

U.S. Public Pension Plan Contribution Indices, 2006–2014

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June 2017

Executive Summary

In March 2016, the Society of Actuaries (SOA) introduced *contribution indices*, metrics that compare pension plan contributions to benchmarks that represent the contribution level needed to pay down unfunded liabilities or to satisfy a specific requirement.¹ This study explores various contribution indices for employer contributions among 160 state and large city public sector pension plans in the United States² over 2006–2014, using the assets and liabilities reported under Government Accounting Standards Board (GASB) guidelines.³ The analysis isolates employer contributions because state law typically defines employee contribution rates, whereas employer contributions are typically more flexible.⁴ Key observations include:

- For 130 plans with consistently viable data for this study over 2006–2014, total unfunded liabilities as reported under GASB guidelines increased about 150% from about \$400 billion in 2006 to approximately \$1 trillion in 2014, while liabilities increased 47%, from about \$2.5 trillion to roughly \$3.7 trillion.
- In every year studied, most of the 160 plans with enough data to complete analysis for the year received insufficient employer contributions to maintain their unfunded liabilities—they experienced negative amortization. In 2014, 72% of plans experienced negative amortization, up from 65% in 2006.
- Many plans with negative amortization contributed at least as much as their target contribution. However, at the peak in 2010, 76% of target contributions entailed negative amortization. By 2014, the percentage fell to 67%, roughly the same level as 2006.⁵
- For 2014, 3% of plans showed a funding surplus and 20% of plans received enough employer contributions to fund their shortfall within 30 years without it growing through negative amortization in the meantime.
- Employer contributions for the same 130 plans increased 76%, from about \$48 billion in 2006 to roughly \$85 billion in 2014. Employee contributions increased 30% during this period, from \$28 billion to \$37 billion, while payroll and prices both increased 17%.⁶

¹ Society of Actuaries, “Multiemployer Pension Plan Contribution Analysis,” March 2016, <http://www.soa.org/Research/Research-Projects/Pension/2016-multiemployer-pension-plan-analysis.aspx>.

² Large public sector pension plans are also known as “systems.” This report generally uses the term “plan.” The source of data for this study is PublicPlansData.org database as of February 3, 2017.

³ Most plans use discount rates based on a long-term expected return on assets, and prior to 2014, GASB allowed various actuarial cost methods for determining liabilities. The authors anticipate that post-2014 GASB reporting requirements and additional analysis will enable including market-based liabilities and contribution indices in future studies of contribution indices.

⁴ For this study, employer contributions include contributions from all sources other than employee contributions.

⁵ This study uses the term “target contribution” to represent the Actuarially Determined Contribution as defined by GASB Statements 67 and 68 for years starting with 2014, and the Annual Required Contribution as defined by GASB Statements 25 and 27 prior to 2014.

⁶ Prices are measured by the annual average Consumer Price Index for All Urban Consumers (CPI-U).

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Overview of Plans Studied

This study uses data from Public Plans Data (PPD) as of February 3, 2017.⁷ PPD includes 160 state and large city public pension plans in the United States that cover roughly 27 million participants, more than 10 million of whom are currently receiving benefits. States typically govern these plans, and employee contributions are common. State law typically defines employee contributions. Regulations, if any, for determining employer contributions vary significantly from state to state, and may vary from plan to plan within a state.

While funding regulations vary, they share a goal: to fund the plan so that assets are available to pay participants' benefits when they come due. In general, pension plan assets come from only two sources: contributions and investment returns. This study explores in isolation whether employer contributions were effective at paying down unfunded liabilities in any given year, without regard to the many other factors that also affect funded status.⁸

This analysis uses assets and liabilities reported to meet Government Accounting Standards Board (GASB) guidelines, primarily because the data are available. Prior to 2014, the reported GASB values reflect a variety of actuarial cost methods, asset methods, discount rates and other actuarial assumptions.⁹ Values are consistent across plans only in that they were chosen to represent the plan for financial reporting. For example, the discount rates used to compute liabilities in 2014 ranged from 4.29% to 8.5%; most discount rates fell between 7.5% and 8.0%, with the average discount rate at 7.6%.

Because of the variety of methods and assumptions in use, readers must exercise care when interpreting results. The authors anticipate that post-2014 GASB reporting requirements and additional analysis will enable determining contribution indices more consistently across plans, as well as including market-based liabilities and market-based contribution indices in future studies.

Neither the authors nor the SOA intends the use of reported values as commentary on their appropriateness for funding, financial reporting or any other purpose for these or other plans.

