FTI CONSULTING™

SUBTASK 4.2 REPORT

EVALUATION OF THE SIMULATION OF PLAN SPONSORS AND PLAN VIABILITY

One of Three Twelve-Month Reports

IN-DEPTH TECHNICAL REVIEW OF THE PENSION BENEFIT GUARANTY CORPORATION'S MULTIEMPLOYER AND SINGLE-EMPLOYER PENSION MODELS

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Introduction

In July 2015, the Social Security Administration (SSA) engaged the FTI Consulting team (FTI) to conduct an 18-month, in-depth technical review of the Pension Benefit Guaranty Corporation's (PBGC) single-employer (SE) and multiemployer (ME) Pension Insurance Modeling System (PIMS). Task 4 of the Statement of Work (SOW) consists of 10 subtasks required for this in depth review - nine specific areas of review and a final report.[1] Three of the subtask reports are due at the end of each of the six-, 12- and 18-month periods. This report for Subtask 4.2, along with those for Subtasks 4.3 and 4.7, is due at the end of the 12-month period (with approved extension). As a part of our review of PIMS, this report documents our evaluation of the simulation of plan sponsors and plan viability in PIMS.

Due to the long period between the formulation of the project and the eventual award of work and start of the analysis, and given the ongoing evolution of the PIMS model, certain questions originally expected to be addressed under this subtask have been eliminated. These include studies of emerging trends, where the PIMS team and/or other entities have potentially duplicative studies underway.

The simulation of plans and the firms that sponsor them lies at the core of PIMS, and is the basis for forecasts of PBGC's insurance claims, risk exposure, financial position, and potential insolvency. Therefore, the selection of plans and plan sponsors and the simulation of a plan's future funded status and benefits to be paid should be reasonable and representative of plans covered by PBGC's pension insurance.

Because PBGC's insurance differs for SE and ME plans, it is important to note that the PIMS model has a "core" that is similar for the two types of plans, but then diverges to reflect the differences between them. PIMS modeling of both types of plans begins with a selection of a sample of firms and plans considered to be representative of all those insured. The initial participant counts, liabilities, and funded positions are calibrated with values reported by plan sponsors on Form 5500 Schedule SB (for SE plans) and MB (for ME plans). For each forecast year, PIMS performs actuarial valuations to calculate plan liabilities and required contributions. It determines results in years after the initial valuation date by rolling forward plan assets, reflecting the assumptions chosen for the model and using the plan's projected population and benefit payments. This report reviews both SE-PIMS and ME-PIMS, addressing their sampling methods, actuarial calculations, and assumptions regarding plan sponsor behaviors.

We address the following key questions raised in Subtask 4.2:

- How representative are the samples of sponsors and sponsored plans?

- How often and how carefully are the samples updated?

- Should the ME model focus on labor unions, rather than firms, as primary plan sponsors?

- Detailed actuarial calculations are required for the plan-specific simulations of contributions paid in, benefits paid out, fund asset growth, the accruing liabilities for future benefits, and

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[1] Social Security Administration, Evaluation of the Pension Benefit Guaranty Corporation's Pension Models, Description/Specification/Work Statement, page 14.

required PBGC premiums. Are the assumptions used to project plan-specific values reasonable and consistent with plan assumptions reported on Schedules SB and MB?

- Is the level of simplification of plan rules and plan funding requirements appropriate? Are there appropriate feedbacks between the firms' financial status and the evolution of the sponsored plans?

- Is the PIMS model of PBGC's interest rate factors appropriate?

- Are the mortality rates used in the model up-to-date and appropriate to the population being simulated?

- Is the calibration process reasonable?

- For ME plans, are the projections of the "PPA Zone" reasonable? Is the Funding Improvement Plan/Rehabilitation Plan (FIP/RP) hierarchy reasonable?

We emphasize two areas having great impact on PIMS actuarial projections: liability calibration and the modeling of plan sponsor behavior. Because components of PIMS's actuarial calculations are "trued-up" by liability calibrations, any given component may not, in itself, have a significant impact on the aggregate actuarial projection. Therefore, in evaluating PIMS's *calibration procedures*, we focus on:

1) the level and pattern of Normal Costs;

2) the interest rate sensitivity of the Normal Costs and liabilities; and

3) the level and pattern of benefit payments.

From our experience in replicating reported pension actuarial calculations, if the above three areas are adequately addressed, the result of the calculations will generally be within a reasonable range of actuarial projections.

In evaluating PIMS's *modeling of plan sponsor behavior*, we address:

1) employers' contributions to the pension plans;

2) the payment of PBGC premiums;

3) "de-risking" of pension plans;

4) plan sponsors' investment and funding decisions when in financial distress;

5) ME plan trustee decisions with respect to Funding Improvement and Rehabilitation Plans; and

6) assumptions with respect to Multiemployer Pension Reform Act of 2014 (MPRA).

For SE plans, recent de-risking by plan sponsors tends to reduce PBGC's risk exposure; however, ME plan sponsors have not implemented de-risking as often as SE plan sponsors. Further, it is not clear how much ME plan trustee decisions can affect either sponsor contributions or benefit levels, since both are determined through collective bargaining. However, insofar as PIMS makes assumptions about those decisions, they are commented where appropriate.

Also in respect to SE plans, from an actuarial standpoint, we believe the variable having the most impact on PBGC's projected financial status is a plan's underfunding on a plan termination basis. When an SE plan sponsor files for bankruptcy, the claim against PBGC is related to the plan's unfunded liabilities.

For ME plans, and again from an actuarial standpoint, we believe the variable having the most impact on PBGC's projected financial status is projected benefit payments. This variable is highlighted because projected benefit payments directly affect plan assets, and therefore the likelihood and timing of insolvency. We would note, however, that over a 10-year horizon, accuracy in projecting benefit payments does not have a significant impact for SE pension insurance, because the same benefit payments are taken out of assets and liabilities, leaving the plan underfunding essentially unchanged.

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Findings

Appropriate Focus of ME Plan Modeling

1) As to whether the ME model should focus on unions rather than firms as "primary plan sponsors," in most cases relevant work should first of all seek an understanding of the economic situation of a typical unionized firm (in the case of SE plans, the subject firm), based on trends in its industry. Potentially useful data sources are discussed in this report, with several listed in Appendix A.

"Other Broad Factors" To Be Considered in Assessing Plan Sponsor Vulnerability

2) Given the concern for possible "fat tail" events (see page 12) transpiring over the long term, we believe that liability forecasting for both ME and SE plans should give additional consideration to the following broad categories:

   a. Long-term trends in industry employment and unionization;

   b. Long-term industry import pressure;

   c. Planned relocation of a substantial portion of production capacity abroad;

   d. Long-term trend in industry automation;

   e. Industry regulatory changes; and

   f. Litigation or governmental investigations.

Representativeness of Sampled Plans and Plan Sponsors

In respect to plan sampling, we recommend:

3) Establishment of a definitive set of rules for sample selection, insofar as is practical reflecting the conclusions reached by the industry-focused analyses. For example (and conditional upon testing), use of a stratified sample also incorporating some minimum number of plans in industries exhibiting the greatest declines in union membership.

4) Full documentation of those rules and any subsequent changes, as well as the thinking behind them, is found to be optimal.

5) Periodic testing of sample representativeness in terms of key solvency-related attributes, such as the ratio of active to inactive plan participants – or, better still, the trend in that ratio. To the extent that such attributes differ as between the sample and the full population, the sample cannot be used to reliably generalize about the solvency of the population. However, there are statistical means of correcting for such differences.

6) Testing the historical correlation between the incidence and/or extent of plan insolvencies, on the one hand, and materially incomplete plan Form 5500 filings, on the other. (Here again, insofar as the sample of plans inputted into PIMS may be biased due to the exclusion of plans with incomplete filings, that bias is, at least in theory, correctible.)

PIMS Modeling of PBGC's Interest Rate Factors

7) The use of a 33 basis point spread over the 30-year Treasury rate for a discount rate is reasonable.

PIMS Modeling of Mortality Assumptions

8) Mortality used in both the SE- and ME-PIMS reasonably reflects current mortality and anticipated longevity improvements.

Calibration of Core Actuarial Calculations

9) Because PIMS is unable to completely separate the wage growth assumption and the benefit accrual rate for salary-related plans, a calculation of the ratio of Normal Cost to payroll and the ratio of Normal Cost to active head count is recommended.

10) For multiemployer plans, prospective calibration only applies to percent of contribution (POC) plans. PBGC should explore ways of calibrating prospective factors for other types of plans.

11) We recommend that PBGC use asset allocation information in SE- and ME-PIMS because it is a better forward-looking indicator of anticipated asset performance (see page 34).

General Comments on Plan Sponsor Behavior

12) We believe PBGC should model de-risking trends with SE-PIMS, perhaps as a separate study initially before incorporating it into the Projections Report. We suggest that PIMS can model the impact of de-risking by adjusting pension plans' asset allocation and PBGC's premium collection.

MPRA Modeling

13) With respect to the modeling of MPRA's benefit suspension and partition, we recommend that the PIMS modifications continue to be made based on Treasury's considerations in approving benefit adjustments (see page 43).

Appropriate Focus of ME Plan Modeling: Unions or Firms?

One question raised in the SOW for Subtask 4.2 – which overlaps with several others under Subtasks 4.1 and 4.3 – is whether the ME model should focus on unions rather than firms as "primary plan sponsors." Putting aside any possible legal considerations, this is essentially an issue of appropriate emphasis in the economic, financial, actuarial and other analyses required to best estimate the extent of ME plan insolvencies over both the near- and (quite) long term, subject of course to budget constraints.

Viewed from that perspective, the simplified schematic below portrays certain key influences on plan viability, as well as the economic agents most immediately and directly affected by those influences. As indicated, while ultimately impacting a sponsoring union (in terms of size, bargaining power, financial condition, etc.) and its sponsored plan(s), relatively more of these influences, or pressures, are first felt by the employers making the plan contributions. As noted in our Subtask 4.1 report,[2] those industries accounting for PBGC's largest liabilities – both multi- and single-employer – have for many years been characterized by long-term declines in employment or unionization, and/or impacted with particular severity by technological, import-related, and/or regulatory events (i.e., airlines, steel, automotive, printing and publishing, grocery stores, electrical machinery and equipment, apparel, furniture and trucking – also see below).

