The Pension Analytics Group

Multiemployer Solvency Crisis: Assessing Plans' Capacity for Self-Stabilization

1. Summary

In a paper released this past July, we presented simulation results of the multiemployer pension system assuming no changes in relevant law[1]. Using the Multiemployer Pension Simulation Model (MEPSIM[2]), we projected that about 130 multiemployer pension plans covering 2.1 million participants will become insolvent in the next 20 years, and that the Pension Benefit Guaranty Corporation's (PBGC) multiemployer guarantee fund[3] -- the backstop against such insolvencies -- will itself be exhausted by 2027.

We now turn our attention to potential solutions to this serious funding challenge. The present paper is the first in a series that we intend to release over the coming months, each of which will offer quantitative assessments of options for stabilizing the multiemployer pension system and, in particular, for preventing the exhaustion of the PBGC's guarantee fund.

Three main options are available to prevent the exhaustion of the guarantee fund: (1) empower plans to take stronger actions to avoid or delay insolvency; (2) reduce the level of the PBGC's benefit guarantee, and/or (3) increase the revenue flowing into the fund, either through premium increases or by securing additional revenue sources. This is a lot of ground to cover, so we will focus on Option One in the present paper, and will evaluate Option Two and Option Three in future papers.

For each plan projected to become insolvent under our baseline assumptions, we used MEPSIM to estimate the benefit cuts and/or contribution increases needed to achieve financial stability. Key findings from our research are as follows:

- As one would expect, the earlier a multiemployer pension plan recognizes that it is on a path to insolvency, the more palatable the menu of options to avoid that outcome.
- The time horizon needed to effectively address solvency issues, however, is longer than many may realize. For plans within 30 years of insolvency, efforts to reduce underfunding through contribution increases or cuts to future benefit accruals are likely to be insufficient.
- For deeply troubled plans, significant across-the-board cuts of accrued benefits are generally the only realistic option for avoiding insolvency.
- Although the Multiemployer Pension Reform Act (MPRA) of 2014 ostensibly provided plans with greater leeway to cut accrued benefits, in practice few plans can actually qualify for MPRA. Generally, by the time a plan is within 20 years of insolvency – an eligibility criterion defined in the Act -- the benefit cuts required to avoid insolvency are so large that they are not legally permissible under MPRA.

[1] The paper is entitled "The Multiemployer Pension System: Simulations of the Status Quo", and can be downloaded at this URL: www.PensionAnalytics.org/Our_Papers.

[2] MEPSIM was developed by the Pension Analytics Group and is available online at www.PensionAnalytics.org.

[3] For a description of the PBGC's multiemployer insurance program, see https://www.pbgc.gov/prac/multiemployer.

- To provide more plans with an opportunity to avoid, or at least delay, insolvency, stakeholders and policymakers may want to consider the following adjustments to MPRA: (1) increase the years-to-insolvency maximum from 20 to 35 years, (2) allow plans to cut benefits below the PBGC's guaranteed benefit level, and (3) permit benefit cuts even if they fail to prevent insolvency, but rather merely delay it, thereby mitigating plans' projected exacerbation of the PBGC's deficits.
- Broadening MPRA's eligibility criteria, however, will not necessarily have a significant impact because plans can choose not to utilize the relief.
- Absent a law that either succeeds in motivating troubled plans to reduce benefits on their own, or *forces* them to do so, adjustments to MPRA's eligibility criteria will probably be insufficient to prevent the exhaustion of the PBGC's guarantee fund.
- Additional policy remedies will therefore be required, such as changes to the level of guaranteed benefits and/or increases to the revenue flowing into the guarantee fund.

In Section Two, we begin our discussion of these issues by revisiting simulations of the status quo that we presented in our previous paper. These simulations provide a sense of the number of projected insolvencies and their impact on the PBGC, should the system remain on its present course. In Section Three, we examine the benefit cuts and/or contribution increases required to stabilize each of the plans projected to become insolvent in the status quo scenario. For many plans, the required adjustments are so severe that they are either unlikely to be voluntarily adopted, or not legally permissible under MPRA. Therefore, in Section Four, we examine the impact of a 25% across-the-board benefit cut, irrespective of whether the cut is sufficient to stabilize each plan. Our premise is that a cut of this magnitude, while significant, might well be acceptable to those plans that are heading towards insolvency. In Section Five, we offer our conclusions. Lastly, an appendix provides a description of MEPSIM, a discussion of our baseline assumptions, and a sensitivity analysis in which the assumptions are varied.

