SOCIETY OF ACTUARIES

Impact of Mortality Change on U.S. Single Employer Pension Plan Funding

By Lisa Schilling and Patrick Wiese   April 2017

Executive Summary

In December 2016, the Internal Revenue Service (IRS) issued proposed updated mortality tables starting in 2018 for minimum funding requirements for single employer defined benefit pension plans.[1] This study estimates the impact of the proposed change on the single employer pension system as a whole; the impact on individual plans may differ. Here are highlights of the research:

- The proposed mortality tables increase liabilities and reduce funded status:[2]
    - On a funding basis, estimated aggregate 2018 Funding Target liabilities increase 2.9% from $2.278 trillion to $2.343 trillion, and the estimated cost of current year benefit accruals (normal cost) increases 1.6%, from $49.6 billion to $50.4 billion.
        - The estimated aggregate unfunded Funding Target would increase 35%, from $63 billion to $85 billion.
        - Estimated aggregate minimum required contributions for 2018 would increase 11% from $7.1 billion to $7.9 billion. Note that many plan sponsors have been contributing considerably more than the minimum amount required. Assuming that recently exhibited contribution patterns continue, 2018 contributions would rise about 4%, from $94 billion to $98 billion.
    - For PBGC premiums, estimated aggregate 2018 Premium Funding Target liabilities would increase 3.1%, from $2.679 trillion to $2.763 trillion.[3]
        - The estimated aggregate unfunded Premium Funding Target (also known as unfunded vested benefits) would increase 24%, from $217 billion to $268 billion.
        - Estimated PBGC premiums for 2018 would increase 12% because of the mortality change, from $8.6 billion to $9.6 billion, assuming that actual contributions follow recently exhibited patterns.
- Analysis illustrates that, in the end, it costs less to fund expected longevity directly than to pay amortized losses that arise from undervaluing it.

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[1] REG–112324–15, RIN 1545–BM71, *Federal Register* Vol. 81, No. 250, December 29, 2016, p. 95911.
[2] Internal Revenue Code section 430 and its accompanying regulations govern funding requirements for single employer pension plans.
[3] PBGC premiums are governed by Employee Retirement Income Security Act of 1974 (ERISA) sections 4006–4007 and accompanying regulations 29 CFR Parts 4006–4007.

Proposed Mortality Rules

The RP-2000 mortality table and mortality projection scale AA form the basis for current mortality table requirements for single employer pension plan minimum funding.[4] The RP-2014 mortality table and mortality projection scale MP-2016 will form the basis for proposed requirements beginning in 2018.[5] For simplicity, the authors refer to the current mortality requirements as "RP-2000" and the proposed requirements as "RP-2014."

Current and proposed rules permit either static or generational mortality projection. After consultation with actuaries who work with large single employer pension plans, it is the authors' understanding that most plans use static projections for funding purposes. Consequently, this study uses static projections. The authors do not intend the use of static projection to serve as recommendation of this approach or any other approach.

However, the authors' analysis shows that results using generational projection are very similar for liabilities, but less so for normal cost. The Impact on Normal Cost and Contributions section discusses this further.

Impact on Funding Target and Funded Status

This study presents estimates of aggregate liabilities for minimum funding purposes (Funding Target) and funded status[6] based on the following key assumptions:
- Actual contributions continue to follow recent patterns relative to plan funding levels as determined for both funding regulations and PBGC premiums,[7]
- Treasury High Quality Market (HQM) corporate bond yield curve spot interest rates remain constant after 2016 and
- Asset returns after 2016 equal 6% annually.

The authors chose these assumptions for illustration only. The assumptions do not represent predictions or expectations of economic environments. The Appendix provides a more complete list of the assumptions and methods used in this study.

The authors estimate the proposed mortality update would increase the aggregate 2018 Funding Target by about 2.9%, from approximately $2.278 trillion to roughly $2.343 trillion. Based on analysis of solely traditional pension plans, one might expect a slightly higher increase of 3%–5%, depending on the discount rate and age and gender mix of a plan population. However, the mortality change does not affect cash balance liabilities to the same extent as traditional pension plans.

