

2019 Public Pension Funding Study

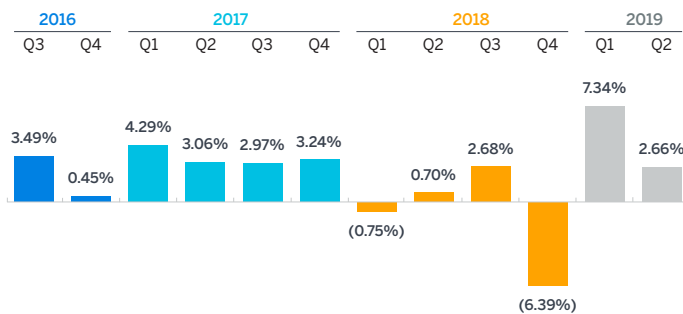
Rebecca A. Sielman, FSA



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 liability for each plan based on our independent assessment of the expected real return on each plan's investments.

This 2019 report is based on information that was reported by the plan sponsors at their most recent fiscal year-ends—June 30, 2018 is the measurement date for three-quarters of the plans in our 2019 study. For many plans, the 12 months since that date brought considerable volatility to both equity returns and fixed income returns. We estimate that aggregate plan assets rose from \$3.69 trillion as of the most recent fiscal year-ends to \$3.84 trillion as of June 30, 2019.

FIGURE 1: ESTIMATED QUARTERLY RETURN ON AGGREGATE PLAN ASSETS

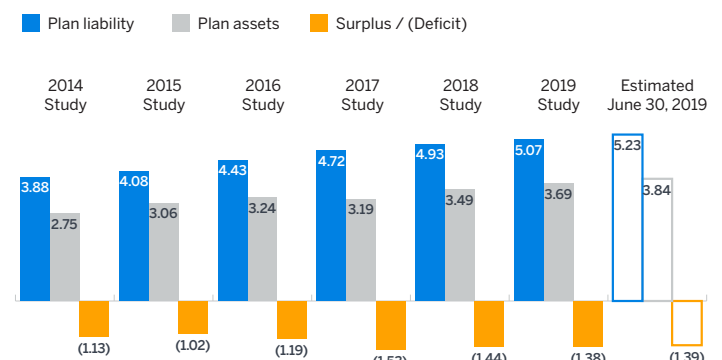


The aggregate Total Pension Liability reported at the last fiscal year-ends was \$5.07 trillion, growing from \$4.93 trillion as of the prior fiscal year-ends. We estimate that the Total Pension Liability has since climbed to \$5.23 trillion as of June 30, 2019. The aggregate system-reported underfunding as of the last fiscal year-ends stood at \$1.38 trillion, which is a modest improvement from \$1.44 trillion of underfunding a year earlier. Despite the volatile markets we have seen in the past 12 months, we estimate that the underfunding has remained at about the same level from the last fiscal year-ends through June 30, 2019. To the extent that systems lowered their interest rate assumptions after the fiscal year-ends reflected in this report, our estimated figures as of June 30, 2019 likely understate the aggregate liability and the aggregate underfunding.

Highlights

- As of June 30, 2019, the aggregate funded ratio is estimated to be 73.4%
- Aggregate liabilities topped the \$5 trillion mark for the first time, but asset growth modestly outpaced liability growth
- Plan sponsors continued to reduce the interest rate assumptions they use for determining contribution amounts
- Meanwhile market expectations for investment returns ticked modestly upward

FIGURE 2: AGGREGATE SYSTEM-REPORTED FUNDED STATUS (\$ TRILLIONS)



Note: The plan liability amounts from the 2014 and 2015 studies are the accrued liability used for funding purposes; the 2016 through 2019 studies report the GASB 67/68 Total Pension Liability.

FIGURE 3: AGGREGATE SYSTEM-REPORTED FUNDED RATIO

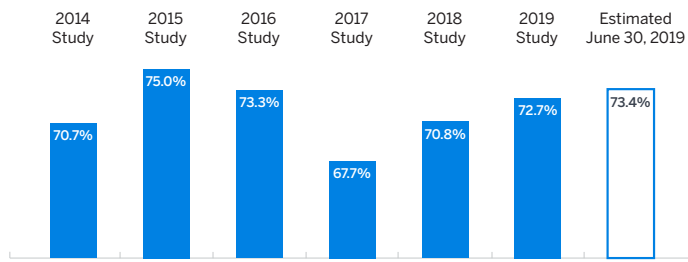
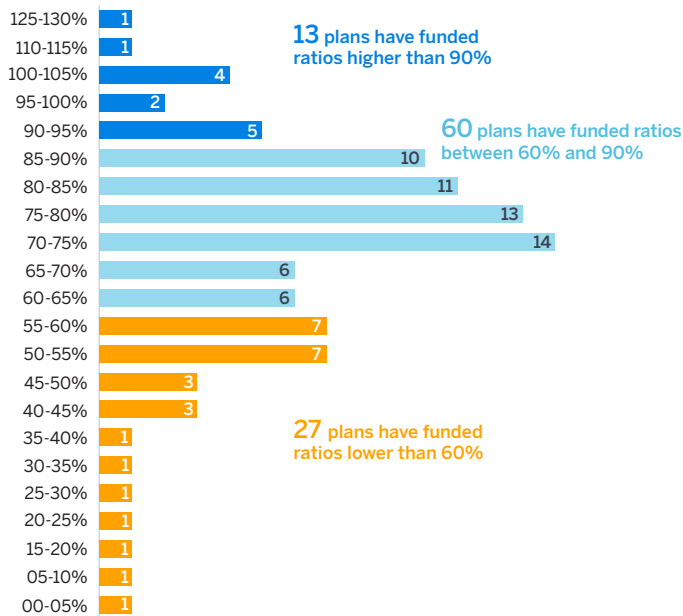
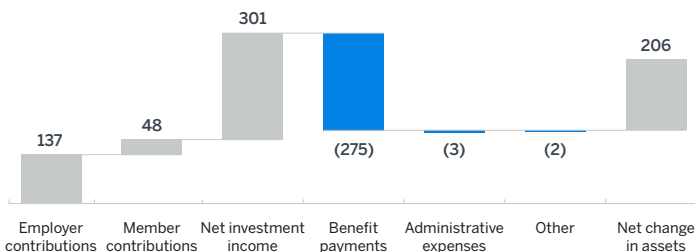