Funded Status

For purposes of this analysis, the PPD is sparsely populated for years prior to 2006 and after 2014. Therefore, this study is limited to the years 2006 through 2014. For 2014, aggregate liabilities for 156 plans of \$4.3 trillion were 73% funded, leaving an unfunded liability of \$1.2 trillion.

Figure 1 shows the progression of total liabilities for 130 plans that have consistently complete data for 2006–2014. While liabilities increased 47%, the funded portion increased 28% and unfunded liabilities grew about 150%. In 2006, liabilities of roughly \$2.5 trillion were 84% funded, with an unfunded liability of about \$400 billion. In 2014, liabilities had grown to approximately \$3.7 trillion, while the unfunded portion had grown to approximately \$1.0 trillion and the percent funded had fallen to 73%.

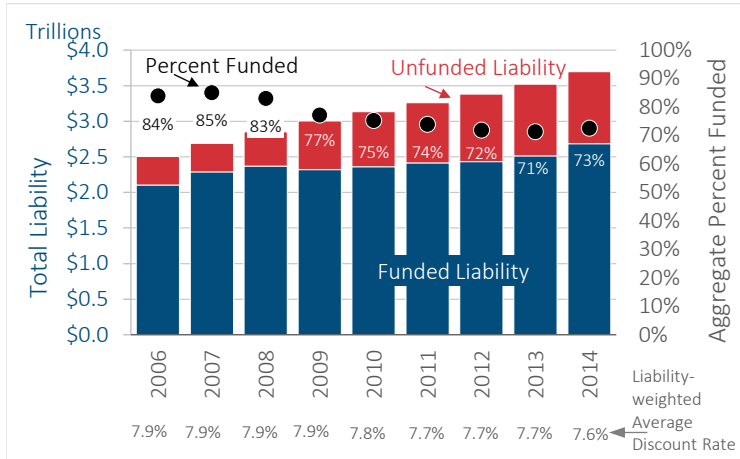
⁷ The Center for Retirement Research at Boston College produces the PPD in partnership with the Center for State & Local Government Excellence and the National Association of State Retirement Administrators; the Center states that it “accounts for 95 percent of state/local pension assets and members in the US.” Public Plans Data Website: <http://publicplansdata.org/public-plans-database/>.

⁸ Unfunded liabilities are net of the portion of liabilities that employee contributions are expected to fund.

⁹ Beginning with fiscal years beginning after June 15, 2014, all plans are required to use the same actuarial cost method to determine liabilities for financial disclosure. For earlier fiscal years, a number of actuarial cost methods were acceptable.

Note that because one plan’s surplus assets are not available to fulfill another plan’s unfunded liability, calculation of the aggregate unfunded liability excludes any surplus assets.

Figure 1
AGGREGATE LIABILITIES AND FUNDED STATUS (130 PLANS)



A pension plan’s funded status reflects the culmination of many historical and current factors, including plan sponsor approaches to plan and risk management, asset allocation, investment experience, actuarial methods and assumptions for computing plan liabilities, the method for determining contributions and the amount of actual contributions. The progression of aggregate funded status provides context within which to understand the topic of this study, contribution indices. Understanding how funded status reached its current state is a topic for another study.

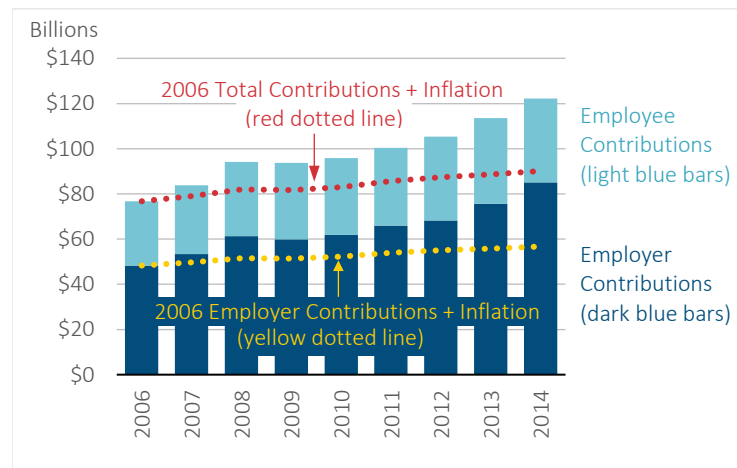
Aggregate Contributions

Figure 2 demonstrates that contributions for the same 130 plans included in Figure 1 increased significantly from 2006 to 2014.

Employer contributions increased 76%, from about \$48 billion in 2006 to roughly \$85 billion in 2014, and employee contributions increased 30%, from about \$28 billion in 2006 to approximately \$37 billion in 2014. Total contributions increased about 59% from 2006 to 2014.