2. Simulations of the Status Quo

Total contributions to multiemployer plans have roughly doubled since 2001, while total normal cost – a proxy for the annual rate at which workers accrue additional benefits – has been roughly flat. These statistics suggest that plans are depending primarily on contribution increases, not benefit cuts, to address deficits. Our historical analysis of data for individual plans supports this conjecture. Therefore, our "status quo" simulations assume this pattern continues through 2025, with plans raising contributions while holding unit benefits constant.

After 2025, however, we assume it will no longer be possible to raise contributions-per-worker while holding benefit levels unchanged. If this approach were to continue indefinitely, the internal-rate-of-return (IRR) that equalizes the present value of benefit accruals with contributions would drop to an unrealistically low level. Already, for many plans, this IRR has fallen below the risk-free rate-of-return. This issue will be discussed further in a subsequent paper. We assume that plans earn a 6% rate-of-return on their assets. Our logic for this assumption is presented in Appendix C, while Appendix D contains a sensitivity analysis in which this important assumption is varied.

Under our status quo assumptions, 131 plans -- covering 2.1 million participants, of whom only 480 thousand are current workers and close to one million are current retirees -- are projected to become insolvent during the next 20 years, at a present value cost of $78 billion to the PBGC. If forecasting is expanded to cover the next 50 years, 453 plans are projected to become insolvent, at a present value cost of $185 billion to the PBGC. This heavy burden is projected to exhaust the PBGC's multiemployer guarantee fund by 2027.

Table One – which was presented in our prior paper -- categorizes plans into five Groups (A through E) by their projected year of insolvency. Within Group A -- the worst-situated Group, with plans headed toward insolvency

before 2027 -- the median values for two key ratios, (i) workers to total participants and (ii) assets to liabilities, are just 16.2% and 35.6%, respectively. These ratios progressively improve as one ascends from Group A to E.

Table 1. Projected Insolvencies and Claims on the PBGC, under our Baseline Assumptions

Group	Projected Year of Plan Insolvency	Number of Insolvent Plans	Total Plan Participants (1000s)	Total Retired Participants (1000s)	Median Ratio of Workers to Total Participants	Median Ratio of Assets to Liabilities[4]	Present Value of Projected Assistance Payments (Billions)
A	2017 to 2026	39	634	359	16.2%	35.2%	$32.0
B	2027 to 2036	92	1,525	582	21.9%	52.2%	46.3
C	2037 to 2046	120	1,493	446	34.4%	61.4%	44.1
D	2047 to 2056	102	1,602	467	38.7%	68.5%	46.8
E	2057+	100	779	254	40.4%	75.6%	15.5
Total		453	6,032	2,109	33.3%	62.7%	184.7
A + B		131	2,158	942	19.4%	48.8%	78.3
Projected Year of Exhaustion of the PBGC's Multiemployer Guarantee Fund = 2027							

In the next section of this paper, for each group of plans from A to E, we present estimates of the contribution increases or benefit cuts required to avoid insolvency. As one would expect, these adjustments are greatest for plans in groups A and B. Indeed, MPRA focuses exclusively on these plans. Plans projected to become insolvent more than 20 years in the future receive no relief under MPRA.

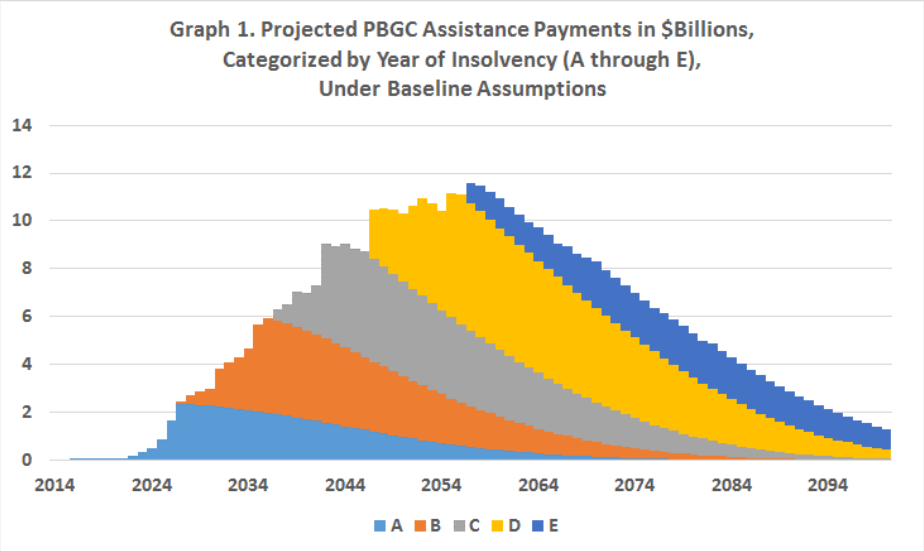
Therefore, we find it noteworthy that most plans projected to become insolvent between 20 and 40 years in the future (groups C and D) cannot easily be shifted onto a sustainable trajectory. While these plans require smaller contribution increases or benefit cuts than plans in Groups A and B, the adjustments are nevertheless significant, as we demonstrate subsequently in this paper.

