drop in reported accrued liabilities from \$106 billion in 2012 to \$94 billion in 2013. Benefit reforms enacted by the state legislature drove the decline. The reduction of the plan's UAAL in 2013 to \$31.8 billion is certainly positive, but the asset-liability gap still remains much wider than prior to the market downturn.

### Pensions expose US municipals to asset volatility and market risk

During the past decade, public pensions have increased their reach for yield and, in turn, their exposure to riskier and more volatile assets. They have been seeking high returns for some time; a shift away from fixed-income investments was already evident in the 1990s (see Exhibit 5).

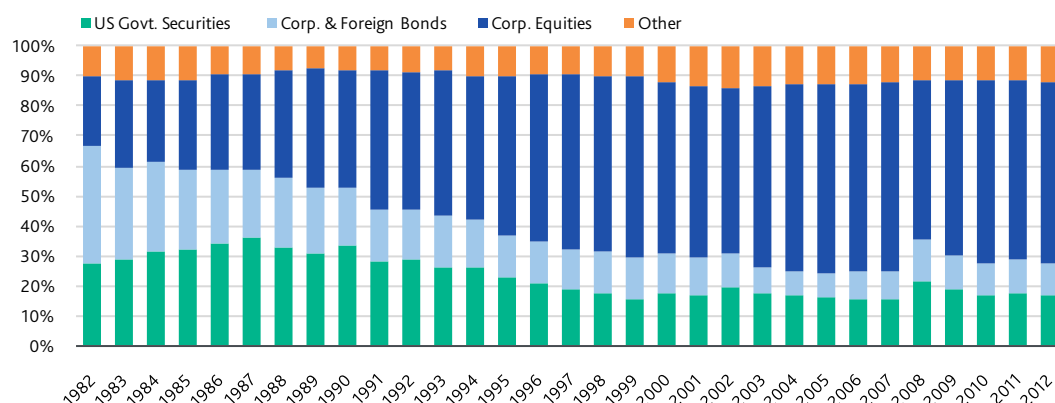
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<sup>8</sup> Teacher Retirement System of Texas, *Actuarial Valuation – August 31, 2007*, October 29, 2007.

EXHIBIT 5

**Pension Plans' Reach for Yield Began Decades Ago**

Asset Allocation by Major Category (1982 - 2012)



Source: US Federal Reserve Board of Governors - Flow of Funds Accounts of the United States (Table L.117 State and Local Government Employee Retirement Funds)

Having already allocated more to equities, public-sector pension plans are also assuming more risk within given asset classes. This stands in stark contrast to US corporates, which have taken asset allocation in an opposite direction, as part of a larger de-risking approach to their defined benefit pension exposure.<sup>9</sup>

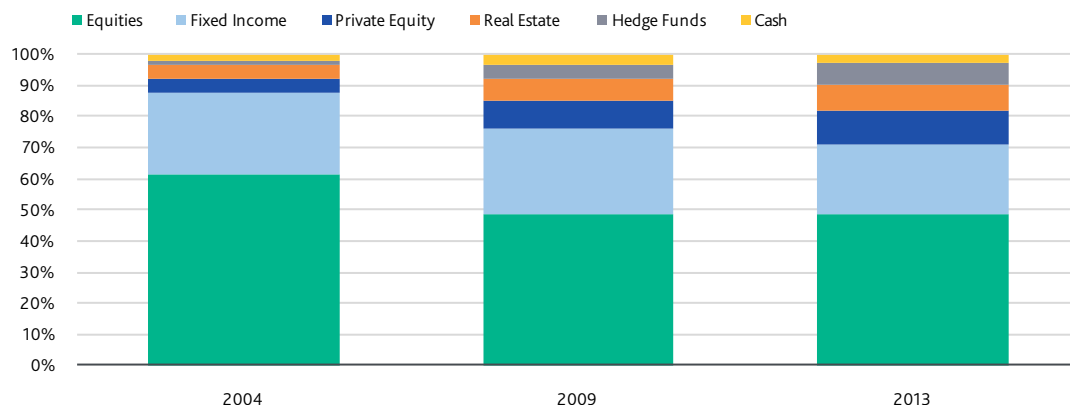
High yield and private debt are now a part of many fixed-income allocations<sup>10</sup> for public-sector pensions, as are emerging and frontier market positions within equities. In an effort to boost returns and diversify holdings, pension funds have also increasingly turned to alternative investments, broadly defined as real estate, private equity, hedge funds, infrastructure and commodities. Pensions have dabbled in these classes since the 1980s. However, in 2004, most plans still had relatively small exposures, with alternatives averaging 10% across our 25 plans; real estate was most often the dominant asset class in this group. By 2013, alternatives grew to account for a quarter of the portfolio, on average, with private equity and hedge funds gaining in importance (see Exhibit 6).

<sup>9</sup> See [Divergent Pension Risks: US Corporates Will Remain in Far Better Position than State and Local Governments](#), April 10, 2014; [The US Public Pension Landscape: Patterns of Funding, Correlation and Risk](#); September 9, 2013

<sup>10</sup> See <http://www.bloomberg.com/news/2013-07-22/new-jersey-pension-funds-consider-adding-to-high-yield-in-2014.html>; Donald Boyd and Peter Kiernan, "The Blinken Report: Strengthening the Security of Public Sector Defined Benefit Plans," Nelson A. Rockefeller Institute of Government, January 2014.



EXHIBIT 6

**Asset Allocation Has Continued to Shift to Riskier Assets**

Sources: Top 25 plan CAFRS; Moody's Investors Service calculations

The widespread use of high-return accounting assumptions suggests that pension plans will continue to maintain or grow their alternative assets, although the exact strategies on this point among the 25 plans are certainly diverse. For example, the Pennsylvania Public School Employees' Retirement System has 57% in alternative investments while the Teachers System of Georgia has none.<sup>11</sup> Some plans are clearly having second thoughts about alternative investments after some undesired experiences, including New Jersey,<sup>12</sup> CalPERS, and CalSTRS.<sup>13</sup>

Alternative investments may have their place in the diversified management of pension fund assets, but they also bring longer holding periods, less liquidity, and higher fees. They will also likely have less transparent pricing, typically falling into FAS 157<sup>14</sup> Level 3, making valuation difficult when assessing funded status and the need for contributions. And, of course, their performance is not guaranteed.

### Demographic trends exacerbate underfunding and asset risks

Negative demographic trends exacerbate the challenge of closing the large gaps in pension funding. The overhang of pension liabilities already incurred is putting extra strain on government budgets burdened with their own current operating and pension funding demands. Amortization periods commonly at or near 30 years add to the overhang because they generally exceed the average remaining working lifetime of active employees. As a result, government budgets often include pension costs for employees no longer working, as well as for current employees. Further, the large overhang of liabilities from an aging pension plan increases the exposure that budgets of sponsoring municipalities have to steep asset declines, an exposure present even when a plan is fully funded.

Across all 25 plans, the ratio of active employees to retirees has declined since 2014. The decline is generally steady and significant, averaging 28% across the 25, although it does vary, ranging from about 12%-13% for the plans in Los Angeles and New York to over 50% for Michigan's pension system. In all cases, the number of retirees is growing.

<sup>11</sup> Partly a factor of state legislature banning alternative investments; law was revised in late 2012.