Exhibit A

KEY ECONOMIC DETERMINANTS OF PLAN VIABILITY

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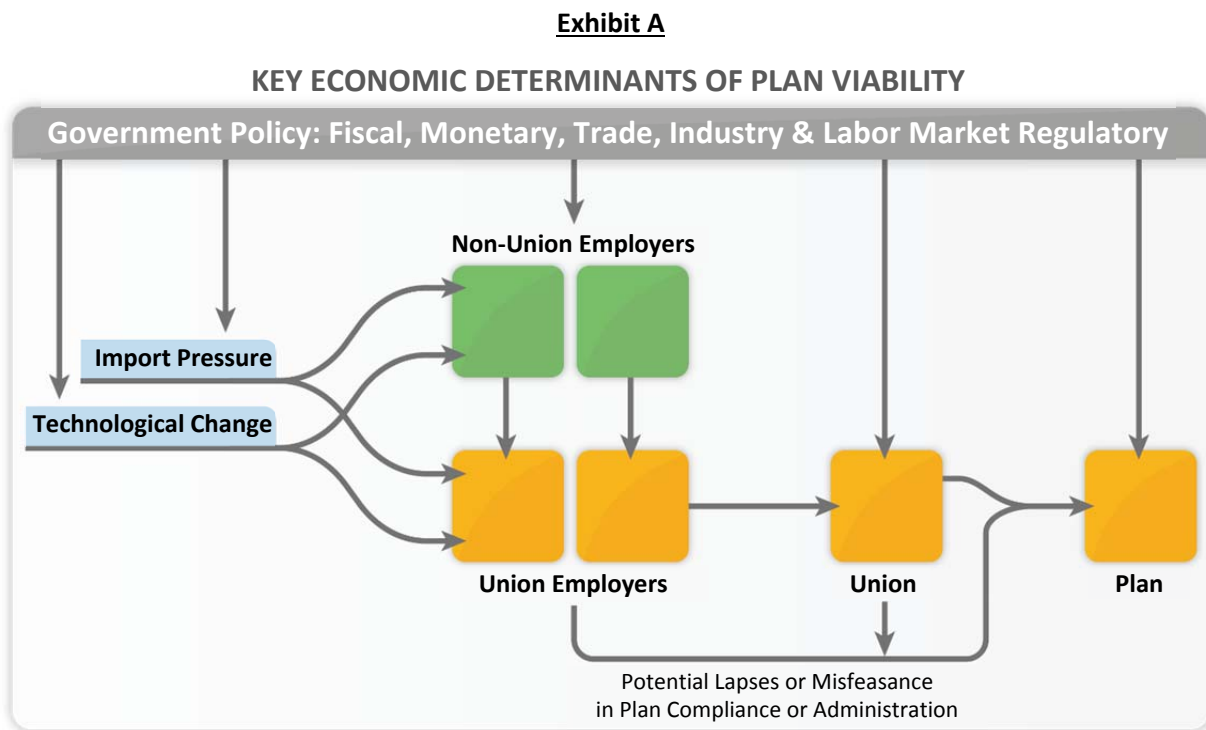
[2] At pages 14-36.

Further, a given union may represent workers in several different industries. For example, the Communication Workers of America (CWA) represents both printing, publishing and media workers (CWA/ITU) and workers in the electrical, electronics and manufacturing sectors (UE-CWA) – the latter including, for example, both automakers and companies such as GE, and separate CWA ME pension plans are maintained for each of the aforesaid worker groups.[3] While domestic employment and union membership in all these industries have, for many years, been adversely impacted by technological change – and, in the manufacturing sector, by import competition and the related relocation of production abroad – the various domestic industries covered by these CWA plans differ sufficiently in terms of economic outlook to merit separate analyses. Reflecting that fact is another: as of September 30, 2014, of all 24 ME plans deemed likely to require PBGC support in excess of $100 million outside of those in the trucking industry, six are in the printing and publishing industry, representing $3.6 billion in estimated liability, while only two are in the motor vehicle industry, representing just $0.3 billion in estimated liability, and only one in the electrical machinery and equipment industry, representing just $0.4 billion.[4] (To be sure, in absolute terms, all these dollar amounts are significant.)

For the forgoing reasons, and as further documented below, we believe that in most cases one should first seek an understanding of the economic situation of a typical unionized firm (in the case of SE plans, the subject firm), based on key trends in its industry.

In the following section, we elaborate on this recommendation, based both on additional reference to findings in our Subtask 4.1 report and other research performed in regard to the issue below.

"Other Broad Factors" To Be Considered in Assessing Plan Sponsor Vulnerability

Several questions posed in the SOW for Subtask 4.3 relate to the possible desirability of the ME program's considering one or more broad factors impacting plan sponsor vulnerability not otherwise cited in the SOW. Because the answers to those questions flow directly from the considerations raised above, we address the questions here, rather than in the Subtask 4.3 report.

Coupled with observations and recommendations presented in our Subtask 4.1 report,[5] the discussion in the preceding section suggests that, insofar as economically feasible, the following factors be considered in both the ME and SE programs, especially in relation to possible "fat tail" events:

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[3] http://www.cwa-union.org/for-members/cwa-pensions-and-trusts.

[4] Source: File titled, "ME PROBSwReserves 9 30 14.xls," provided by PBGC.

[5] E.g., "It is our understanding that, at present, PIMS modeling does not systematically address industry-level trends in union representation, potentially indicative of significant changes in both industry- and firm-specific competitive advantage and financial soundness. Over the last several decades, such changes have arisen from, among other things, economic advancements worldwide, liberalized conditions of international trade, technological innovation, and the deregulation of key industries in the United States. All these factors (and more) have exposed industry incumbents to intensified competition, and to often sharply-varying degrees." Subtask 4.1 report, page13. Indeed, the relevance of these factors is noted, where most appropriate, throughout the first half of the 4.1 report. For ease of reference, certain relevant citations are reproduced here:

Jonathan Haskel, Robert Lawrence, Edward Leamer, and Matthew Slaughter, "Globalization and U.S. Wages: Modifying Classic Theory to Explain Recent Facts," *Journal of Economic Perspectives*, Spring 2012; Robert Feenstra and Gordon Hansen, "Globalization, Outsourcing, and Wage Inequality," National Bureau of Economic Research, Working Paper 5424, 1996; David Autor, Lawrence Katz, and Melissa Kearney, "Trends in U.S. Wage Inequality:

1. *Long-term trends in industry employment and unionization*, utilizing the data sources cited in our Subtask 4.1 report.

2. *Long-term industry import pressure*, based on trends in import penetration, related antidumping and countervailing duty case activity, and data in industry analyst reports. Consultation with USITC industry specialists is also advisable.

3. *Planned relocation of a substantial portion of production abroad*, as disclosed in company annual reports, SEC filings and industry analyst reports. Also note that many unions follow such activity.

4. *Long-term trend in industry automation*, utilizing both existing and pending analyses by Departments of Labor and Commerce, industry trade publications, and those of the robotics and related product developers.

5. *Industry regulatory changes* either: (a) directly impacting the extent of competition between union and non-union employers, such as the spread of "right-to-work laws" and modification or elimination of "prevailing wage" laws; or (b) indirectly impacting industry employment, as in the case of environmental law, through its impact on the coal industry via electric utility regulation.

6. *Litigation or governmental investigations* as might suggest material misrepresentation of plan solvency, and related press coverage.

A more detailed list of industry-specific data sources is provided in Appendix A.

The relevance of factors such as those above in attempting to identify large-plan vulnerability is also indicated by recent research on a closely-related topic: systematic corporate default risk, or "default clustering." In a 2012 working paper issued by the European Central Bank,[6] Koopman, Lucas and Schwaab identify three basic sources of default clustering: (a) macroeconomic (i.e., related to general economic conditions, of the kind varied in alternative PIMS runs); (b) industry-level factors; and (c) "frailty," a factor capturing default clustering "...above and beyond what can be explained by macroeconomic variables and firm-specific effects."[7] Assessing the relative importance of these factors by means of a non-Gaussian dynamic factor model, they conclude as follows:

> In our study of defaults for U.S. firms, we found that approximately one third of default rate volatility at the industry and rating level is

Revising the Revisionists," *Review of Economics and Statistics*, May 2008, pages 300-323; Efraim Benmelech, Nittai Bergman, and Ricardo Enriquez, "Negotiating with Labor under Financial Duress," *Review of Corporate Finance Studies*, February 2012; Justin Pierce and Peter Schott, "The Surprisingly Swift Decline of U.S. Manufacturing Employment," National Bureau of Economic Research Working Paper 18655, December 2012; Willem Thorbecke and Hanjiang Zhang, "The Effect of Exchange Rate Changes on China's Labor-Intensive Manufacturing Exports," Research Institute of the Economy, Trade and Industry (Japan) Discussion Paper 08-E-038, September 2008; and United States Government Accountability Office, "Commercial Aviation: Bankruptcy and Pension Problems Are Symptoms of Underlying Structural Issues," Report to Congressional Committees, September 2005.

[6] Siem Jan Koopman, Andre Lucas, and Bernd Schwaab, "Dynamic Factor Models with Macro, Frailty, and Industry Effects for U.S. Default Counts: The Credit Crisis of 2008," ECB Working Paper No. 1459, August 2012.

[7] Koopman, Lucas, and Schwaab, op. cit., page 4.

systematic [i.e., unrelated to factors specific to a given firm]. The systematic default rate volatility [i.e., about 66% of it] can be further decomposed into macro and frailty driven. The part due to dependence on common macroeconomic conditions and financial activity ranges from about 30% for sub investment up to 60% for investment grade companies. The remaining share of systematic credit risk is captured by frailty and industry risk.[8]

Thus, pursuant to their analysis, only about 20-40% of default rate volatility [.30(.66) - .60(.66)] is attributable to measurable macroeconomic conditions, with the rest ascribable to firm-specific, industry-level, or uncertain factors ('frailty'). However, based on certain observed correlations, they conjecture that the last "…capture changes in economic conditions which are hard to quantify, but impact the quality and default experience of bank portfolios in an economically significant way."[9]

The significance of industry-level factors in causing financial distress has also been documented in a large body of research, well summarized in a recent paper by Akhigbe, Madura and Martin, who themselves conclude that, "…specific news about financial distress such as bankruptcy announcements of one firm can emit a negative signal about its corresponding industry," and that, by virtue of the same effect,"…a pronounced stock price decline of one firm yields significant negative valuation effects for rivals, on average."[10]

Industry-Wide Impacts of Technological Change

While our Subtask 4.1 report addressed technological change chiefly in the context of current wage trends,[11] the 2016 *Economic Report of the President* and the research literature cited therein explain the employment-suppressing effects of robotics, which also should be considered, if only in a broad-gauge way, in identifying industries whose pension plans are likely to be imperiled over the next 10 to 20 years.

