2020 Public Pension Funding Study

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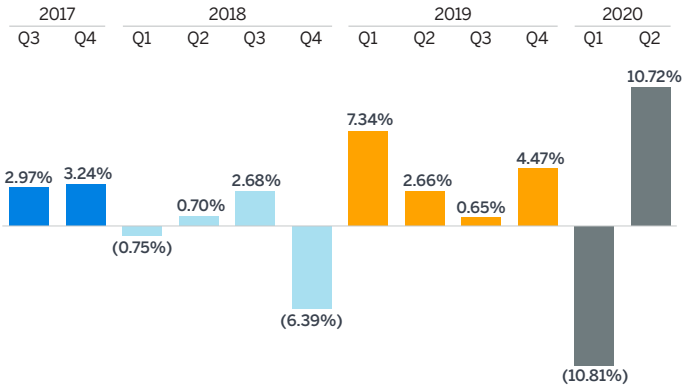
Milliman

The Milliman Public Pension Funding Study annually explores the funded status of the 100 largest U.S. public pension plans. We report the plans' own assessments of how well funded individual plans are. We also recalibrate the liability for each plan based on our independent assessment of the expected real return on each plan's investments.

This 2020 report is based on information that was reported by the plans at their most recent fiscal year-ends—June 30, 2019 is the measurement date for three-quarters of the plans in our 2020 study. The 12 months since that date were marked by extreme market volatility amid the onset of the COVID-19 pandemic. The market conditions have taken a toll around the world, and U.S. public pension plans are no exception (see sidebar on page 2). We estimate that aggregate plan assets rose just slightly from $3.82 trillion as of the most recent fiscal year-ends to $3.84 trillion as of June 30, 2020.

FIGURE 1: ESTIMATED QUARTERLY RETURN ON AGGREGATE PLAN ASSETS



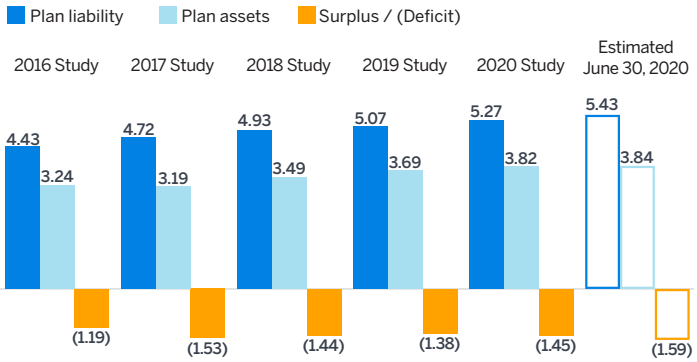
The aggregate Total Pension Liability reported at the last fiscal year-ends was $5.27 trillion, growing from $5.07 trillion as of the prior fiscal year-ends. We estimate that the Total Pension Liability has further increased to $5.43 trillion as of June 30, 2020. The aggregate plan-reported underfunding as of the last fiscal year-ends stood at $1.45 trillion, which is higher than the $1.38 trillion of underfunding a year earlier, and has fallen back to levels reported two years ago.

Highlights

- As of June 30, 2020, the aggregate funded ratio is estimated to be 70.7%, down from 73.4% a year earlier
- Aggregate liabilities have climbed to $5.27 trillion, while asset growth supporting those liabilities has struggled to keep pace
- The COVID-19 pandemic has brought short-term economic uncertainty
- Market expectations for future investment returns have continued their long-term downward trend

With the market volatility observed since the onset of the pandemic, we estimate that the underfunding has increased further to $1.59 trillion as of June 30, 2020. To the extent that plans lowered their interest rate assumptions (often referred to as the investment return assumption) after the fiscal year-ends reflected in this report, our estimated figures as of June 30, 2020 likely understate the aggregate liability and the aggregate underfunding.

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



Impact of COVID-19 Pandemic

Since early 2020, the COVID-19 pandemic has been affecting public pension plans across the United States in a number of ways. Most visible is the market volatility, which has impacted plan asset levels. In addition, we expect that furloughs and shutdowns have impacted pay levels and employee contribution amounts. Constrained tax revenues and shifting budget priorities may have caused some employers to pull back on their contributions as well. Because the information we collected for this 2020 study is from fiscal years that ended December 31, 2019 or earlier, we do not yet have insight into these forces. More concrete evidence of the pandemic's impact will be available once next year's financial statements are published.