<sup>12</sup> [Asset Managers Stand to Benefit from Investor Shift to Alternative Investments](#), January 29, 2014; [Calpers Rethinks Its Risky Investments](#)

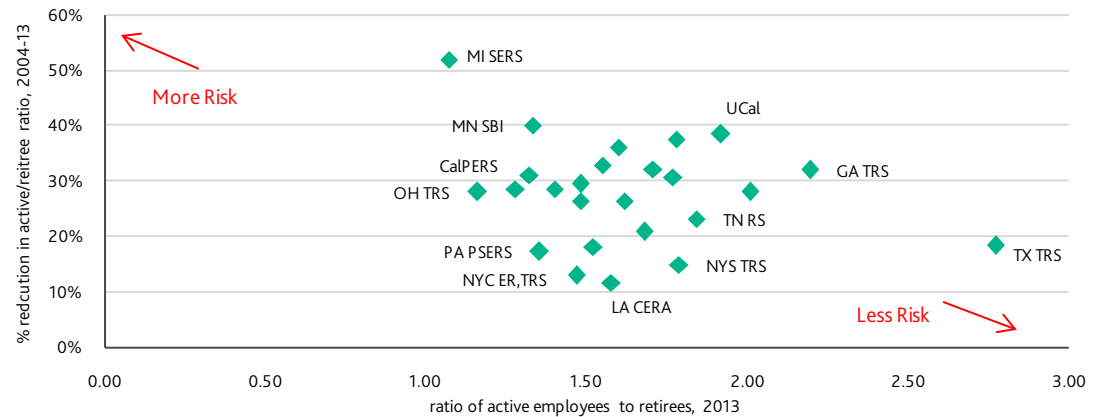
<sup>13</sup> [Public Pension Managers Rethink Hedge Fund Ties](#); [How CalPERS bet big on real estate and lost](#); [Big Firms a Drag on Pension Funds](#)

<sup>14</sup> Financial Accounting Standards Board [Fair Value Measurements](#)

The main variable behind the range of change in the overall ratio between plans is the level of employment, which has remained relatively steady and seen some uptick for New York City and Los Angeles County; Michigan's count of active employees, by contrast, has declined steadily in this period (see Exhibit 7).

EXHIBIT 7

### Base of Active Employees to Retirees Is Shrinking



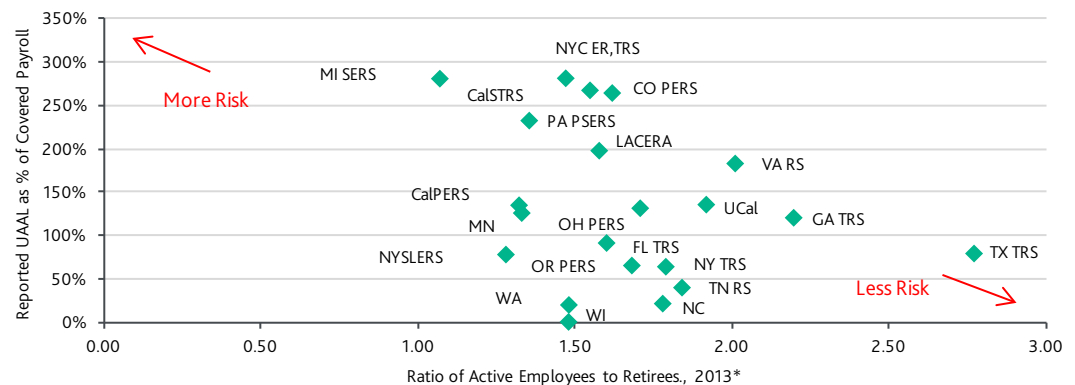
Sources: Top 25 plan CAFRS, Moody's Investors Service calculations

Combined with large unfunded liabilities, aging plan demographics effectively transfer costs incurred by a previous generation onto the present one, increasing the burden on current government operations. The transfer can have an important credit consideration: an increasing budgetary burden from pension contributions potentially crowds out other expenditure priorities for state and local governments, increasing risk to bondholders.

To show the range of this exposure, we look at the largest 25 plans in terms of unfunded liability as a percentage of covered payroll (see Exhibit 8).

EXHIBIT 8

### Underfunding and Burden on Active Payroll Amplify Demographic Decline



Sources: Top 25 plan CAFRS, Moody's Investors Service calculations

The pension solvency test provides another indicator of the adequacy of pension plan funding in terms of demographics. The solvency test parses plan liabilities across three tiers, or shares: member accumulated contributions, current retiree benefits, and the employer share for active employees.

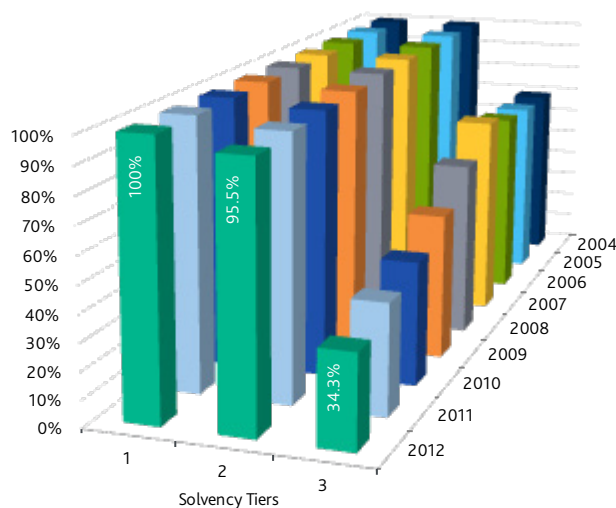
Hypothetically assuming a plan termination, the test measures the adequacy of plan assets to cover each tier's liabilities in a cascade where:

- » accrued liabilities with respect to accumulated employees' contributions are paid first;
- » accrued liabilities for current retirees receiving benefits are paid next; and
- » accrued liabilities with respect to active member employer financed benefits are paid last

A pension plan that is fully funded or over-funded will show 100% or more in each of these categories, but many public-sector plans can only partially cover the third tier. Since the public-sector employer is likely to remain, there is time for the plan sponsor to fund its liabilities. A plan that was unable to cover its Tier 2 retiree liabilities and was invading its Tier 1 coverage, however, would be in dire straits; it would also show that the pension burden of retirees was being fully borne by the current generation of employees because of the broad insufficiency of accumulated assets. Of the 18 of the top 25 plans that consistently disclose solvency tests going back to 2004, including Tennessee's biennial reporting, none show this kind of severe problem (see Exhibit 9). Even using our adjustments to reported liabilities, no plan studied would have zero coverage of Tier 2 liabilities, although this coverage would be substantially reduced. For example, the CalSTRS defined benefit program reported Tier 2 coverage of 100% and Tier 3 coverage of 0.7% as of 30 June 2012. Using our adjustments would reduce Tier 3 to 0% and Tier 2 to 58%. Similarly, Michigan's reported 79% for Tier 2 would drop to about 45%.

EXHIBIT 9

### Solvency Ratios Are Gradually Weakening



Sources: Top 25 plan CAFRS, Moody's Investor Service calculations

Note: Excludes MN, NC, NJ, NYC, PRIM, and UCal for reporting inconsistencies

In all cases, Tier 1 liabilities have remained 100% covered throughout this period. However, asset coverage of Tier 3 liabilities shows consistent erosion after a period of slight improvement through 2007. Most recently, 100% Tier 2 coverage has been breached in five plans, beginning with Colorado in 2008, Ohio Teachers in 2009, and Michigan in 2010; the Pennsylvania and Maryland systems followed suit in 2012. This exhibit excludes two other plans because lags in the reporting of their solvency tests would also appear to have breached Tier 2 coverage. New Jersey fell into this category in 2009; as of 2011, Tier 2 coverage was 80% overall, and 57% in the state employee component of the system. Based on available solvency reporting for the main components of the New York City system, Tier 2 coverage for the large teacher's plan was 89% in 2011; the overall system trend has been weakening.