While cash balance liabilities make up a meaningful portion of the aggregate Funding Target, the precise portion is difficult to determine. Form 5500 and its Schedules do not provide for reporting the portion of liabilities that stems from cash balance benefit designs. In addition, some plans have both traditional and cash balance or other

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[4] Internal Revenue Code section 430 and its accompanying regulations govern funding requirements for single employer pension plans.
[5] REG–112324–15, RIN 1545–BM71, *Federal Register* Vol. 81, No. 250, December 29, 2016, pp. 95911–95929. The proposed regulation specifies adjustments to RP-2014 and indicates potential updates to reflect anticipated future projection scale updates.
[6] Internal Revenue Code section 430 and its accompanying regulations govern minimum funding requirements for single employer pension plans.
[7] The Appendix provides a description of the methodology used to estimate contributions.

hybrid designs. After analysis and consultation with actuaries working with large single employer pension plans, the authors estimate that roughly 10% of the aggregate Funding Target stems from cash balance designs.

In the years between reported data and 2018, asset growth exceeds liability growth under the assumptions used in this study. Nonetheless, the system's aggregate funded status will decline slowly through 2018, primarily because of decreasing discount rates (also known as "effective interest rates").

Although this study assumes that HQM spot interest rates remain constant, the methodology for computing required discount rates recognizes historical HQM spot interest rates, which were higher than current levels. As time progresses, those higher historical rates have less influence on the result, causing the discount rate to drop roughly 20 basis points a year from 2014 to 2018.[8] The authors estimate that for the single employer system as a whole, for each 25 basis point (0.25%) drop in discount rate, the aggregate Funding Target increases roughly 3%.

Figure 1 shows how the proposed mortality change affects the aggregate Funding Target and aggregate funded percent. Note that the aggregate funded percent is the portion of the system-wide Funding Target that is funded, which is different from the average or aggregate funded ratio. The aggregate funded percent recognizes that one plan's surplus cannot be used to satisfy another plan's deficit. Therefore, it does not recognize individual plans' surplus.

While the estimated aggregate Funding Target would increase about 2.9%, the aggregate funded percent would drop only 1%, from 97% to 96%. The aggregate funded percent would fall by a smaller percentage than the Funding Target would rise because many plans have enough surplus to cover the increase in their Funding Target, although their surplus would shrink.

Figure 1
AGGREGATE FUNDING TARGET AND FUNDED PERCENT
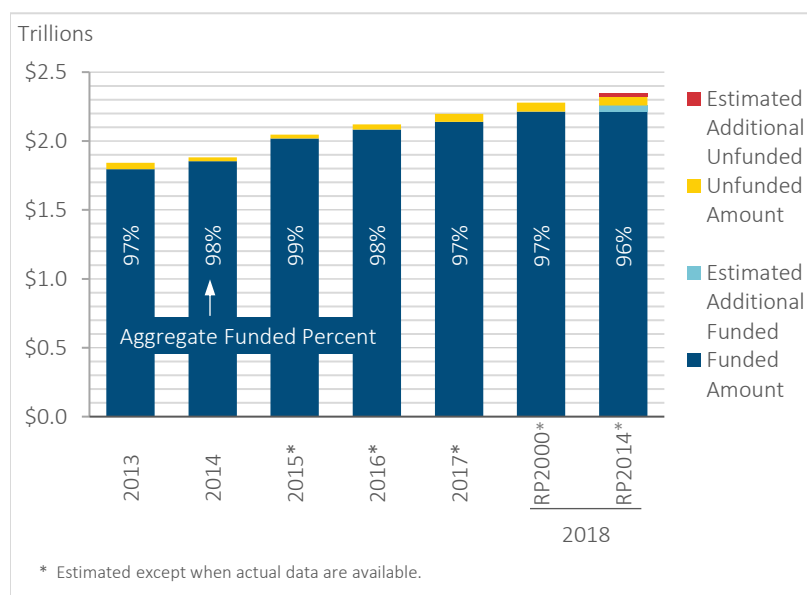
Although Figure 1 shows that the system's unfunded liability increases, it does not illustrate well the magnitude of the increase. Plans that have a deficit on the current mortality basis would see an increased deficit, and it could be significant. And some plans with a small surplus would find themselves with a funding deficit. Figure 2 and Figure 3 on the following page illustrate this dynamic more readily. The authors estimate that the aggregate