Noting, among other things, that the industries at present most prone to this form of automation are automotive, chemical, rubber, plastics, metal and food processing,[12] the report further presents data indicating that workers earning less $20 an hour as of 2010 have an 83% chance of their jobs being automated; those earning between $20 and $40, a 31% chance.[13]

Union- and Employer-Specific Factors

Referring back to the question of appropriate focus in terms of ME plan sponsorship, we do not intend to suggest that the influence of the sponsoring union on the financial soundness of an ME plan should

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[8] Koopman, Lucas, and Schwaab, op. cit., page 39. Sub-investment grade companies are likely a better match for those ME plan sponsors apt to experience financial difficulty.

[9] Koopman, Lucas, and Schwaab, op. cit., page 40.

[10] Aigbe Akhigbe, Jeff Madura and Anna Martin, "Intra-Industry Effects of Negative Stock Price Surprises," *Review of Quantitative Finance and Accounting*, March 2014, pages 541-559.

[11] At pages 7-9.

[12] Council of Economic Advisers, *Economic Report of the President*, February 2016, pages 233-235.

[13] Council of Economic Advisers, op. cit., pages 236-239.

be overlooked; moreover, there will certainly be instances in which that influence merits as much or more attention than the economic condition of the related industry. For example, through collective bargaining, unions can play an important role in determining plan contribution and benefit levels. Further factors of influence include the technical knowledge, extent of due diligence, and standards of governance applied by plan administrators in selecting fund managers and overseeing their performance; the competence and ethical standards of those managers themselves, as well as those managing subordinate funds;[14] and the level of compliance with applicable law and plan provisions on the part of all parties, including sponsoring employers. All those considerations, of course, are also relevant to SE plans.

For example, in an evaluation of corruption and racketeering in the New York City construction industry conducted in the late 1980's, the New York State Organized Crime Task Force (OCTF) found that:

> Of the two major types of frauds involving union pension and welfare funds, one is perpetrated by contractors and the other by fund trustees. Contractors defraud the workers' funds by bribing union officials to permit double-breasted shops [those employing both union and non-union workers] and off-the-books payrolls under which contributions to the employee benefit funds are avoided. Workers are sometimes willing to forgo fringe benefits in return for unreported cash wages that can be shielded from federal, state and local taxes.

And that:

> [Plan] Trustees and/or consultants use a variety of schemes to exploit opportunities to bilk the pension and welfare funds of which they are the fiduciaries. Corrupt trustees embezzle funds by simply withdrawing money in their own or fictitious names.   They make "loans" to

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[14] These first two considerations take on increasing importance with increasing investment in securities that are not publicly traded, and other "hard to value assets." As noted by the U.S. Department of Labor: "The difficulty [with FASB Statement No. 157 compliance] arises with a further requirement that [pension plan] fiduciaries have an adequate understanding of the characteristics of investments in the valuation process in order to determine whether certain valuations are reasonable. To the extent discussed, there appears to be no disagreement among the Council members with respect to investments that have an ascertainable value. However, valuing alternative investments can present unique challenges. Often alternative investments are investments for which there is not a readily determinable fair value or a market. For example, as noted in the Plan Advisory on Valuing and Reporting Plan Investments issued by the AICPA, alternative investments are not generally listed on national exchanges or over-the-counter markets, nor are quoted market prices available from sources such as financial publications, the exchanges, or the National Association of Securities Dealers' Automated Quotations System. To complicate the matter, according to the AIPCA Study, these alternative investment/hedge fund managers generally provide limited information to third parties, and the assets themselves can range from marketable securities to complex and/or illiquid investments, and such assets may not be disclosed by the alternative investment/hedge fund managers." U.S. Department of Labor, Employee Benefits Security Administration, *Report on Hard To Value Assets and Target Date Funds*, 2008, "Consensus of [2008 ERISA Advisory] Council Recommendations – Hard to Value Assets," available at https://www.dol.gov/ebsa/publications/2008ACreport1.html. More concretely, also see, for example, Elliot Blair Smith, "How the Teamsters Pension Disappeared More Quickly under Wall Street than the Mob," *MarketWatch*, April 6, 2016. Available at http://www.marketwatch.com/story/how-the-teamsters-pension-disappeared-more-quickly-under-wall-street-than-the-mob-2016-04-04.

themselves, friends, and organized crime associates, without expectation of repayment. They fraudulently pay for nonexistent goods and services, or pay money to ineligible "beneficiaries." They steer contracts for benefit plan services… to companies controlled by fellow racketeers or to legitimate companies willing to pay kickbacks to obtain these lucrative contracts."[15]

However, the foregoing is not meant to suggest that unions, union employers, or union-affiliated employees are less likely to comply with ERISA than non-union-affiliated plan stakeholders.

In respect to PIMS specifically, in our view, and also based on FTI's experience in other areas, lapses in plan governance are apt to be correlated with the incidence of inaccuracies and/or omissions in financial reporting, a consideration with implications for plan sampling (see below).

More Specific Recommendations, Based on the Foregoing

1. As noted in our Subtask 4.1 report, "…PBGC's liability forecasting process might benefit from: (a) incorporation of a unionization-trend variable in the PIMS modeling, perhaps through modification of the weights assigned to alternative future outcomes, or modification of current benefit plan sampling methods; and (b) greater investment, in relative terms, in economic research and analysis aimed at pinpointing, and assessing the impacts of, major competitive shifts and structural changes in domestic industry."

2. As to the plan sampling process specifically, stratification procedures might allow for a larger number of plans in categories based on one or more of the following industry-specific criteria, in the following preliminary order of priority: (a) long-term trend in number of covered employees; (b) long-term trend in industry employment overall; (c) forecast job displacement due to automation; (d) recent trends in import penetration, ideally coupled with industry intelligence as to firm relocation plans; and (e) projected impacts of statewide right-to-work laws, changes in prevailing wage law, and other regulatory changes.

3. As to PIMS modeling, for each plan, take as baseline assumption the observed long-term trend in the number of covered employees in the

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[15] New York State Organized Crime Task Force, op. cit., pages 23 and 25. For a more recent assessment and related data, see, for example, James B. Jacobs, "Is Labor Union Corruption Special?" New York University Public Law and Legal Theory Working Paper, New York University School of Law, February 2014, available at http://lsr.nellco.org/cgi/viewcontent.cgi?article=1451&context=nyu_plltwp; American Institute of Certified Public Accountants, Employee Benefit Plan Audit Quality Center, "Employee Benefit Plans, DOL Criminal Enforcement Cases, April 2009 - November 2011," available at https://www.aicpa.org/interestareas/employeebenefitplanauditquality/resources/toolsandaids/downloadabledocuments/dol_ebsa_criminal_case_summaries_november2011.pdf; and, more generally, the related U.S. Department of Labor website, https://www.dol.gov/olms/regs/compliance/enforce_2015.htm.

related industry, rather than a single, economy-wide trend assumed to hold true for every industry.

4. As noted our Subtask 4.3 report, use of degree of industry unionization or the trend in same as an explanatory variable in PIMS bankruptcy might well improve the model's long-term performance.

Representativeness of Sampled Plans and Plan Sponsors

ME Plans

Current Practice

As of FY2014, the sample of ME plans used by PBGC to forecast its ME plan liabilities broke down as follows: (a) 27 insolvent plans; (b) 29 terminated "probable" plans (see below); (c) 44 ongoing "probable" plans; and (d) 184 non-booked plans.[16] The total number of insured ME plans is about 1400.[17]

As stated in the PBGC's FY2014 Projections Report and confirmed by PBGC staff, "Generally, ME-PIMS attempts to individually model almost all the large and medium [ME] plans the external model determines may be 'critical and declining [i.e., MPRA-eligible]'."[18] "Large" plans are those with over 35,000 participants; "medium," those with between 2500 and 35,000; "small," those with less than 2500. The ME-PIMS also models a sample of plans in the "small" category. [19] Notably, the PIMS sample of plans includes 10 of the 11 largest plans (in terms of estimated liability) and at least half of all troubled medium-sized plans, as identified by PBGC staff.

The following information regarding PBGC's ME plan sampling and categorization should be noted:

1. PIMS's current sampling method comprises: (a) a set of plans identified at some point in the past, through a process undocumented and at least to some extent not now understood; and (b) a process for adding plans to, or deleting plans from, that initial set, consistent with criteria set forth in PBGC's FY 2014 Projections Report (pages 43-44).

2. The Multiemployer Working Group (MWG) is, "…an interdepartmental committee that is responsible for overseeing the process of developing and reviewing the results of the multiemployer contingency list for PBGC's annual statements."[20] The MWG classifies problematic ongoing plans as follows: [21]

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[16] FY2014 Projections Report, page 43.

[17] FY2014 Projections Report, page 6.

[18] FY2014 Projections Report, page 44.

[19] FY2014 Projections Report, pages 43-44.

[20] "Multiemployer Working Group Procedures for 2015," May 19, 2015, page 1 and generally.

(a) "Probable," for plans already insolvent, terminated plans with insufficient cash flow to cover obligations, and ongoing plans projected to become insolvent less than 10 years after the PBGC financial closing date; and

(b) "Reasonably Possible," for those projected to become insolvent between 10 and 20 years after that date.[22]

3. We understand that PBGC also makes its own, independent determination of whether a plan fits into one of the above categories.

