

On a market value basis, public pension funded status increased by more than 4% in 2014

Imminent funding challenges: Flat equity performance in 2015 and lower return expectations going forward

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INTRODUCTION

The Milliman Public Pension Funding Study annually explores the funded status of the 100 largest U.S. public pension plans. We report the plan sponsor's own assessment of how well funded a plan is. We also recalibrate the accrued liability for each plan based on our independent assessment of the expected return on each plan's investments. This process enables us to independently determine funded status without reflecting any bias or lag that may exist in the plan sponsor's own return expectations. We measure liability on the same basis used by plan sponsors looking to systematically fund their plans over a long time horizon as a going concern. There are other measures of liability that may be used for financial reporting purposes, for determining the cost of settling liabilities in the near-term based on current market conditions, or on the basis of discounting future benefits using "risk-free rates," as employed in some studies of the health of public pension plans.

Funded ratios using the market value of assets increased strongly in the Milliman 2015 Public Pension Funding Study, relative to the 2014 study, largely reflecting continued strong asset growth through 2014. Most pension plans saw high market rates of return in both the 2012–2013 and 2013–2014 periods. Because of the time lag in reporting, the impact of the 2015 downturn in the equity market will not generally be reported for some time.

This year's study found that the gap between the recalibrated accrued liability and the sponsor-reported accrued liability continues to widen, from 2.6% in the Milliman 2013 Public Pension Funding Study to 3.8% in 2014 to 4.6% in 2015. This widening gap in liability mirrors a corresponding widening between the investment return assumptions reported by the plans in the study and our independently determined investment return assumptions. While 20

HIGHLIGHTS

- Strong market performance through 2014 has led to an increase in overall reported funded ratios, from 70.7% to 75.0% on a market value of assets basis.
- After several years of strong returns the flat market to date during 2015 will erode funded ratios, although the impact will not be fully recognized for several years in most plan sponsors' funding policies.
- A significant headwind for funded status is generated by the continued decline in market consensus views on long-term return expectations—lower return assumptions mean higher liabilities.
- For the first time, retired and inactive members outnumber active members.

of the 100 plans in the study have lowered their reported investment return assumptions since the Milliman 2014 Public Pension Funding Study, most plans in the study have left their investment return assumptions unchanged. The median investment return assumption reported by the plans decreased from 8.00% in the 2012 study to 7.75% in the 2013 and 2014 studies, and it declined only slightly to 7.65% in the 2015 study. These decreases have not kept pace with the continued decline in market consensus views on long-term future investment returns. Our study's median independently determined investment return assumption has decreased from 7.65% in the 2012 study to 7.47% in the 2013 study to 7.34% in the 2014 study to 7.25% in the 2015 study. In aggregate, this suggests

FIGURE 1: MILLIMAN 100, AGGREGATE FUNDED STATUS (\$ TRILLIONS)

	2012		2013		2014		2015	
	SPONSOR REPORTED	RECALIBRATED FIGURES						
Investment return assumption								
Median	8.00%	7.65%	7.75%	7.47%	7.75%	7.34%	7.65%	7.25%
Liability-weighted	7.80%	7.55%	7.67%	7.44%	7.65%	7.32%	7.57%	7.21%
Accrued liability	\$3.60	\$3.71	\$3.77	\$3.86	\$3.88	\$4.03	\$4.08	\$4.26
Plan assets								
Market value	\$2.51	\$2.51	\$2.58	\$2.58	\$2.75	\$2.75	\$3.06	\$3.06
Actuarial value	\$2.71	\$2.71	\$2.73	\$2.73	\$2.80	\$2.80	\$2.94	\$2.94
Funded ratio								
Market assets	69.8%	67.8%	68.5%	66.8%	70.7%	68.2%	75.0%	71.7%
Actuarial assets	75.1%	73.0%	72.4%	70.6%	72.1%	69.4%	72.0%	68.9%
Unfunded accrued liability								
Market assets	\$1.09	\$1.20	\$1.19	\$1.28	\$1.13	\$1.28	\$1.02	\$1.20
Actuarial assets	\$0.89	\$1.00	\$1.04	\$1.13	\$1.08	\$1.23	\$1.14	\$1.32

that for many plans that have not recently lowered their reported assumptions, some decrease in the investment return assumption may be appropriate. Plans should continue to monitor emerging market return expectations and adjust their assumptions as needed, to ensure that liabilities are calculated using assumptions that are based on best-estimate expectations from investment professionals. Note that lower investment return assumptions cause accrued liabilities to increase and therefore cause funded ratios to fall.

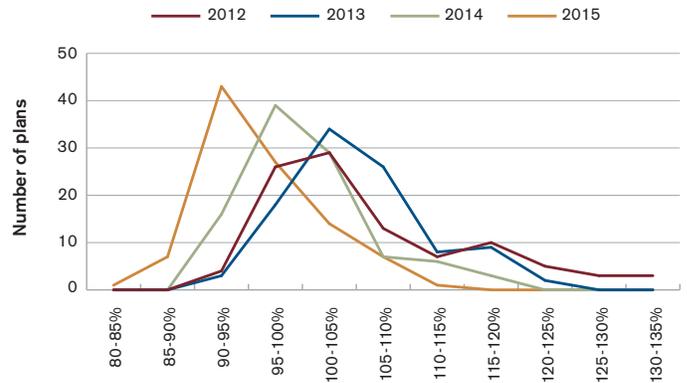
ASSETS

The 100 plans in this study reported assets totaling \$3.06 trillion on a market value basis, up significantly from \$2.75 trillion in the Milliman 2014 Public Pension Funding Study. Most plans calculate an *actuarial value of assets* as part of the mechanics of determining plan sponsor contributions. This calculation typically involves using investment gains/losses from a particular year to offset investment losses/gains from a nearby year. This process of smoothing out market ups and downs helps to dampen year-to-year fluctuations in the plan sponsor’s contribution. Actuarial values tend to lag behind changes in the market and can deviate from market value substantially when there are large market movements. The generally strong market performance since the financial crisis has resulted in almost 80% of the plans in this study currently having market values in excess of actuarial values. The 100 plans in this study reported assets totaling \$2.94 trillion on an actuarial value basis, compared with \$2.80 trillion in the Milliman 2014 Public Pension Funding Study.