[8] Under Internal Revenue Code section 430 as amended by the Moving Ahead for Progress in the 21st Century Act (MAP-21), the Highway and Transportation Funding Act of 2014 (HATFA) and the Bipartisan Budget Act of 2015 (BBA), spot interest rates are averaged and may be further adjusted to fall within specified corridors, which widen over time. Under the recent and current interest rate environments, while more stable than without the adjustments, the resulting discount rates have declined. "Spot interest rate" refers to the High Quality Market corporate bond yield curve published by the U.S. Department of the Treasury.

unfunded Funding Target (deficit) would increase 35%, from $63 billion to $85 billion, and the aggregate surplus would fall 14%, from $314 billion to $271 billion.

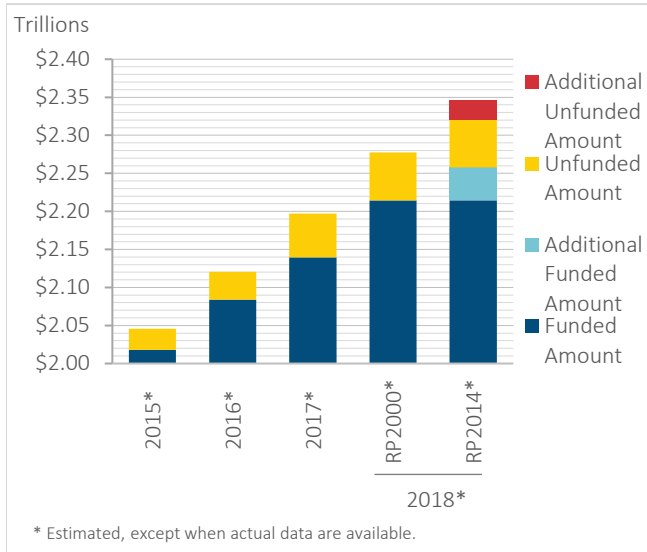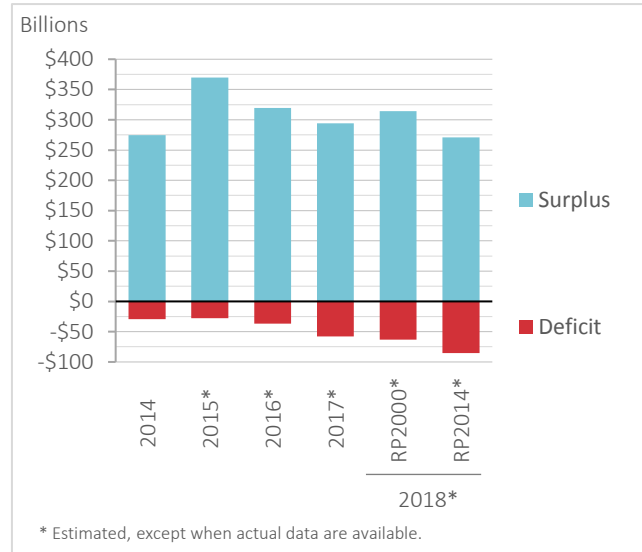**Figure 2**
CLOSER VIEW: AGGREGATE FUNDING TARGET

* Estimated, except when actual data are available.

Figure 3
AGGREGATE FUNDING SURPLUS AND DEFICIT

* Estimated, except when actual data are available.

Impact on Normal Cost and Contributions

The proposed mortality change generates a smaller increase in the cost of current year benefit accruals (normal cost) than in the Funding Target. While the estimated Funding Target increase for 2018 is about 2.9%, the estimated increase in normal cost is only about 1.6%, from $49.6 billion to $50.4 billion.