The MWG's decision as to whether to classify a large or medium ongoing plan as "probable" or "reasonably possible" is based in part on forecast dates of plan insolvency (DOI) by the Actuarial Services Division (ASD) of the Benefits Administration and Payments Department, and, in the case of large plans, on a Plan Data Analysis (PDA) as well.[23] In addition to Form 5500 and other data, a PDA is expected to consider, "…industry trends, active participant base trends, contribution history and trend, anticipated benefit payments, public statements made by the plan and its designated representatives, and interactions between PBGC and the plan over the fiscal year."[24]

In the context of a given analysis, a sample of the population(s) at issue (in this case, all insured plans and their sponsors) may be considered "representative" if its composition, in terms of attributes relevant to that analysis (in this case, plan and plan sponsor solvency, for example) approximates that of the population(s). Absent the relative concentration of a relevant attribute in one or more distinct sub-groups of the population, that goal of representativeness may be economically met by drawing a simple random sample from the entire population. However, if such concentrations exist (for example, accidents among teenage drivers), or if there is reason to believe they might, for maximum reliability extra steps must be taken to assure that the population sub-groups at issue are sufficiently represented in one's sample. That is the principle behind "stratified sampling."[25]

As discussed above, and for clear practical reasons (cost considerations and/or data availability), the sample of ME plans run through PIMS in FY 2014 totaled 284 across all plan categories, out of a total of roughly 1400, and was not randomly drawn.[26] The sample did not include plans representing a

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[21] The Multiemployer Program Division (MEPD), the Office of the Chief Counsel (OCC), the Negotiations and Restructuring Actuarial Division (NRAD), the Financial Operations Department (FOD), the Benefits Administration and Payment Department), and the Office of Policy and External Affairs (OPEA). "Multiemployer Working Group Procedures for 2015," May 19, 2015, pages 1-2.

[22] "Multiemployer Working Group Procedures for 2015," May 19, 2015, pages 1-2 and 5, and FY2014 Projections Report, page 7. Ongoing plans with more than 2500 participants and projected insolvency dates lying outside the twenty-year window are classified as "Remote."

[23] "Multiemployer Working Group Procedures for 2015," May 19, 2015, page 4.

[24] "Multiemployer Working Group Procedures for 2015," May 19, 2015, page 4"Multiemployer Working Group Procedures for 2015," page 9.

[25] See, for example, Paul Levy and Stanley Lemeshow, *Sampling of Populations*, Fourth Edition (Wiley: Hoboken NJ, 2008), pages 122-123.

[26] Given, for example, the stated goal of including "…almost all the largest plans" in the sample, and "…decreasing proportions of smaller plans…" (FY2014 Projections Report, page 43).

potentially large portion (the obverse of "more than half") of PBGC's ME plan exposure, based on non-current Form 5500 data[27] – themselves, at least in some cases, of questionable reliability. Which is not to say that we are advocating evaluation of all ME plans, or even a majority, but rather consideration of the desirability of adding plans of significant size in industries particularly vulnerable to the economic forces described in the sections preceding.

Similarly, and as also noted above, and again for clear practical reasons, the MWG's decisions as to which large or medium ongoing ME plans are "probables" or "reasonably possibles" – decisions made, it should be emphasized, independent of PBGC staff's own determinations – are in part judgmental, with greatest focus placed (in the form of PDA's) on plans with more than 35,000 participants. Thus, this more rigorous MWG process[28] excludes the potential PBGC liabilities (as measured by number of plan participants) indicated in red in Exhibit B on the following page. The associated plans, and their sponsors, constitute a portion of the plan universe still largely unexplored, at least in terms of the economic and industry trends capable of producing "fat tail" events 10 to 20 years down the road. Given the very real possibility of industry- and/or economy-wide contagion (addressed in our Subtask 4.3 report), as well as variation in the extent of future plan deficits on a per-participant basis, the *relative* smallness of these plans need not manifest in only relatively small events.

With respect to the sampling of ME plans to be run through PIMS, beyond the objective of modeling almost all the large and medium plans determined by their actuaries to be critical and declining, it is our understanding that the following holds true:[29]

(a) Wherever plan provisions allow – a consideration that excludes only one plan – all plans representing a billion dollars or more in forecast liability are included. (Also note that the PIMS plan sample is scaled-up to the universe of plans.)

(b) The selection of plans is also constrained by limitations on the extent of Form 5500 data – and also, implicitly, by the possible inaccuracy of that data, insofar as plans with substantially overstated asset values might escape close scrutiny.

(c) Sample plans are replaced when, "…information for the specific plan and/or sponsor is not available or [the] plan is terminated."[30]

(d) The sample may also be modified pursuant to judgments by PBGC staff, as in 2015, when plans projected to be MPRA-eligible were added.

(e) As suggested above, the original sample of non-booked plans (modified only pursuant to the above) was specified years ago by individuals presently unavailable for comment, nor is PBGC in possession of any documentation that might shed light on the methodology they employed.

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[27] FY2014 Projections Report, page 42.

[28] Based on our examination of the 10 sampled PDAs, a process which, nonetheless, does not address any of the six broad evaluative factors listed earlier and below.

[29] Based on discussions with PBGC staff, and related documentation.

[30] E-mail from Jensen Chan to Glenn Meyers et al, July 26, 2016.

Number of Participants by ME Plan per 2013 Form 5500*
(1277 Plans Represented)

Plans wih Over 35,000 Participants (48)

Source: PBGC Form 5500 Database
* Most recent data available.
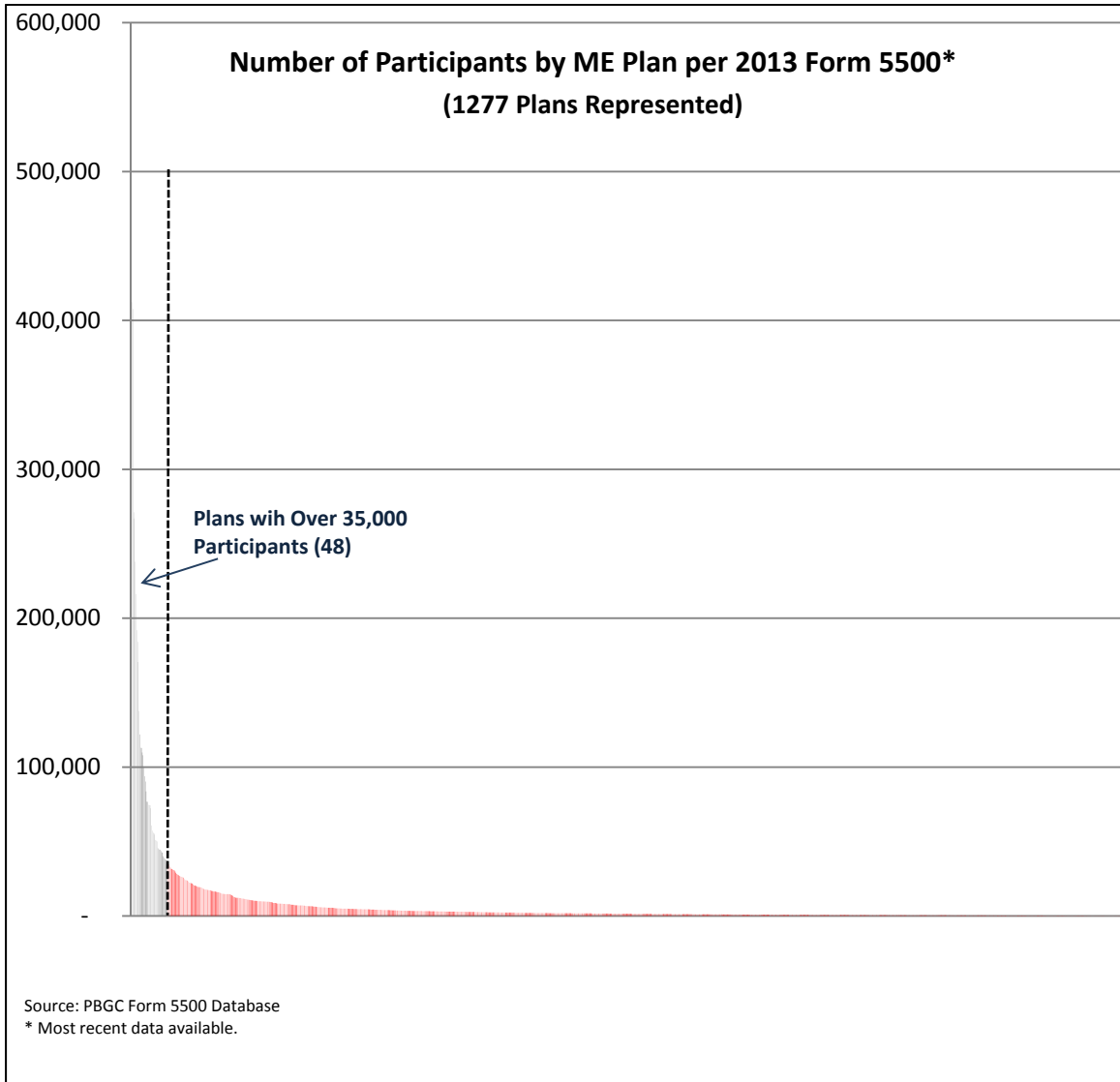
In most cases, comparison of the ME plans run through PIMS in FY 2015 with those classified by the MWG as probable or reasonably possible liabilities in the year before[31] confirms a high level of coverage:

> ➢ In the case of **currently insolvent plans**, 18 out of the 36 representing net PBGC liabilities of at least $10 million were inputted into PIMS; of those representing net liabilities of $50 million or more, 9 out of 9.

> ➢ In the case of **terminated plans projected to become insolvent**, 26 out of the 37 representing net PBGC liabilities of at least $10 million were inputted into PIMS; of those representing net liabilities of $50 million or more, 13 out of 14.

> ➢ In the case of **ongoing plans projected to become insolvent**, 30 out of the 34 representing net PBGC liabilities of at least $100 million were inputted into PIMS; of those representing net liabilities of $1.0 billion or more, 9 out of 9.

> ➢ And in the case of **plans projected to become insolvent 10 to 20 years in the future** ("Reasonably Possibles"), 9 of 17 were inputted into PIMS, and of those representing net PBGC liabilities of at least $100 million, 8 out of 13.

Further, the initial ("Year Zero") plan liability values run through PIMS are virtually identical to the values calculated by the MWG, as reported in PBGC's financial statements.[32] Insofar as the former are indeed calibrated to the latter, MWG's selection of plans to be booked exerts an important (and arguably necessary[33]) influence on PIMS's liability forecasts.

However, given the judgmental (or "non-probabilistic") character of the plan sampling methods employed by both the MWG and PBGC, the relative lack of documentation of the process by which the PBGC's sample was drawn, as well as its apparent insensitivity to the considerations raised in the section below (and elsewhere) are of some concern. Note, for example, the following guideline by the Office of Management and Budget:

> When a non-probabilistic sampling method is employed, include the following in survey design documentation: a discussion of what options were considered and why the final design was selected, an estimate of the potential bias in the estimates, and the methodology to be used to measure estimation error. In addition, detail the selection process and demonstrate that units not in the sample are impartially excluded on objective grounds in the survey design documentation.[34]

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[31] Based on Excel spreadsheet titled, "ASD Probs and RPs," provided by PBGC on July 26, 2016.