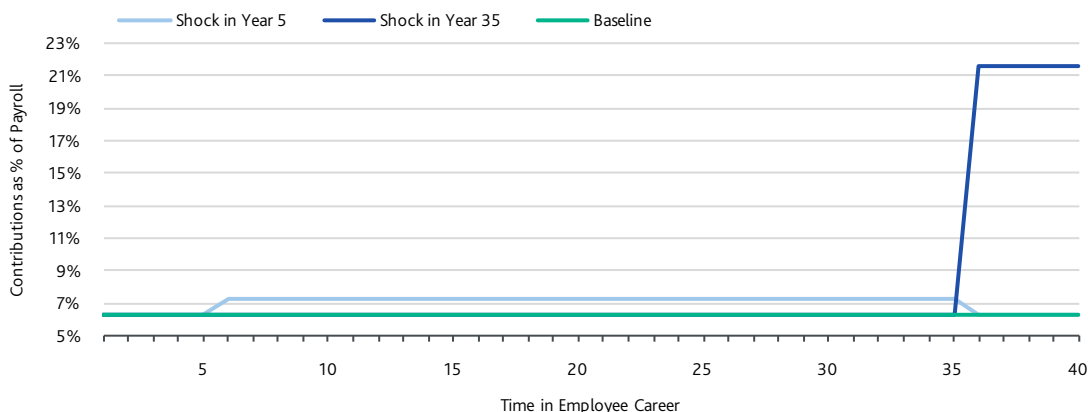
### Investment downside risk increases with age of the pension plan

A youthful worker at the beginning of a career can more readily accept risk in a retirement account and tolerate more negative asset “shock” than a senior approaching retirement. The same wisdom behind “stable value” retirement investing applies no less to governments with significant demographic overhang in their pension plans, but for a different reason. The individual retiree has little remaining time to earn or to re-invest. For the pension plan and the sponsoring municipality, the negative asset shock is a matter of both timing *and* scale.

Consider the hypothetical pension for a single 40-year career employee, where annual investment return is 7.5% and entry age normal cost contributions are split between employer and employee at 6.0% of salary each. If a 20% asset loss is introduced in year five, with no other deviations from assumptions, the employer’s annual contribution would increase by about 20% to just over 7% of payroll and remain there for 30 years in order to pay employer normal costs and amortize the one-time asset loss (i.e., the unfunded liability). However, if the same 20% negative asset shock occurs in year 35, the employer contribution must rise more than 200% to pay normal cost and amortize the unfunded liability in 30 years, to 22% of payroll (see Exhibit 10).

EXHIBIT 10

#### Burden of Asset Losses Increases With Aging Demographics



Source: Moody's Investors Service

The downside impact of volatile asset performance to the employer is substantially higher later in the employee’s career because the cost to replenish the loss of accumulated assets relative to the payroll base—and by proxy, the municipal employer’s current operations<sup>15</sup>—is so much higher. Now, consider that a typical plan among the top 25 will have about 65 retirees for every 100 active employees; the retirees in this plan have long ago earned their benefits and should be fully asset-funded, but the active employees’ ages range across the career spectrum, and they have only partially earned their benefits. Extending our simple example to the typical aging pension plan with thousands of employees and retirees highlights the risk facing government budgets because asset accumulation is so back-loaded. As plan demographics age, the risk that a sharp asset downturn poses to the sponsoring government’s budget increases because the size of assets set aside have increased so much relative to *the size of operations* of the government sponsor.

This increased risk, combined with the shift towards risk and volatility in asset allocation, creates an enormously unstable situation for state and local governments. As pension plan demographics age, and

<sup>15</sup> Importantly, plan-covered payroll will not always serve as an accurate proxy for government operations. For example, a closed plan will likely experience rapidly declining payroll. Measuring the size of assets relative to government operations, as opposed to covered payroll, can address this measurement issue.

assets relative to government budgets increase, the government plan sponsor has relatively less and less capacity to absorb the cost of a significant decline in assets. Yet, to justify high discount rates that in turn reduce the size of reported liabilities and suppress near-term contribution requirements, US public pension funds have generally taken steps in their asset allocation that increase the likelihood of such an event. The risks inherent in the search for yield loom large.

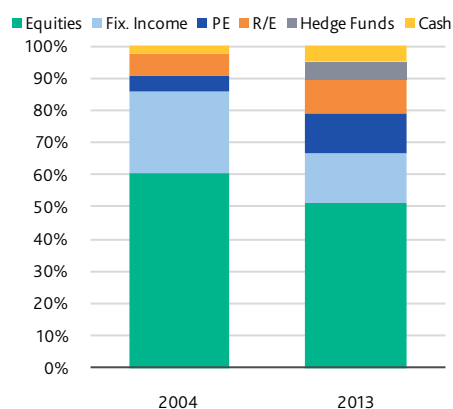
## Appendix

### Note:

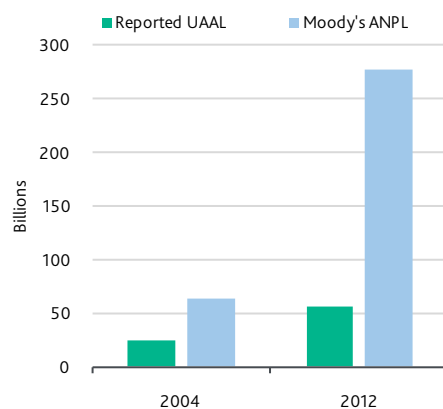
This appendix presents data related to assets, asset allocations, liabilities and key actuarial assumptions for each of the 25 largest public pension plans, as determined by assets under unified management. Plan information and Moody's adjustments are presented for 2004 reporting for all plans. Asset values and allocations are reported for 2013 financial reporting for all plans. If available in audited plan financial statements, all plan asset, liability and Moody's pension adjustment data is provided for 2013. If not, then the most recent year reported in plan financial statements is also provided. MVA reflects net assets unless noted.

### California Public Employees' Retirement System (CalPERS)

#### Pension Asset Allocation



#### Pension Liability Reported vs. Moody's Adjusted

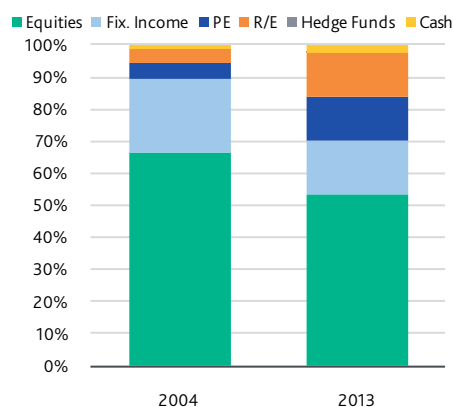


	2004	2012	2013
MVA (Billion)	167.58	236.98	261.99
AAL (Billion)	194.61	340.43	N/A
Assumed Investment Rate of Return	7.8%	7.5%	7.5%
Actual Investment Rate of Return	16.6%	0.1%	13.2%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	64.20	278.26	N/A

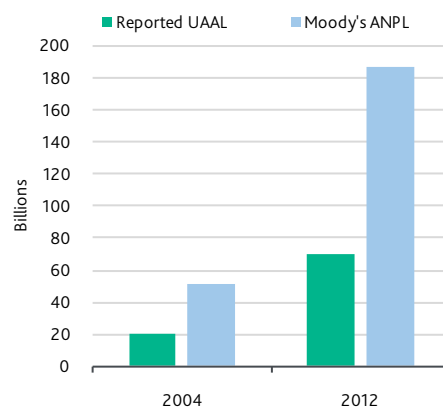
Source: CalPERS Comprehensive Annual Financial Reports 2003-2013

### California State Teachers' Retirement System (CalSTRS)

#### Pension Asset Allocation



#### Pension Liability Reported vs. Moody's Adjusted



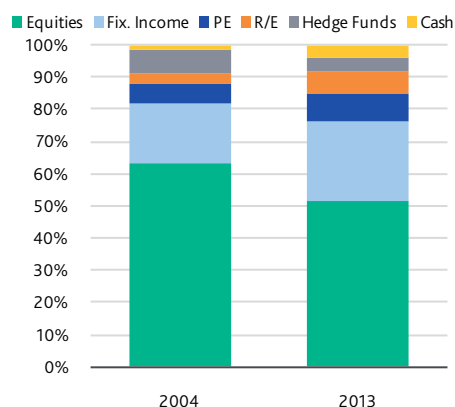
	2004	2012	2013
MVA (Billion)	116.06	151.32	166.35
AAL (Billion)	136.75	222.92	N/A
Assumed Investment Rate of Return	8.0%	7.5%	7.5%
Actual Investment Rate of Return	17.4%	1.8%	13.8%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	51.80	337.38	N/A