Should plans in groups C and D remain on their present trajectories, our projections indicate that they will generate over $90 billion in claims on the PBGC. This second wave of insolvencies – following the initial wave associated with groups A and B – will greatly prolong the projected stream of PBGC assistance payments, as shown in Graph One[5]. Projected assistance payments reach a peak of $11.2 billion in 2055 – just as the last of the claims from group D are materializing -- and then decline slowly. Thus, the issue of Group C and Group D plans being vulnerable to insolvency is important not only for those plans, but also for the long-term financial health of the PBGC.

Finally, note that our status quo scenario assumes the PBGC benefit guarantee is not indexed. As a consequence, the real value of the guarantee erodes significantly across time. Assuming an average inflation rate of 2%, by 2050 the purchasing power of the guaranteed benefit will have been cut in half relative to current levels. Thus, the status quo projection reflects only what is needed to preserve an insurance that lacks protection against price inflation. Obviously, any attempts to protect participants of failing multiemployer plans against erosion of purchasing power, over what can be seen as a lengthy period of time, will add significant financial responsibility to a PBGC insurance program that already appears quite overburdened.

[4] We computed this funding ratio by dividing the market value of assets by the plan's unit credit liability, adjusted to a 6% discount rate.

[5] The five colors in Graph One represent the five groups of plans presented in Table One. Assistance for plans in Group A -- projected to become insolvent before 2027 – appear in light blue; those for plans in Group B (projected to become insolvent after 2027 but before 2037) in red, and so on.



3. Estimates of Benefit Cuts and Contribution Increases Needed to Avoid Insolvency

A plan headed toward insolvency can be restored to financial health via contribution increases, assuming that the associated employers have sufficient economic strength to finance the increases. Alternatively -- or in combination with contribution increases -- benefit cuts can be implemented, provided that the cuts fall within legally prescribed limits. This begs the following question: what level of contribution increases or benefit cuts is required to save those plans currently headed towards insolvency?

For each plan projected to become insolvent in our status quo scenario, we used MEPSIM to calculate the following: (1) the across-the-board benefit cut required to avoid insolvency; (2) the required benefit cut across working-age participants, assuming that the benefits of current retirees are fully protected, and (3) the required contribution increase in the absence of any benefit cuts. For each of these three types of actions, we assumed an implementation year of 2018.

Our calculations assume that the "across-the-board" benefit cut is a flat percentage applied to the pensions of current retirees, to the accrued rights of working-age participants, and to future benefit accruals. A "working-age" benefit cut, in contrast, leaves the pensions of current retirees unchanged.

A contribution increase of "x%" means that contributions-per-worker are subject to a stand-alone increase of "x%" in 2018, with future annual contribution increases – as specified in our baseline assumptions -- built on top of this elevated contribution level. We recognize that plans would normally phase in a significant contribution increase over a period of one or more bargaining cycles (i.e. over more than a single year). However, we decided to model a single, discrete contribution increase because this approach permits an apples-to-apples comparison against the benefit cuts, which are implemented immediately (in 2018) rather than being phased in.

Benefit cuts and contribution increases were calculated such that a plan comes within a "hair's breadth" of insolvency but does not exhaust its assets. Therefore, these actions can be viewed as the bare minimum necessary to prevent insolvency. To avoid such a close encounter with insolvency, larger benefit cuts or contribution increases would be required.

The results of our calculations – shown in Table Two -- make it clear that the earlier a plan recognizes that it is headed toward insolvency, the more satisfactory the available range of remedial actions. Strikingly, even if a plan waits until it is within 30 years of insolvency – seemingly an ample remediation horizon -- its options to save itself

are likely to be harsh. In fact, for many plans, the required benefit cuts are so severe that they are not legally permissible. This issue is discussed in the next section of the paper.