FIGURE 3: AGGREGATE PLAN-REPORTED FUNDED RATIO

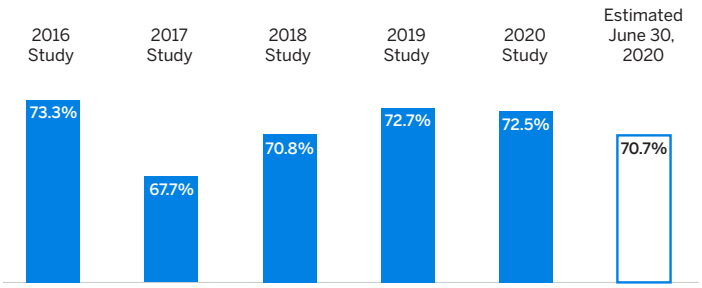
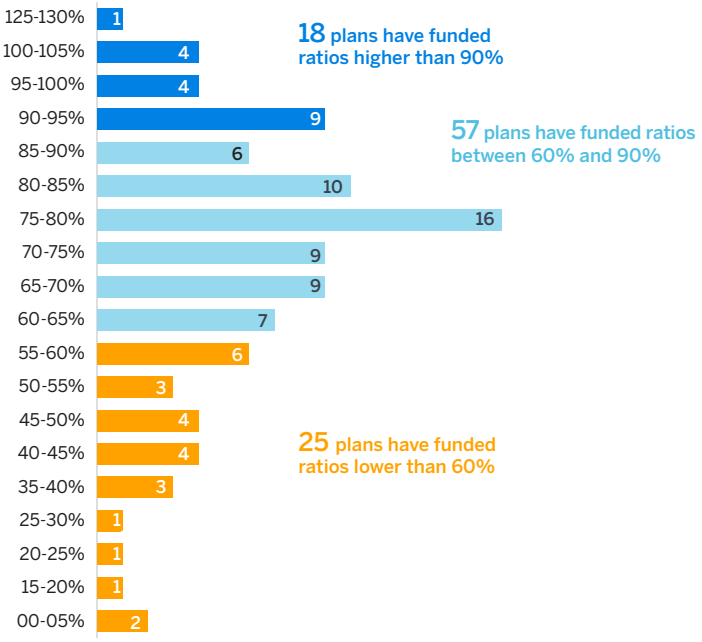


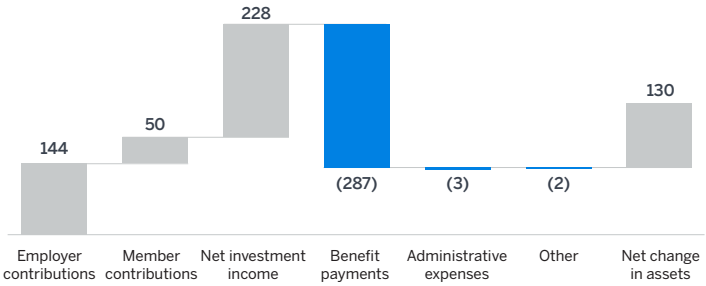
FIGURE 4: PLAN-REPORTED FUNDED RATIO AT MOST RECENT FISCAL YEAR-ENDS



Overall, the 100 plans reported benefit payouts totaling $287 billion in their most recent fiscal years. Reported contributions totaled $194 billion, with $144 and $50 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 CHANGE IN ASSETS, MOST RECENT FISCAL YEAR ($ BILLIONS)



We project that in the period July 2020 to June 2021 the plans will receive combined contributions from employers and members of $216 billion and pay out a total of $316 billion in benefits and administrative expenses, for a net cash outflow of $100 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)

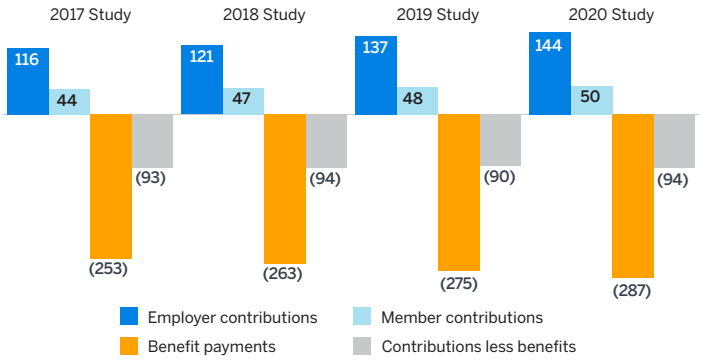
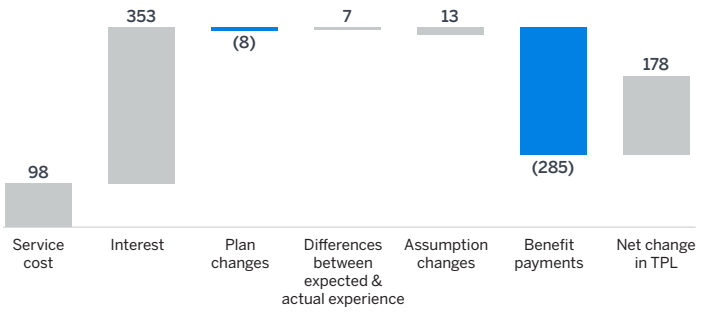


Figure 7 summarizes the change in Total Pension Liability reported by the plans in their most recent fiscal years. In general, a plan's liability is increased by service cost and interest, and reduced by benefit payments. Changes in assumptions or plan provisions can increase or decrease a plan's liability, depending on the nature of the change.

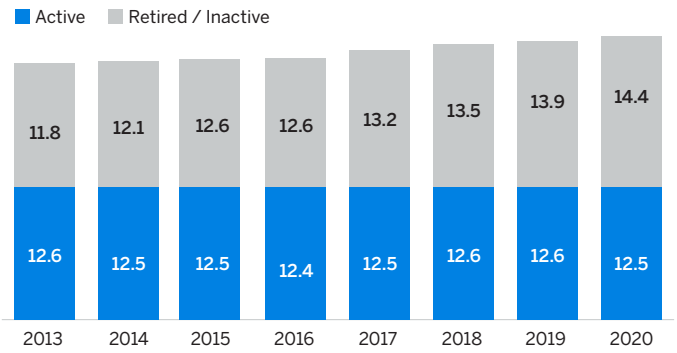
FIGURE 7: REPORTED CHANGE IN TOTAL PENSION LIABILITY, MOST RECENT FISCAL YEAR ($ BILLIONS)