Source: CalSTRS Comprehensive Annual Financial Reports 2003-2013

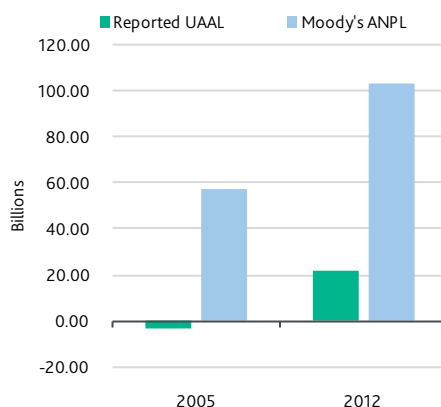
Notes: Participants include all California school districts

## New York State and Local Employee Retirement System

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

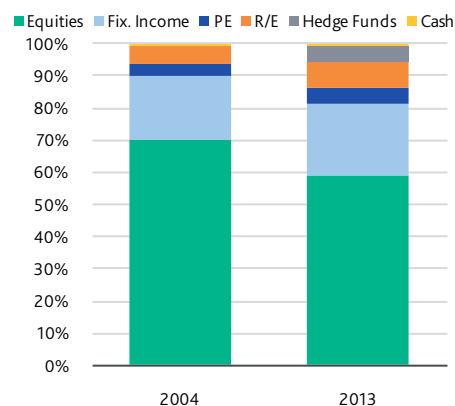


	2004	2012	2013
MVA (Billion)	120.80	153.39	164.22
AAL (Billion)	127.02	169.27	N/A
Assumed Investment Rate of Return	8.0%	7.5%	7.5%
Actual Investment Rate of Return	28.8%	6.0%	10.4%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	35.11	102.80	N/A

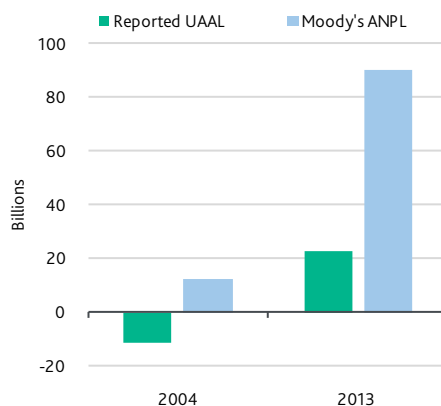
Source: New York State and Local Retirement System Comprehensive Annual Financial Reports 2004-2013

## Florida Retirement System

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



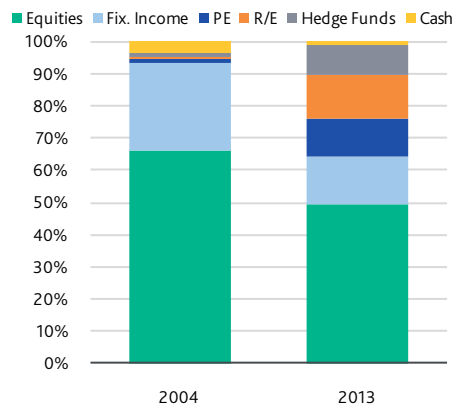
	2004	2013
MVA (Billion)	100.93	129.67
AAL (Billion)	95.19	153.30
Assumed Investment Rate of Return	7.8%	7.8%
Valuation Date	7/1/04	7/1/13
Citibank Discount Rate	6.3%	4.8%
Adjusted Net Pension Liability (Billion)	12.43	90.10

Source: Florida Retirement System Annual Reports 2003-2013

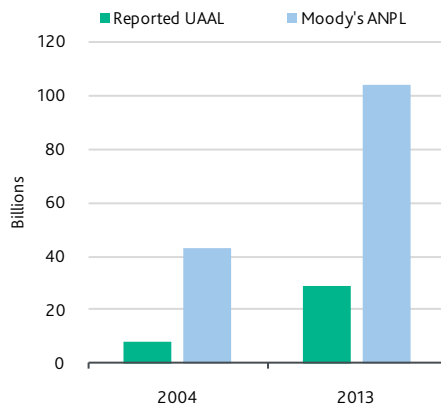


## Teacher Retirement System of Texas (TRS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

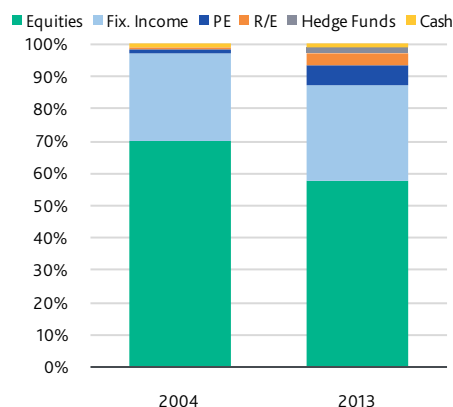


	2004	2013
MVA (Billion)	84.20	117.39
AAL (Billion)	96.74	150.67
Assumed Investment Rate of Return	8.0%	8.0%
Valuation Date	8/31/04	8/31/13
Citibank Discount Rate	5.8%	4.9%
Adjusted Net Pension Liability (Billion)	42.61	103.85

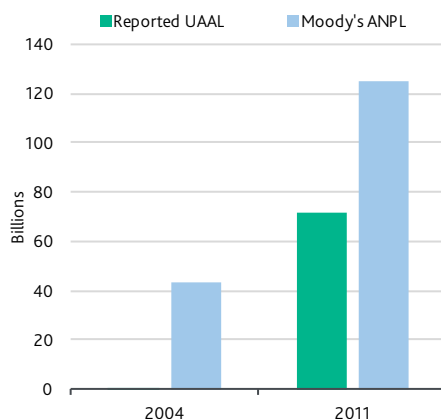
Source: Teacher Retirement System of Texas Comprehensive Annual Reports 2003-2013

## New York City Retirement

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



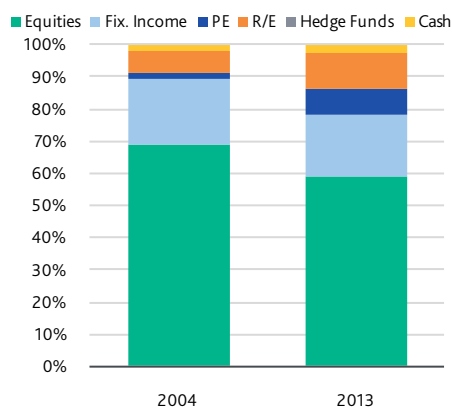
	2004	2011	2013
MVA (Billion)	80.28	89.89	95.37
AAL (Billion)	100.91	182.99	N/A
Assumed Investment Rate of Return	8.0%	7.0%	7.0%
Actual Investment Rate of Return	N/A	23.2%	12.1%
Valuation Date	6/30/04	6/30/11	6/30/13
Citibank Discount Rate	6.3%	5.7%	4.8%
Adjusted Net Pension Liability (Billion)	43.58	125.34	N/A

Source: New York City Comptroller's Comprehensive Annual Financial Reports 2003-2013

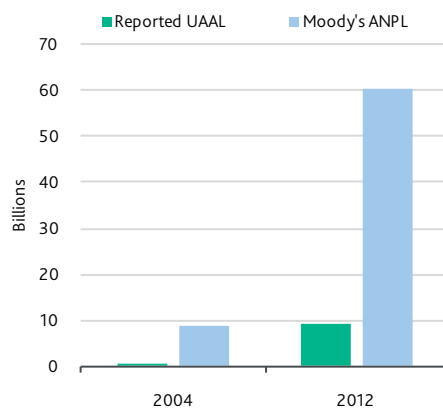
Notes: 2011 is the latest reported actuarial valuation date