FIGURE 4: SYSTEM-REPORTED FUNDED RATIO AT MOST RECENT FISCAL YEAR-ENDS



Overall, the 100 plans reported benefit payouts totaling \$275 billion in their most recent fiscal years. Reported contributions totaled \$185 billion, with \$137 billion and \$48 billion provided by employers and members, respectively. Figure 5 summarizes the change in asset balances reported by the plans in their most recent fiscal years.

FIGURE 5: REPORTED CHANGES IN ASSETS, MOST RECENT FISCAL YEAR (\$ BILLIONS)



We project that, in the period July 2019 to June 2020, the plans will receive combined contributions from employers and members of \$203 billion and will pay out a total of \$299 billion in benefits and administrative expenses, for a net cash outflow from the plans of \$96 billion. This continues a steady trend of increases in both contributions flowing into the plans and benefits flowing out of the plans, as shown in Figure 6.

FIGURE 6: REPORTED CASH FLOWS (\$ BILLIONS)

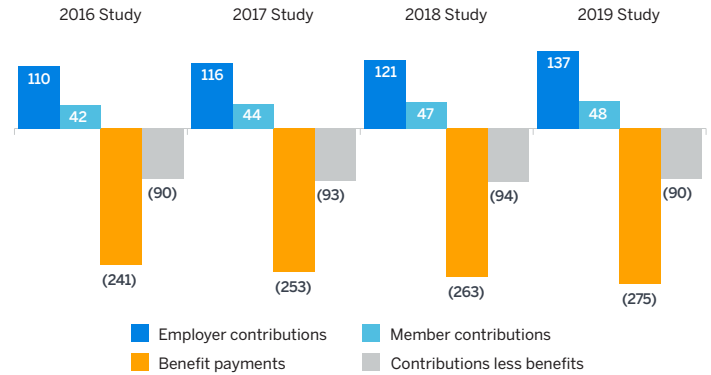
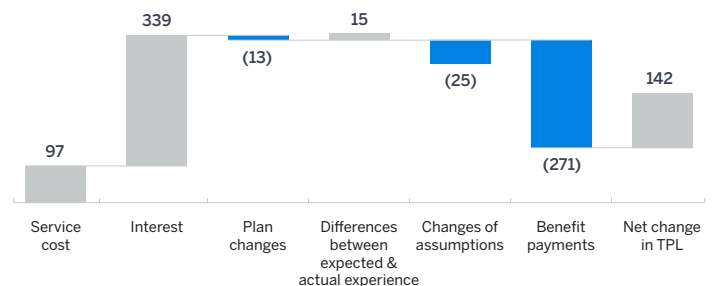


Figure 7 summarizes the change in Total Pension Liability reported by the plans in their most recent fiscal years. In general, a plan's liability is increased by service cost and interest, and reduced by benefit payments.

FIGURE 7: REPORTED CHANGE IN TOTAL PENSION LIABILITY, MOST RECENT FISCAL YEAR (\$ BILLIONS)

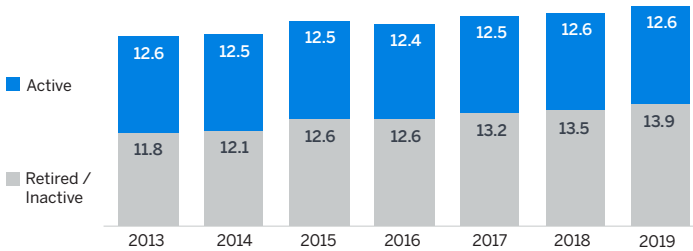


Changes in assumptions or plan provisions can increase or decrease a plan's liability, depending on the nature of the change.

Liabilities

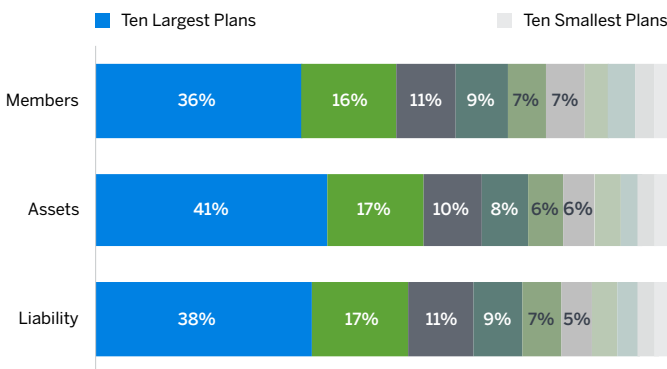
The plans reported an aggregate Total Pension Liability of \$5.07 trillion for the 26.5 million members covered by the plans in the study. The number of active members covered by these plans has been essentially flat for the past seven years, while the number of retired and inactive members has increased each year.

FIGURE 8: NUMBER OF PLAN MEMBERS (MILLIONS)



The 100 public plans individually range in size of accrued liability from \$10 billion to \$456 billion. Collectively, the 10 largest plans (ranked by liability) cover 36% of the total members, hold 41% of the aggregate assets, and have 38% of the aggregate liability.

FIGURE 9: ACCRUED LIABILITY



Funded ratio does not vary much by the size of the plan, although it is interesting to note that the 10 smallest plans have a significantly higher aggregate funded ratio than any other decile.