Table 2. Median Benefit Cuts or Contribution Increases Needed to Prevent Insolvency

Group	Projected Year of Insolvency	(Option 1) Median Required Cut of Accrued Benefits Across All Participants	(Option 2) Median Required Cut of Accrued Benefits of Those Not Yet Retired	(Option 3) Median Required Contribution Increase
A	2017 to 2026	56.1%	100.0%	378.1%
B	2027 to 2036	25.9%	66.9%	91.2%
C	2037 to 2046	14.9%	29.5%	44.4%
D	2047 to 2056	9.0%	16.0%	25.0%
E	2057+	2.9%	5.3%	7.7%

Notes: (i) This table shows median results. If you wish to view the results for each individual plan, please refer to the scatterplots in Appendix A. (ii) The contribution increase is modeled as single, discrete jump occurring in 2018. In addition, contribution increases of 1.5% per year are assumed through 2025, as outlined in our baseline assumptions.

For plans in Group A -- those with a projected insolvency date between 2017 and 2026 -- the median across-the-board benefit cut needed to avoid insolvency is 56%, and the median required contribution increase is nearly 380%. For the median plan in Group A, a 100% reduction of the pensions of working-age participants would be insufficient to avoid insolvency.

Ascending from Group B to Group D, the actions required to avoid insolvency become less severe, but remain significant. Only when we reach Group E – plans projected to become insolvent more than 40 years in the future – do the required adjustments fall to levels that could be viewed as manageable.

Plans in Groups C and D are of particular concern because they are not eligible for relief under MPRA, yet they require significant adjustments to avoid insolvency. For example, the median plan in Group C would need to cut the accrued benefits and future accruals of its working-age participants by nearly 30% to avoid insolvency. Alternatively, the plan could make an across-the-board benefit cut of 15%, or increase contributions by 44%. None of these adjustments is trivial.

Across all groups, A through E, the required percentage contribution increase significantly exceeds the corresponding across-the-board benefit-cut percentage. This result arises because most plans have a low ratio of workers to total participants and, as a consequence, the contributions flowing into a plan are typically quite small relative to the plan's total liability. Under these circumstances, it is difficult to stabilize a plan solely through contribution increases.

The results in Table Two assume that the benefit cuts and contribution increases take effect in 2018. Delay is costly: with each passing year, the adjustments needed to place a plan on a sustainable trajectory become increasingly harsh, as indicated in Table Three, which shows the effect of delaying a stabilization action from 2018 to 2019.

For plans in Group A, the median across-the-board benefit cut required to avoid insolvency increases by 4% -- from 56% to 60% -- if it is implemented in 2019 instead of 2018. The cost of delay declines as one moves upwards from Group A to E, but the cumulative effect across a number of years remains significant. For example, for Group C, the cost of delay for a working-age benefit cut is 2.3% per year. Thus, a five-year delay would boost the required benefit cut by more than 11%.

Table 3. Increase in Median Required Benefit Cut or Contribution Increase if Implemented in 2019 Instead of 2018

Group	Projected Year of Insolvency	(Option 1) Median Required Cut of Accrued Benefits Across All Participants	(Option 2) Median Required Cut of Accrued Benefits of Those Not Yet Retired	(Option 3) Median Required Contribution Increase
A	2017 to 2026	4.0%	NA	30.4%
B	2027 to 2036	1.7%	7.6%	6.2%
C	2037 to 2046	0.8%	2.3%	2.7%
D	2047 to 2056	0.4%	1.2%	1.5%
E	2057+	0.1%	0.4%	0.5%

4. Effect of a 25% Across-the-Board Benefit Cut

Because most multiemployer plans are demographically mature, and because many have experienced significant declines in the number of active workers, efforts to stabilize plans via contribution increases or cuts to future benefit accruals are likely to be insufficient. In fact, the results presented in Table Two suggest that, for many plans, across-the-board benefit cuts – applied to most or all participants, including current retirees – are the only realistic option for avoiding insolvency.

Understandably, participants will tend to strongly resist such cuts, but the alternative is bleak: plan assets will eventually be depleted, regular benefit payments will cease, and, because the PBGC's multiemployer guarantee fund is itself expected to be exhausted in the near future, assistance payments may be unavailable, or will be much lower than the guaranteed level. Under these challenging circumstances, participants may view a benefit cut as the lesser of two evils.