The ratio of actuarial value to market value is a measure of the extent to which plans have experienced overall market gains or losses in the past few years. A ratio over 100% indicates more recent losses than gains (i.e., the actuarial value exceeds the market value by the amount of deferred market losses), while a ratio under 100% indicates more recent gains than losses. In both 2012 and 2013, the median ratio of actuarial value to market value was 104%, indicating that not all of the losses from the financial crisis had been reflected

in the actuarial value. However, the median ratio dropped to 99% in 2014 and further to 95% in 2015, reflecting the strong market gains experienced in the 2012–2014 period. Looking ahead, we expect those gains will continue to systematically flow into actuarial values over the next several years, tempered somewhat by the equity losses many plans have suffered in 2015. Figure 2 shows the relationship of these two asset measures for the plans in this study.

FIGURE 2: ACTUARIAL VALUE VS. MARKET VALUE



LIABILITIES

The plans reported aggregate accrued liabilities of \$4.08 trillion for the more than 25 million members covered by the plans in the study. Individually, the plans range in size of accrued liability from \$9 billion to \$375 billion. The 10 largest plans account for nearly 40% of the total accrued liability and the top half of the plans represent more than 80% of the total.

The reported aggregate accrued liability consists of \$1.67 trillion for the 12.5 million plan members who are still working, plus \$2.41 trillion for the 12.6 million plan members who are retired and receiving benefits or who have stopped working but have not yet started collecting their pensions. Over the past four years, the number of active members has been fairly stable while the number of retired and inactive members has climbed steadily, as illustrated in Figure 3. For the first time, the number of retired and inactive members is larger than the number of active members.

FIGURE 3: NUMBER OF PLAN MEMBERS

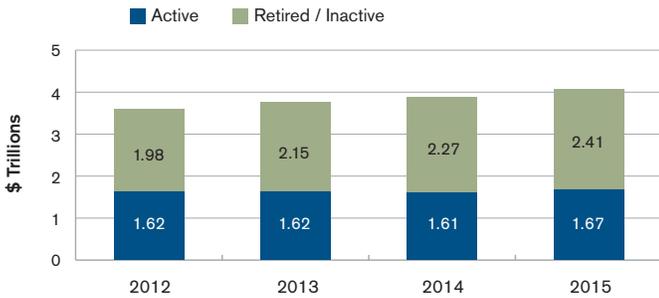


METHODOLOGY

This study is based on the most recently available Comprehensive Annual Financial Reports and actuarial valuation reports, which reflect valuation dates ranging from June 30, 2012, to January 1, 2015; about 70% are from June 30, 2014, or later. For the purposes of this study, the reported asset allocation of each of the plans has been analyzed to determine an independent measure of the expected long-term median rate of return on plan assets. The sponsor-reported accrued liability for each plan has then been recalibrated to reflect this independently determined investment return assumption. This study therefore adjusts for differences between each plan’s reported assumed real rate of investment return and an independently calibrated current market assessment of the expected real return based on actual asset allocations. This study is not intended to price the plans’ liabilities for financial reporting or near-term plan settlement purposes nor to analyze the funding of individual plans.

The aggregate sponsor-reported accrued liabilities similarly show virtually no change in the accrued liability for active members but continued growth in the accrued liability for retired and inactive members (see Figure 4).

FIGURE 4: SPONSOR-REPORTED ACTUARIAL ACCRUED LIABILITY



On average, active members have a sponsor-reported accrued liability of \$134,000 per person and retired and inactive members have a sponsor-reported accrued liability of \$191,000 per person. In aggregate, the plans currently have assets sufficient to cover 100% of the sponsor-reported accrued liability for retirees and inactive members but only 39% of the assets needed to cover the sponsor-reported accrued liability for active plan members.

CAPITAL MARKET ASSUMPTIONS

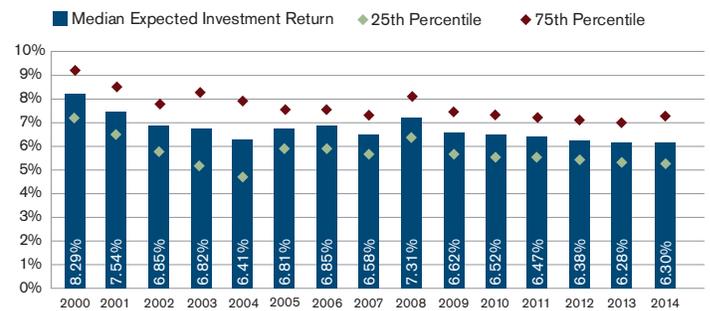
The market’s consensus views on long-term future investment returns have been declining since the turn of the century. Figure 5 illustrates this trend by showing the expected long-term future return for a hypothetical asset allocation, based on Milliman’s capital market assumptions for each year since 2000. Over this period, expected real returns on equity investments have fallen by about 215 basis points, while expected real returns on fixed-income investments have fallen by about 170 basis points; overall, the median expected investment return for the illustrated hypothetical asset allocation fell from 8.29% in 2000 to 6.30% in 2014. Many pension plan sponsors have been shifting their investment return assumptions downward in response to this trend, in some cases via a single significant

NEW MORTALITY TABLE

The Society of Actuaries (SOA) periodically publishes mortality tables for use in valuing pension liabilities. In October 2014, the SOA issued the latest such table, RP-2014, which is based on mortality experience from private pension plans. The SOA has also embarked on a project to create a mortality table based on experience exclusively from public pension plans. We expect that public plans and their actuaries are reviewing RP-2014 and evaluating whether to adopt some version of it or wait for the table specific to public plans, which is expected to be published in a few years. To the extent that use of a new mortality table projects longer life spans, accrued liabilities will increase and funded ratios will decrease.

reduction but more commonly through a series of smaller reductions. Where assumptions of 8.5% were once commonplace, more than half of the plans in the study now have assumptions of 7.65% or below. For many public pension plans, a reduction of 100 basis points in the investment return assumption causes a 12% to 13% increase in the accrued liability, which in turn causes a reduction in the funded ratio and an increase in the actuarially determined contribution. If market outlooks remain at current levels or decline further, it is likely that many plans will implement additional reductions in their investment return assumptions.