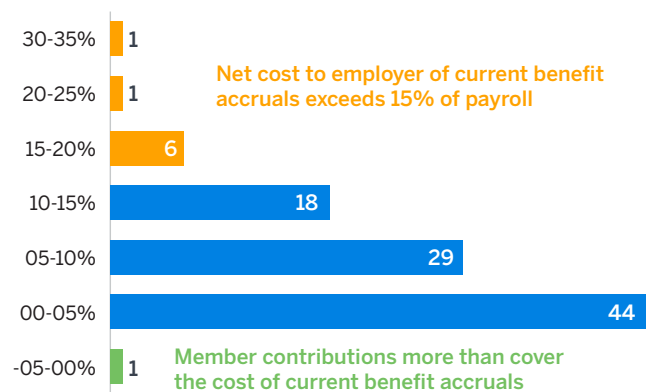
Cost of benefits being earned each year

Service cost is the portion of the actuarial present value of projected benefit payments that is attributable to a given year. In other words, it is the cost to the plan to provide the benefits that active members earn by working one more year. The plans report the service cost in their Governmental Accounting Standards Board (GASB) 67/68 disclosures as a component of the change in the Total Pension Liability from one reporting date to the next.

In order to determine the relative value of the pension benefits plans provide annually to their active members, we started with each plan's reported service cost. We then subtracted out the portion of that cost that is paid for with contributions from the active members during the year. Then we divided by each plan's total payroll so that we could adjust for the relative size of a plan. The resulting metric is termed the net employer-paid service cost as a percentage of payroll, and represents the relative richness of the pension benefits paid for by the plan sponsors.

Overall, three-quarters of the plans provide an estimated employer-paid pension benefit in the range of 0% to 10% of payroll; the most common levels of employer-paid pension benefits are 0% to 5% (44 plans) and 5% to 10% (29 plans). There is one plan with a negative net service cost, which means that contributions from active members more than cover the annual cost of their own annual pension accruals. On the flip side, there are eight plans with a net cost of more than 15% of payroll, indicating relatively costly benefits.

FIGURE 10: RECALIBRATED NET SERVICE COST AS PERCENTAGE OF PAYROLL

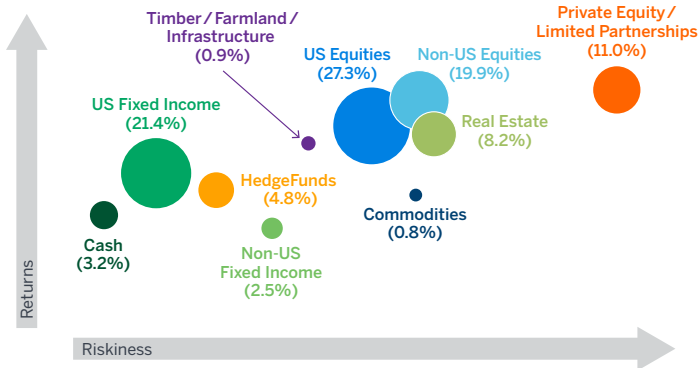


There is very little correlation between the richness of the benefits provided and the funded status of the plan; that is, plans with generous benefits are neither better funded nor more poorly funded than plans with modest benefits.

Assets

The plans included in this study are invested in a mix of asset classes with different risk/return characteristics, as illustrated in Figure 11.

FIGURE 11: ASSET ALLOCATION, 2019

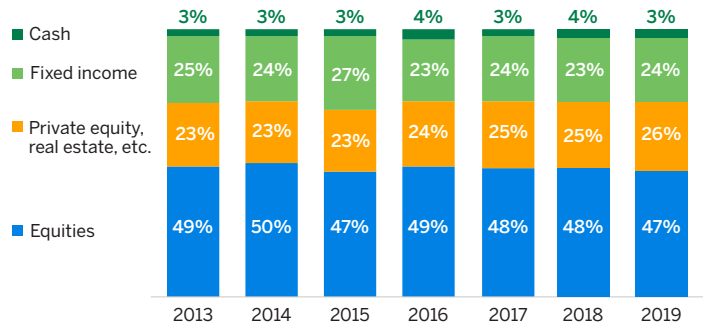


Note: The expected return and risk/volatility metrics are based on Milliman’s capital market assumptions as of June 30, 2019.

Over the past six years there has been very little change in the overall asset allocation of these plans (see Figure 12). While some plans have modified their asset allocation policies over the past six years, in aggregate there has not been a material move toward riskier investments.

We found little correlation between plans’ asset allocations or reported discount rates and whether the plans are well funded or poorly funded (as measured by their funded ratios).