## New York State Teachers' Retirement System (NYSTRS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



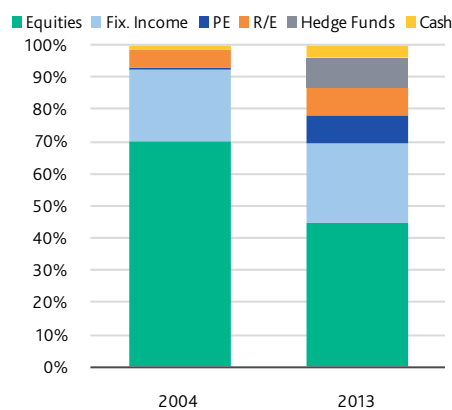
	2004	2012	2013
MVA (Billion)	80.28	88.06	95.37
AAL (Billion)	72.6	92.25	N/A
Assumed Investment Rate of Return	8.0%	8.0%	8.0%
Actual Investment Rate of Return	16.1%	2.8%	13.7%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	8.83	60.24	N/A

Source: New York State Teachers' Comprehensive Annual Financial Reports 2003-2013

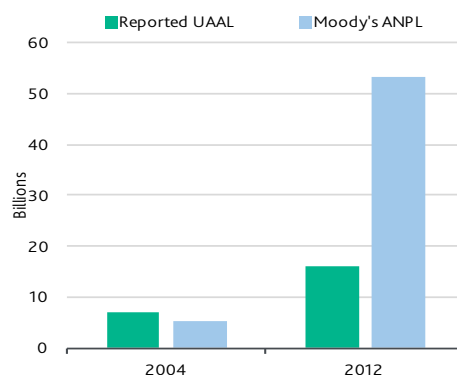
Notes: Reported UAAL reflects actuarial asset valuation

## Ohio Public Employees Retirement System (OPERS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



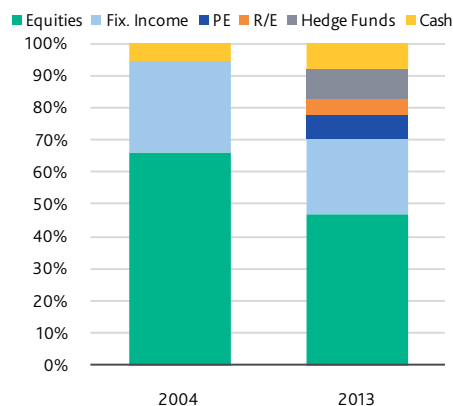
	2004	2012	2013
MVA (Billion)	65.25	81.45	88.99
AAL (Billion)	57.60	83.88	N/A
Assumed Investment Rate of Return	8.0%	8.0%	8.0%
Actual Investment Rate of Return	12.5%	14.4%	14.0%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	5.45	53.40	N/A

Source: Ohio Public Employees Retirement System Comprehensive Annual Reports 2003-2014

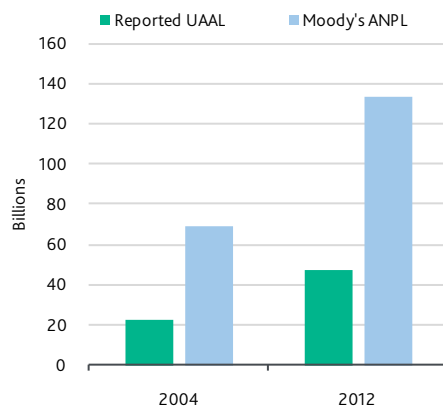
Notes: Reported UAAL reflects actuarial asset valuation

## State of New Jersey Division of Pensions and Benefits

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



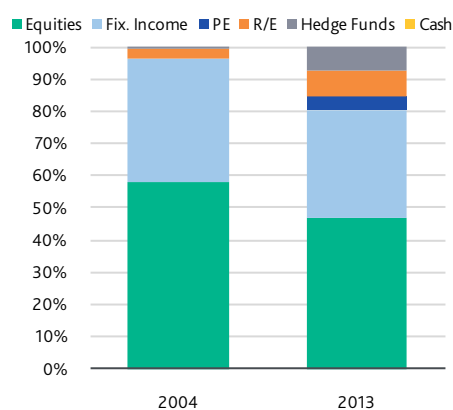
	2004	2012	2013
MVA (Billion)	71.65	77.88	81.93
AAL (Billion)	104.92	133.15	N/A
Assumed Investment Rate of Return	8.8%	7.9%	7.9%
Actual Investment Rate of Return	12.0%	2.5%	11.8%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	69.26	133.61	N/A

Source: State of New Jersey Comprehensive Annual Report 2003-2014

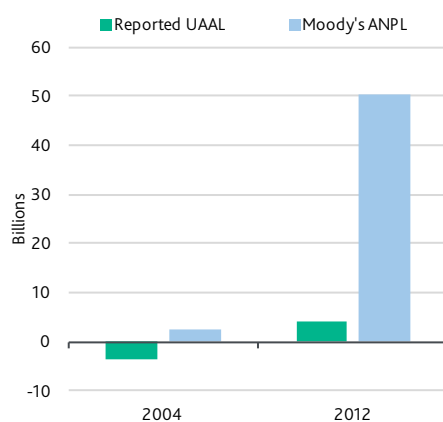
Notes: Excludes all health benefit programs

## North Carolina

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



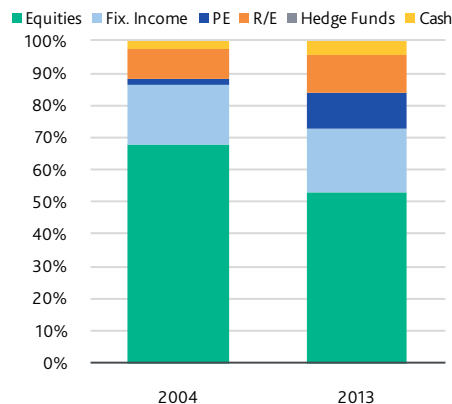
	2004	2012	2013
MVA (Billion)*	62.67	74.47	79.99
AAL (Billion)	58.03	85.08	N/A
Assumed Investment Rate of Return	7.3%	7.3%	7.3%
Actual Investment Rate of Return	12.0%	2.2%	9.5%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	2.38	50.46	N/A

Source: State of North Carolina Department of State Treasurer Annual Reports 2003-2014

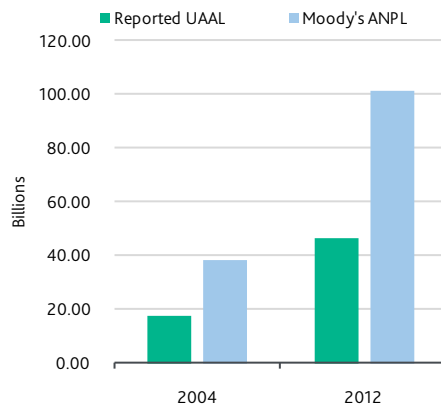
Notes: Excludes all health benefit programs; \*MVA reflects fair market value; net assets not consistently reported.