Liabilities

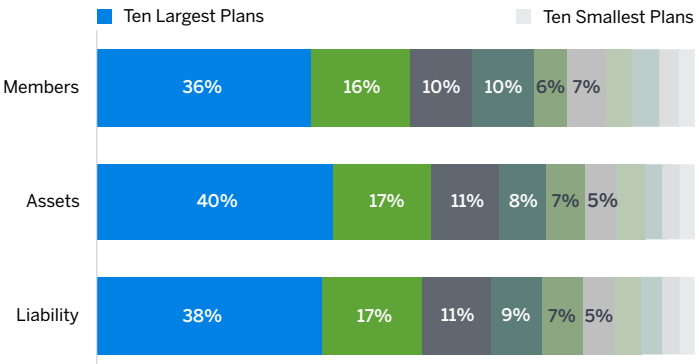
The plans reported an aggregate Total Pension Liability of $5.27 trillion for the 26.9 million members covered by the plans in the study. The plans continue the trend of growing more mature. Figure 8 illustrates that the number of active members covered by these plans has been essentially flat for the past eight 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 Total Pension Liability from $10 billion to $495 billion. Collectively, the 10 largest plans (ranked by liability) cover 36% of the total members, hold 40% of the aggregate assets, and have 38% of the aggregate liability.

FIGURE 9: COMPARISON OF PLANS RANKED BY TOTAL PENSION LIABILITY



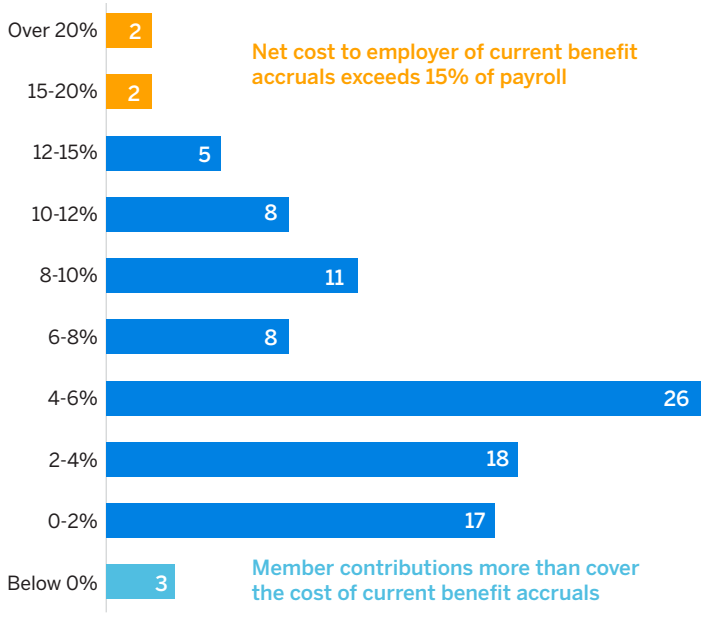
Cost of benefits being earned each year

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 compare the relative value of pension benefits the 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. And we then divided by each plan's total payroll so that we could adjust for the relative size of the plan. The resulting metric is the net employer-paid service cost as a percentage of payroll and represents the relative richness of the pension benefits that are being paid for by the plans.

Overall, 83% of the plans provide an estimated employer-paid pension benefit in the range of 0% to 10% of payroll; the most common level of employer-paid pension benefits is 4% to 6% (26 plans). There are three plans 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 four plans with a net cost of 15% of payroll or more, indicating relatively costly benefits.

FIGURE 10: EMPLOYER-PAID NET SERVICE COST AS PERCENTAGE OF PAYROLL

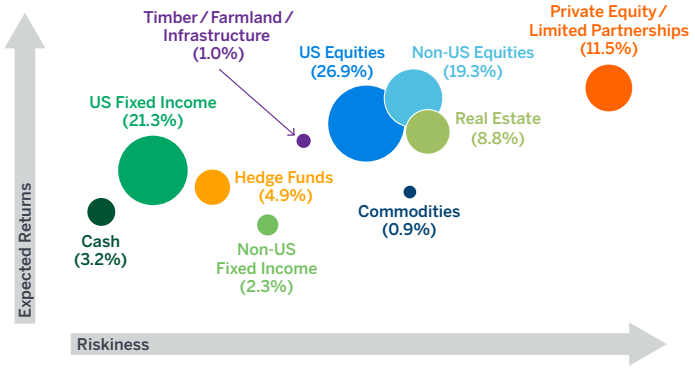


There is very little correlation between the richness of the benefits provided and the funded status of the plan; that is, plans with generous benefits are neither better funded nor more poorly funded than plans with modest benefits.

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.

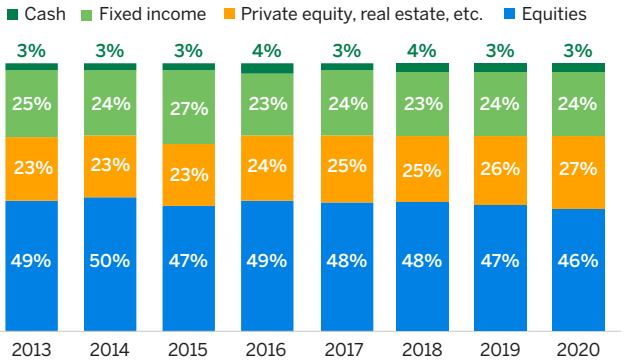
FIGURE 11: AGGREGATE ASSET ALLOCATION, 2020



Note: The expected return and riskiness metrics are based on Milliman's capital market assumptions as of June 30, 2020.