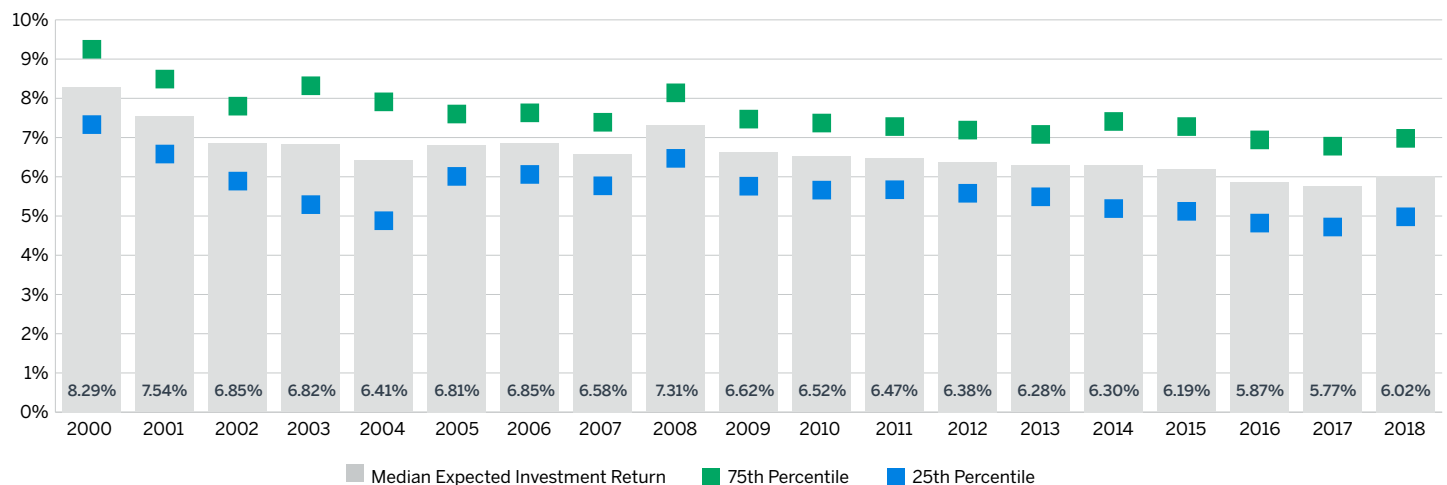
FIGURE 12: AGGREGATE ASSET ALLOCATIONS OVER TIME



The market’s consensus views on long-term future investment returns have been declining since the turn of the millennium. Figure 13 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, the median expected investment return for the illustrated hypothetical asset allocation fell from 8.29% in 2000 to a low of 5.77% in 2017, with a modest uptick to 6.02% in 2018. Where interest rate assumptions of 8.00% were once the norm, 85 of the plans in the study now have assumptions of 7.50% or below (compared to 80 in the 2018 study). Thirty of the plans lowered their assumptions from the 2018 study to the 2019 study; nearly 90% of the plans have lowered their assumptions at least once since our inaugural 2012 study.

The terms “interest rate” and “discount rate” are often used interchangeably; both represent a rate that is used to translate future expected benefit payments into current day liabilities. For this study, we use the term “interest rate” to indicate the assumption the plan sponsor has chosen to determine contribution amounts, and we use the term “discount rate”

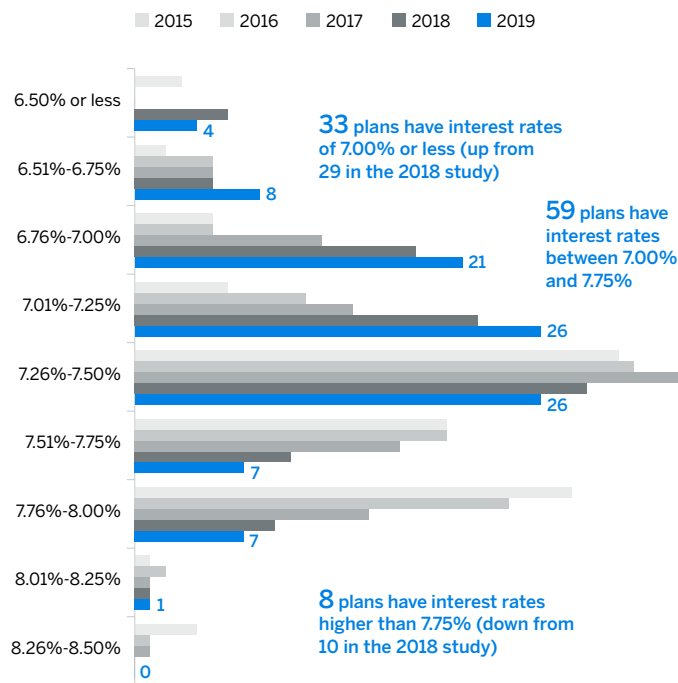
FIGURE 13: EXPECTED RETURN FOR A HYPOTHETICAL ASSET ALLOCATION BASED ON MILLIMAN’S CAPITAL MARKET ASSUMPTIONS



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.

to indicate the rate that is used to measure liabilities for GASB 67/68 financial reporting purposes. Interest rates have continued to move lower each year, with a median of 7.25% and ranging from 5.32% to 8.10% (see Figure 14). For most of the plans in this study, the funding interest rate and the financial reporting discount rate are the same. However, GASB 67/68 requires that the discount rate be adjusted downward in situations where current contribution policy is projected to result in a plan running out of plan assets at some future date (using the GASB-mandated testing methodology). Such a downward adjustment currently occurs for 12 of the plans in the study. Notably, several of these plans had less severe downward adjustments in this study than was the case at their prior fiscal year-ends, indicating an improved outlook in terms of future solvency.

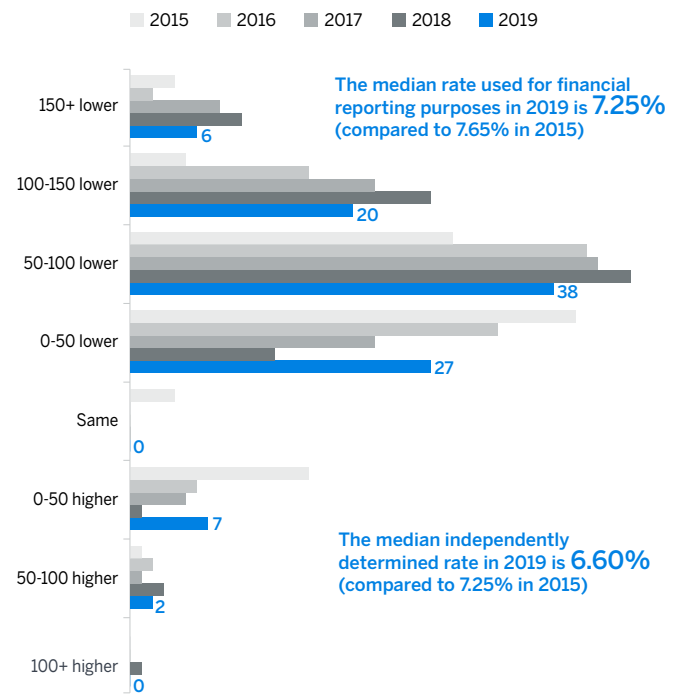
FIGURE 14: SPONSOR-REPORTED FUNDING INTEREST RATE



Recalibrating the Total Pension 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 as of June 30, 2019. 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 6.60%, which is 65 basis points lower than the 7.25% median discount rate used by the plans.