[32] E-mail from Liaw Huang to Glenn Meyers et al, Oct. 7, 2016.

[33] Ibid.

[34] Office of Management and Budget, "Standards and Guidelines for Statistical Survey," September 2006, page 7.

Limited Consideration of Key Influences

As noted earlier, in addition to Form 5500 and other data, the PDAs used by the MWG are expected to consider, "…industry trends, active participant base trends, contribution history and trend, anticipated benefit payments, public statements made by the plan and its designated representatives, and interactions between PBGC and the plan over the fiscal year."[35] However, based on an examination of 10 PDAs for very large plans filed in 2015, no industry trends were cited, nor were long-term trends in any of the plan parameters assumed to be relevant.

Indeed, neither industry-level trends in total employment or employment of union members specifically appears to be considered at any stage in PBGC's liability forecasting process. As noted in PBGC's FY 2014 Projections Report, "ME-PIMS does not currently assume [more precisely, take into consideration] industry-specific employment trends."[36] Instead, it "…models net annual changes in employment levels…" on an aggregate (cross-industry) basis, and in such a way to result in, "…a mean net decrease in the active multiemployer population of 1.3 percent per year across all [forecast] scenarios."[37] At least in regard to the forecasting of "fat tail" events, and possibly more generally, a key defect of this broad-brush approach is that it ignores differing industry trends in employment, both overall and of union members specifically, due in part to differences in degree of exposure to import competition and automation, as discussed in our Subtask 4.3 report in relation to plan sponsor vulnerability.

For example, while the assumed 1.3% average annual decline in the active multiemployer population implies a cumulative decline of 33.4% over a 32-year period, over the period 1983-2014, the actual decline in the number of union members employed in domestic manufacturing was 73.5%;[38] and while the assumed 1.3% average annual decline implies a cumulative decline of 11.1% over a 10-year period, the actual from 2005 to 2014 was 30.2%.[39]

Relatedly – and even less realistically, in the case of manufacturing at least – SE-PIMS, "…assumes a stationary mean active participation level"[40] (i.e., an essentially flat long-term trend).

Discrepancies such as those just described are indicative not only of possible shortcomings in plan sampling procedures, but also in the processing of sampled plans by PIMS, potentially leading to a significant understatement of PBGC's future liabilities, as best forecast. We appreciate that at present PBGC may be constrained from obtaining significant additional economic data, and/or integrating that data into PIMS, but the potential benefits in terms of forecast accuracy should nonetheless be noted.

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[35] "Multiemployer Working Group Procedures for 2015," May 19, 2015, page 4"Multiemployer Working Group Procedures for 2015," page 9.

[36] FY2014 Projections Report, page 46.

[37] Ibid.

[38] Source: Unionstats.com, based on the Current Population Survey's Outgoing Rotation Group Earnings Files.

[39] Ibid.

[40] FY2014 Projections Report, page 52.

Recommendations

Particularly given the concern for possible "fat tail" events transpiring over the long term, we believe that, as a general principle,[41] and of course subject to budget constraints, liability forecasting for both ME and SE plans should give additional consideration to the broad categories of evidence previously cited:

1. Long-term trends in industry employment and unionization;

2. Industry import pressure;

3. Planned relocation of industry production abroad;

4. Expected pace of industry automation;

5. Industry regulatory changes;

6. Litigation or governmental investigations concerning plan administration.

More specifically, in regard to the classification of plans and their resulting treatment in the overall liability forecasting process, investment in related research and analytical work might be allocated in rough proportion to the extent of PBGC's related exposure, as measured by number of plan participants:

a. Sixty percent to ME plans with more than 35,000 participants – as shown in Exhibit C on the next page, the 48 plans in this category as of 2013 accounted for 58% of PBGC's ME plan exposure as of that year[42]; and

b. Forty percent to all "medium" plans – the 405 plans in this category as of 2013 accounted for another 34% of PBGC's ME plan exposure as of that year.[43]

With regard to "medium" plans, some subset of the six plan influences listed above (or implied by the sixth) could be used just for screening initially, with only those plans "testing positive" for possible problems subjected to further scrutiny. (For example, forecasts of the number of active participants could be revisited based on trends in the number of covered employees in the industries in question, obtainable at unionstats.com).

Additionally, and specifically in regard to plans inputted into PIMS, we recommend:

1. Establishing a definitive set of rules for sample selection, insofar as is practical reflecting the conclusions reached by the industry-focused analyses. For example (and conditional upon testing), use of a stratified sample also incorporating some minimum number of plans in industries exhibiting the greatest declines in union membership.

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[41] And as implied, to the extent not explicitly recommended, in our Subtask 4.1 report.

[42] The most recent for which data is available. Source: PBGC Form 5500 database.

[43] This proposed allocation of effort is, of course, both tentative, given our lack of study of the subject plans, and subject to change based on future forecasting experience.

Exhibit C

Total Number of ME Plan Participants per 2013 Form 5500*

48 Plans

1,229 Plans

Plans with More Than 35k Participants

Plans with Less Than 35k Participants

Source: PBGC Form 5500 Database
* Most recent data available.
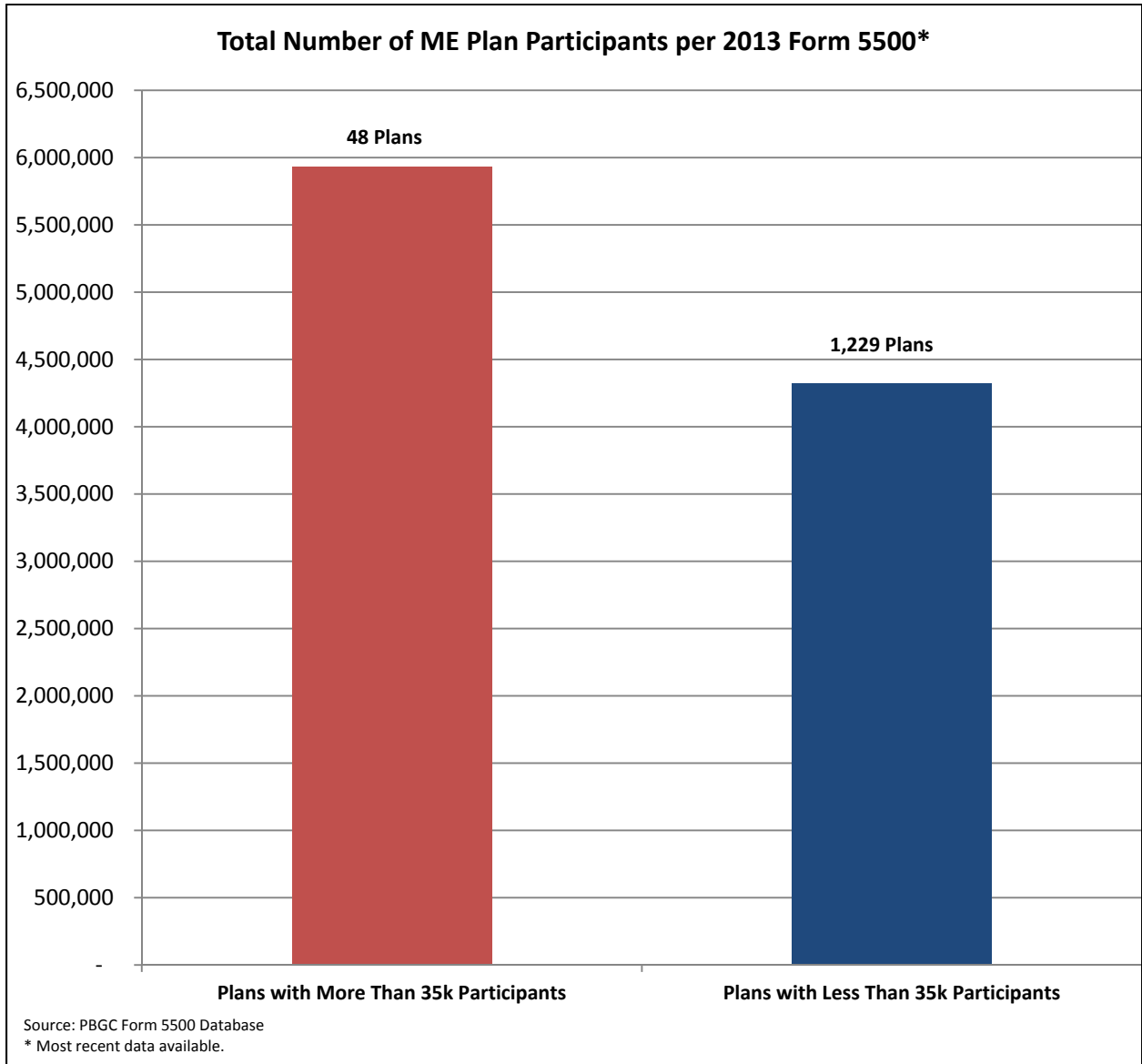
(Even if the application of those rules does not result in a sample materially different from the current, a consistently-applied and objective basis for plan selection would help avert potential criticism in this area.)

2. Fully documenting those sample selection rules found to be optimal, and the thinking behind them, as well a similar documentation of any subsequent changes;

3. Periodically testing sample representativeness in terms of key solvency-related attributes, such as the ratio of active to inactive plan participants – or, better still, the trend in that ratio. To the extent that such attributes differ as between the sample and the full population, the sample cannot be used to reliably generalize about the solvency of the population. However, there are statistical means of correcting for such differences.

4. Testing the historical correlation between the incidence and/or extent of plan insolvencies, on the one hand, and materially incomplete plan Form 5500 filings, on the other. (Here again, insofar as the sample of plans inputted into PIMS may be biased due to the exclusion of plans with incomplete filings, that bias is, at least in theory, correctible.[44])

Finally, given the relative stability of the inventory of booked ME plans but for those dropped from it, once a soundly based and documented sample of such plans is established, it ought not be necessary to revisit that sample more often than every few years.[45] Indeed, it would be unrealistic to expect that the related data collection and analysis could take place more frequently, and the incremental gain in timeliness would almost certainly not be worth the cost.