During this period, aggregate payroll and prices both increased 17%.^{10,11}

Figure 2
AGGREGATE CONTRIBUTIONS (130 PLANS)



Even though total contributions increased 59% from 2006 to 2014, unfunded liabilities grew 150% as noted in the Funded Status section on page 2. The financial crisis of 2007–2008 likely explains some of the growth in unfunded liabilities from 2008 to 2009, and some of the subsequent growth if a plan uses asset-smoothing techniques. But it probably does not explain all of the growth.

As previously mentioned, many factors affect a plan’s funded status. The analysis that follows isolates whether employer contributions were effective at paying down unfunded liabilities in any given year, without regard to the

¹⁰ Employer contributions include contributions from all sources other than employee contributions.

¹¹ Prices are measured by the annual average Consumer Price Index for All Urban Consumers (CPI-U).

many other factors that also affect funded status.¹² Although in some cases state law defines employer contributions, in most cases they are more flexible. Therefore, this study focuses on employer contributions.

Benchmarks

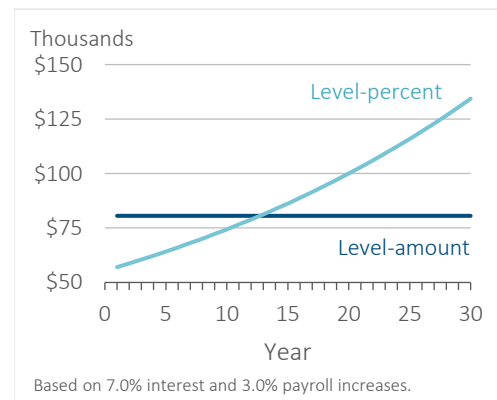
In general, a contribution index is the ratio of an actual contribution to a benchmark. Benchmarks typically represent a regulatory standard or a pace for funding an unfunded liability (for example, eliminate a funding shortfall over *X* number of years). A contribution index for a regulatory benchmark evaluates the degree to which a contribution met the regulatory standard for a given year. A contribution index for a funding-pace benchmark measures whether a contribution made progress at paying down that year’s unfunded liability, in isolation from any of the other influences that affect funded status.

This study considers the benchmarks described below. Neither the authors nor the SOA intends the use of these benchmarks as commentary on their appropriateness for funding these or any other pension plans, financial reporting or any other purpose.

- **Target Contribution.** The contribution determined according to the funding policy that is defined by a plan or its governance board. For years prior to 2014, the target contribution was generally represented in financial statements as the Annual Required Contribution (ARC), defined by GASB Statements 25 and 27. Starting with 2014, the target contribution is typically represented in financial statements as the Actuarially Defined Contribution (ADC), defined by GASB Statements 67 and 68.
- **Maintain Unfunded Liability.** The contribution level required to maintain the existing unfunded liability, that is, to hold it steady at its current amount. In technical terms, it is the cost of current benefit accruals (normal cost) valued at year-end plus interest on the unfunded liability.¹³
- **30-Year Funding Pace.** This study includes two benchmarks for funding over 30 years. Both benchmarks represent the amount needed to eliminate any unfunded liability in 30 years, but the pattern of payments over time differs. While both benchmarks are the normal cost plus a 30-year amortization payment on any unfunded liability, the difference is the way that amortization payments are determined.
 - Level-amount: amortization payments remain constant at the same dollar amount in each year.¹⁴
 - Level-percent: amortization payments remain constant as a percentage of payroll, but the dollar amount will increase each year as payroll increases. In general, the payment will be much lower at the start of the amortization period than at the end of it.

Figure 3 illustrates the general shape of level-percent and level-amount amortization payments over a 30-year amortization period for an initial unfunded liability of \$1 million. Different assumptions for

Figure 3
AMORTIZATION PAYMENT ILLUSTRATION



¹² Unfunded liabilities are net of the portion of liabilities that employee contributions are expected to fund.

¹³ If unfunded liability is negative, the benchmark is considered to be zero.

¹⁴ Level-amount is also known as level-dollar.

interest and payroll increases would produce different payments, and the slope of the level-percent line may be steeper or flatter.

Amortization over 30 years is common among target contributions. Effective through 2013, GASB Statements 25 and 27 prescribed a maximum amortization period of 30 years.¹⁵ Effective with 2014, GASB Statements 67 and 68 do not explicitly prescribe a maximum amortization period.¹⁶

- **15-Year Funding Pace.** This study also includes two benchmarks for funding over 15 years; they are the same as the 30-year funding-pace benchmarks, but with a shorter 15-year funding period.