FIGURE 15: INDEPENDENTLY DETERMINED RATE VS. SPONSOR-REPORTED RATE

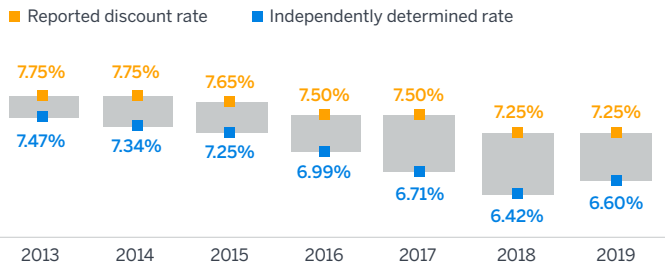


Financial reporting versus funding

The Governmental Accounting Standards Board (GASB) sets the accounting standards for public entities. Statements No. 67 and 68, which became effective in 2014 and 2015, have significantly changed the financial reporting requirements for U.S. public pension plans. Among other changes, these standards require all plans to report a standardized measure of actuarial 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 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. For some plans a different liability measurement is used as part of the process of determining amounts that should be contributed to fund the plan.

Plan sponsors periodically reassess their interest rate assumptions to ensure that they reflect updated market expectations about future investment returns. The frequency of reassessment varies by system, with some reassessing annually and others using as long as a five-year review cycle. As Figure 13 above illustrates, market expectations have been falling for the past two decades. Plan sponsors have been lowering their interest rate assumptions in response, but have often failed to keep pace with market expectations. Milliman’s studies have seen a persistent lag between the plan sponsor’s interest rates and our independently recalibrated interest rates. For the first time since 2013, this study shows a narrowing of the gap in interest rates, as shown in Figure 16. Thirty of the plans in the study lowered their interest rate assumptions since the previous study, while at the same time market expectations rose slightly.

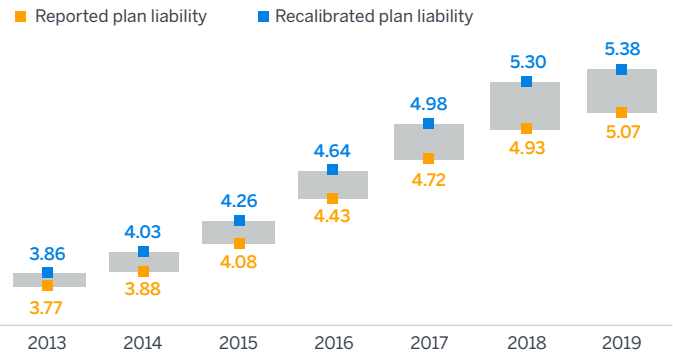
FIGURE 16: REPORTED VS. INDEPENDENTLY DETERMINED RATES



The 2019 gap between the 7.25% median rate used for financial reporting purposes and the 6.60% median independently determined rate indicates that it is likely that plan sponsors will continue to reduce their interest rates.

We used each plan’s independently determined investment return assumption to recalibrate the plan’s Total Pension Liability. In aggregate, these plans have a recalibrated Total Pension Liability of \$5.38 trillion, compared with a sponsor-reported Total Pension Liability of \$5.07 trillion. This year’s study found that the gap between the recalibrated accrued liability and the sponsor-reported accrued liability shrank modestly for the first time, mirroring the narrowing gap in interest rates.

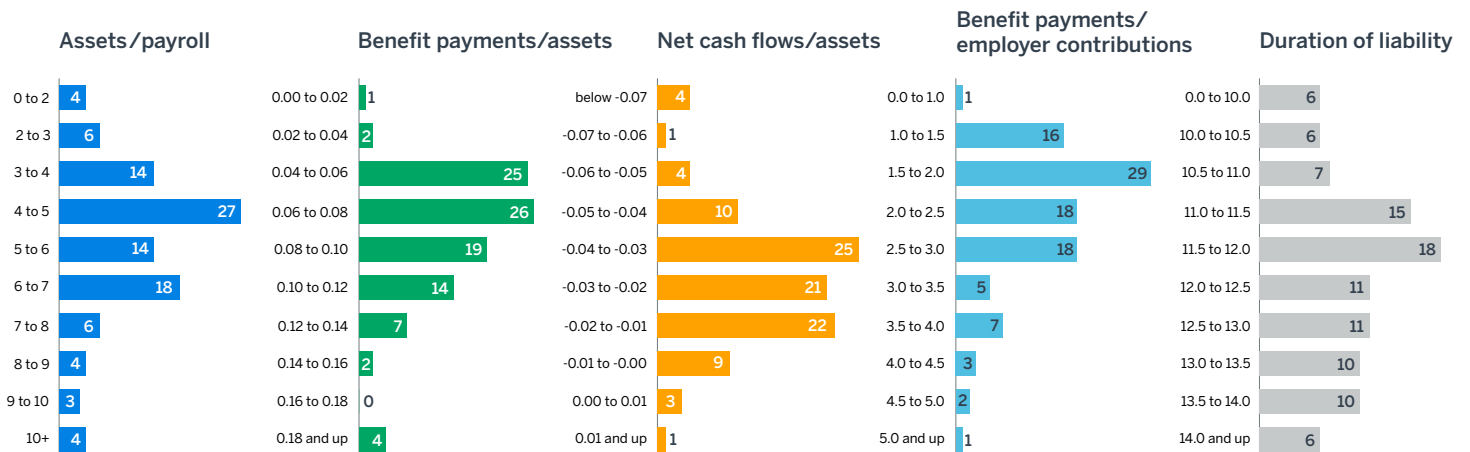
FIGURE 17: AGGREGATE RECALIBRATION RESULTS (\$ TRILLIONS)