Over the past eight years there has been very little change in the overall asset allocation of these plans (see Figure 12), with just a modest, gradual shift from equities to alternative investments.

FIGURE 12: AGGREGATE ASSET ALLOCATIONS OVER TIME

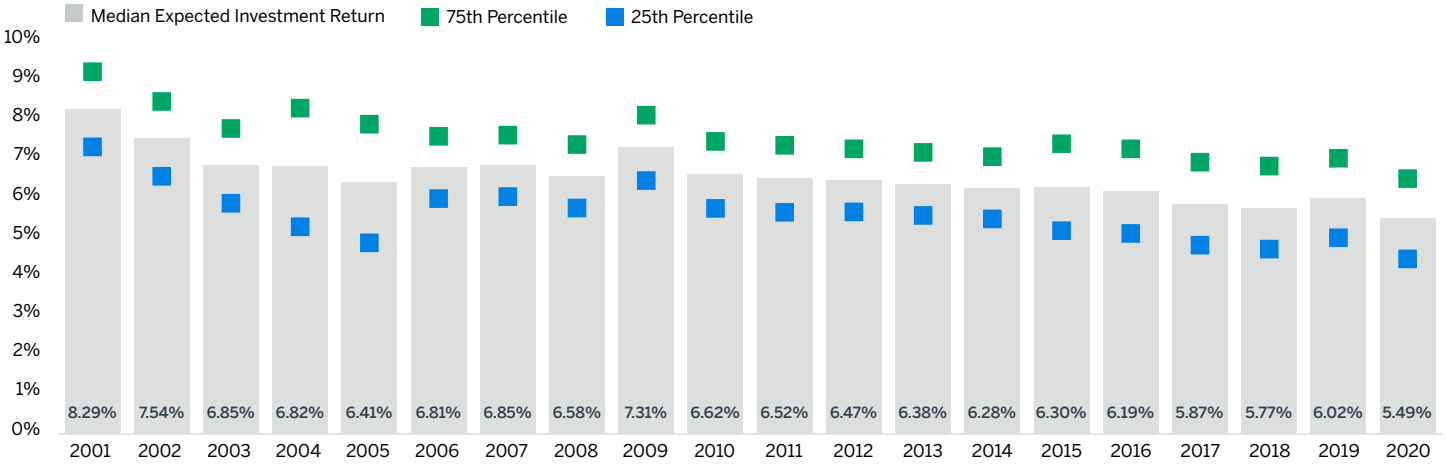


We found little correlation between plans' asset allocations or reported interest rate assumptions and how well funded or poorly funded (as measured by their funded ratios) the plans are.

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 2001. Over this period, the median expected investment return for the illustrated hypothetical asset allocation fell from 8.29% in 2001 to a period low of 5.49% in 2020. Where interest rate assumptions of 8.00% were once the norm, 90 of the plans in the study now have assumptions of 7.50% or below (compared to 85 in the 2019 study). Twenty-eight of the plans lowered their assumptions from the 2019 study to the 2020 study; nearly all plans (96 of the 100) 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 liabilities. For this study, we use the term "interest rate" to indicate the assumption the plan has chosen to determine contribution amounts, and we use the term "discount rate" 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 range from 3.58% to 8.00% (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 (using the GASB-mandated testing methodology) to result in a plan running out of plan assets at some future date. Such a downward adjustment currently occurs for eight of the plans in the study.

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.