In October 2014, the Conference of Consulting Actuaries' Public Plans Community published a white paper to "provide guidance to policymakers and other interested parties on the development of actuarially based funding policies for public pension plans." The paper provides "an ideal amortization period range of 15 to 20 years" for annual fluctuations in the unfunded liability because actual plan experience differed from actuarial assumptions (also known as actuarial gains and losses). Stated rationales for 15 to 20 years include avoiding (a) partial or full contribution holidays that are associated with shorter periods, (b) difficulties with demographic matching and intergenerational inequity that are associated with longer periods and (c) negative amortization, "which starts at around 16 to 18 years for many current combinations of assumptions."^{17, 18}

In February 2014, the Blue Ribbon Panel, an independent an independent panel commissioned by the SOA, recommended that public pension plans disclose for comparison purposes a standardized contribution based on 15-year level-percent amortization as well as other elements that are not relevant to this study.¹⁹

The authors emphasize that a contribution can fall short of a benchmark, but the plan can still find itself better funded than the benchmark would have anticipated because of other financially favorable factors that influence funded status. For example, a contribution may not meet the benchmark for maintaining the unfunded liability, but the unfunded liability may decrease because of better-than-expected investment returns. Similarly, a contribution may exceed a 15-year funding pace benchmark, yet the unfunded liability could grow because of other financially unfavorable influences.

Aggregate Benchmarks

Looking at aggregate contributions and benchmarks provides a high-level overview of whether contributions in isolation have generally increased or decreased unfunded liabilities in a given year. Figure 4 on the following page compares aggregate employer contributions with these six aggregate benchmarks over 2006–2014 for the same 130 plans included in Figure 1 and Figure 2. Several observations from Figure 4 stand out:

¹⁵ Governmental Accounting Standards Board Statement Nos. 25 and 27, November 1994.

¹⁶ Governmental Accounting Standards Board Statements No. 67, paragraph 51 and No. 68, paragraph 139, June 2012, reference Actuarial Standards of Practice.

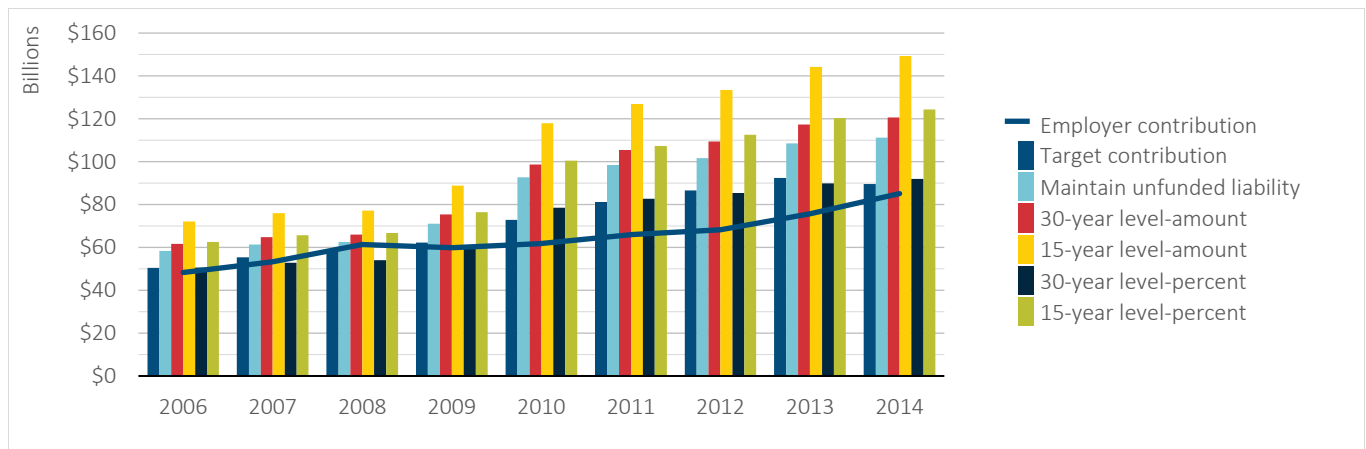
¹⁷ Conference of Consulting Actuaries' Public Plans Community, *Actuarial Funding Policies and Practices for Public Pension Plans*, October 2014, p. 22, https://www.cactuaries.org/Portals/0/pdf/CCA_PPC_White_Paper_on_Public_Pension_Funding_Policy.pdf.

¹⁸ Negative amortization occurs in a pension plan when payment on the unfunded liability fails to cover interest on the unfunded liability, thereby causing the unfunded liability to increase.