FIGURE 5: EXPECTED RETURN FOR A HYPOTHETICAL ASSET ALLOCATION BASED ON MILLIMAN’S CAPITAL MARKET ASSUMPTIONS



Note: Hypothetical asset allocation consists of 35% broad U.S. equities, 15% developed foreign equities, 25% core fixed income, 5% high-yield bonds, 10% mortgages, 5% real estate, and 5% short-term investments; inflation assumption is fixed at 2.5% for all years.

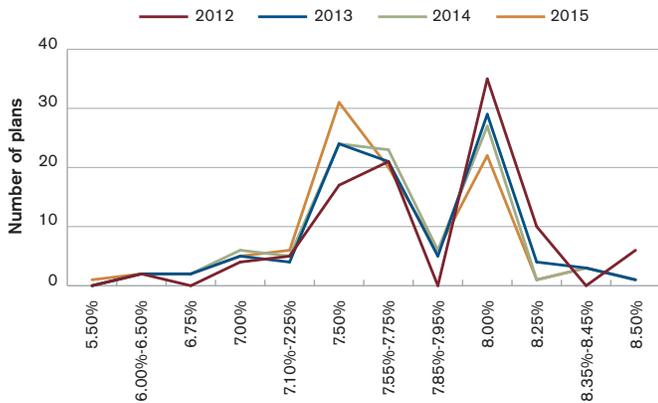
NEW ACCOUNTING STANDARDS

The Governmental Accounting Standards Board (GASB) issued new accounting standards (Statements No. 67 and 68) that significantly changed the financial reporting requirements for U.S. public pension plans, effective beginning in 2014. Among other changes, these standards require all plans to report a standardized measure of accrued liability, referred to as the *total pension liability*. The total pension liability must be calculated using a uniform actuarial cost method (the individual entry age normal cost method) rather than the actuarial cost method the plan uses to determine contribution amounts, and it must be calculated using a discount rate that under certain circumstances may be lower than the investment return assumption used for funding purposes. Additionally, each plan is required to disclose how sensitive its total pension liability is to changes in the discount rate. While this information is helpful in comparing plans on an apples-to-apples basis, for many plans the liability information measured for financial reporting purposes may not be the same as that used for purposes of funding the plan. This separation of financial reporting from funding has been part of the landscape for corporate plan sponsors for many years, but is new to public pension plans.

REPORTED INVESTMENT RETURN ASSUMPTIONS

The plans in this study reported a wide spread of investment return assumptions, with an ongoing movement to lower rates (see Figure 6). The median reported investment return assumption is 7.65%, down slightly from 7.75% in both the Milliman 2013 and 2014 Public Pension Funding Studies. On a liability-weighted basis, which reflects the relative sizes of the plans in the study, the reported investment return assumption is 7.57%, down slightly from 7.65% in 2014. Since the 2014 study, 20 of the plans have lowered their investment return assumptions, most by 25 to 50 basis points, while four of the plans have increased their investment return assumptions.

FIGURE 6: SPONSOR-REPORTED INVESTMENT RETURN ASSUMPTIONS



SELECTION OF THE INVESTMENT RETURN ASSUMPTION

There are three sources of money to pay for public pension benefits: payroll deductions from active members, contributions from plan sponsors, and investment income generated by plan assets. When Milliman actuaries advise plan sponsors on contribution policy, they look to investment professionals for estimates of what level of future investment income a given plan's assets are expected to earn on average over the long term. Different types of investments carry different long-term expectations for investment earnings, so return assumptions vary for each of the different asset classes. Collectively, these return assumptions, along with the associated variances and coefficients of correlation with other asset classes, are known as *capital market assumptions*. They take into account each plan's allocation of investments across the different asset classes and apply the capital market assumptions to arrive at the long-term expected average annual rate of return for that plan's investments. The entity that sets funding policies for the plan then selects the investment return assumption, taking into account the advice received from its actuaries and investment professionals. This investment return assumption is used to discount projected future benefit payments back to the present time so that those future payments are expressed as a net present value in today's dollars.

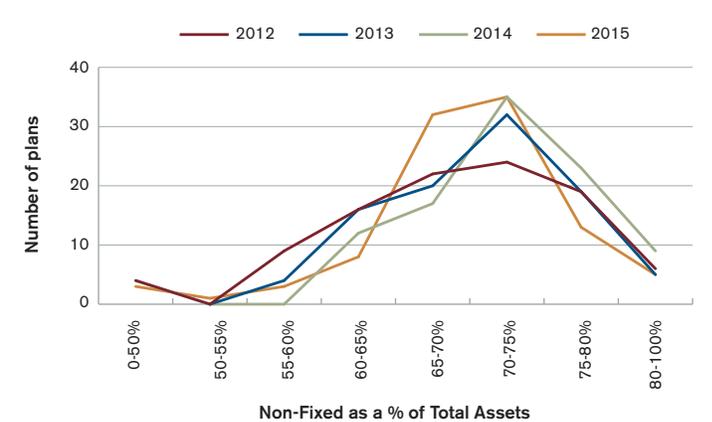
The plans included in this study are invested in a wide array of asset classes, as illustrated in Figure 7. The 2013 and 2014 studies indicated a modest drift away from fixed income into equity investments, but in the 2015 study that trend appears to have reversed back to the allocations seen in 2012.