SE Plans

Current Practice and Representativeness of Sample

The FY2014 Projections Report describes the sample of SE plans inputted into PIMS as follows:

> SE-PIMS has a detailed database of more than 400 actual plans, sponsored by more than 300 firms, which represent ***about half of PBGC's insurance exposure*** in the single-employer defined benefit system measured from the 2012 Form 5500 filings (the most recent year of complete Form 5500 filing data available). The plans selected for the sample are those with ***sponsors that have the largest shares of total plan liabilities*** in the single-employer defined benefit system and where (1) ***sufficient publicly accessible data is available on the sponsor*** to use

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[44] See, for example, Byung-Joo Lee and Lawrence C. Marsh, "Sample Selection Correction Bias for Missing Response Observations," Oxford Bulletin of Economics and Statistics, May 2000, pages 305-322.

[45] Subject to the possible desirability of replacing dropped plans with new ones, drawn from the population by application of the same rules as applied to the initial sample.

the SE-PIMS bankruptcy probability model, and (2) ***plan details can be sufficiently captured*** in the SE-PIMS Model.[46]

As may be evident from the highlighted portions of the passage above, like the sample of ME plans just discussed – and again, likely for sound practical reasons – by virtue of its non-random character, the sample of SE plans inputted into PIMS cannot be assumed to be representative of all insured SE plans, in terms of attributes likely influencing plan viability over the long term. (Perhaps most obviously, other things equal, plans consistently failing to meet reasonable expectations with respect to financial disclosure are more likely to be poorly managed.)

To assure some analytical coverage of those plans that do not satisfy the various filters, we recommend additional research on long-term trends in the related industries – employment, unionization and import trends in particular. The relatively high concentration of current SE liabilities in a quite limited number of industries (motor vehicles, iron and steel, air transportation, apparel, furniture, etc.) – and certainly, in manufacturing in general – suggests that this research could be quite focused. Also, given the nature of such trends and the factors underlying them, updates only once every few years might suffice. And further economies could be realized if more sponsor- and/or plan-specific research were confined to plans in excess of a given size, following the principle now applied in the risk classification of ME plans.

PIMS Modeling of PBGC's Interest Rate Factors

In this section we discuss PBGC's modeling of the plan termination interest rates used for the valuation of the plan termination liability for single-employer plans and the present value of non-recoverable financial assistance for multiemployer plans. PBGC's approach is to survey annuity providers for annuity prices and then solve for interest rates based on PBGC's own mortality experience. For PIMS modeling of future plan termination interest rates, the termination interest rate is assumed to revert from the current level to 33 basis points above the 30-year Treasury.

A significant area of uncertainty is the "basis risk": the anticipated mortality experience from the annuity providers may differ from the anticipated PBGC mortality experience. Therefore, the price obtained from annuity providers is not necessarily indicative of PBGC's book of annuitants. Generally speaking, the annuity price can vary greatly depending on age, payment options, benefit amounts, and expected deferral periods. When more and more plan sponsors engage in "de-risking" strategies for their non-collectively bargained plans, the mortality experience for future PBGC annuitants may shift toward the experience of a collectively bargained population as the proportion of PBGC annuitants who were collectively bargained plan participants increases. The annuity providers may or may not have similar mortality experience.

Additionally, PBGC only surveys a few annuity providers, which may not result in a representative annuity price for the entire annuity market.

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[46] FY2014 Projections Report, page 50 (italics added). The report goes to note that, "The addition of the ability to model cash balance plan structures significantly relaxed the second constraint in this year's Model."

Even recognizing these uncertainties, the approach of projecting the termination interest rate as a spread over the 30-year Treasury is reasonable. We note that historically this spread has been volatile. In recent years, various consulting firms have surveyed interest rates provided by annuity providers for pension risk transfer.[47] The interest rates usually range from 10 basis points to 40 basis points above the 30-year Treasury. Therefore, the 33 basis point spread over the 30-year Treasury used by PIMS is reasonable.

The above discussion presumes that PBGC continues to use annuity purchase rates to value its obligations. As discussed in our Subtask 4.1 report on macroeconomic assumptions, we recommend PBGC use a risk-free yield curve to value its obligations.

PIMS Modeling of Mortality Assumptions

In this section we comment on PBGC's mortality assumptions. Mortality assumptions involve two components: a "base" mortality table and an adjustment (or "scale") to recognize mortality improvement over time. The base table used depends on the specific population being valued and is updated regularly through experience studies, while the mortality improvement scale is usually determined on a national basis.

For the base mortality table, we note that mortality assumptions are used in different places: in the valuation of individual plan liabilities for funding purposes, in advancing a covered population from one year to the next, and in determining the present value of PBGC's financial obligations.

For the purpose of projecting a covered population, PIMS currently uses the "RP-2000" combined healthy mortality table, projected by scale AA to the projection year. For the purpose of determining the present value of PBGC's financial obligations, PIMS uses the "RP-2014" combined healthy mortality table, projected 13 years beyond the applicable valuation year using scale MP-2014.[48] We believe both approaches (base table and projection assumption) have sufficiently taken into account the current level of mortality and anticipated future mortality experience. We make the following comments:

1. The mortality assumptions do not make a "blue-collar" adjustment for multiemployer plans or collectively bargained single-employer plans. We note that a significant portion of multiemployer plans use a version of the table that reflect "blue-collar" mortality in performing the annual actuarial valuation.[49] We recommend that PBGC monitor the mortality assumptions reported in the Form 5500 Schedule MBs, plan financial statements, and PBGC's own mortality experience to determine if a "blue-collar" adjustment is warranted.

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[47] Aon Hewitt's sample of recent annuity rates can be found via the link: https://retirementandinvestmentblog.aon.com/getattachment/f97355cf-36cb-4eb4-a9d7-0fced77be0a2/AHIC-Sample-Annuity-Rates-6-30-2016.pdf.aspx. Other consulting firms have constructed pension buyout indexes. Mercer's pension buyout index is available via http://www.mercer.us/our-thinking/mercer-us-pension-buyout-index.html. Penbridge Advisors makes their pension risk transfer database available via https://prtdatabase.penbridgeadvisors.com.

[48] 2014 Projections Report, pages 46, 52.

[49] The "assump" table under PIMS DB Manager for multiemployer plans shows that a significant number of plans apply a blue-collar adjustment to projected RP-2000 mortality.

2. The Society of Actuaries has published mortality improvement scale MP-2015, which we believe is an improvement over MP-2014. We recommend PBGC update the mortality improvement scale from MP-2014 to MP-2015 (and continue to update as the Society of Actuaries issues further updates, which are anticipated annually).

Calibration of Core Actuarial Calculations

Two important actuarial aspects of modeling future results for a pension plan are the estimation of plan benefits and the probabilities that these benefits will be paid in the future. Discounting the expected value of future benefit payments to valuation date provides the metric "Present Value of Future Benefits," also known as the "PVFB." Using one of several available actuarial cost methods, the actuary assigns some of the total PVFB to "past service" (this is the "Actuarial Accrued Liability" or "AL") and to "future service" (this is the plan's "Normal Cost" or "NC," and the value of all future Normal Costs on the valuation date is the "Present Value of Future Normal Costs," or "PVFNC"). In performing an actuarial valuation, whether it is for a single-employer or multiemployer pension plan, the actuary determines several important actuarial results, including a calculation of the plan's liabilities, the plan's Normal Cost, the plan's projected benefit payments, the actuarial value of plan assets, and the plan's minimum required contributions (under IRC §412, as modified and expanded by IRC §430 for single-employer plans and IRC §431 for multiemployer plans).

To perform these calculations, the actuary projects future results by determining the stream of benefits the plan is expected to produce, reflecting demographic assumptions the actuary makes for the group. These assumptions include probabilities for deaths (mortality), retirement, termination, and disability. In performing the actuarial valuation, the actuary estimates plan benefits using applicable plan provisions and demographic data for the current plan participants, such as age, service, gender, and salary (for active plan participants), and amount and "form" of benefits for inactive plan participants (retirees, surviving spouses, terminated vested participants, and so on). To properly perform an actuarial valuation, the actuary must have been provided with complete and accurate plan participant data and detailed plan provisions.

However, it is difficult for this granular level of data to be available for plans that are incorporated into the PIMS system. Instead of the data and plan specifications noted, the PIMS system relies on information available from Form 5500 Schedule SB or MB. The "participant data" attachment to these schedules provides only "grouped" data for active participants (numbers of active participants in broad bands of age and salary) and incomplete data for inactive participants. The demographic composition of inactive data is obtained either from a 100-year projection of the active data, or from plan surveys.[50] Additionally, plan provisions are simplified to capture major benefit formula types, benefit levels, and early retirement subsidies, but not ancillary benefits or special benefits. Therefore, when compared to a formal actuarial valuation, the PIMS actuarial calculations have a higher degree of uncertainty.

For example, if the projection of liabilities uses an average age for active plan participants that is one year older than both the active and inactive groups' actual average ages, the liability for active participants may be 5% to 10% higher than had the actual data been used, while the inactive group's liability may be 2% to 3% lower than the results using the actual data for that group. And, if the benefit

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[50] 2014 Projections Report, pages 45, 52. PIMS System Description, section 2.3.3.3.

payment form is assumed to be "50% joint and survivor" annuity for participants in receipt of benefit when it is – in fact – a "single life" annuity, the inactive group's liability be approximately 8%[51] higher than if the true "form of benefit" had been used. Thus, if detailed participant data are not available for a particular pension plan, it is common to have the liabilities computed using only these data to differ from a plan's actuarial liability (computed using actual data) by a significant percentage. When detailed plan data are not available, actuaries frequently "calibrate" the results by adjusting data and assumptions to match reported values.

"Calibration" is the process of scaling calculated values to reported values. Over time, one would expect the calibrated values to diverge from reported values and the scaling factors to change. However, over a 10-year time horizon, an appropriate calibration methodology can mitigate major differences in calibrated versus reported values. Longer term, the uncertainty in calibrated results is greater, and the reasonableness of the results depends on the quantities one wishes to study. PIMS relies on a calibration process to produce a reasonable range of liabilities and contributions.