¹⁹ Blue Ribbon Panel, "Report of the Blue Ribbon Panel on Public Pension Plan Funding," February 2014, p. 24, <https://www.soa.org/blueribbonpanel/>.

- Since 2009, aggregate contributions fell short of every benchmark. Prior to 2009, contributions fell short of most benchmarks, except for 2007 and 2008, when contributions slightly exceeded the 30-year level-percent benchmark.
- Aggregate target contributions fell short of the benchmark for maintaining unfunded liabilities in every year except for 2008 when the aggregate employer contributions exceeded the target contributions by \$3 million.
- Shortfalls after 2009 are generally greater than shortfalls prior to 2009.

Figure 4
 AGGREGATE EMPLOYER CONTRIBUTIONS AND BENCHMARKS (130 PLANS)



When aggregate employer contributions fall short of the aggregate benchmark for maintaining the unfunded liability, it means that as a group, these plans did not receive enough employer contributions to cover the cost of current-year benefit accruals and interest on the aggregate unfunded liability. Consequently, one would expect the aggregate unfunded liability to increase over the year, unless other financially favorable circumstances cause it to decrease. The most likely examples of financially favorable circumstances would be better-than-assumed investment returns, lower-than-expected salary increases or changes in the plan population that were financially more favorable than had been assumed.

Contribution Indices

The aggregate view provides an overview of the system as a whole. Contribution indices enable analyzing and comparing individual plans. A contribution index is the ratio of the contribution made for a given year to a benchmark based on the plan’s funded status for the same year. A contribution index of less than 100% means the contribution was less than the benchmark, and a contribution index of more than 100% means the contribution exceeded the benchmark.

This study’s contribution analysis for each year includes all plans for which the PPD shows sufficient data to complete the calculation. Therefore, although the PPD involves 160 plans, the number of plans included in the analysis varies each year.

Figure 5 shows the number of plans included in each year’s analysis.

Figure 6 the shows the percentage of plans that met each benchmark each year. While each plan bears the same weight in the distribution, the authors’ analysis shows that weighting plans by liabilities produces very similar distributions, as does weighting by the number of plan participants.

Figure 5
NUMBER OF PLANS INCLUDED

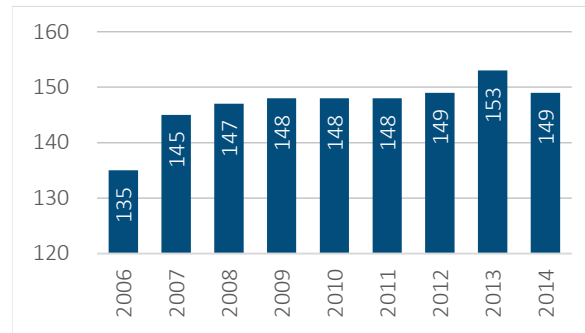
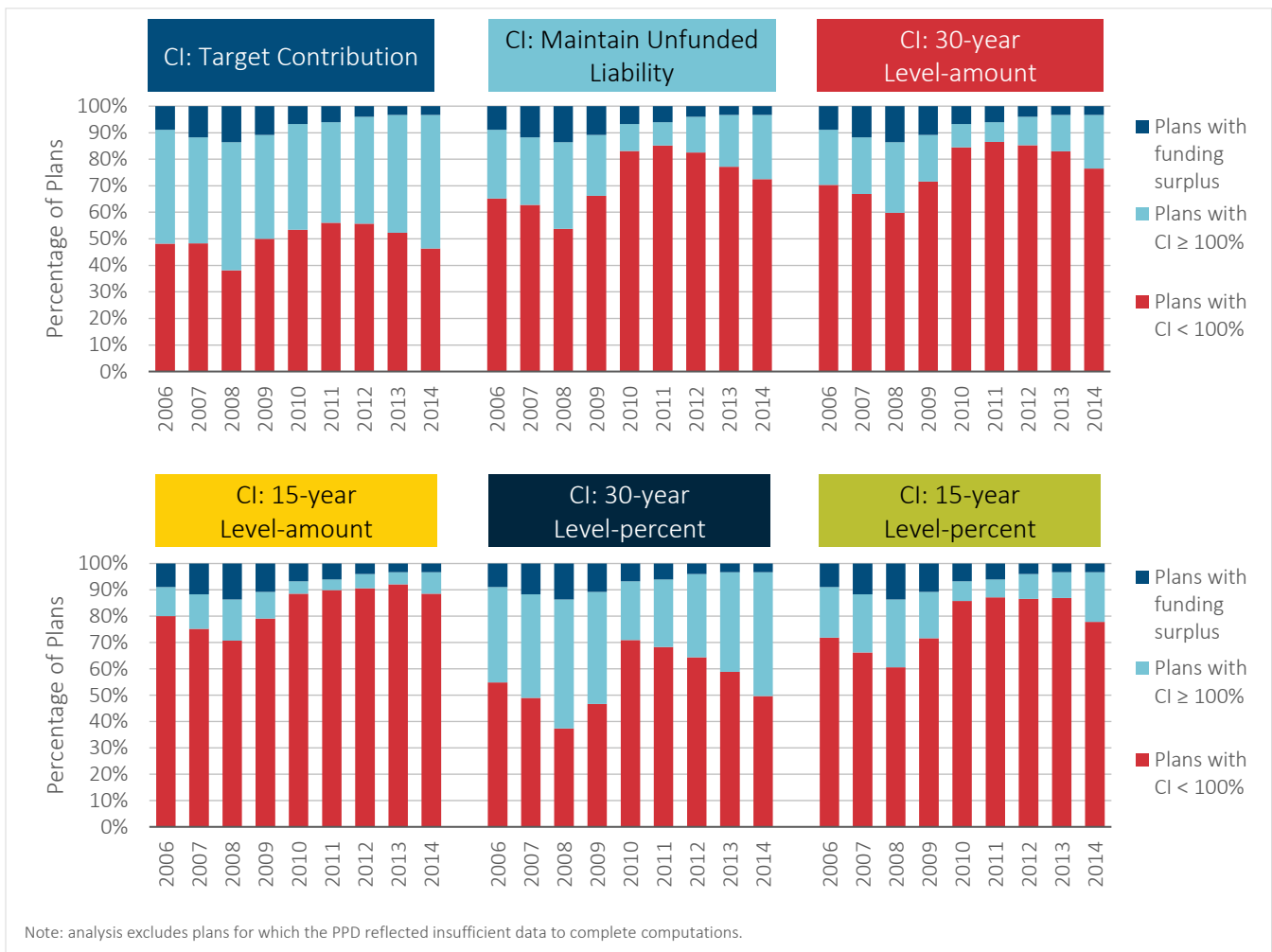