## State Teachers Retirement System of Ohio (OH STRS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

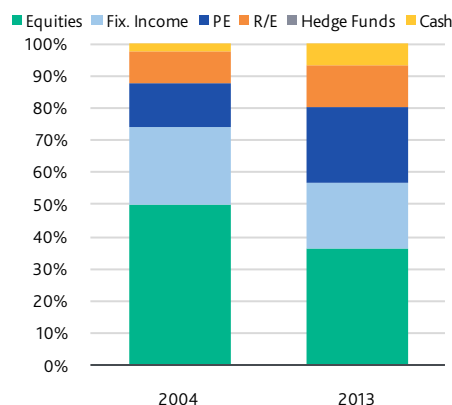


	2004	2012	2013
MVA (Billion)	47.66	64.32	68.65
AAL (Billion)	69.87	106.30	94.37
Assumed Investment Rate of Return	8.0%	7.8%	7.8%
Actual Investment Rate of Return	N/A	2.3%	13.7%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	38.10	101.50	66.63

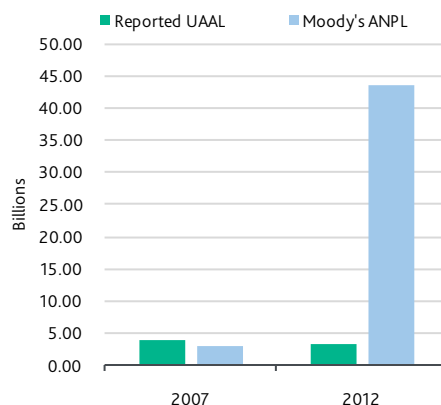
Source: State Teachers Retirement System of Ohio Comprehensive Annual Financial Reports 2004, 2008-2013

## Washington State Investment Board

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



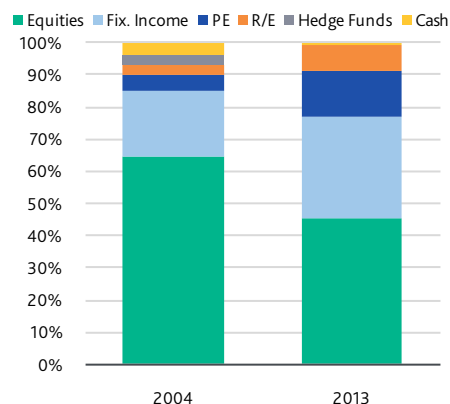
	2007	2012	2013
MVA (Billion)	64.08	61.84	67.99
AAL (Billion)	54.68	66.38	N/A
Assumed Investment Rate of Return	8.0%	7.9%	7.9%
Actual Investment Rate of Return	21.3%	1.4%	12.4%
Valuation Date	6/30/07	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	2.88	43.60	N/A

Source: Washington State Investment Board Annual Reports 2003-2013 | Washington State Department of Retirement Systems (DRS) Comprehensive Annual Financial Report 2013

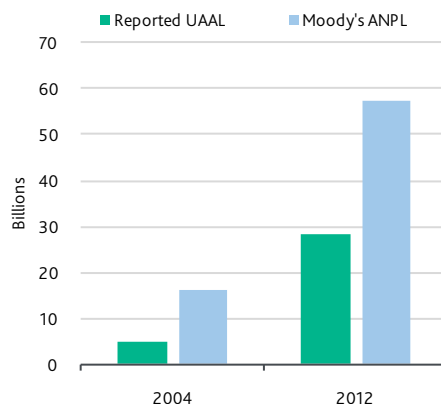
Notes: Data reported from 2013 CAFR with historical data up to 2007; reported UAAL reflects actuarial asset valuation

## Virginia Retirement System

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

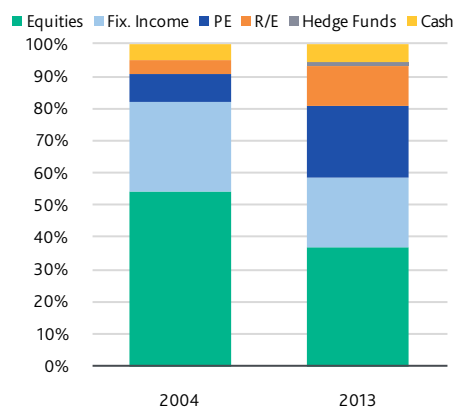


	2004	2012	2013
MVA (Billion)	40.04	58.31	58.38
AAL (Billion)	45.94	81.21	N/A
Assumed Investment Rate of Return	8.0%	7.0%	7.0%
Actual Investment Rate of Return	17.9%	1.4%	11.8%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	16.35	57.37	N/A

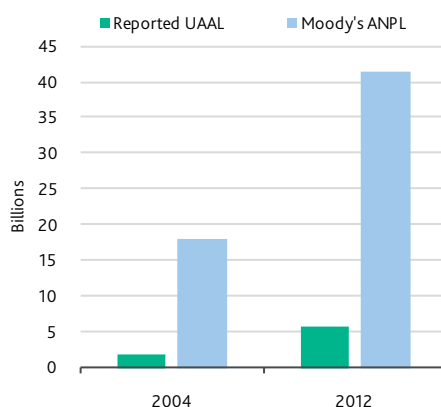
Source: Virginia Retirement System Comprehensive Annual Financial Reports 2003-2013

## Oregon Public Employees Retirement System (OR-PERS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

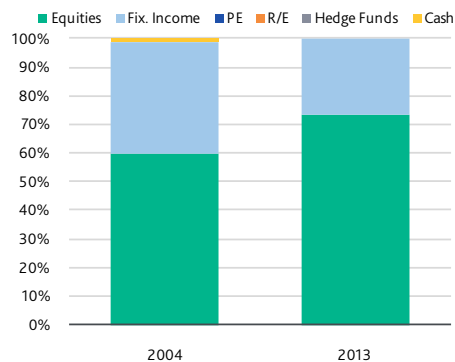


	2004	2012	2013
MVA (Billion)	45.01	53.66	58.48
AAL (Billion)	47.40	60.41	N/A
Assumed Investment Rate of Return	8.0%	7.75%	7.75%
Actual Investment Rate of Return	18.0%	1.61%	12.7%
Valuation Date	12/31/04	12/31/12	12/31/13
Citibank Discount Rate	5.7%	4.1%	4.9%
Adjusted Net Pension Liability (Billion)	17.86	41.47	N/A

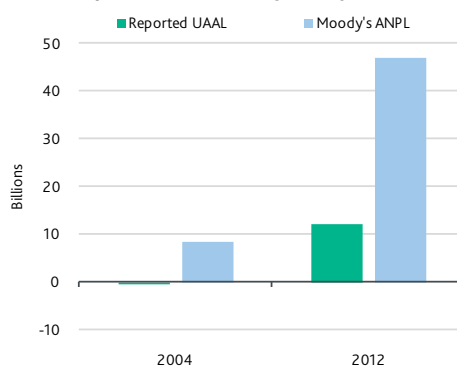
Source: Oregon Public Employees Retirement System Comprehensive Annual Financial Reports 2003-2013

## Teachers Retirement System of Georgia

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

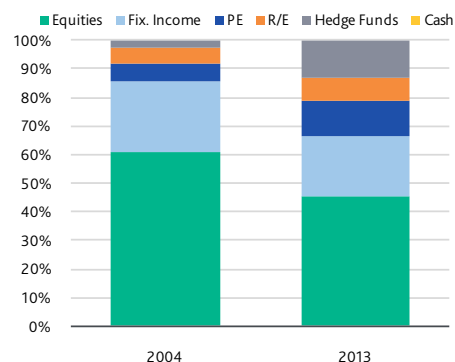


	2004	2012	2013
MVA (Billion)	42.59	53.49	58.59
AAL (Billion)	44.23	66.35	N/A
Assumed Investment Rate of Return	7.5%	7.5%	7.5%
Actual Investment Rate of Return	9.9%	2.2%	13.3%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	8.52	46.93	N/A

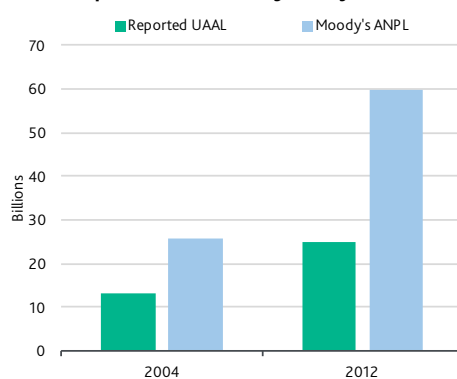
Source: Teachers Retirement System of Georgia Comprehensive Annual Financial Reports 2003-2013

## Massachusetts Pension Reserves Investment Management Board (MA PRIM)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