For active liabilities, PIMS uses a retrospective calibration factor to scale a plan's "Current Liability" to match the plan's starting Current Liability and a prospective calibration factor to match the Current Liability Normal Costs.[52] These scaling factors are applied for all future years and at the benefit level so as to scale benefit payments consistently with liabilities. For inactive liabilities, PIMS uses factors for retirees and terminated vested participants that scale the plan's initial Current Liabilities calculated using imputed data for each group to match the reported Current Liabilities for each group.

Overall we believe PIMS calibration procedures are reasonable. However, we believe there are a few areas, especially with respect to the interest rate sensitivity of the liabilities and Normal Costs, that deserve further review. We believe the following three areas are important in calibrating liabilities:

1) the level and pattern of Normal Costs,
2) the interest rate sensitivity of the liabilities and Normal Costs, and
3) the level and pattern of benefit payments.

The Level and Pattern of Normal Costs

Generally speaking, the actuarial calculation of the required pension contribution is the sum of the actuarially-computed Normal Cost and the amortizations required under IRC §412. For single-employer plans, the level and pattern of Normal Costs directly impact the calculation of cash contributions into a pension plan, as outlined in IRC §430. For multiemployer plans, Normal Costs are an important component of the fund's Minimum Funding Standard Account ("FSA"). The growth of a plan's liabilities over time is a function of its Normal Costs and benefit payments. Each year, the plan's "Accrued Liability" reflects the Accrued Liability in the prior year, increased by the prior year's Normal Cost and

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[51] The sensitivities of liabilities to age and payment form are calculated on a sample plan of a large and mature plan sponsor.

[52] "Current Liability" is measured based on benefits accrued to date using interest rates that are related to 30-year Treasury. Here, in accordance with the meaning of Current Liability used in PIMS documentations, we include in "Current Liability" various measurement methodologies that are similar to Current Liability but with possibly different assumptions. For example, PPA's Funding Target is measured based on benefits accrued to date using the interest rate of high quality corporate bonds. We generally consider Funding Target as "Current Liability." The use of the retrospective and prospective calibration factors can be found in the ASSUMP.CPP module.

interest, and reduced by benefits that were paid during the previous year. But, a plan's benefit payments also reduce the plan's assets, and so do not have a direct impact on a plan's "unfunded" liabilities (the difference between the plan's liabilities and its assets). Thus, the pattern of Normal Costs has a greater impact on the calculation of a plan's required contributions than projected benefit payments.

The level of Normal Costs depends on many factors, including the plan's benefit accrual rate, the assumptions used in the computation of the liabilities, and the actuarial funding method used to perform the calculations.

One of the methods available to a multiemployer plan actuary is the "Entry Age Normal" or "EAN" cost method. This method produces a Normal Cost that is a percent of salary, if the formula depends on salary, or as a dollar amount if the formula does not depend on salary. The EAN method has the interesting characteristic that the Normal Cost, once computed for a plan participant, does not change over the participant's working lifetime (the percent does not change if the plan is salary-related; the dollar amount does not change if the plan is not salary-related) if the underlying actuarial assumptions do not change. Calibration of an EAN Normal Cost requires an accurate Normal Cost as a percent of salary or as a per-capita Normal Cost (depending on the benefit formula). In our experience with EAN calibrations, when the Normal Cost rate or the per-capita Normal Cost is closely matched, the forecast of unfunded liabilities and plan costs will also be close over a 10-year period. In the absence of actuarial gains and losses, the long-term trend of the cost of the pension plan and the size of the plan liabilities is driven by the wage growth rate and the size of covered active population, both of which can be considered as input variables exogenous to the core actuarial calculations.

However, for single-employer plans, EAN is not used. Thus, for plans not using EAN three different effects are calibrated together:

1) the plan's benefit accrual rate,
2) the effect of actuarial cost methods, and
3) the effect of actuarial assumptions.

An ideal calibration would separate out benefit accrual rate from wage growth rate and the size of the covered active population. Assuming the benefit accrual rate stays the same throughout the forecast, the wage growth rate and the size of the covered population are exogenous economic variables driving the long-term trend of Normal Costs. However, this is difficult to achieve in practice, because actuarial assumptions are often intertwined with the level of benefit accruals.

Our understanding of PIMS calibration methodology is that PIMS establishes the pattern of Normal Costs by modeling retirement, termination, disability, and death decrements explicitly and assumes a 3% wage growth rate for the benefit improvement assumption. Additionally, for salary-related plans, PIMS uses imputed salary merit scales derived from the age-service-salary distribution of current active populations.[53] Based on our understanding of the approach used by the model, we believe these assumptions and methods are reasonable. If we assume actuarial valuations also use a similar wage

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[53] A description of the calibration method can be found in the document "PIMS System Description" and the 2014 Projections Report. The calculation of liability and Normal Costs can be found in the ASSUMP.CPP module. The modeling of decrements can be found in the ANNUITY.CPP module.

growth rate,[54] then the pattern of Normal Costs should be reasonable compared with reported values, at least over a 10-year forecast period. In the absence of other information that can improve calibration, simpler methods should prevail. Thus, we conclude that the level and pattern of Normal Costs from PIMS are reasonable.

We point out two areas on the level and pattern of Normal Costs that may be helpful to look at:

1. The Normal Cost pattern generally changes gradually over time. Since we are unable to completely separate the wage growth assumption and benefit accrual rate, it may be beneficial to calculate the ratio of Normal Cost to payroll and the ratio of Normal Cost to active head count, while keeping the interest rate constant. We calculated these ratios on the PLN output file and observed their trends over the forecast. There is variability in these ratios, however, after taking into account the change in discount rates, the overall average ratio appears to be reasonable except for the final average salary formula, for which the ratios in year 10 appear to be lower than expected. We recommend that PBGC monitor these ratios and adjust the wage growth assumptions as appropriate.

2. We notice that for a large number of multiemployer plans the prospective calibration factors failed to calibrate (in the CAB output file). PBGC has indicated that the prospective calibration factors are calibrated only for percent of contribution (POC) plans. PBGC should explore ways of calibrating prospective factors for other types of multiemployer plans. Nevertheless, the aggregate Normal Cost is within five percent of the aggregate reported Normal Cost, which we find to be reasonable.

The Interest Rate Sensitivity of the Liabilities and Normal Costs

In a stochastic forecast, there are at least two reasons why the calibration of interest rate sensitivity (commonly known as "duration") will be critical to actuarial projections.

- The interest rate sensitivity of the liabilities and Normal Costs directly affects the measurement of plan liabilities, plan underfunding, required contributions, and the size of PBGC claims.

- Interest rate sensitivity of plan liabilities is a key quantity for the measurement of interest rate risk. Therefore, getting the interest rate sensitivity right is important if we want to model the "de-risking" activities of plan sponsors of single-employer pension plans, or if we want to model an investment policy that hedges interest rate risk. Because the active and inactive liabilities have different interest rate sensitivities, it is often important to check the mix between active and inactive liabilities throughout the forecast.

By examining the PLN file output we find that at year zero, the average duration for single-employer plans is approximately 13.2 years, and the average duration for multiemployer plans is approximately 13.8 years. In year 10, the average duration for single-employer plans reduces to approximately 11.9 years, and the average duration for multiemployer plan reduces to approximately 11.9 years.[55] Based

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[54] Since the assumption of wage growth rate used in funding valuations is not known, the impact of this assumption can be assessed in aggregate from the PLN output file.

[55] For simplicity the average duration calculated in this section is weighted by plan, not by liability.

on our general experience, a typical plan has an interest rate duration of 12 to 14. Thus the PLN file durations appear to be in a reasonable range. The reduction in duration may be a result of a plan freeze and a reduction in active participants. However, there are a few areas that may deserve further study.

1. For single-employer plans, PIMS assumes that all participants are male and elect single life annuities, which lowers liability duration. Similarly, the average ages of retirees, terminated vested participants, and active employees will have an impact on the interest rate duration of the liabilities. Thus, PBGC should compare the average retiree and terminated vested participant ages to available information on Schedules SB and MB.

2. When examining the average duration by benefit formula type, we note that for single-employer plans, at year zero, the average liability duration differs by plan design

   a. For "cash balance" plans (Plan_Kind = "C") the average duration is approximately 14.4
   b. For a final average pay plan (Plan_Kind = "S") the average duration is 13.4
   c. For a flat-dollar plan (Plan_Kind = "F") the average duration is 11.2.[56]

   Usually we expect cash balance plans to have lower durations because this plan design allows for lump sum payments equal to the cash balance account. Also the duration difference between the final average pay formula and the flat dollar formula seems to be larger than what we would expect. Therefore, PBGC should review how PIMS calculates liability durations by benefit formula type.

The extent to which PIMS modeling takes into account interest rate sensitive cash flows is also of special interest. For the cash balance formula, it is common to have the cash balance interest-crediting rate and the annuity conversion rate vary with the valuation interest rate. When the rates move together, interest rate sensitivity of the liabilities and Normal Costs will be significantly reduced. For cash balance formulas, PIMS models different interest crediting rate provisions, such as the 30-year Treasury rate or a spread over a one-year Treasury rate, as well as a minimum interest-crediting rate.[57] The interest crediting rates are derived from the inflation rate and 30-year Treasury rate for each macroeconomic scenario. For valuation purposes, PIMS appears to use the valuation-year interest-crediting rate to project the cash balance account. Thus, the interest rate sensitivity of the cash balance formula seems to be adequately reflected in liability calculation. The longer duration in the PLN file for cash balance plans is likely to be the result of not moving the cash balance interest-crediting rate with the valuation interest rate. PIMS does not use duration in its actuarial calculations, but we believe assessing the interest rate sensitivity of PIMS actuarial calculations is an important step in validating PIMS overall actuarial modeling.

For a public company, interest rate sensitivity of the accounting liability may be inferred from the pension footnote of a company's 10-K filings. While the interest rate sensitivity for accounting purposes cannot be used directly for calibration within PIMS, it nevertheless can provide a consistency check against PIMS calculation of liability duration. We recommend that PIMS sensitivity analysis be compared to 10-K sensitivity results when possible.

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[56] From the PLN file.

[57] The cash balance input can be found in the table bfcashbal under PIMS DB Manager for single-employer plans. The updating of cash balance benefit is found in the BENEFIT.CPP module.

The Level and Pattern of Benefit Payments

Benefit payments are used when projecting a plan's liabilities and assets. The level and pattern of benefit payments will be especially important for projections related to multiemployer plans because the projection of plan insolvency directly depends on such payments. For single-employer plans, the calibration of benefit payments may not be critical over a 10-year projection period, but over a longer time horizon, the level and pattern of benefit payments will impact the projected size of the pension plan relative to the size of the sponsoring firms.