For some plans, however, the size of the required benefit cut may be too bitter a pill for participants to swallow, even if the alternative is insolvency. For example, the median required across-the-board benefit cut for plans in Group A is 56%. It would be a challenge to convince participants or their representatives to adopt a cut of this magnitude. Furthermore, the average benefit currently in pay status across the multiemployer system is less than $1,000 a month. Retirees may feel that they cannot absorb a significant cut to such modest benefits.

Therefore, we modeled the effects of a 25% across-the-board cut, which, in our view, is an adjustment that many plans and their participants would find acceptable. For some plans, a 25% cut will be more than is required to prevent insolvency, but for the weakest plans it will be insufficient. While we could have modeled a smaller adjustment for those plans that do not require a 25% cut, this would not have altered the number of projected insolvencies. Therefore, for the sake of simplicity, we applied the same 25% cut to all plans. For those plans that require larger adjustments, a 25% cut is nevertheless beneficial, because it both postpones the projected insolvency date and reduces the projected claims on the PBGC.

We simulated five different options, each of which involves a 25% benefit cut, but which vary with respect to the criteria used to determine if a plan would be eligible for cuts:

1. Only plans within 20 years of insolvency would be eligible to cut benefits. Furthermore, the cut must be projected to prevent a plan's insolvency as opposed to merely delaying it. Lastly, reductions below 110% of the level of the PBGC benefit guarantee would not be permitted. These conditions are similar to the criteria that were established under the Multiemployer Pension Reform Act of 2014.

2. Identical to Option One, but without the criterion that the benefit cut must be sufficient to prevent a plan's insolvency. Thus, a benefit cut that merely delays insolvency (in other words, any cut) would be permissible.

3. Identical to Option Two, except plans would be permitted to reduce benefits below the PBGC guarantee level. However, cuts below the level required to prevent insolvency would not be permitted.

4. Identical to Option Three, except the years-to-insolvency threshold would be increased to 30 years.

5. Identical to Option Three, except the years-to-insolvency threshold would be increased to 40 years.

Table 4. Projected Impact of a 25% Across-the-Board Benefit Cut

	Plan Must Be Within "X" Years of Insolvency	Benefit Cut Must Prevent Future Insolvency?	Permit Cuts Below 110% of PBGC Guarantee?	Number of Plans Implementing Benefit Cuts	Guarantee Fund's Year of Exhaustion	Total Number of Insolvent Plans	PV of Projected Assistance Payments (Billions)
1	20	Yes	No	16	2027	437	$182.0
2	20	No	No	153	2031	437	168.9
3	20	No	Yes	153	2034	390	133.9
4	30	No	Yes	275	2034	283	78.3
5	40	No	Yes	360	2034	199	45.1
	Baseline Scenario with No Benefit Cuts			0	2027	453	184.7

As evidenced by the results for Option One, the benefit cut has little impact when it is limited to those plans that satisfy the existing MPRA eligibility criteria. For most plans within 20 years of insolvency, either the simulated benefit cut is insufficient to prevent insolvency (a MPRA requirement) or the cut pushes benefits below 110% of the PBGC benefit guarantee, which is not permitted under MPRA.

Options Two through Five illustrate the potential impact of relaxing the eligibility criteria. Keep in mind that these options assume that every eligible plan implements a benefit cut. In fact, such broad utilization of the relief is unlikely because plan participants and their representatives may push back against efforts to cut benefits, even if the alternative is insolvency. Therefore, the results in Table Four overstate the likely impact of any changes to the benefit-cut eligibility criteria.

In regard to increasing the years-to-insolvency threshold from 20 years to a significantly higher level -- as modeled in Options Four and Five -- the rationale for such a change is evident in Table Two, which presents required benefit cuts or contribution increases as a function of the projected time until insolvency. For plans with a projected insolvency date 30 to 40 years in the future, the median required across-the-board benefit cut is about 10%, and the median required contribution increase is 25%. Adjustments of this magnitude, while challenging, are realistic. However, for plans within 10 to 20 years of insolvency, the median required across-the-board benefit cut is 26%, and the median required contribution increase is over 90%. Adjustments of this size may be viewed as harsh, and, as a consequence, are less likely to be adopted.

5. Conclusions

The adage "a stitch in time saves nine" is applicable to defined benefit pension plans. The longer a plan on a downward trajectory waits to take corrective actions, the greater will be the required benefit cuts and/or contribution increases.

The legislative framework established under MPRA provides leeway for plans within 20 years of insolvency to implement benefit cuts. This is too short a time horizon, in our opinion. Our analysis indicates that a plan that is projected to become insolvent within 20 years typically has only a single effective option for avoiding insolvency: a large, across-the-board benefit cut, applicable to both workers and current retirees alike – quite a drastic solution from the perspective of plan participants.