FIGURE 7: ASSET ALLOCATIONS

CLASS	2012	2013	2014	2015
Fixed income	26%	25%	24%	27%
Cash	4%	3%	3%	3%
Total fixed income	30%	28%	27%	30%
Equities	51%	49%	50%	47%
Private equity, real estate etc.	19%	23%	23%	23%
Total non-fixed income	70%	72%	73%	70%

While the aggregate 2015 investment allocation is 70% in non-fixed-income classes and 30% in fixed income, there is considerable investment allocation variation from plan to plan. Figure 8 illustrates this variation, showing the percentage of plan assets invested in non-fixed-income asset classes.

FIGURE 8: PERCENTAGE ALLOCATION TO NON-FIXED-INCOME ASSET CLASSES



We found no significant relationship between plans' asset allocations or reported interest rate assumptions and how well or poorly funded they are; that is, there is no evidence supporting the notion that poorly funded plans take on more investment risk or use higher interest rate assumptions than well-funded plans.

RECALIBRATING THE ACCRUED LIABILITY

Using each plan's specific asset allocation, we determined the 50th percentile 30-year geometric average annual real rate of return based on Milliman's capital market assumptions of December 31, 2014. We then applied each plan's reported inflation assumption to arrive at our independently determined investment return assumption for that plan. The median of the resulting independently determined investment return assumptions is 7.25%, which is 40 basis points lower than the 7.65% median assumption reported by the plans in 2015 and nine basis points lower than the 7.34% median independently determined rate from the Milliman 2014 Public Pension Funding Study. Figure 9 details how the independently determined investment return assumptions compare with the investment return assumptions reported by the plans. Note that, for 18 of the 100 plans, the independently determined investment return rate is higher than the plan's reported investment return assumption; this suggests that those plans have included a margin for conservatism in their reported investment return assumptions.

FIGURE 9: INDEPENDENTLY DETERMINED RATE VS. SPONSOR-REPORTED RATE

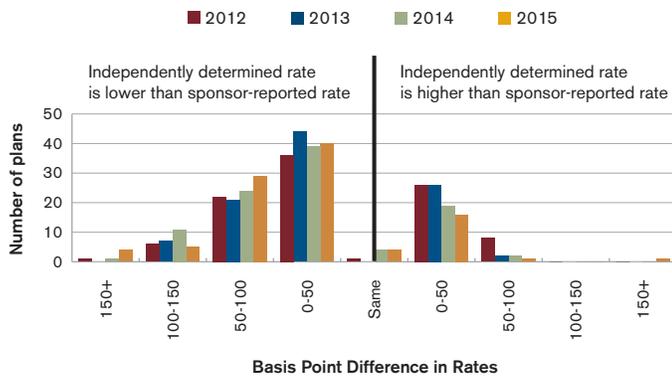
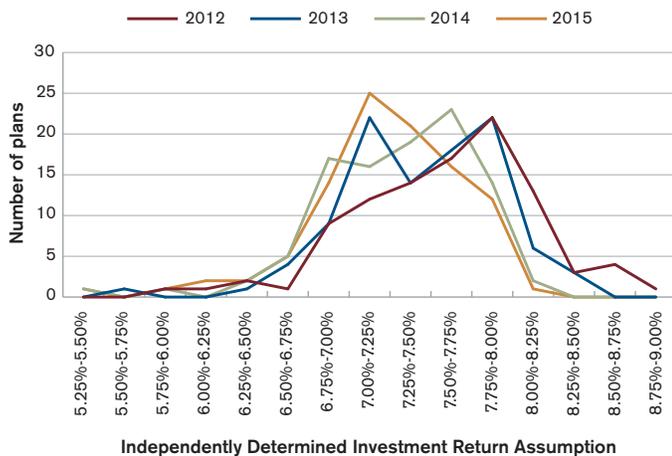


Figure 10 illustrates how the independently determined rates have generally declined over the past four years.

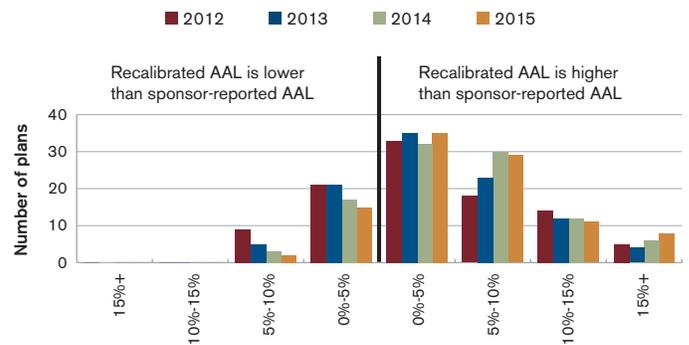
FIGURE 10: INDEPENDENTLY DETERMINED RATES OVER TIME



RECALIBRATED ACCRUED LIABILITIES

We used each plan's independently determined investment return assumption to recalibrate the plan's accrued liabilities. In aggregate, these plans have a recalibrated accrued liability of \$4.26 trillion, compared with a sponsor-reported accrued liability of \$4.08 trillion—an aggregate difference of 4.6%. For 81 of the plans in the study, the recalibrated accrued liability is within 10% of the sponsor-reported accrued liability (see Figure 11).

FIGURE 11: RECALIBRATED AAL VS. SPONSOR-REPORTED AAL



SENSITIVITY ANALYSIS

A relatively small change in the investment return assumption can have a significant impact on the accrued liability. How big that impact is depends on the makeup of the plan's membership: a less "mature" plan with more active members than retirees has a higher sensitivity to interest rate changes than a more mature plan with a bigger retiree population. Other factors, such as automatic cost of living features, also come into play in determining a plan's sensitivity. Using an interest rate that is 100 basis points higher or lower than the independently determined investment return assumption moves the aggregate recalibrated accrued liability by 10.6% to 13.8% (see Figure 12), but can move accrued liability by as little as 9.8% for the most mature plans or as much as 14.4% for the least mature plans.