The percentage increase is lower for the normal cost than the Funding Target for several reasons. Mortality assumption changes affect cash balance plan liabilities much less than traditional plan designs. Cash balance plans represent about 30% of the normal cost but only about 10% of the Funding Target, based on the authors' analysis and consultation with actuaries who work with large single employer pension plans. Consequently, mortality assumption changes affect the aggregate normal cost less than the Funding Target.

Further, the proposed static projection method generates a lesser increase in the normal cost than in the Funding Target. The proposed method is intended to approximate generational projection.[9] The authors find that the static approach generally accomplishes the goal for the Funding Target. But for the normal cost, the static approach falls slightly short of results based on generational projection, primarily because the approximation is less effective at ages below 40. Results for ages below 40 influence the normal cost to a much greater degree than the Funding Target, because the normal cost reflects results for only actively employed participants while the Funding Target reflects results for all participants.

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[9] REG–112324–15, RIN 1545–BM71, *Federal Register* Vol. 81, No. 250, December 29, 2016, p. 95915.

The proposed mortality table change would also affect contributions. Consider minimum required contributions after offsetting all available credit and prefunding balances. The authors estimate that the proposed mortality change would increase the aggregate minimum required contribution for 2018 by about 11%, from about $7.1 billion to roughly $7.9 billion.

However, many plan sponsors have been contributing considerably more than the minimum amount required, as Figure 4 shows. Assuming that plan sponsors continue to follow similar contribution patterns as in recent years, the authors estimate that aggregate contributions for 2018 would rise about 4% because of the mortality update, from an estimated $94 billion to approximately $98 billion.[10]

Figure 4
AGGREGATE EMPLOYER CONTRIBUTIONS

* Estimated except when actual data are available.
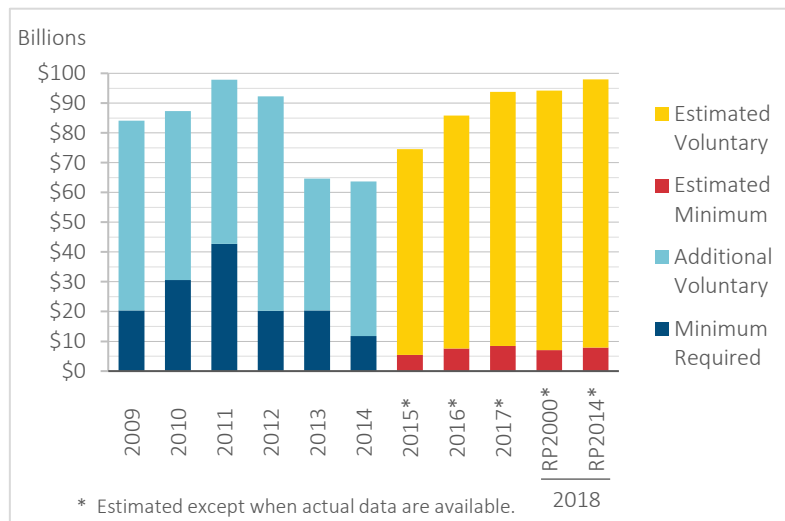
Projected Contributions

Looking further into the future, Figure 5 on the following page compares contributions that use RP-2000 versus RP-2014 mortality assumptions, while assuming that actual mortality experience follows RP-2014. The study assumes that after 2016, HQM spot interest rates remain constant and assets earn 6.0% annually.[11] The graph explores two contribution patterns:

- Actual contributions equal the minimum amount required except when actual data are available (dark blue line for RP-2000 and light blue line for RP-2014)[12] and
- Actual contributions follow the patterns similar to those recently exhibited (red line for RP-2000 and pink line for RP-2014).

With this discount rate scenario, 6.0% annual asset returns generally will cause contribution requirements to decrease over time, because asset growth will exceed liability growth. Different discount rates and/or different asset returns could generate significantly different projected minimum required contributions as well as estimated actual contributions.