Figure 6
FREQUENCY OF CONTRIBUTION INDEX (CI) RANGES



Since 2009, including the plans that had no unfunded liability, on average roughly half of the plans received contributions that met or exceeded the target contribution. However, most plans received insufficient employer contributions to maintain their unfunded liabilities (i.e., experienced negative amortization). In 2014, 72% of plans experienced negative amortization, up from 65% in 2006 but down from 85% at the peak in 2011.

In other words, for many plans, contributing the target contribution was not enough to prevent the unfunded liability from growing—the target contribution entailed negative amortization. The Target Contribution Performance section beginning looks more closely at the dynamic of the target contribution entailing negative amortization.

With respect to level-amount amortization, in 2006, 70% of plans received insufficient employer contributions to fund their shortfall within 30 years, and 80% of plans received insufficient employer contributions to fund their shortfall within 15 years. In the peak year of 2011, the percentages had risen to 86% and 90%, respectively. By 2014, the percentages had decreased to 77% and 89%, respectively although they still exceeded 2006 levels.

More plans’ employer contributions met the level-percent benchmarks than the level-amount benchmarks. Nevertheless, many plans fell short of the level-percent benchmarks. In 2014, 50% of plans failed to meet the 30-year level-percent benchmark, and 78% of plans failed to meet the 15-year benchmark, compared to 55% and 72%, respectively, in 2006.