FIGURE 12: EFFECTS OF CHANGING THE INVESTMENT RETURN ASSUMPTION

	RECALIBRATED ACCRUED LIABILITY (\$ TRILLIONS)		
	-100 BASIS POINTS	INDEPENDENTLY DETERMINED INVESTMENT RETURN	+100 BASIS POINTS
Most mature 25 plans	\$0.92 (+12.2%)	\$0.82	\$0.74 (-9.8%)
Second-most mature 25 plans	\$1.36 (+13.3%)	\$1.20	\$1.07 (-10.8%)
Second-least mature 25 plans	\$1.38 (+14.0%)	\$1.21	\$1.08 (-10.7%)
Least mature 25 plans	\$1.19 (+14.4%)	\$1.04	\$0.92 (-11.5%)
All 100 plans in aggregate	\$4.85 (+13.8%)	\$4.26	\$3.81 (-10.6%)

ASSET VOLATILITY RATIO

The *asset volatility ratio* is a metric that helps plan sponsors anticipate the impact of investment volatility on actuarially determined contribution rates. The asset volatility ratio is the ratio of plan assets to the payroll for active members covered by the plan. A lower ratio means that plan assets are relatively small compared with payroll; this implies that a single-year deviation in asset performance may not move the contribution rate much. A higher ratio, on the other hand, signals that a similar single-year deviation in asset performance could translate into a significant shift in the actuarially determined contribution rate. It is unsurprising that, as pension plans have accumulated assets and their member populations have matured over the past several decades, asset volatility ratios have risen. These higher ratios mean that actuarially determined contribution rates are now more sensitive than they once were to investment volatility, despite the use of asset-smoothing methods to help mitigate the impact of market movements. Figure 13 illustrates how changes in the asset volatility ratio over time can alter the relationship between investment volatility and contribution volatility.

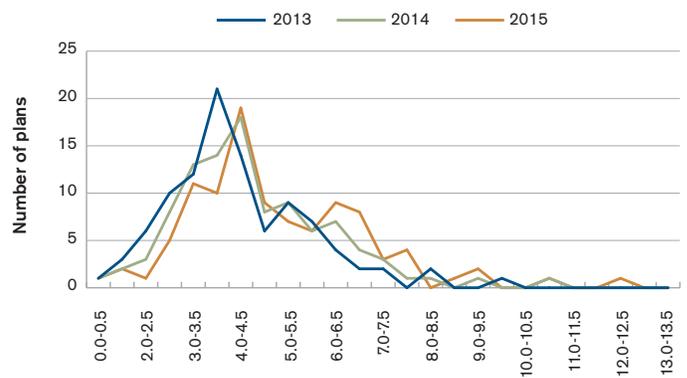
FIGURE 13: ASSET VOLATILITY RATIO ILLUSTRATION FOR A HYPOTHETICAL PENSION PLAN

	1983	1993	2003	2013
Market value of assets	\$30,000	\$110,000	\$260,000	\$390,000
Covered payroll	20,000	40,000	70,000	80,000
Asset volatility ratio = assets ÷ payroll	1.50	2.75	3.71	4.88
Increase in contribution rate resulting from a 10% asset loss (using 15-year level dollar amortization)	1.58%	2.90%	3.91%	5.14%

Note that not all plans are funded via contribution rates that are applied to payroll; for some plans, the contribution is determined as a specific dollar amount that will not exhibit the same volatility relative to payroll.

The median asset volatility ratio for the plans included in this study is 4.6, up from 4.3 in the Milliman 2014 Public Pension Funding Study (see Figure 14). Thirty-five percent of the plans now have an asset volatility ratio of 5.5 or higher, indicating that their actuarially determined contributions will be more volatile in reaction to future market swings. Two years ago, just 18% of the plans exceeded the 5.5 mark, suggesting that for a significant number of plans the actuarially determined contribution levels are becoming more and more sensitive to market swings.