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[10] The Appendix provides a description of the methodology for estimating actual contributions. Different actual contributions could cause estimated minimum required contributions to differ.

[11] These assumptions are for illustration only and do not represent a realistic or expected economic environment. The Appendix provides more detail about additional assumptions employed.

[12] To determine minimum required contributions, plan sponsors may choose to offset all, a portion or none of the credit balance or prefunding balance that may be available. Some plan sponsors have chosen not to offset all that is available, so some plans report a higher minimum required contribution than actually required. This analysis shows the absolute minimum amount required, except when actual data differ. Hence, 2016 minimum required contributions are significantly less than for 2015 because 2015 reflects a partial year of actual data.

Figure 5
PROJECTED AGGREGATE CONTRIBUTIONS—ILLUSTRATION

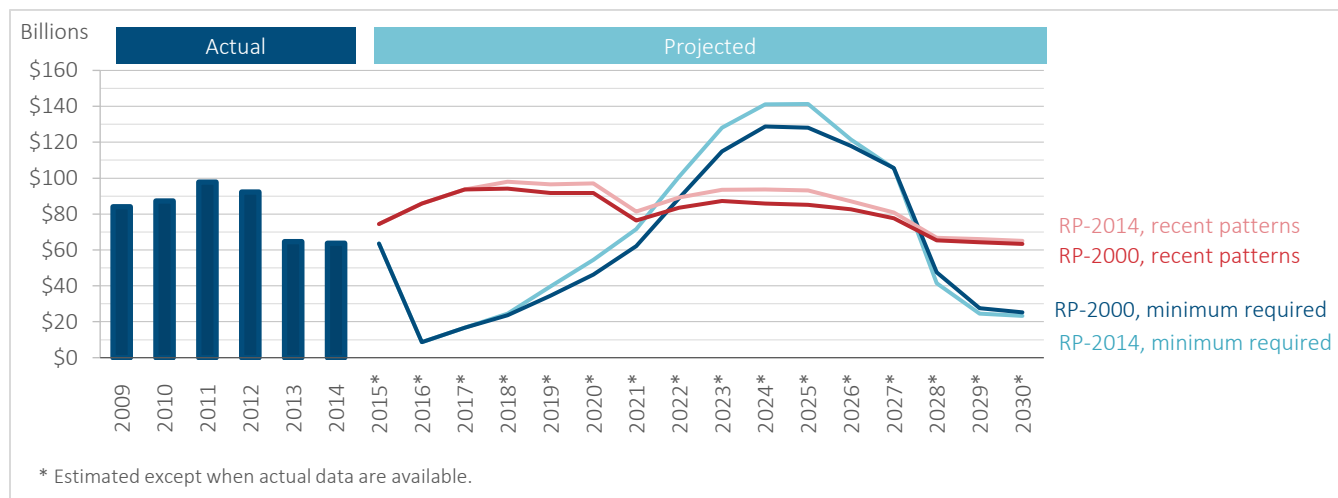* Estimated except when actual data are available.

Figure 5 shows that, under these assumptions, contributions using RP-2014 are higher through 2025 than those using RP-2000. However, beginning in 2028, the RP-2014 minimum required contribution is slightly *less* than the RP-2000 minimum required contribution. By that point, the RP-2014 minimum required contributions are driven entirely by the normal cost while the RP-2000 minimum contributions comprise both normal cost and amortization payments on the actuarial losses realized each year because of mortality experience. This illustrates that, in the end, it is cheaper to fund expected longevity directly than to play catch up after undervaluing it.

Impact on PBGC Premiums

Single employer PBGC premiums consist of two components: a flat amount per plan participant that is the same across plans (Flat Rate Premium) and an amount that varies by plan because it is a percentage of the value of unfunded vested benefits (Variable Rate Premium). The rules for determining Variable Rate Premiums reference the mortality requirements for minimum funding. The Appendix shows the scheduled Flat and Variable Rate Premiums.[13]

While the mortality table requirements for minimum funding and PBGC premiums are the same, the liability calculations differ in other ways. For example, the PBGC premium liability (Premium Funding Target) excludes nonvested benefits and allows much less smoothing of discount rates.[14] To model unfunded vested benefits, this analysis uses unsmoothed spot rates. Otherwise, the assumptions match those used in the previous sections.