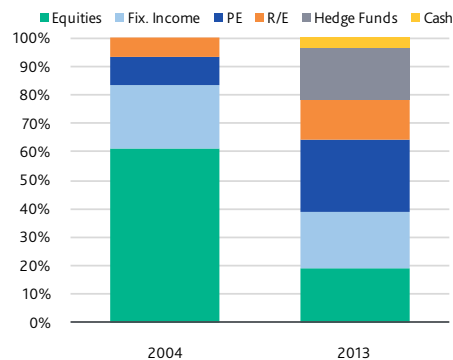


	2004	2012	2013
MVA (Billion)	32.64	48.87	53.23
AAL (Billion)	46.06	67.55	71.87
Assumed Investment Rate of Return	8.3%	8.0%	8.0%
Actual Investment Rate of Return	19.4%	-0.1%	12.7%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	25.62	59.72	52.95

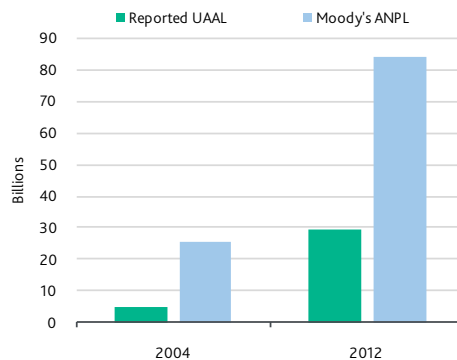
Sources: Massachusetts Pension Reserves Investment Management Board Annual Reports 2005-2013, the Commonwealth of Massachusetts Investor Program Pension Actuarial Reports 2003-2013

## Pennsylvania Public School Employees' Retirement System (PSERS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

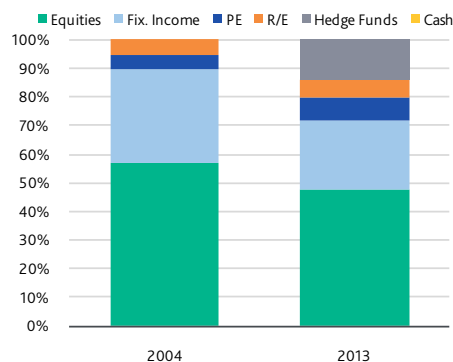


	2004	2012	2013
MVA (Billion)	48.54	48.76	49.28
AAL (Billion)	56.98	87.76	N/A
Assumed Investment Rate of Return	8.5%	7.5%	7.5%
Actual Investment Rate of Return	19.7%	3.4%	8.0%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	25.73	84.06	N/A

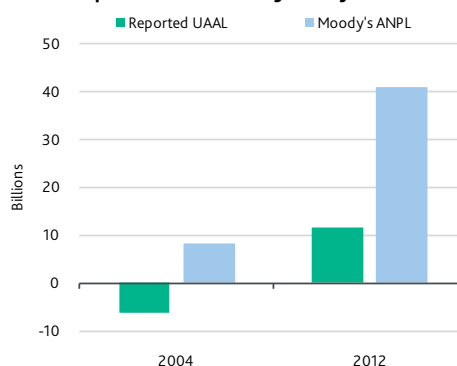
Source: Public School Employees' Retirement System Comprehensive Annual Financial Reports 2003-2013

## University of California Retirement System

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



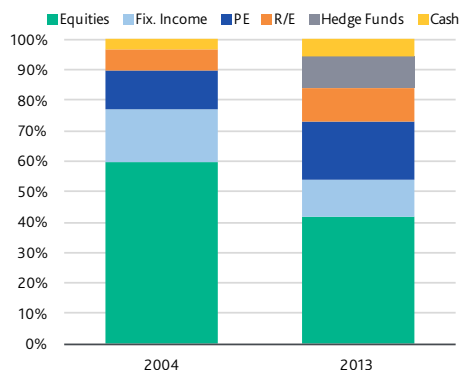
	2004	2012	2013
MVA (Billion)	32.289	41.81	45.34
AAL (Billion)	35.03	54.62	N/A
Assumed Investment Rate of Return	7.5%	7.5%	7.5%
Actual Investment Rate of Return	14.7%	0.4%	11.7%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	8.19	40.86	N/A

Source: University of California Retirement System Annual Reports 2006-2013

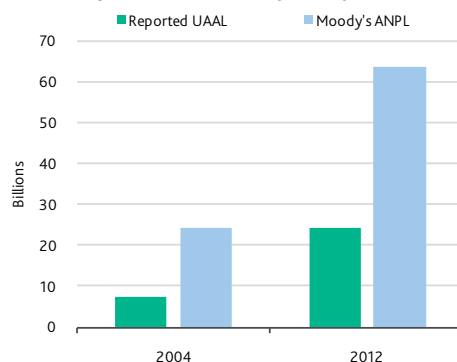


## Michigan State Employees' Retirement System (MSERS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

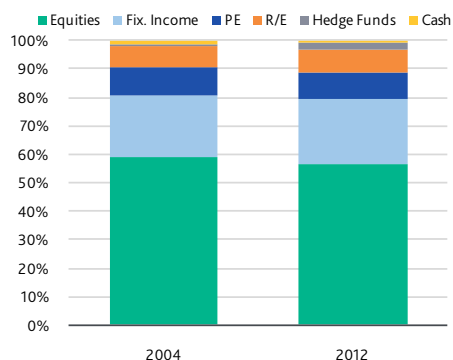


	2004	2012	2013
MVA (Billion)	36.77	39.6	42.61
AAL (Billion)	46.32	62.72	N/A
Assumed Investment Rate of Return	8.0%	8.0%	8.0%
Actual Investment Rate of Return	12.6%	13.5%	12.5%
Valuation Date	9/30/04	9/30/12	9/30/13
Citibank Discount Rate	5.7%	3.9%	4.9%
Adjusted Net Pension Liability (Billion)	24.48	63.67	N/A

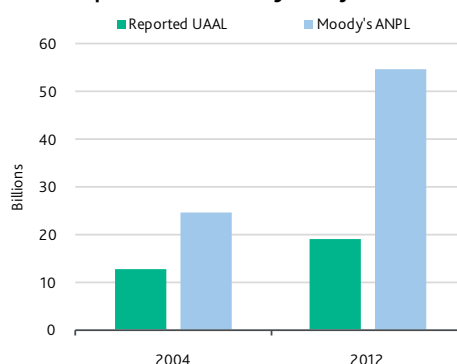
Source: Michigan Office of Retirement Services Public School Employees Comprehensive Annual Financial Reports 2003-2013

## Colorado Public Employees' Retirement Association (PERA)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

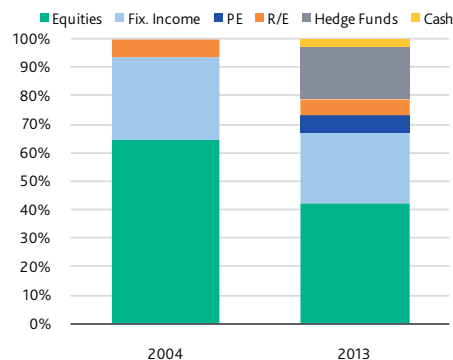


	2004	2012	2013
MVA (Billion)	36.85	39.88	43.77
AAL (Billion)	43.57	58.3	63.13
Assumed Investment Rate of Return	8.5%	8.0%	8.0%
Actual Investment Rate of Return	14.1%	12.9%	15.6%
Valuation Date	12/31/04	12/31/12	12/31/13
Citibank Discount Rate	5.7%	4.1%	4.9%
Adjusted Net Pension Liability (Billion)	24.51	54.75	47.85

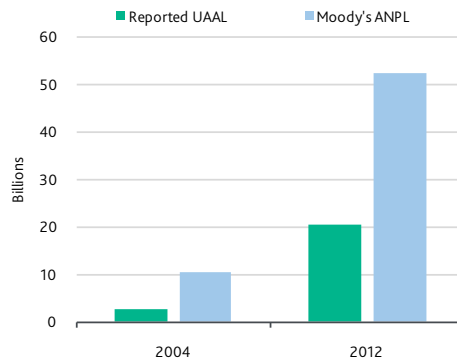
Source: Colorado Public Employees' Retirement Association Comprehensive Annual Financial Reports 2003-2013