FIGURE 14: ASSET VOLATILITY RATIO



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SPONSOR-REPORTED DATA

PLAN NAME	VALUATION DATE	ACCRUED LIABILITY	MARKET VALUE			ACTUARIAL VALUE			COUNT OF ACTIVE MEMBERS	COUNT OF INACTIVE / RETIRED MEMBERS
			VALUE OF ASSETS	SURPLUS / (UNFUNDED) ACCRUED LIABILITY	FUNDED RATIO	VALUE OF ASSETS	SURPLUS / (UNFUNDED) ACCRUED LIABILITY	FUNDED RATIO		
Alabama Employees' Retirement System	09/30/13	14,537	10,013	(4,524)	68.9%	9,546	(4,991)	65.7%	84,035	71,462
Alabama Teachers' Retirement System	09/30/13	29,666	20,642	(9,024)	69.6%	19,630	(10,036)	66.2%	133,919	102,417
Alaska Public Employees' Retirement System	06/30/13	11,946	6,694	(5,252)	56.0%	6,511	(5,435)	54.5%	20,955	36,095
Arizona Public Safety Personnel Retirement System	06/30/14	12,233	5,936	(6,297)	48.5%	6,019	(6,214)	49.2%	18,526	13,646
Arizona State Retirement System	06/30/14	40,957	33,337	(7,620)	81.4%	31,195	(9,762)	76.2%	203,201	345,786
Arkansas Public Employees' Retirement System	06/30/14	8,864	7,512	(1,352)	84.7%	6,895	(1,969)	77.8%	45,841	45,428
Arkansas Teachers' Retirement System	06/30/14	17,310	14,856	(2,454)	85.8%	13,375	(3,935)	77.3%	74,352	50,241
California Public Employees' Retirement System	06/30/13	375,000	261,622	(113,378)	69.8%	281,928	(93,072)	75.2%	759,509	911,703
California State Teachers' Retirement System	06/30/14	230,872	169,406	(61,466)	73.4%	158,495	(72,377)	68.7%	420,887	458,442
Chicago Municipal Employees' Annuity and Benefit Fund	12/31/14	12,307	5,179	(7,128)	42.1%	5,039	(7,268)	40.9%	30,160	40,350
Chicago Public Schools	06/30/14	19,504	10,816	(8,688)	55.5%	10,046	(9,458)	51.5%	30,654	32,540
Colorado Public Employees' Retirement Association	12/31/13	66,921	43,774	(23,147)	65.4%	41,123	(25,798)	61.5%	200,183	125,848
Connecticut State Employees' Retirement System	06/30/14	25,506	10,473	(15,033)	41.1%	10,585	(14,921)	41.5%	49,976	47,260
Connecticut State Teachers' Retirement System	06/30/14	26,349	16,221	(10,128)	61.6%	15,547	(10,802)	59.0%	51,433	47,321
Cook County Employees' Annuity and Benefit Fund	12/31/14	14,141	9,068	(5,073)	64.1%	8,811	(5,330)	62.3%	21,656	30,270
Florida State Retirement System	07/01/14	160,131	149,967	(10,164)	93.7%	138,621	(21,510)	86.6%	511,751	505,037
Georgia Employees' Retirement System	06/30/14	16,992	13,292	(3,700)	78.2%	12,376	(4,616)	72.8%	60,486	51,332
Georgia Teachers' Retirement System	06/30/13	72,221	58,595	(13,626)	81.1%	58,595	(13,626)	81.1%	208,616	194,620
Hawaii State Employees' Retirement System	06/30/14	22,220	14,203	(8,017)	63.9%	13,642	(8,578)	61.4%	67,206	51,192
Idaho Public Employee Retirement System	07/01/14	14,928	13,865	(1,063)	92.9%	13,833	(1,095)	92.7%	66,223	52,280
Illinois Municipal Retirement Fund	12/31/14	37,465	34,833	(2,632)	93.0%	32,700	(4,765)	87.3%	173,579	249,930
Illinois State Employees' Retirement System	06/30/14	39,527	14,582	(24,945)	36.9%	13,316	(26,211)	33.7%	62,844	91,013
Illinois State Teachers' Retirement System	06/30/14	103,740	45,824	(57,916)	44.2%	42,151	(61,589)	40.6%	159,838	235,297
Illinois State Universities Retirement System	06/30/14	37,430	17,391	(20,039)	46.5%	15,845	(21,585)	42.3%	80,845	142,890
Indiana Public Employees' Retirement Fund	06/30/14	16,732	14,104	(2,628)	84.3%	13,791	(2,941)	82.4%	137,567	150,960
Indiana State Teachers' Retirement Fund	06/30/14	21,592	10,691	(10,901)	49.5%	10,394	(11,198)	48.1%	70,414	59,427
Iowa Public Employees' Retirement System	06/30/14	32,004	28,039	(3,965)	87.6%	26,460	(5,544)	82.7%	165,911	180,148
Kansas Public Employee Retirement System	12/31/14	25,130	16,322	(8,808)	65.0%	15,662	(9,468)	62.3%	154,203	140,948
Kentucky County Employees' Retirement System	06/30/14	13,061	8,590	(4,471)	65.8%	8,085	(4,976)	61.9%	90,309	68,498
Kentucky Employees' Retirement Systems	06/30/14	12,367	3,120	(9,247)	25.2%	2,952	(9,415)	23.9%	44,389	53,099
Kentucky Teachers' Retirement System	06/30/14	30,184	18,093	(12,091)	59.9%	16,174	(14,010)	53.6%	73,407	84,027
Los Angeles City Employees' Retirement System	06/30/14	16,249	11,791	(4,458)	72.6%	10,945	(5,304)	67.4%	24,009	23,563
Los Angeles City Water and Power Employees' Retirement Plan	07/01/14	10,976	9,710	(1,266)	88.5%	8,878	(2,098)	80.9%	8,960	10,223
Los Angeles County Employees' Retirement Association	06/30/14	54,942	47,722	(7,220)	86.9%	43,654	(11,288)	79.5%	92,466	71,900
Los Angeles Fire and Police Pension Plan	06/30/14	18,114	16,990	(1,124)	93.8%	15,678	(2,436)	86.6%	13,097	12,633
Louisiana State Employees' Retirement System	06/30/14	17,878	11,625	(6,253)	65.0%	10,606	(7,272)	59.3%	40,321	105,378
Louisiana Teachers' Retirement System	06/30/14	28,120	17,900	(10,220)	63.7%	16,146	(11,974)	57.4%	82,886	100,396
Maine Public Employees' Retirement System	06/30/14	12,320	10,338	(1,982)	83.9%	10,018	(2,302)	81.3%	39,669	32,391
Maryland State Employees' Combined System	06/30/14	22,060	15,345	(6,715)	69.6%	14,547	(7,513)	65.9%	84,825	96,997
Maryland Teachers	06/30/14	36,883	27,491	(9,392)	74.5%	26,068	(10,815)	70.7%	104,470	93,149
Massachusetts State Board of Retirement System	01/01/15	33,679	23,739	(9,940)	70.5%	22,720	(10,959)	67.5%	88,508	62,114
Massachusetts Teachers' Retirement System	01/01/14	40,742	24,183	(16,559)	59.4%	22,940	(17,802)	56.3%	88,788	61,034
Michigan Municipal Employees' Retirement System	12/31/13	10,957	7,404	(3,553)	67.6%	7,861	(3,096)	71.7%	34,809	40,080
Michigan Public School Employees' Retirement System	09/30/13	63,840	40,016	(23,824)	62.7%	38,044	(25,796)	59.6%	212,525	217,187
Michigan State Employees' Retirement System	09/30/14	15,648	9,923	(5,725)	63.4%	9,438	(6,210)	60.3%	15,439	62,168
Minnesota Public Employees' Retirement Association	06/30/14	21,283	17,405	(3,878)	81.8%	15,645	(5,638)	73.5%	143,343	131,639
Minnesota State Retirement System	07/01/14	12,445	11,499	(946)	92.4%	10,326	(2,119)	83.0%	49,663	51,201
Minnesota Teachers' Retirement Association	07/01/14	24,529	20,290	(4,239)	82.7%	18,182	(6,347)	74.1%	77,243	101,700
Mississippi Public Employees' Retirement System	06/30/14	37,015	24,877	(12,138)	67.2%	22,570	(14,445)	61.0%	161,360	226,057
Missouri Public School Retirement System	06/30/14	38,483	34,381	(4,102)	89.3%	31,847	(6,636)	82.8%	75,168	68,937
Missouri State Employees' Plan	06/30/14	11,495	9,137	(2,358)	79.5%	8,638	(2,857)	75.1%	50,621	61,129
Nebraska Public Employees' Retirement System	06/30/14	10,426	9,451	(975)	90.6%	8,622	(1,804)	82.7%	40,462	41,589