In the current economic environment, both liabilities and unfunded liabilities for PBGC premiums are significantly greater than for minimum funding purposes. On the following page, Figure 6 shows that the mortality change would increase the estimated aggregate 2018 Premium Funding Target from $2.679 trillion to $2.763 trillion—

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[13] PBGC premiums are governed by Employee Retirement Income Security Act of 1974 (ERISA) sections 4006–4007 and accompanying regulations 29 CFR Parts 4006–4007. PBGC Variable Rate Premiums are scheduled to increase significantly, providing plan sponsors with incentive to fund more than the minimum required amounts. The Appendix shows the scheduled rate increases.

[14] For the Funding Target, spot rates are averaged over 25 years, while for Unfunded Vested Benefits, spot rates may be averaged over two years.

about 3.1%, a similar percentage as the Funding Target for minimum funding requirements. However, estimated aggregate unfunded vested benefits would increase 24%, from $217 billion to $268 billion, as Figure 7 exhibits.[15]

Figure 6
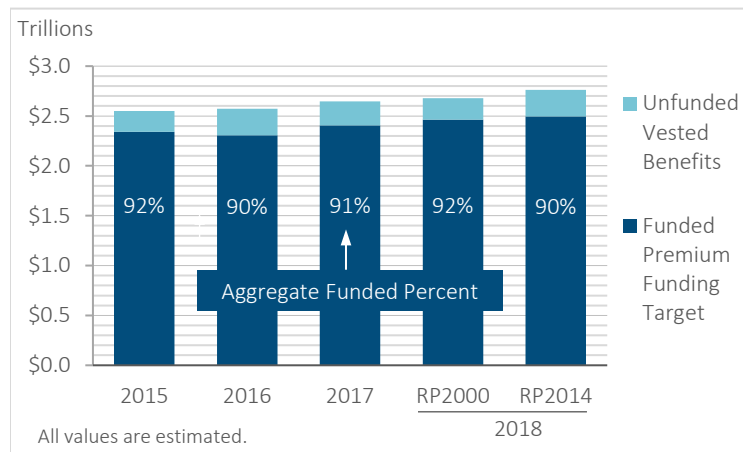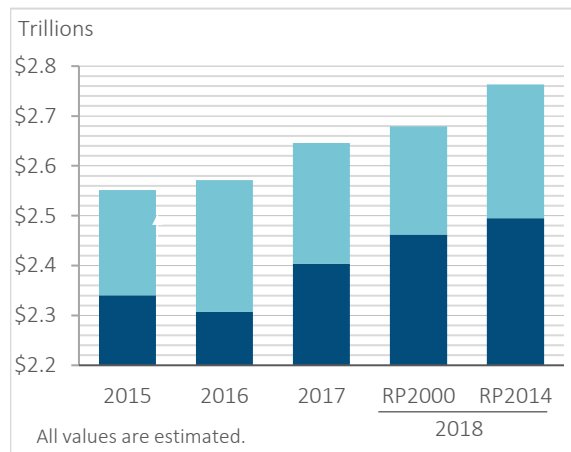AGGREGATE PREMIUM FUNDING TARGET AND UNFUNDED VESTED BENEFITS

Figure 7
CLOSER VIEW: AGGREGATE PREMIUM FUNDING TARGET AND UNFUNDED VESTED BENEFITS

The proposed mortality tables would increase estimated 2018 PBGC premiums by about 12%, from approximately $8.6 billion to approximately $9.6 billion, as Figure 8 shows. This increase is smaller than the percentage increase in unfunded vested benefits for two reasons. The proposed mortality table change does not affect the Flat Rate Premium, which depends only on the number of participants. In addition, the Variable Rate Premium has a per-participant cap, which is not affected by a mortality table change.