Therefore, policymakers may well need to consider expanding MPRA's criteria to include plans that are within 20 to 35 years of insolvency. Thus, any plan within 35 years of insolvency would be eligible for MPRA. This relaxation of MPRA's eligibility criteria would permit plans to address funding problems at an earlier stage, before they become unmanageable.

With respect to plans already within 20 years of insolvency, MPRA permits benefit cuts only if they are sufficient to prevent the plan's projected insolvency. For many plans, this means that benefits must be cut by 50% or more. Cuts this severe will in some cases violate MPRA's own constraints but, even where permissible, are unlikely to be voluntarily implemented, even if the alternative is insolvency. As a consequence, many troubled plans have no realistic means to decelerate the rapid decline of their funding ratio.

To address this issue, policymakers may want to consider permitting troubled plans to implement benefit cuts that are intended simply to delay insolvency. Delaying insolvency by even a few years is a worthwhile goal. The longer a plan's insolvency is delayed, the greater will be the overall level of intergenerational fairness provided by the plan, and the smaller will be the claim that is ultimately placed upon the PBGC. Indeed, with a bit of good fortune in the capital markets, a plan that has bought itself some additional time through benefit cuts might actually recover, thereby avoiding insolvency altogether. The probability of recovery will be increased even if a benefit cut is initially believed to be short of the level required to prevent insolvency.

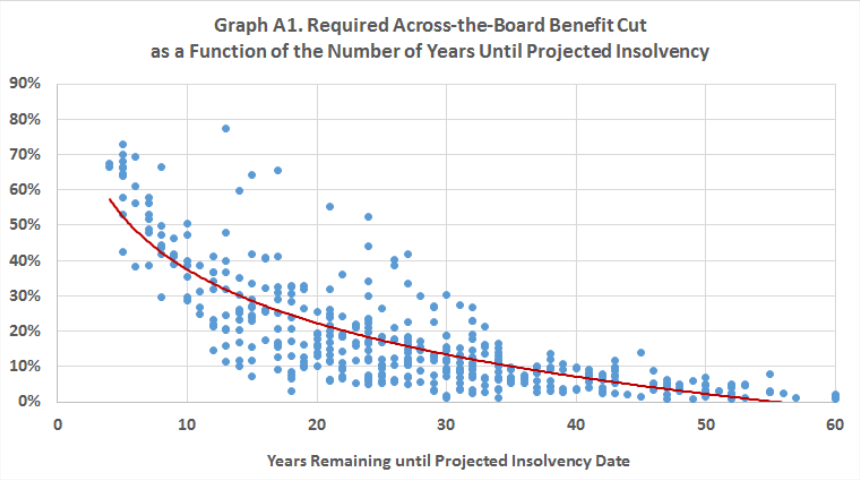
While relaxing MPRA's eligibility criteria is likely to reduce future claims on the PBGC, the magnitude of the effect is uncertain because the relief is voluntary as opposed to mandatory. Plan participants and their representatives may resist a proposal to cut benefits, even if a strong mathematical argument can be offered in favor of the cut. Therefore, policymakers may wish to consider options to increase the incentives for plans to adopt benefit cuts. We will consider various options in a future paper.

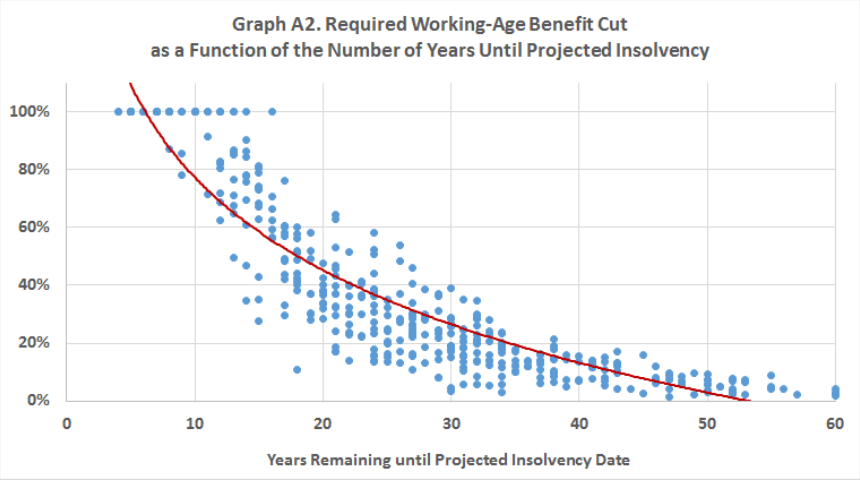
Absent either the success of such incentives or a remarkable run of good luck in the markets where plans invest their funds, a law that *forces* troubled plans to reduce benefits may need to be researched as the only approach sufficient to prevent the exhaustion of the PBGC's guarantee fund, if changes to the multiemployer system are made only from the plans' side.