SPONSOR-REPORTED DATA

PLAN NAME	VALUATION DATE	ACCRUED LIABILITY	MARKET VALUE			ACTUARIAL VALUE			COUNT OF ACTIVE MEMBERS	COUNT OF INACTIVE / RETIRED MEMBERS
			VALUE OF ASSETS	SURPLUS / (UNFUNDED) ACCRUED LIABILITY	FUNDED RATIO	VALUE OF ASSETS	SURPLUS / (UNFUNDED) ACCRUED LIABILITY	FUNDED RATIO		
Nevada State Public Employees' Retirement System	06/30/14	43,997	33,575	(10,422)	76.3%	31,466	(12,531)	71.5%	100,522	69,841
New Hampshire Retirement System	06/30/14	11,045	7,414	(3,631)	67.1%	6,701	(4,344)	60.7%	48,307	32,351
New Jersey Police and Firemen's Retirement System	07/01/14	34,605	25,094	(9,511)	72.5%	25,129	(9,476)	72.6%	40,106	42,631
New Jersey Public Employees' Retirement System	07/01/14	49,098	29,028	(20,070)	59.1%	29,895	(19,203)	60.9%	266,526	161,446
New Jersey Teachers' Pension and Annuity Fund	06/30/14	53,750	27,643	(26,107)	51.4%	29,045	(24,705)	54.0%	153,335	95,098
New Mexico Educational Retirement Board	06/30/14	16,971	11,346	(5,625)	66.9%	10,715	(6,256)	63.1%	61,173	78,835
New Mexico Public Employees' Retirement Association	06/30/14	17,784	14,393	(3,391)	80.9%	13,483	(4,301)	75.8%	49,288	38,512
New York City Employees' Retirement System	06/30/12	67,417	42,655	(24,762)	63.3%	44,677	(22,740)	66.3%	187,114	146,867
New York City Police Pension Fund	06/30/12	42,016	25,480	(16,536)	60.6%	26,777	(15,239)	63.7%	34,240	47,384
New York City Teachers' Retirement System	06/30/12	58,783	32,775	(26,008)	55.8%	33,871	(24,912)	57.6%	112,460	86,407
New York State and Local Employees Retirement System	04/01/13	149,281	161,686	12,405	108.3%	132,138	(17,143)	88.5%	498,266	496,563
New York State and Local Police & Fire	03/31/14	25,850	24,475	(1,375)	94.7%	23,147	(2,703)	89.5%	31,218	35,993
New York State Teachers' Retirement System	06/30/13	94,584	95,367	783	100.8%	82,743	(11,841)	87.5%	266,100	160,050
North Carolina Local Governmental Employees' Retirement System	12/31/13	21,538	21,784	246	101.1%	21,498	(40)	99.8%	123,455	108,403
North Carolina Teachers' and State Employees' Retirement System	12/31/13	65,806	62,789	(3,017)	95.4%	62,364	(3,442)	94.8%	310,370	312,961
Ohio Police and Fire Pension Fund	01/01/14	16,578	11,921	(4,657)	71.9%	11,063	(5,515)	66.7%	27,451	30,662
Ohio Public Employees' Retirement System	12/31/12	83,876	68,088	(15,788)	81.2%	67,853	(16,023)	80.9%	348,235	657,919
Ohio Schools Employees' Retirement System	06/30/14	17,457	12,821	(4,636)	73.4%	11,882	(5,575)	68.1%	121,251	79,654
Ohio State Teachers' Retirement System	07/01/14	96,167	70,989	(25,178)	73.8%	66,657	(29,510)	69.3%	169,295	169,244
Oklahoma Public Employees' Retirement System	07/01/14	8,754	8,570	(184)	97.9%	7,759	(995)	88.6%	43,947	37,504
Oklahoma Teachers' Retirement System	06/30/14	19,576	14,229	(5,347)	72.7%	12,369	(7,207)	63.2%	89,570	67,093
Orange County Employees' Retirement System	12/31/14	16,413	11,428	(4,985)	69.6%	11,450	(4,963)	69.8%	21,459	19,958
Oregon Public Employees' Retirement System	12/31/13	62,594	62,522	(72)	99.9%	54,090	(8,504)	86.4%	162,185	169,330
Pennsylvania Public School Employees' Retirement System	06/30/14	92,353	52,980	(39,373)	57.4%	57,232	(35,121)	62.0%	263,312	234,367
Pennsylvania State Employees' Retirement System	12/31/14	44,751	27,333	(17,418)	61.1%	26,585	(18,166)	59.4%	104,431	129,303
Puerto Rico Government Employees Retirement System	06/30/13	23,712	731	(22,981)	3.1%	731	(22,981)	3.1%	125,671	124,497
Puerto Rico Teachers Retirement System	06/30/13	12,252	1,907	(10,345)	15.6%	1,907	(10,345)	15.6%	41,553	39,065
Rhode Island Employees Retirement System	06/30/14	10,543	6,396	(4,147)	60.7%	6,191	(4,352)	58.7%	24,567	27,879
Sacramento County Employees' Retirement System	06/30/14	8,581	7,810	(771)	91.0%	7,313	(1,268)	85.2%	12,049	13,250
San Bernardino County Employees' Retirement Association	06/30/14	9,660	7,995	(1,665)	82.8%	7,751	(1,909)	80.2%	19,497	14,974
San Diego County Employees' Retirement Association	06/30/14	12,141	10,110	(2,031)	83.3%	9,824	(2,317)	80.9%	17,466	21,464
San Francisco City and County Employees' Retirement System	07/01/14	21,123	19,921	(1,202)	94.3%	18,012	(3,111)	85.3%	29,526	33,293
South Carolina Retirement System	07/01/13	41,196	22,791	(18,405)	55.3%	25,753	(15,443)	62.5%	193,206	275,411
South Dakota Retirement System	07/01/14	9,887	10,608	721	107.3%	9,887	0	100.0%	38,951	40,554
Tennessee Consolidated Retirement System	07/01/13	41,913	37,567	(4,346)	89.6%	39,249	(2,664)	93.6%	209,964	163,995
Texas County & District Retirement System	12/31/14	26,253	23,795	(2,458)	90.6%	23,752	(2,501)	90.5%	125,860	132,640
Texas Employees' Retirement System	08/31/14	32,925	25,050	(7,875)	76.1%	25,432	(7,493)	77.2%	134,162	112,579
Texas Municipal Retirement System	12/31/14	26,647	23,727	(2,920)	89.0%	22,860	(3,787)	85.8%	104,019	98,509
Texas Teacher Retirement System	08/31/14	160,036	132,779	(27,257)	83.0%	128,398	(31,638)	80.2%	857,342	445,305
University of California Retirement Plan	07/01/14	60,417	52,784	(7,633)	87.4%	48,328	(12,089)	80.0%	120,568	142,420
Utah Retirement Systems	01/01/14	22,462	19,729	(2,733)	87.8%	18,396	(4,066)	81.9%	75,381	90,015
Virginia Employees' Retirement System	06/30/13	79,078	54,973	(24,105)	69.5%	52,125	(26,953)	65.9%	328,277	204,871
Washington Public Employees' Retirement System	06/30/13	36,681	30,806	(5,875)	84.0%	32,388	(4,293)	88.3%	150,706	217,566
Washington State Law Enforcement Officers' and Fire Fighters' Plan 1 and 2	06/30/13	11,269	12,777	1,508	113.4%	13,379	2,110	118.7%	16,830	12,810
Washington State Teachers' Retirement System	06/30/13	17,465	14,237	(3,228)	81.5%	15,123	(2,342)	86.6%	65,935	54,043
West Virginia Teachers' Retirement System	06/30/13	9,930	5,751	(4,179)	57.9%	5,751	(4,179)	57.9%	35,593	36,878
Wisconsin Retirement System	12/31/13	85,329	86,367	1,038	101.2%	85,276	(53)	99.9%	255,396	372,021
Wyoming Retirement System	01/01/15	8,371	6,672	(1,699)	79.7%	6,610	(1,761)	79.0%	36,489	49,907