Figure 8
ESTIMATED AGGREGATE PBGC PREMIUMS
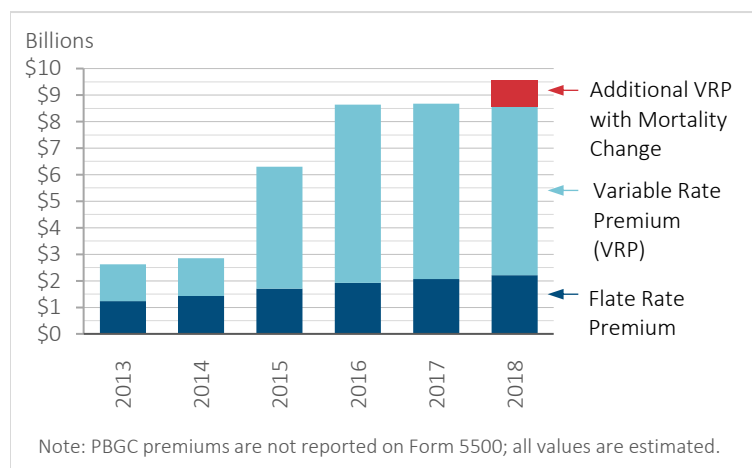
These estimates assume that actual contributions follow similar patterns as recently exhibited. Different actual contributions could result in different Variable Rate Premiums.

Further, independent of the proposed mortality table change, PBGC premium rates will increase significantly over the next several years.[16] Plan sponsors may feel incented to increase voluntary contributions further in order to reduce their unfunded vested benefits, which would in turn reduce their Variable Rate Premiums.

[15] To determine unfunded vested benefits, PBGC premium liabilities are offset by the market value of assets, rather than a smoothed actuarial value of assets, which may be used for minimum required funding.
[16] PBGC premiums are governed by Employee Retirement Income Security Act of 1974 (ERISA) sections 4006–4007 and accompanying regulations 29 CFR Parts 4006–4007. PBGC Variable Rate Premiums are scheduled to increase significantly, providing plan sponsors with incentive to fund more than the minimum required amounts. The Appendix shows the scheduled rate increases.

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Appendix: Data, Methods and Assumptions

Data

Analysis is based on publicly available data from the Department of Labor Form 5500 as of October 28, 2016, for all single employer plans that filed Form 5500 (not Form 5500-EZ) for either 2014 or 2015. The resulting database includes roughly 7,500 traditional and cash balance plans, which represent approximately 98% of the single employer plan universe's total liabilities. Other than adjustments for obvious errors, data were used as reported. The most recent complete plan year of reporting in the database is 2014, and 2015 represents a partial year of reporting. The authors' model uses the most recent data available for each plan.

Methods

The authors' model performs simulations for each plan and then aggregates results. The model imputes a set of projected benefit payments—separately for normal cost, active participants, terminated vested participants and retirees—based on the assumptions below, scaled for each plan so that the resulting actuarial present value of benefits equals the plan's 2014 Funding Target for the corresponding participant group. After initial development of projected benefit cash flows, the deferred benefits (active and terminated participants) are modeled as a single liability, which eliminates the need for a termination assumption.

Based on analysis of *aggregate* levels of contributions in recent years, the authors used the following approach to estimate future *aggregate* contributions. Contribution methodology depends on a plan's funded status at the start of the simulation. In all cases, a contribution cannot be less than the minimum required contribution after offsetting all credit and prefunding balances or greater than the maximum deductible contribution.

- Below the Funding Target: minimum required contribution after offsetting no more than 80% of credit and prefunding balances

- Above the Funding Target: contributions assume a funding policy that maintains the starting relationship between Funding Target and Premium Funding Target funded ratios and amortizes any resulting shortfall.

The authors developed these methods to represent the system *as a whole*; they may not be appropriate for any single plan or group of plans, or for different purposes. Modifications to the methods used may result in significantly different outcomes.