FIGURE 14: PLAN-REPORTED FUNDING INTEREST RATE

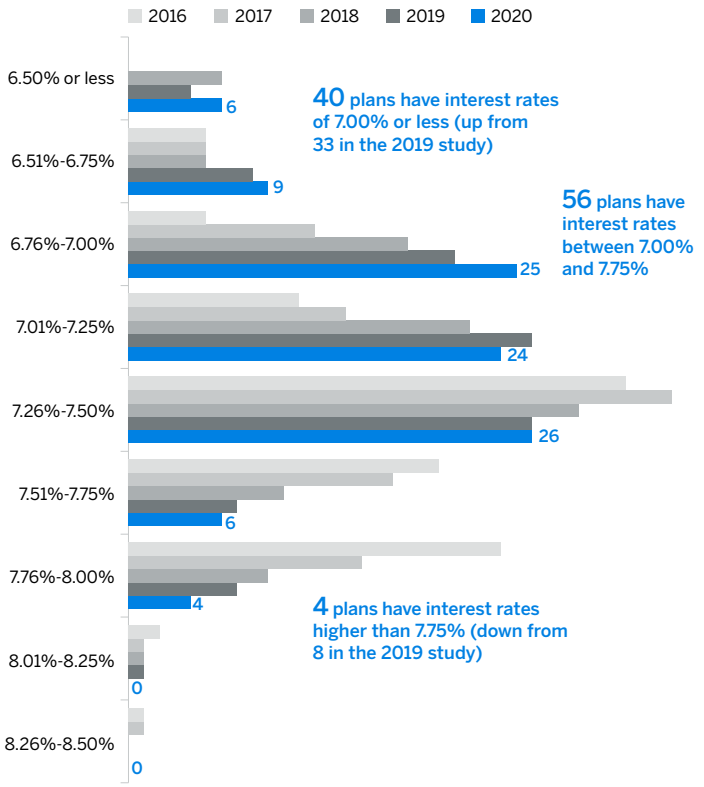
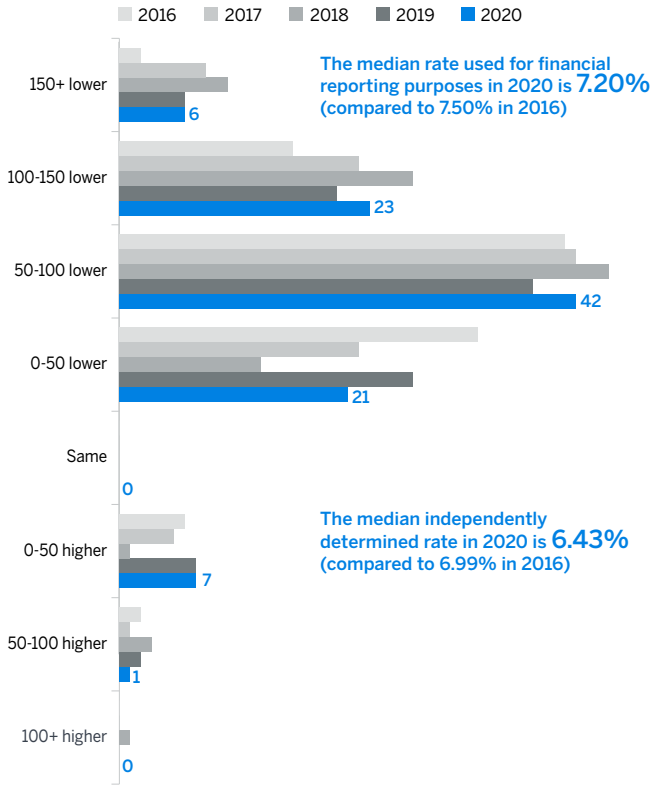


FIGURE 15: GAP BETWEEN INDEPENDENTLY DETERMINED AND PLAN-REPORTED RATES



Recalibrating the Total Pension Liability

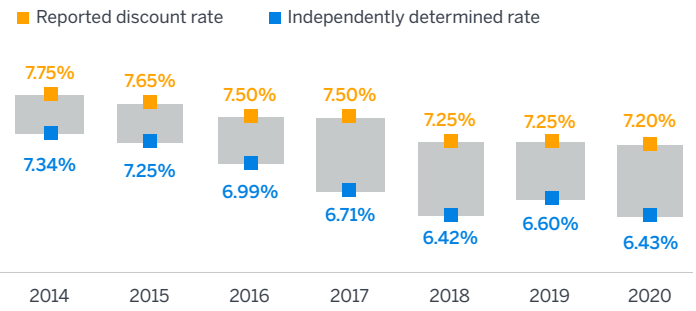
Using each plan's specific asset allocation, we determined the 50th percentile 30-year geometric average annual real rate of return based on Milliman's June 30, 2020, capital market assumptions. We then applied each plan's reported inflation assumption to arrive at our independently determined investment return assumption for that plan. The median of the resulting independently determined investment return assumptions is 6.43%, which is 77 basis points lower than the 7.20% median discount rate used by the plans.

Plans periodically reassess their interest rate assumptions to ensure that they reflect updated market expectations about future investment returns. The frequency of reassessment varies by plan, with some plans reassessing annually and others using as long as a five-year or six-year review cycle. As Figure 13 on page 4 illustrates, market expectations have been falling for the past two decades. Plans 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 plans' interest rates and our independently recalibrated interest rates. The narrowing of this gap in last year's study was short-lived, as the gap has crept back to the 2018 levels (shown in Figure 16 below). Twenty-eight of the plans in the study have followed the market trend and lowered their interest rate assumptions since the previous study.

Financial Reporting vs. Funding

The Governmental Accounting Standards Board (GASB) sets the accounting standards for public entities. Statements No. 67 and 68 specify the financial reporting requirements for U.S. public pension plans and their participating employers. 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), which may differ from the actuarial cost method the plan uses to determine contribution amounts. Under certain circumstances, generally when the plan is receiving a low level of funding, the discount rate used to calculate the Total Pension Liability may be lower than the investment return assumption used for funding purposes. Consequently, for some plans, the liability measurement used in determining amounts that should be contributed to fund the plan differs from the Total Pension Liability. Additionally, each plan is required to disclose how sensitive its Total Pension Liability is to changes in the discount rate.

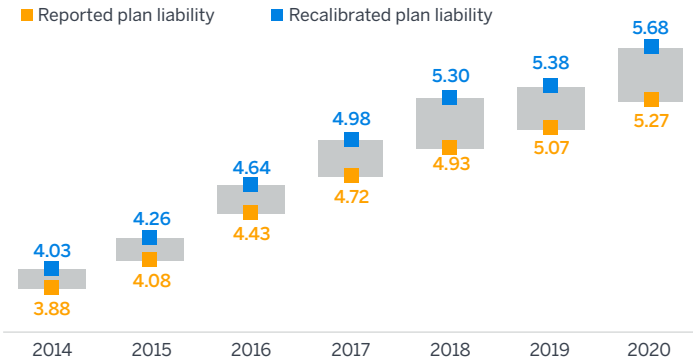
FIGURE 16: REPORTED VS. INDEPENDENTLY DETERMINED RATES



The 2020 gap between the 7.20% median discount rate used for financial reporting purposes and the 6.43% median independently determined rate indicates it is likely that plans 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 $5.68 trillion, compared with a plan-reported Total Pension Liability of $5.27 trillion. Similar to the gap movement in the investment return assumption analysis above, the difference in the recalibrated versus plan-reported liability has widened to 2018 study levels.