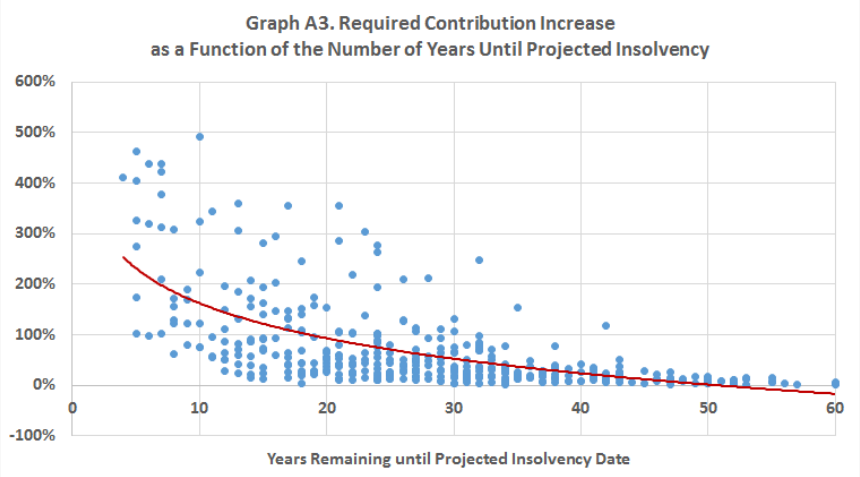
Even the broadest set of eligibility criteria we modeled for a potential liberalization of MPRA produces more than $45 billion in projected claims on the PBGC, leading to exhaustion of the guarantee fund by 2034. Therefore, additional policy remedies will probably be required, such as changes to the level of guaranteed benefits and/or increases to the revenue flowing into the guarantee fund. These options will be covered in our subsequent research efforts.

Appendix A. Scatterplots of Required Benefit Cuts and Contribution Increases

These scatterplots show the underlying simulation results that were summarized earlier in Table Two. While Table Two shows median values, the scatterplots below show the results for each of the 453 plans projected to become insolvent under our baseline assumptions.







Appendix B. A Description of MEPSIM

MEPSIM uses publicly-available 5500 data from 2015 as a starting point for its simulations. The data provide key values for each plan, such as liabilities, assets, contributions, current benefit payments and participant counts. At the outset of each plan simulation, MEPSIM uses an algorithm to create a realistic stream of benefit cash flows with a present value equal to the plan's accrued liability. The accrued benefit stream is tailored to the plan's level of demographic maturity, and to match plan data for current benefits (total payments to plan retirees in 2015). An additional benefit stream is created with a present value equal to the plan's "normal cost". This stream represents the annual rate at which the plan's working age population accrues new benefits.

To move forward in time, MEPSIM performs the following actions in each projection year:

1. Payments coming due are subtracted from plan assets, and simultaneously released from the accrued benefit stream such that they are no longer part of the plan's liability.
2. Assets are further modified to reflect returns (at the user-specified rate), and contributions received.
3. The stream of accrued benefits is increased to reflect the plan's normal cost.

Using this modeling approach, a plan's financial position changes in a realistic manner across time. Some plans will move along a downward trajectory, eventually becoming insolvent, while others will climb upwards. Users can experiment with assumptions such as the return-on-assets, the rate-of-increase of contributions, and the rate-of-increase of the plan's unit benefit, and observe how these changes affect outcomes. For simplicity, the assumptions are applied uniformly across all plans. That is, it is not possible to specify one set of assumptions for plan "A", a different set for plan "B", etc. For the next version of MEPSIM, we are considering adding the ability to vary assumption sets by major industry category.

MEPSIM is a deterministic model. As such, it does not include some features that might be found in a stochastic multiemployer model, such as the endogenous determination of contribution and benefit levels as a function of a plan's asset return experience. Rather, contribution and benefit increases are entirely exogenous in MEPSIM.

We are considering developing a stochastic version of MEPSIM to complement the deterministic version. Should we create a stochastic version, it is likely that we would add the capacity to endogenize contribution and benefit increases.