ASOP 51 and plan maturity measures

The Actuarial Standards Board issued a new Actuarial Standard of Practice (ASOP 51), which directs pension actuaries to provide plan sponsors with information regarding the risks faced by pension plans. Pension actuaries in particular are directed to include metrics with respect to each plan’s maturity level, because a plan’s maturity affects everything from how sensitive the liability is to changes in the discount rate to asset allocation decisions to cash management and liquidity considerations. Figure 18 illustrates the range of maturity levels for the plans in this study using five of the maturity metrics discussed in ASOP 51.

FIGURE 18: MATURITY METRICS



Market value of assets compared to payroll: This metric, also known as the asset volatility ratio, helps plan sponsors anticipate the impact of investment volatility on actuarially determined contribution rates. A lower ratio means that plan assets are relatively small compared to 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 asset gain or loss 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, 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.

Benefit payments compared to market value of assets: This metric provides the plan sponsor with insight into managing the plan's liquidity needs. If annual benefit payouts are small relative to the overall size of plan assets, the liquidity needs of the plan will be low and more of the assets can be invested in longer-term or less liquid holdings. However, as a plan's membership shifts to more retirees drawing monthly benefits, care is needed to ensure that cash is available to pay benefits.

Net cash flows compared to market value of assets: The liquidity pressures caused by high levels of benefit payments

may be mitigated by similarly high levels of contributions flowing into the plan from employers and members. Plans with net cash flows close to zero may therefore be in position to invest in longer-term or less liquid holdings even though significant funds are being expended annually on benefits. Nearly all of the plans in this study have negative cash flows, meaning that benefit payments and administrative expenses exceed incoming contributions.

Benefit payments compared to employer contributions: As with the preceding two metrics, this metric helps plan sponsors understand and manage their cash flows and liquidity needs. For plans where benefit payouts are significantly higher than incoming contributions, greater attention may need to be devoted to investments that throw off higher interest or dividend income in order to meet cash flow needs.

Duration of the accrued liability: This metric helps plan sponsors understand how sensitive their liabilities are to changes of 100 basis points in discount rates. A relatively small change in the discount rate can have a significant impact on the Total Pension Liability. A less mature plan with more active members than retirees typically 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.

Methodology

This study is based on the most recently available Comprehensive Annual Financial Reports for the 100 largest public pension systems, which reflect measurement dates ranging from June 30, 2015, to December 31, 2018; 91 are from June 30, 2018, 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 real rate of return on plan assets. The sponsor-reported Total Pension 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 discount rate 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 purposes of determining contribution amounts or near-term plan settlement purposes nor to analyze the funding of individual plans.

Public Pension Mortality

The Society of Actuaries (SOA) periodically publishes mortality tables for use in valuing pension liabilities. In January 2019, the SOA issued a set of mortality tables that were constructed based on experience exclusively from public pension plans. We expect that public plans and their actuaries are reviewing these tables and evaluating whether and when to adopt them. To the extent that use of a new mortality table projects longer life spans, accrued liabilities will increase and funded ratios will decrease.