FIGURE 17: AGGREGATE RECALIBRATION RESULTS ($ TRILLIONS)



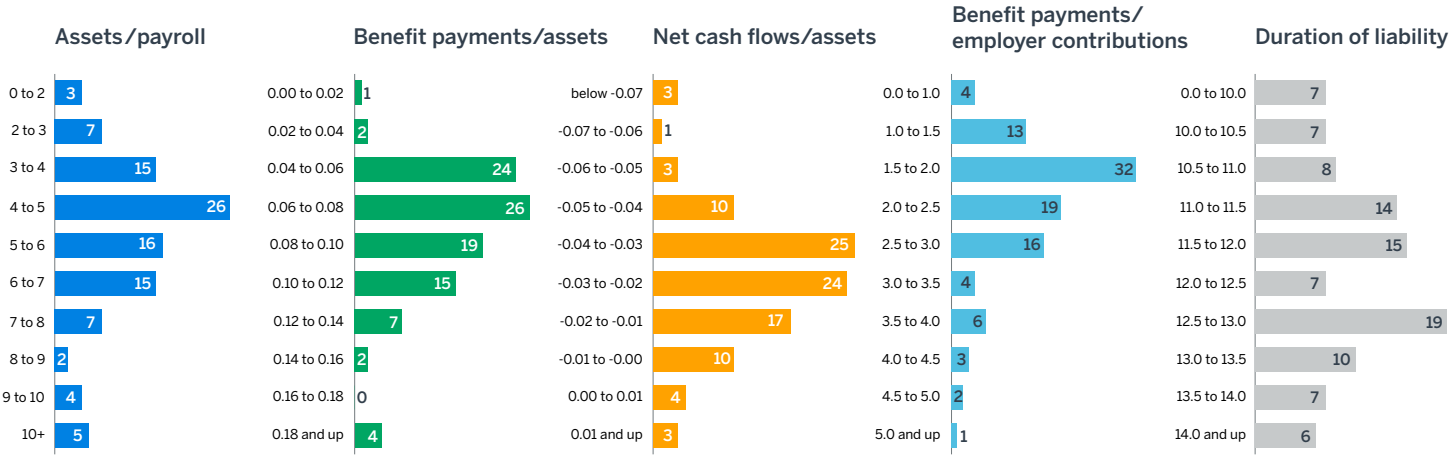
ASOP 51 and plan maturity measures

Actuarial Standards of Practice (ASOP) 51 directs pension actuaries to provide plan sponsors with information regarding the risks faced by pension plans. In particular, pension actuaries 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.

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 signficiant 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 rates 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.

FIGURE 18: MATURITY METRICS



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 a 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 a change in the discount rate of 100 basis points. 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 discount 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 plans, which reflect measurement dates ranging from June 30, 2017, to December 31, 2019; 91 are from June 30, 2019 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 plan-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.