Assumptions

This study is based on the assumptions outlined in this section. Neither the authors nor the Society of Actuaries intends the use of these assumptions and methods for this study to serve as recommendations for using these or any other assumptions for any other purpose. The authors developed these assumptions to represent the system *as a whole*. Different assumptions may be more appropriate for a specific plan or group of plans, or for a different purpose. Different assumptions may result in significantly different outcomes.

The authors chose economic assumptions for this study for illustration only. The assumptions do not represent predictions or expectations of economic environments by the authors or the Society of Actuaries. Different economic assumptions may produce significantly different outcomes.

The assumptions used in this study are outlined below.

- Mortality:[17]
  - Current: RP-2000 mortality table projected with Scale AA for 15 years for active and terminated vested participants and for seven years for participants receiving benefits.
  - Proposed: RP-2014 mortality table projected backward to 2006 with MP-2014 and then forward with MP-2016 to the valuation date plus eight years for males and nine years for females, with an additional adjustment by age. For ages below 80, the projection period is increased by one year for each year below 80. For ages above 80, the projection period is reduced by one-third of a year for each year above 80.
  - Mortality experience: RP-2014 mortality table projected backward to 2006 with MP-2014 and then forward generationally with MP-2016.

- Discount rates after 2016: Treasury High Quality Market (HQM) corporate bond yield curve spot interest rates remain constant after December 2016.[18]

- Premium Funding Target is estimated using unsmoothed spot rates.

- Market value of asset returns:
  - For 2014 through 2016 when actual data were not available:[19]

Plan Year	Asset Return
2014	10.60%
2015	1.05%
2016	8.24%

  - After 2016: 6.0% annually.[18]

- Actuarial value of assets:
  - For plans with the most recent actuarial value of assets equal to market value: market value of assets
  - For other plans: market value of assets is adjusted for two-thirds of the prior year's asset gain or loss and one-third of two years' prior asset gain or loss

- Cash balance plan prevalence: for plans that have indicated cash balance plan type on Form 5500, cash balance benefits generate the following percentages of liabilities:
  - 75% of normal cost
  - 50% of liabilities for active and terminated vested participants

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[17] Current and proposed rules permit either static or generational mortality projection. After consultation with actuaries who work with large single employer pension plans, it is the authors' understanding that most plans use static projections for funding purposes. Therefore, this study uses static projections to determine liabilities. The authors do not intend the use of static projection to serve as recommendation of this approach or any other approach.

[18] The authors chose these assumptions for illustrative purposes only. The assumptions do not represent expectation of future economic environments.

[19] These returns were developed assuming 60% equities and 40% fixed income; S&P 500 returns of 13.69%, 1.38% and 11.96% for 2014, 2015 and 2016, respectively; and Bloomberg Barclays US Aggregate Bond TR returns of 5.97%, 0.56% and 2.65%, respectively.

- Lump sums:
  - Traditional designs: 1% of the combined liabilities for deferred benefits is assumed to be taken as a single sum each year.
  - Cash balance: 5% of the combined liabilities for active and terminated vested participants are assumed to taken as a single sum each year, and all new retirees are assumed to take their benefit in a single sum each year.

- Annuity forms: equally split between single life annuities and joint and 50% survivor annuities

- Retirement age: 63

- Gender: two-thirds male and one-third female

- PBGC premiums (this study estimates PBGC premiums through 2018 only):[20]

Plan Year	Flat Rate per Participant	Variable Rate per $1,000 of Unfunded Vested Benefits	Variable Rate Cap per Participant
2014	$49	$14	$412
2015	$57	$24	$418
2016	$64	$30	$500
2017	$69	$34	$517
2018	$74	$38[21]	$517[21]
2019	$80	$42[21]	$517[21]
2020 and after	$80[21]	$42[21]	$517[21]

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[20] PBGC premiums are governed by Employee Retirement Income Security Act of 1974 (ERISA) sections 4006–4007 and accompanying regulations 29 CFR Parts 4006–4007.

[21] Rate is subject to indexing and therefore might be higher. Rates used in this analysis assume no indexing.

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