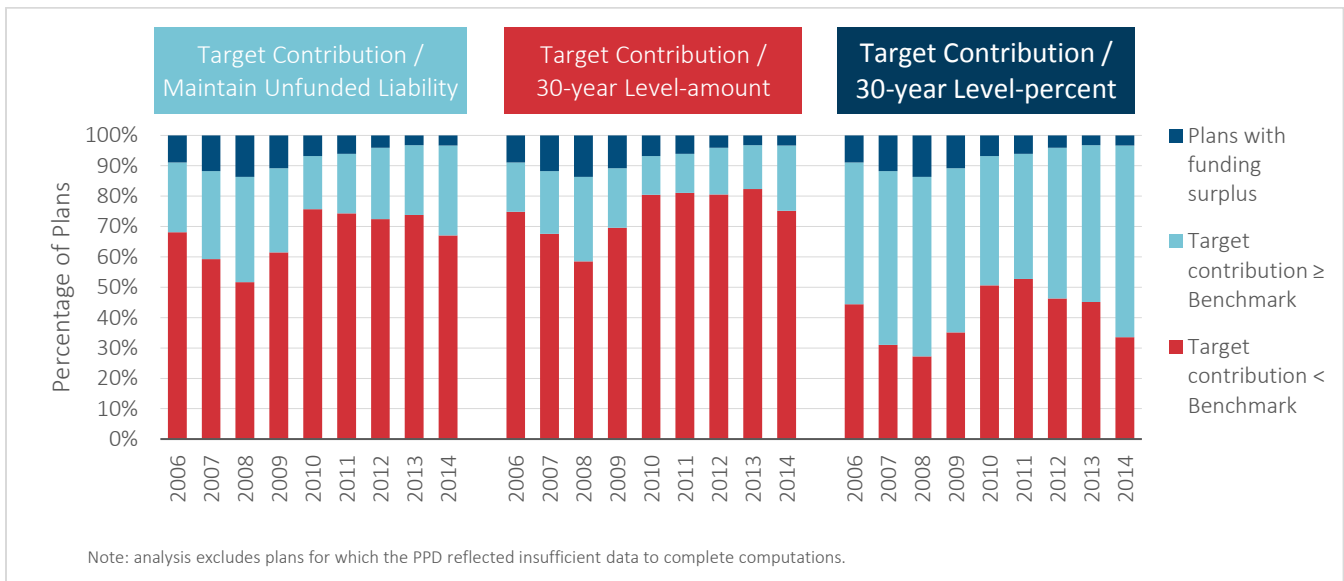
Plans that use a 30-year level-percent amortization approach to determine the target contribution and contribute the target contribution may be falling short of their benchmarks because of differences in funded status in the year that the target contribution was determined and the year it is paid. In addition, the target contribution may be determined using a layered approach to amortization.

Target Contribution Performance

Figure 6 on page 7 reveals that some plans whose contributions were too low to prevent their unfunded liabilities from growing also had target contributions that fell short of the same benchmark. Figure 7 looks at target contributions more closely, comparing them to benchmarks for maintaining the unfunded liability and 30-year funding.

Figure 7

TARGET CONTRIBUTION AS PERCENTAGE OF FUNDING-PACE BENCHMARKS



In 2006, 68% of the target contributions failed to meet the benchmark for maintaining the unfunded liability, 75% of the target contributions fell short of the 30-year level-amount benchmark and 44% of the target contributions fell short of the 30-year level-percent benchmark. By 2014, the percentages were 67%, 75% and 34%, respectively. At the peak in 2010, 76% of the target contributions fell short of the benchmark for preventing the unfunded liability from growing.

Many public plans have a two-year lag between the date as of which funded status is determined along with the target contribution and the date that the actual contributions are paid. This time lag presents a challenge that private sector plans do not face. The benchmarks for this study remove the time lag and use a direct (not layered) amortization of funded status for the year that the contribution is paid. Thus, the time lag’s effect becomes apparent in the contribution index results.

Plans with Negative Amortization

Certain contribution allocation methods may lead to negative amortization, even though they are expected to eliminate an unfunded liability by the end of an allocation period.²⁰ Under these methods, if actual experience matches all actuarial assumptions, the unfunded liability will increase in the early years of the allocation period, which increases vulnerability to investment risk. If plan assets earn less than the assumed rate of return during the negative amortization period, the unfunded liability will grow because of two factors: negative amortization and less-than-expected investment returns.

Figure 6 on page 7 demonstrates that a significant percentage of plans experienced negative amortization in any given year. Figure 8 shows the number of plans that experienced negative amortization each year. For only the plans experiencing negative amortization in any given year, Figure 9 shows more detailed contribution index ranges for maintaining the unfunded liability.