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	9/30/19	7.70%	18,354	12,568	5,785	68.5%	86,565	83,834
Alabama Teachers' Retirement System	9/30/19	7.70%	36,676	25,619	11,057	69.9%	137,161	113,744
Alaska Public Employees' Retirement System	6/30/19	7.38%	14,964	9,489	5,474	63.4%	12,316	43,420
Arizona Public Safety Personnel Retirement System	6/30/19							
Arizona State Retirement System	6/30/19	7.50%	54,376	39,825	14,551	73.2%	211,945	396,205
Arkansas Public Employees Retirement System	6/30/19	7.15%	11,246	8,833	2,413	78.5%	45,963	53,405
Arkansas Teacher's Retirement System	6/30/19	7.50%	21,913	17,742	4,171	81.0%	72,164	61,710
California Public Employees' Retirement System	6/30/19							
California State Teachers' Retirement System	6/30/19	7.10%	329,178	238,862	90,316	72.6%	451,429	513,232
Chicago Municipal Employees' Annuity and Benefit Fund	12/31/19	7.00%	17,260	4,081	13,180	23.6%	32,162	27,645
Chicago Public Schools	6/30/19	6.72%	25,166	11,039	14,127	43.9%	29,295	38,243
Colorado Public Employees' Retirement Association	12/31/19	7.25%	77,903	51,778	26,125	66.5%	213,294	155,112
Connecticut State Employees Retirement System	6/30/18	6.90%	34,214	12,528	21,687	36.6%	49,153	51,722
Connecticut State Teachers' Retirement System	6/30/18	8.00%	31,111	17,947	13,164	57.7%	50,594	48,931
Cook County Employees' Annuity and Benefit Fund	12/31/19	4.14%	25,072	11,491	13,581	45.8%	19,551	34,565
Delaware State Employees' Pension Plan	6/30/19	7.00%	10,674	9,117	1,557	85.4%	37,068	31,994
Florida State Retirement System	6/30/19	6.90%	198,012	163,574	34,439	82.6%	500,111	560,021
Georgia Employees' Retirement System	6/30/19	7.30%	17,744	13,617	4,127	76.7%	59,207	112,849
Georgia Teachers' Retirement System	6/30/19	7.25%	100,292	78,789	21,503	78.6%	226,387	245,606
Hawaii State Employees' Retirement System	6/30/19	7.00%	29,917	16,598	13,319	55.5%	66,271	75,637
Idaho Public Employee Retirement System	6/30/19	7.05%	18,381	17,239	1,141	93.8%	72,502	61,656
Illinois Municipal Retirement Fund	12/31/19							
Illinois State Employees' Retirement System	6/30/19	6.75%	51,886	18,492	33,394	35.6%	62,026	100,295
Illinois State Teachers' Retirement System	6/30/19	7.00%	134,371	53,263	81,108	39.6%	163,027	260,477
Illinois State Universities Retirement System	6/30/19	6.59%	48,437	19,717	28,720	40.7%	62,589	150,886
Indiana Public Employees' Retirement Fund	6/30/19	6.75%	16,576	13,271	3,305	80.1%	129,099	122,994
Indiana State Teachers' Retirement Fund	6/30/19	6.75%	20,370	9,883	10,486	48.5%	68,805	68,699
Iowa Public Employees' Retirement System	6/30/19	7.00%	39,801	34,011	5,791	85.5%	172,304	195,988
Kansas Public Employee Retirement System	6/30/19	7.75%	29,549	20,648	8,901	69.9%	146,104	157,132
Kentucky County Employees Retirement System	6/30/19	6.25%	19,369	9,574	9,795	49.4%	90,980	127,112
Kentucky Employees Retirement Systems	6/30/19	5.32%	17,584	2,915	14,669	16.6%	37,401	85,669
Kentucky Teachers' Retirement System	6/30/19	7.50%	34,667	20,372	14,295	58.8%	72,647	64,605
Los Angeles City Employees' Retirement System	6/30/19	7.25%	20,793	14,816	5,978	71.3%	26,632	22,473
Los Angeles City Water and Power Employees' Retirement Plan	6/30/19	7.00%	13,812	12,987	825	94.0%	10,362	10,978
Los Angeles County Employees Retirement Association	6/30/19	7.38%	70,309	58,295	12,014	82.9%	99,196	75,120
Los Angeles Fire and Police Pension Plan	6/30/19	7.25%	23,001	21,262	1,738	92.4%	13,535	13,620
Louisiana State Employees' Retirement System	6/30/19	7.60%	19,528	12,283	7,245	62.9%	39,533	109,647
Louisiana Teachers' Retirement System	6/30/19	7.55%	31,574	21,649	9,925	68.6%	85,998	113,193

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	6/30/19	6.75%	17,923	15,113	2,810	84.3%	51,859	57,128
Maryland State Employees' Combined System	6/30/19	7.40%	26,620	18,095	8,524	68.0%	81,217	106,073
Maryland Teachers	6/30/19	7.40%	43,489	32,803	10,686	75.4%	107,782	103,625
Massachusetts State Board of Retirement System	6/30/19							
Massachusetts Teachers' Retirement System	6/30/19	7.25%	54,751	29,537	25,214	53.9%	94,103	67,110
Michigan Municipal Employees' Retirement System	12/31/19	8.00%	33,295	33,981	(687)	102.1%	30,263	51,430
Michigan Public School Employee's Retirement System	9/30/19	6.80%	84,643	50,857	33,786	60.1%	177,681	237,216
Michigan State Employees Retirement System	9/30/19	6.70%	18,896	12,228	6,668	64.7%	8,107	63,430
Minnesota Public Employees Retirement Association	6/30/19	7.50%	27,970	22,441	5,529	80.2%	154,130	168,554
Minnesota State Retirement System	6/30/19	7.50%	15,179	13,772	1,407	90.7%	51,997	59,527
Minnesota Teachers Retirement Association	6/30/19	7.50%	29,250	22,876	6,374	78.2%	82,965	118,721
Mississippi Public Employees' Retirement System	6/30/19	7.75%	45,799	28,207	17,592	61.6%	150,651	181,861
Missouri Public School Retirement System	6/30/19	7.50%	47,974	40,594	7,380	84.6%	78,863	72,148
Missouri State Employees' Plan	6/30/19	7.10%	13,958	7,916	6,041	56.7%	46,864	66,569
Nebraska Public Employees Retirement Systems School Retirement System	6/30/19	7.50%	13,436	12,215	1,221	90.9%	42,713	31,606
Nevada State Public Employees' Retirement System	6/30/19	7.50%	57,920	44,284	13,636	76.5%	109,167	87,397
New Hampshire Retirement System	6/30/19	7.25%	13,982	9,171	4,812	65.6%	48,288	40,904
New Jersey Police and Firemen's Retirement System	6/30/19	6.85%	46,164	27,792	18,372	60.2%	42,295	44,609
New Jersey Public Employees' Retirement System	6/30/19	6.28%	71,004	29,848	41,156	42.0%	252,598	179,357
New Jersey Teachers' Pension and Annuity Fund	6/30/19	5.60%	84,216	22,697	61,519	27.0%	156,066	106,820
New Mexico Educational Retirement Board	6/30/19	7.25%	21,122	13,545	7,577	64.1%	60,197	101,336
New Mexico Public Employees Retirement Association	6/30/19	7.25%	21,989	15,508	6,482	70.5%	48,730	57,510
New York City Employees' Retirement System	6/30/19	7.00%	87,516	68,995	18,522	78.8%	196,879	196,005
New York City Police Pension Fund	6/30/19	7.00%	54,997	45,193	9,804	82.2%	36,165	52,123
New York City Teachers' Retirement System	6/30/19	7.00%	73,347	57,990	15,357	79.1%	120,826	100,049
New York State and Local Employees Retirement System	3/31/19	7.00%	189,803	182,718	7,085	96.3%	501,037	566,772
New York State and Local Police & Fire	3/31/19	7.00%	34,128	32,451	1,677	95.1%	32,573	39,589
New York State Teachers' Retirement System	6/30/19	7.10%	119,879	122,477	(2,598)	102.2%	254,740	177,980
North Carolina Local Governmental Employees' Retirement System	6/30/19	7.00%	29,867	27,136	2,731	90.9%	129,986	145,922
North Carolina Teachers and State Employees Retirement System	6/30/19	7.00%	83,326	72,959	10,367	87.6%	310,765	390,839
Ohio Police and Fire Pension Fund	12/31/19	8.00%	22,373	15,637	6,737	69.9%	29,087	29,792
Ohio Public Employees Retirement System	12/31/18	7.20%	108,684	81,408	27,276	74.9%	293,180	843,204
Ohio Schools Employees' Retirement System	6/30/19	7.50%	20,527	14,544	5,983	70.9%	159,363	86,488
Ohio State Teachers Retirement System	6/30/19	7.45%	97,841	75,727	22,114	77.4%	170,004	315,642
Oklahoma Teachers' Retirement System	6/30/19	7.50%	23,270	16,652	6,618	71.6%	90,014	77,605