Appendix C. Baseline Assumptions

Our baseline assumptions are as follows:

Table C1. Baseline Assumptions

	Through 2025	After 2025
Return on plan assets	6.0%	6.0%
Rate of increase of the number of active workers	-1.5%	0.0%
Rate of increase of contributions-per-worker	1.5%	0.0%
Rate of increase of each plan's unit benefit	0.0%	0.0%
Rate of increase of the PBGC's guaranteed benefit	0.0%	0.0%

- To set our baseline assumption for asset returns, we reviewed the latest medium and long-term capital market forecasts by Vanguard, the McKinsey Global Institute, and JP Morgan. Together, these reports suggest that, for a portfolio allocated 60% to equity and 40% to bonds, a realistic expected return over the next 25 years is 6%. Therefore, we adopted 6% as our baseline assumption for the rate-of-return.
- Between 2001 and 2015, the total number of active workers declined at an average rate of 1.5%. We have assumed this trend will continue through 2025, after which the number of workers is assumed to be stable. We adopted the stabilization assumption with caution, bearing in mind that if, in fact, the decline in active workers ends up continuing, we will be understating the likely insolvencies and attendant costs to the PBGC.
- We assume contributions-per-worker increase annually by 1.5% through 2025, then remain level.
- Each plan's unit benefit is assumed constant across time.
- The level of the PBGC's benefit guarantee is assumed to remain unchanged.
- We use a rate of 2.55% for discounting the projected stream of PBGC assistance payments. This rate value was determined as a level-equivalent of the full Treasury yield curve from July 3, 2017 for discounting projected assistance payments. We used the projected assistance stream from a baseline run for this purpose, but also found the equivalence-value quite insensitive to assumption changes.

Note that, during the period up to 2025, the number of contributors is assumed to decline at precisely the same rate (1.5%) that contributions-per-worker is assumed to increase; therefore, aggregate contributions will remain constant.

Appendix D. Sensitivity Analysis

The simulation results presented thus far assume that all plans experience asset returns of 6% per year. Results are quite sensitive to this assumption. Therefore, for each policy option shown earlier in Table Four, we performed a pessimistic simulation using a 5% rate-of-return and an optimistic simulation using a 7% rate-of-return. The results are presented in Table D1 below. Note that the option labeled "0" (zero) is the baseline option for which no benefit cuts are assumed.

Only the asset-return assumption was varied. All other assumptions were held at their baseline levels. This simplification ignores the fact that plans might adjust either their contribution or benefit levels to reflect asset return experience. For example, lower-than-expected returns could motivate a plan to implement additional contribution increases.

However, as we explained in Section Two of this paper, we believe that many plans could be approaching a threshold beyond which additional contribution increases will become increasingly challenging. Furthermore, few plans have availed themselves of the benefit reduction relief offered under MPRA. Lastly, we are varying the assumed rate-of-return through a narrow range. Therefore, in our view, it is reasonable to use the same contribution and benefit increase assumptions for all options.

Table D1. Projected Impact of a 25% Across-the-Board Benefit under Asset Returns of 5%, 6% and 7%

	Return On Assets	Plan Must Be Within "X" Years of Insolvency	Benefit Cut Must Prevent Future Insolvency?	Permit Cuts Below 110% of PBGC Guarantee?	Number of Plans Implementing Benefit Cuts	Guarantee Fund's Year of Exhaustion	Total Number of Insolvent Plans	PV of Projected Assistance Payments (Billions)
0	5%	NA	NA	NA	0	2027	673	$266.7
1		20	Yes	No	22	2027	654	259.0
2		20	No	No	206	2030	654	244.3
3		20	No	Yes	206	2032	600	193.2
4		30	No	Yes	428	2032	420	112.4
5		40	No	Yes	563	2032	286	83.9
0	6%	NA	NA	NA	0	2027	453	$184.7
1		20	Yes	No	16	2027	437	$182.0
2		20	No	No	153	2031	437	168.9
3		20	No	Yes	153	2034	390	133.9
4		30	No	Yes	275	2034	283	78.3
5		40	No	Yes	360	2034	199	45.1
0	7%	NA	NA	NA	0	2028	262	$119.7
1		20	Yes	No	18	2028	244	116.7
2		20	No	No	111	2033	244	104.8
3		20	No	Yes	111	2037	212	81.1
4		30	No	Yes	180	2037	149	58.1
5		40	No	Yes	212	2037	117	39.9