Figure 8
NUMBER OF PLANS WITH NEGATIVE AMORTIZATION

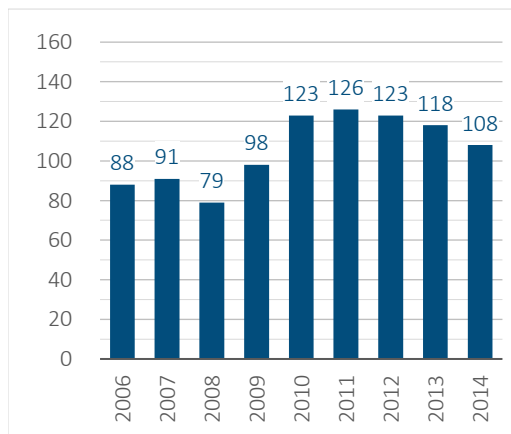
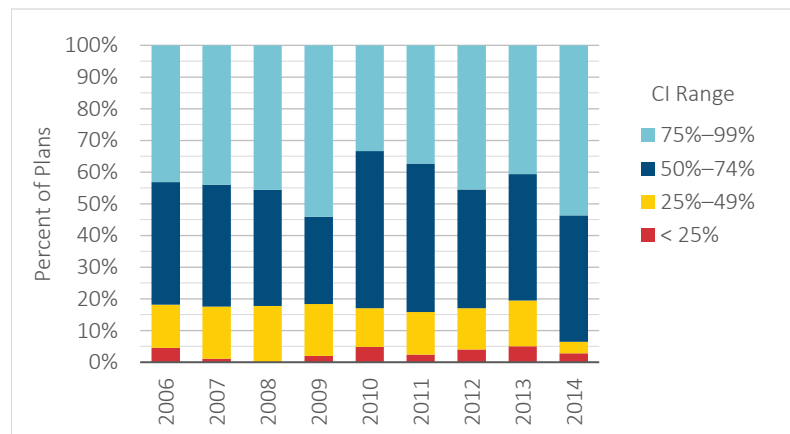


Figure 9
CI: MAINTAIN UNFUNDED LIABILITY— ONLY PLANS WITH NEGATIVE AMORTIZATION



In each year studied, between 50% and 70%—56% on average—of plans that experienced negative amortization received less than 75% of the employer contributions needed to maintain their unfunded liability. For a plan that

²⁰ Contribution allocation methods that use open amortization periods, for example, may never be expected to eliminate an unfunded liability without additional contributions.

received 75% of the amount required to maintain its unfunded liability, the employer contribution would have needed to be 33% greater to prevent the unfunded liability from growing.

During 2006–2013, between 15% and 20%—18% on average— of plans that experienced negative amortization received less than half of the employer contributions needed to maintain their unfunded liability. For 2014, the percentage dropped to 6%.

In all years studied, fewer than 5% of the plans with negative amortization received less than one-quarter of the employer contributions needed to maintain their unfunded liability.

Data and Methods

This study uses plan-level data from Public Plans Data (PPD) as of February 3, 2017. The Center for Retirement Research at Boston College produces the PPD in partnership with the Center for State & Local Government Excellence and the National Association of State Retirement Administrators, and states that it “accounts for 95 percent of state/local pension assets and members in the US.”²¹

For purposes of this analysis, the PPD is sparsely populated for years prior to 2006 and after 2014. Therefore, this study is limited to the years 2006 through 2014. For some plans, data were sufficient to complete calculations except the payroll growth assumption was missing. In these cases, the authors used the rates reported in the actuarial valuation reports that were available on PublicPlansData.org, or used the inflation assumption reported for GASB purposes plus 50 basis points. If the inflation assumption was missing, the authors used the average of the inflation assumptions that were populated. Otherwise, data were used as reported except for adjustments for obvious errors.

Assets and liabilities used in this study are those reported to meet GASB reporting guidelines, and they reflect a variety of actuarial methods and assumptions. Contribution indices previously published by the SOA have been based on liabilities determined under the unit credit cost method—including market value or market-related liabilities—and the market value of assets. However, unit credit liabilities are not widely available in the PPD. Because of the difficulties involved in adjusting plan-level data for different cost methods without availability of more detailed data, this study forgoes uniformity and uses the reported GASB values. In addition to reflecting a variety of cost methods, GASB reporting among these plans also reflects a variety of asset valuation methods, discount rates, mortality tables and other actuarial assumptions.

Because funded status and benchmarks for this study are developed from liabilities and assets that reflect a variety of actuarial methods and assumptions, they do not reflect a mathematically consistent basis. In addition, they do not represent a market value of liabilities and assets. They are consistent only from the perspective that they reflect the assumptions and methods that plan trustees, actuaries or other agents have chosen to represent the plan for financial reporting under GASB guidelines.

Neither the authors nor the SOA intends the use of reported values as commentary on their appropriateness for funding these or any other pension plans, financial reporting or any other purpose. Modifications to the

²¹Center for Retirement Research at Boston College and the Center for State & Local Government Excellence, Public Plans Data, <http://publicplansdata.org/public-plans-database/>.

assumptions and methods used may result in different numerical outcomes. Different assumptions and methods may be more appropriate for analysis of a specific plan or small set of plans.

Acknowledgments

Thanks to the following individuals for their advice and arm's-length review of this study prior to publication. Any opinions expressed may not reflect their opinions or those of their employers. Any errors belong to the authors alone.

- Randall J. Dziubek, ASA, EA, MAAA
- David W. Vanderweide, FSA
- Amy Williams, ASA, FCA, MAAA

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