Acknowledgements

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Appendix

SPONSOR-REPORTED DATA

Plan Name	Measurement Date	GASB 68 Discount Rate	Total Pension Liability (\$ millions)	Fiduciary Net Position (\$ millions)	Net Pension Liability (\$ millions)	Funded Ratio	Count of Active Members	Count of Inactive / Retired Members
Alabama Employees' Retirement System	9/30/18	7.70%	17,862	12,720	5,142	71.2%	85,657	80,810
Alabama Teachers' Retirement System	9/30/18	7.70%	35,878	25,935	9,943	72.3%	136,941	111,414
Alaska Public Employees' Retirement System	6/30/18	8.00%	14,276	9,307	4,969	65.2%	13,611	40,745
Arizona Public Safety Personnel Retirement System	6/30/18							
Arizona State Retirement System	6/30/18	7.50%	52,438	38,492	13,946	73.4%	210,136	386,476
Arkansas Public Employees Retirement System	6/30/18	7.15%	10,809	8,603	2,206	79.6%	46,205	51,254
Arkansas Teacher's Retirement System	6/30/18	7.50%	21,132	17,493	3,639	82.8%	72,341	59,368
California Public Employees' Retirement System	6/30/18							
California State Teachers' Retirement System	6/30/18	7.10%	316,776	224,869	91,907	71.0%	449,595	499,917
Chicago Municipal Employees' Annuity and Benefit Fund	12/31/18	7.00%	16,809	3,914	12,894	23.3%	31,285	27,591
Chicago Public Schools	6/30/18	6.81%	24,547	11,105	13,443	45.2%	28,958	37,947
Colorado Public Employees' Retirement Association	12/31/18	7.25%	76,414	44,907	31,507	58.8%	211,584	150,752
Connecticut State Employees Retirement System	6/30/17	6.90%	33,053	11,982	21,071	36.3%	50,019	49,603
Connecticut State Teachers' Retirement System	6/30/17	8.00%	30,637	17,134	13,502	55.9%	50,877	50,817
Cook County Employees' Annuity and Benefit Fund	12/31/18	7.25%	21,723	9,862	11,861	45.4%	19,671	33,500
Delaware State Employees' Pension Plan	6/30/18	7.00%	10,320	9,028	1,291	87.5%	37,119	30,922
Florida State Retirement System	6/30/18	7.00%	191,317	161,197	30,121	84.3%	516,825	555,551
Georgia Employees' Retirement System	6/30/18	7.30%	17,628	13,517	4,111	76.7%	60,406	109,195
Georgia Teachers' Retirement System	6/30/18	7.50%	94,095	75,533	18,562	80.3%	226,061	233,717
Hawaii State Employees' Retirement System	6/30/18	7.00%	29,917	16,598	13,319	55.5%	66,271	75,637
Idaho Public Employee Retirement System	6/30/18	7.05%	17,750	16,275	1,475	91.7%	71,112	60,040
Illinois Municipal Retirement Fund	12/31/18							
Illinois State Employees' Retirement System	6/30/18	7.00%	50,520	17,463	33,056	34.6%	61,397	98,122
Illinois State Teachers' Retirement System	6/30/18	7.00%	129,914	51,970	77,945	40.0%	160,859	256,433
Illinois State Universities Retirement System	6/30/18	6.65%	46,816	19,321	27,495	41.3%	62,844	148,284
Indiana Public Employees' Retirement Fund	6/30/18	6.75%	16,091	12,694	3,397	78.9%	132,181	119,914
Indiana State Teachers' Retirement Fund	6/30/18	6.75%	20,146	9,164	10,983	45.5%	71,706	67,147
Iowa Public Employees' Retirement System	6/30/18	7.00%	38,643	32,315	6,328	83.6%	170,378	191,034
Kansas Public Employee Retirement System	6/30/18	7.75%	28,597	19,696	8,901	68.9%	143,947	153,206
Kentucky County Employees Retirement System	6/30/18	6.25%	17,876	9,367	8,509	52.4%	91,081	90,100
Kentucky Employees Retirement Systems	6/30/18	5.32%	16,759	2,650	14,109	15.8%	39,068	65,012
Kentucky Teachers' Retirement System	6/30/18	7.50%	33,709	19,982	13,727	59.3%	72,205	63,191
Los Angeles City Employees' Retirement System	6/30/18	7.25%	19,945	14,235	5,709	71.4%	26,042	22,249
Los Angeles City Water and Power Employees' Retirement Plan	6/30/18	7.25%	13,188	12,277	910	93.1%	10,114	10,893
Los Angeles County Employees Retirement Association	6/30/18	7.38%	67,057	56,300	10,757	84.0%	98,484	73,340
Los Angeles Fire and Police Pension Plan	6/30/18	7.25%	21,737	20,482	1,255	94.2%	13,442	13,424
Louisiana State Employees' Retirement System	6/30/18	7.65%	19,104	12,284	6,820	64.3%	39,293	108,494
Louisiana Teachers' Retirement System	6/30/18	7.65%	30,872	21,044	9,828	68.2%	85,045	110,418

Appendix

SPONSOR-REPORTED DATA (CONTINUED)

Plan Name	Measurement Date	GASB 68 Discount Rate	Total Pension Liability (\$ millions)	Fiduciary Net Position (\$ millions)	Net Pension Liability (\$ millions)	Funded Ratio	Count of Active Members	Count of Inactive / Retired Members
Maine Public Employees Retirement System	6/30/18	6.75%	17,236	14,569	2,666	84.5%	51,522	55,701
Maryland State Employees' Combined System	6/30/18	7.45%	25,530	17,453	8,077	68.4%	81,208	104,985
Maryland Teachers	6/30/18	7.45%	42,916	31,480	11,436	73.4%	106,846	102,389
Massachusetts State Board of Retirement System	6/30/18							
Massachusetts Teachers' Retirement System	6/30/18	7.35%	52,503	28,792	23,711	54.8%	93,119	66,078
Michigan Municipal Employees' Retirement System	12/31/18							
Michigan Public School Employee's Retirement System	9/30/18	7.05%	81,044	50,343	30,701	62.1%	207,732	235,216
Michigan State Employees Retirement System	9/30/18	7.00%	18,445	12,398	6,047	67.2%	9,473	63,482
Minnesota Public Employees Retirement Association	6/30/18	7.50%	27,101	21,553	5,548	79.5%	153,059	162,838
Minnesota State Retirement System	6/30/18	7.50%	14,679	13,293	1,386	90.6%	51,223	57,930
Minnesota Teachers Retirement Association	6/30/18	7.50%	28,643	22,362	6,281	78.1%	82,495	115,415
Mississippi Public Employees' Retirement System	6/30/18	7.75%	44,396	27,763	16,633	62.5%	150,687	174,314
Missouri Public School Retirement System	6/30/18	7.50%	46,702	39,260	7,442	84.1%	78,700	69,992
Missouri State Employees' Plan	6/30/18	7.25%	13,613	8,035	5,578	59.0%	47,806	64,593
Nebraska Public Employees Retirement Systems School Retirement System	6/30/18							
Nevada State Public Employees' Retirement System	6/30/18	7.50%	55,069	41,432	13,638	75.2%	107,506	83,715
New Hampshire Retirement System	6/30/18	7.25%	13,652	8,837	4,815	64.7%	48,121	39,432
New Jersey Police and Firemen's Retirement System	6/30/18	6.51%	46,798	27,099	19,699	57.9%	41,517	43,794
New Jersey Public Employees' Retirement System	6/30/18	5.66%	72,866	29,472	43,394	40.4%	254,780	175,493
New Jersey Teachers' Pension and Annuity Fund	6/30/18	4.86%	86,797	22,991	63,806	26.5%	155,496	104,922
New Mexico Educational Retirement Board	6/30/18	5.69%	24,862	12,970	11,891	52.2%	60,358	96,431
New Mexico Public Employees Retirement Association	6/30/18	7.25%	21,383	15,210	6,172	71.1%	48,862	54,581
New York City Employees' Retirement System	6/30/18	7.00%	83,300	65,662	17,638	78.8%	195,847	185,970
New York City Police Pension Fund	6/30/18	7.00%	54,156	42,799	11,357	79.0%	35,961	51,384
New York City Teachers' Retirement System	6/30/18	7.00%	73,244	54,532	18,711	74.5%	118,201	98,486
New York State and Local Employees Retirement System	3/31/18	7.00%	183,401	180,173	3,227	98.2%	500,945	550,514
New York State and Local Police & Fire	3/31/18	7.00%	32,914	31,904	1,011	96.9%	32,470	38,697
New York State Teachers' Retirement System	6/30/18	7.25%	118,107	119,916	(1,808)	101.5%	255,930	174,945
North Carolina Local Governmental Employees' Retirement System	6/30/18	7.00%	28,355	25,982	2,372	91.6%	128,779	137,009
North Carolina Teachers and State Employees Retirement System	6/30/18	7.00%	80,383	70,427	9,956	87.6%	311,234	375,095
Ohio Police and Fire Pension Fund	12/31/18	8.00%	22,104	13,941	8,163	63.1%	28,408	29,707
Ohio Public Employees Retirement System	12/31/17	7.50%	102,639	87,087	15,552	84.8%	336,112	773,484
Ohio Schools Employees' Retirement System	6/30/18	7.50%	19,998	14,271	5,727	71.4%	158,343	86,423
Ohio State Teachers Retirement System	6/30/18	7.45%	96,904	74,916	21,988	77.3%	170,327	313,913
Oklahoma Teachers' Retirement System	6/30/18	7.50%	22,196	16,145	6,051	72.7%	88,534	76,039