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	12/31/19	7.00%	21,754	16,679	5,076	76.7%	22,257	24,940
Oregon Public Employees Retirement System	6/30/19	7.20%	87,501	70,204	17,298	80.2%	176,763	194,838
Pennsylvania Public School Employees' Retirement System	6/30/19	7.25%	105,516	58,734	46,783	55.7%	255,749	262,853
Pennsylvania State Employees' Retirement System	12/31/18	7.25%	47,768	26,937	20,831	56.4%	103,007	138,037
Puerto Rico Government Employees Retirement System	6/30/17	3.58%	30,092	(2,109)	32,201	-7.0%	118,657	122,757
Puerto Rico Teachers Retirement System	6/30/17	3.58%	16,418	517	15,901	3.1%	35,474	44,405
Rhode Island Employees Retirement System	6/30/19	7.00%	11,819	6,362	5,457	53.8%	24,275	29,704
Sacramento County Employees' Retirement System	6/30/19	7.00%	11,896	9,822	2,074	82.6%	12,678	15,983
San Bernardino County Employees' Retirement Association	6/30/19	7.25%	13,300	10,588	2,712	79.6%	21,823	19,970
San Diego City Employees' Retirement Association	6/30/19	6.50%	10,427	7,768	2,659	74.5%	5,757	13,110
San Diego County Employees Retirement Association	6/30/19	7.00%	16,906	12,863	4,043	76.1%	18,173	25,857
San Francisco City and County Employees' Retirement System	6/30/19	7.40%	30,555	26,079	4,477	85.3%	34,202	39,892
South Carolina Retirement System	6/30/19	7.25%	50,073	27,239	22,834	54.4%	196,184	325,211
South Dakota Retirement System	6/30/19	6.50%	12,462	12,473	(11)	100.1%	41,500	39,314
Tennessee Consolidated Retirement System	6/30/19	7.25%	24,449	25,039	(590)	102.4%	56,294	82,634
Texas County & District Retirement System	12/31/19							
Texas Employees' Retirement System	8/31/19	4.42%	57,336	27,351	29,985	47.7%	141,865	130,580
Texas Municipal Retirement System	12/31/19							
Texas Teacher Retirement System	8/31/19	7.25%	209,961	157,978	51,983	75.2%	884,540	543,194
University of California Retirement Plan	6/30/19	6.75%	88,405	70,279	18,126	79.5%	127,927	179,948
Utah Retirement Systems	12/31/19	6.95%	38,396	35,199	3,198	91.7%	97,672	128,918
Virginia Employees Retirement System	6/30/19	6.75%	99,300	76,872	22,428	77.4%	335,170	259,370
Washington Public Employees' Retirement System	6/30/19	7.40%	55,200	50,383	4,817	91.3%	161,048	142,583
Washington State Law Enforcement Officer's and Fire Fighters' Plan 1 and 2	6/30/19	7.40%	15,974	20,267	(4,293)	126.9%	18,564	14,383
Washington State Teachers' Retirement System	6/30/19	7.40%	24,901	21,822	3,078	87.6%	77,870	63,838
West Virginia Teachers' Retirement System	6/30/19	7.50%	10,874	7,899	2,975	72.6%	33,174	39,563
Wisconsin Retirement System	12/31/18	7.00%	100,295	96,737	3,558	96.5%	257,911	383,981

Study technical appendix: Methodology

EXPECTED INVESTMENT RETURN

For the purposes of this study, we recalibrated liabilities for included plans to reflect discounting at our independently calculated 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 June 30, 2020, capital market assumptions to calculate the 50th percentile 30-year real rate of return, and then combined the estimated real rate of return with 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).

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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