## Maryland State Retirement and Pension System (SRPS)

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

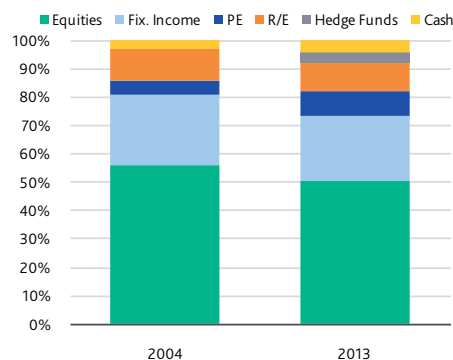


	2004	2012	2013
MVA (Billion)	32.98	37.18	40.36
AAL (Billion)	36.33	57.87	60.06
Assumed Investment Rate of Return	7.8%	7.7%	7.7%
Actual Investment Rate of Return	16.2%	0.4%	10.6%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	10.29	52.55	45.22

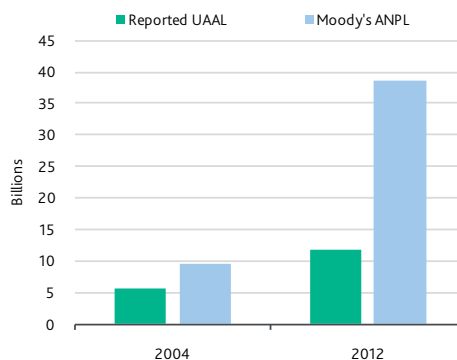
Source: Maryland State Retirement and Pension System Comprehensive Annual Financial Reports 2003-2013

## Los Angeles County Employees Retirement System (LACERA)

### Pension Asset Allocation



### Pension Liability: Reported vs. Moody's Adjusted

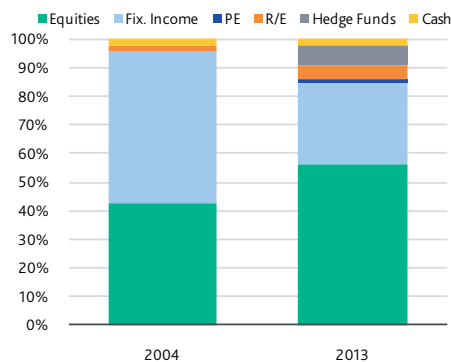


	2004	2012	2013
MVA (Billion)	29.48	38.31	41.77
AAL (Billion)	32.7	50.81	N/A
Assumed Investment Rate of Return	7.8%	7.5%	7.5%
Actual Investment Rate of Return	16.5%	0.1%	11.9%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	9.47	38.59	N/A

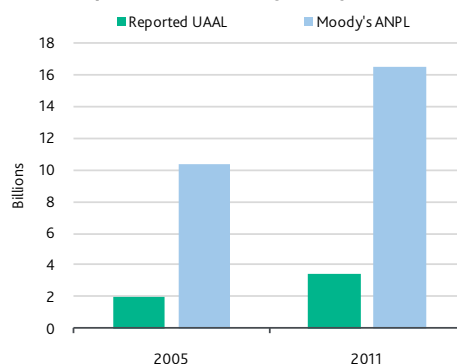
Source: Los Angeles County Employees Retirement Association Comprehensive Annual Financial Reports 2004,2007-2013

## Tennessee Consolidated Retirement System

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

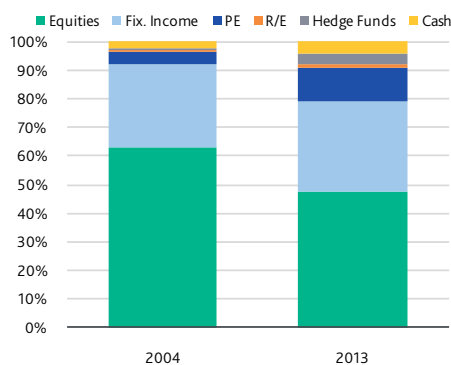


	2005	2011	2013
MVA (Billion)	27.22	33.66	37.56
AAL (Billion)	28.12	40.07	N/A
Assumed Investment Rate of Return	7.5%	7.5%	7.5%
Actual Investment Rate of Return	7.3%	19.6%	9.9%
Valuation Date	6/30/05	6/30/11	6/30/13
Citibank Discount Rate	5.1%	5.7%	4.8%
Adjusted Net Pension Liability (Billion)	10.33	16.41	N/A

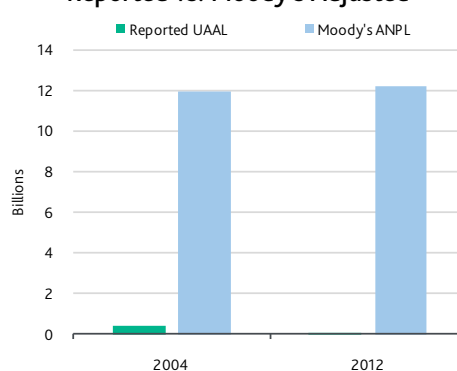
Source: Tennessee Consolidated Retirement System Comprehensive Annual Financial Reports 2005-2013

## Wisconsin Department of Employee Trust Funds

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted

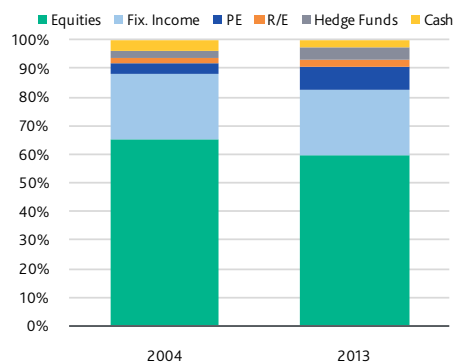


	2004	2012	2013
MVA (Billion)	67.88	81.07	N/A
AAL (Billion)	66.62	78.68	N/A
Assumed Investment Rate of Return	7.8%	5.5%	5.5%
Actual Investment Rate of Return	16.6%	1.3%	11.1%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	11.95	12.22	N/A

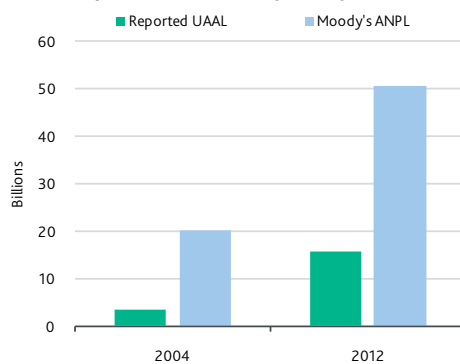
Sources: Wisconsin Department of Employee Trust Funds Comprehensive Annual Financial Reports 2003-2012, State of Wisconsin Investment Board Annual Reports 2003-2013

## Minnesota State Board of Investment

### Pension Asset Allocation



### Pension Liability Reported vs. Moody's Adjusted



	2004	2012	2013
MVA (Billion)	40.23	52	57.3
AAL (Billion)	46.48	63.87	65.34
Assumed Investment Rate of Return	8.5%	8.0%	8.0%
Actual Investment Rate of Return	16.5%	2.4%	14.2%
Valuation Date	6/30/04	6/30/12	6/30/13
Citibank Discount Rate	6.3%	4.1%	4.8%
Adjusted Net Pension Liability (Billion)	20.35	50.68	39.24

Sources: Public Employees Retirement Association of Minnesota Comprehensive Annual Financial Reports 2003-2013, Teachers Retirement Association Comprehensive Annual Financial Reports 2003-2013, Minnesota State Board of Investment Annual Reports 2003-2013

## Moody's Related Research

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- » [Divergent Pension Risks: US Corporates Will Remain in Far Better Position than State and Local Governments, April 2014 \(167224\)](#)
- » [The US Public Pension Landscape: Patterns of Funding, Correlation and Risk, September 2013 \(157154\)](#)

### Rating Methodology:

- » [Adjustments to US State and Local Government Reported Pension Data, April 2013 \(151398\)](#)

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Report Number: 174297

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