Appendix

SPONSOR-REPORTED DATA (CONTINUED)

Plan Name	Measurement Date	GASB 68 Discount Rate	Total Pension Liability (\$ millions)	Fiduciary Net Position (\$ millions)	Net Pension Liability (\$ millions)	Funded Ratio	Count of Active Members	Count of Inactive / Retired Members
Orange County Employees Retirement System	12/31/18	7.00%	20,679	14,482	6,197	70.0%	21,929	23,700
Oregon Public Employees Retirement System	6/30/18	7.20%	84,476	69,328	15,149	82.1%	173,002	190,685
Pennsylvania Public School Employees' Retirement System	6/30/18	7.25%	104,369	56,364	48,005	54.0%	256,362	258,405
Pennsylvania State Employees' Retirement System	12/31/17	7.25%	46,697	29,405	17,292	63.0%	102,978	136,288
Puerto Rico Government Employees Retirement System	6/30/15	3.80%	32,669	(579)	33,248	-1.8%	119,790	126,742
Puerto Rico Teachers Retirement System	6/30/15	3.82%	16,308	1,313	14,995	8.1%	37,700	42,188
Rhode Island Employees Retirement System	6/30/18	7.00%	11,700	6,272	5,428	53.6%	24,462	29,174
Sacramento County Employees' Retirement System	6/30/18	7.00%	11,213	9,252	1,961	82.5%	12,677	15,392
San Bernardino County Employees' Retirement Association	6/30/18	7.25%	12,601	10,067	2,534	79.9%	21,465	18,927
San Diego City Employees' Retirement System	6/30/18	6.50%	10,058	7,445	2,614	74.0%	5,967	12,945
San Diego County Employees Retirement Association	6/30/18	7.25%	15,672	12,274	3,398	78.3%	17,869	24,956
San Francisco City and County Employees' Retirement System	6/30/18	7.50%	28,841	24,558	4,283	85.2%	33,946	39,148
South Carolina Retirement System	6/30/18	7.25%	48,822	26,415	22,407	54.1%	193,985	316,333
South Dakota Retirement System	6/30/18	6.50%	12,233	12,236	(2)	100.0%	41,180	46,926
Tennessee Consolidated Retirement System	6/30/18	7.25%	23,604	24,033	(429)	101.8%	59,026	83,526
Texas County & District Retirement System	12/31/18							
Texas Employees' Retirement System	8/31/18	5.69%	47,944	27,753	20,191	57.9%	141,535	127,203
Texas Municipal Retirement System	12/31/18							
Texas Teacher Retirement System	8/31/18	6.91%	209,611	154,569	55,042	73.7%	872,999	525,458
University of California Retirement Plan	6/30/18	7.25%	76,546	66,774	9,773	87.2%	129,879	168,541
Utah Retirement Systems	12/31/18	6.95%	36,708	31,260	5,449	85.2%	97,423	123,718
Virginia Employees Retirement System	6/30/18	7.00%	93,123	73,755	19,369	79.2%	331,959	251,509
Washington Public Employees' Retirement System	6/30/18	7.40%	52,536	46,363	6,173	88.2%	157,876	139,093
Washington State Law Enforcement Officer's and Fire Fighters' Plan 1 and 2	6/30/18	7.40%	15,063	18,908	(3,846)	125.5%	18,155	13,837
Washington State Teachers' Retirement System	6/30/18	7.40%	23,145	19,774	3,371	85.4%	76,132	62,462
West Virginia Teachers' Retirement System	6/30/18	7.50%	10,843	7,721	3,122	71.2%	33,891	38,706
Wisconsin Retirement System	12/31/17	7.20%	101,427	104,397	(2,969)	102.9%	257,413	375,389

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 rates of return on current plan assets. To develop the expected rates 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 June 30, 2019, capital market assumptions to calculate the 50th percentile 30-year real rate of return, and then combined 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 the sensitivity information disclosed in published Comprehensive Annual Financial Reports. Where this information was not available, we made adjustments based on available information.



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