STUDY TECHNICAL APPENDIX

Methodology: Expected investment return

For the purposes of this study, we recalibrated liabilities for included plans to reflect discounting at the expected rate of return on current plan assets. To develop the expected rate of return used in these calculations, we relied on the most recently available asset statements for each plan, particularly on Statements of Plan Net Assets as disclosed in published Comprehensive Annual Financial Reports. We did not make adjustments for potential differences between actual asset allocations and target policy asset allocations.

Our method to calculate the expected rate of return was a “building-block method,” using geometric averaging methodology. We used Milliman’s December 31, 2014, capital market assumptions to calculate the 50th percentile 30-year real rate of return, and then added the plan’s inflation assumption to arrive at the total expected investment return on plan assets. Where the plan inflation assumption was not available, we used an inflation assumption of 2.50%. We did not make any adjustment to the expected rate of return for plan expenses, nor did we include any assumption for investment alpha (i.e., we did not assume any excess return over market averages resulting from active versus passive management).

Methodology: Liability recalibration

We performed the recalibration of liabilities for pension plans included in the study using adjustment benchmarks based on detailed calculations for certain pension plans meeting broad categorization definitions. For these benchmark plans, we developed precise liability duration separately for active, terminated vested, and retired member populations. These calculated liability durations were modified durations, further adjusted for plan- and population-specific convexity. We applied a variety of cost-of-living adjustments (COLAs) to the various benchmark plans, resulting in a library of adjustment factors taking into account plan type, plan provisions, demographic group, and COLA.

We then selected liability-adjustment factors for each plan in the study based on plan type, COLA provisions, and average demographic characteristics where available. For example, a teachers’ plan was typically matched with a set of teachers’ plan adjustment factors, with similar COLA provisions. If average ages, service levels, or expected working lifetimes were available, we also used these criteria to aid in choosing the adjustment factors. For each liability recalibration calculation, we then recalculated the selected benchmark durations to reflect the actual starting plan investment return assumption. We performed separate liability adjustments for active, terminated vested, and retired liabilities, thereby adjusting for varying maturity levels by cohort.

The liability durations used for adjustment provide an estimate of the sensitivity of the present value of benefits (PVB) to changes in the investment return assumption. We assumed that, for active populations, the actuarial accrued liabilities (AAL) varied 85% as much as the PVB when liabilities were reported under the projected unit credit cost method, and 70% as much as the PVB when liabilities were reported under the entry age normal cost method. These assumptions for the relative change in AAL compared with PVB were based on the average results of a survey of actual changes in AAL versus PVB for selected Milliman clients. Although most plans in the study reported liability results under one of these two cost methods, a handful of plans disclosed liabilities only under the frozen initial liability cost method. For those plans, we used the entry age normal assumption for the relative change of AAL to PVB.

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