For single-employer plans, because the main variable of interest is unfunded liability on a termination basis, if calibrated benefit payments are lower than actual benefit payments, but the Normal Costs and interest rate sensitivities are calibrated correctly, then the mis-calibration of benefit payments should not have a significant impact on the projection of required contributions and unfunded liabilities. However, the size of the projected pension liability may be significantly different from the actual pension liability at the end of the forecast horizon. Although the size of the pension liability may not be the main object of interest for the SE insurance program, the size of the pension plan relative to the size of the sponsoring firm is an important measure of pension risk to the sponsoring firm. For example, a pension liability of a mature pension plan that is three times the sponsoring firm's active payroll initially may have this stable relationship throughout the forecast; but if the benefit payments are calibrated incorrectly, the pension liability may grow to be five times the sponsoring firm's active payroll, or reduced to be one times the sponsoring firm's active payroll at the end of the forecast. Recent studies have shown that the size of the pension liability, not just the unfunded pension liability, may act as an overhang over a corporation and increase the leverage ratio of the corporation, which in turn will impact bankruptcy probabilities.[58] Thus, over a longer forecast horizon, the level and pattern of benefit payments will be important even for single-employer plans. This problem may not be as visible over a 10-year forecast horizon. Thus, we believe the simplification PIMS has taken to forecast benefit payments for single-employer plans should not materially impact the main quantity of interest, namely, plan underfunding. Furthermore, if actions were taken to improve the liability duration calibration of single-employer plans, it should also improve benefit payments calibration. For a longer term forecast (for example, 20 to 30 years), we suggest that a metric that captures the size of the pension liability relative to the size of the firm, for example the ratio of pension liability to active payroll, should be reviewed for reasonableness.

For multiemployer plans, since survey data are used for the cash flow model, we believe the level and pattern of benefit payments are reasonable.

Comparison with a Roll-forward Model

When the above three areas of calibration are carefully taken into account, actuarial projections can give reasonable results even if participant level data are not used. Actuarial estimates without using participant level data are known as non-seriatim methods. A simple non-seriatim method is a roll-

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[58] Long, C., et al, "Pensions in Practice: How corporate pension plans impact stock prices," 2010. Their study found empirical and statistical evidence that pensions weigh on the stock prices of pension-heavy companies. Pension-heavy is defined as pension liability in excess of 25% of a company's market cap. For a discussion of pension plans and corporate leverage, see Coughlan, G., et al, "CALM: Holistic corporate risk management including pensions," 2003.

forward of plan assets and liabilities. A roll-forward projection model for single-employer plans can be constructed with the following properties:

- The initial assets and liabilities match the reported value.
- A pre-defined set of patterns of Normal Costs and benefit payments reflecting the maturity of a pension plan are used for the calibration of benefit accrual rates.
- Liabilities are rolled forward from one year to the next.
- Liabilities and Normal Costs are adjusted based on appropriate interest rate sensitivity.

In our experience, an appropriately calibrated roll-forward model can also give a reasonable range of results. PBGC should explore the possibility of constructing a roll-forward model as a tool for quick policy analysis, as well as using it to examine the extent current PIMS produces superior results over a simple roll-forward model.

A roll-forward projection model can be refined for multiemployer plans by separating active and inactive liabilities, so that the inactive liabilities can take into account the pattern of benefit payments based on surveyed data.

We note that CBO's 2005 study of PBGC's risk exposure used a greatly simplified liability model, namely the Accumulated Benefit Obligation (ABO) from 10-K filings for all future years.[59] It appears that in CBO's model, there is no mention that ABO is adjusted for interest rate sensitivity. We suggest that if PBGC were to incorporate a simplified liability model in its forecast, interest rate sensitivity should be incorporated into the modeling.

Simplification in Plan Provisions and Actuarial Assumptions

PIMS modeling of plan liabilities omits pre-retirement death benefits and subsidized disability benefits. These ancillary benefits usually are a small portion of the total liability except for plans that cover hazardous occupations. Therefore, using calibration to account for such ancillary benefits is a reasonable approach. Since ancillary benefits for active participants are generally not guaranteed by PBGC, omitting these liabilities should not have a significant impact on PBGC's risk exposure.

In the Appendix, we summarize the actuarial methods and assumptions utilized by PIMS that our team reviewed. As discussed in the previous section, we review the impact of PBGC's simplification of plan provisions and actuarial assumptions in the context of the calibration process. Except for the items noted in liability calibration, we find these simplifications to be adequate and still provide a reasonable pattern of Normal Costs and benefit payments for the calibration of plan liabilities and Normal Costs.

On the projection of plan asset returns, PIMS currently does not model plan asset allocations.[60] However, asset allocation information is available in Form 5500 Schedule R for both single- and multiemployer plans, and can be readily incorporated into PIMS. We recommend that PBGC consider using asset allocation information in SE- and ME-PIMS because it is a better forward-looking indicator of anticipated asset performance.

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[59] Congressional Budget Office, "The Risk Exposure of the Pension Benefit Guaranty Corporation", 2005, pages 21, 24.

[60] See 2014 Projections Report, pages 46, 52.

The Choice of Current Liability for Calibration

For both single-employer and multiemployer plans, calibration is based on Current Liability and Current Liability Normal Cost. For single-employer plans this is a natural choice because PPA's funding target liability and PBGC's plan termination liability are similar to Current Liability. Therefore, calibrating current liability provides a reasonable basis for estimating minimum funding requirements and plan underfunding in the event of bankruptcy.

For multiemployer plans, the minimum funding requirement and the funding standard account are based on Actuarial Accrued Liability (AL). Therefore a more precise method is to calibrate to the Actuarial Accrued Liability and Actuarial Accrued Liability Normal Cost. One possible method is to calibrate the retiree and term-vested Current Liabilities first, and then re-calculate the retiree and term-vested actuarial liabilities using actuarial liability assumptions. The actuarial accrued liability for actives can be backed-into by subtracting estimated retiree and term-vested actuarial liabilities from the total actuarial liability. Then the calibration for active participants can proceed on the Actuarial Accrued Liability basis. We recommend this approach as it will in most cases yield a more direct calculation of the funding standard account than the current method of amortizing the difference in AL.

General Comments on Plan Sponsor Behavior

In the following sections we assess PIMS assumptions on plan sponsor behavior. Plan sponsor behavior includes the following: the modeling of plan sponsors' contributions to pension plans, the payment of PBGC premiums, the modeling of "de-risking" trends, the modeling of covered populations, the modeling of trustees' implementation of Funding Improvement Plans and Rehabilitation Plans, and the modeling of the implementation of MPRA.

Employer Contributions – Single-Employer Plans

For single-employer plans PIMS models the main funding requirements under PPA:

- Target liability, target Normal Costs and seven-year amortization of unfunded liabilities, including a calculation of at risk target liability and Normal Cost
- Funding relief pursuant to WRERA
- Funding interest rate stabilization provisions of MAP-21 and HATFA
- 24-month smoothing of plan assets
- The application of credit balances

PIMS assumes that plan sponsors will apply credit balances toward minimum required contributions and contribute the minimum required contributions thereafter. The appendix contains additional details on PIMS modeling of the minimum funding requirements under PPA for single-employer plans. We believe PIMS adequately models the minimum funding requirements for single-employer plans.

Studies by the Society of Actuaries have continued to show that employers contribute more than the minimum required contributions to single-employer pension plans.[61] Reasons given for such behavior include:

- Plan sponsors desire greater funding flexibility by building up credit balances.
- Plan sponsors can avoid increasing variable rate premiums by contributing more than minimum required contributions, especially when the cost of variable rate premium exceeds the cost to borrow and fund the pension plan.

With respect to modeling employer contributions for single-employer plans, we agree with PBGC's current modeling approach, that is, reflecting minimum required contributions in the projection of plan contributions and plan assets, but making adjustments for the payment of PBGC premiums.

Although the sequence of returns and contributions can produce significantly different asset values, a pension plan rarely has credit balances in a distressed termination, as PBGC has observed. Therefore, the credit balances will be "spent down" over time by firms in financial distress. Because the credit balances are credited with actual investment returns, the market value of assets net of credit balances is a good proxy for the market value of plan assets after the credit balances are spent down. The timing of when a firm will spend down its credit balances is uncertain because the financial condition of a firm may change abruptly. We believe it is unnecessary to model the building up of credit balances only to have it spent down during financial distress.

Plan Sponsor Behavior with Respect to Increasing Variable Premium Rates

However, the impact of additional contributions on the payment of PBGC's variable-rate premium is cumulative and will not be reversed. Therefore, we believe it is appropriate to model the reduction in variable-rate premium due to employer contributions in excess of the minimum required contributions.

PIMS models reduce variable-rate premiums in two ways: first, it increases the assets used for variable-rate premium purposes by 21% of the funding target to be phased in over five years if the bankruptcy probability is less than 3%, and second, it reduces the forecasted premium rate by half of the forecasted premium rate over 0.9% (that is, the increase in premium is only 50% collectible), and adds a year of delay.[62] These adjustments were made to reflect historical levels of excess funding, and the plan sponsor's incentive to minimize variable rate premium. These assumptions are further adjusted with recent experience in the collection of variable-rate premiums. We find these adjustments to be reasonable. However, the plan sponsors' behavior with respect to future variable premium rate increases is uncertain, and the parameter of 50% collectability is only a guess. Additionally, with variable premium rates indexed for inflation, the variable-rate premium may be capped by the per-participant variable premium cap in the future. Thus, PBGC should review the adjustment pertaining to

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[61] For a discussion of the aggregate contributions compared to various contribution benchmark, see Society of Actuaries, "Contribution Indices: U.S. Single Employer Pension Plans", 2016.

[62] The parameters for the asset bump can be found in the table PlanCom of PIMS DB Manager for single-employer plans. The adjustment for assets used for PBGC variable premium calculations can be found in the PLAN.CPP module. The adjustment for the variable premium rate can be found in the PBGC.CPP module. The one-year delay of the variable-rate premium increase is done in the post-PIMS processing spreadsheet.

collectability and update the formula as variable-rate premium experiences unfold. PBGC indicated that it has initiated a contribution policy study for single-employer plans.

Plan Sponsor Behavior of Firms in Financial Distress

Since the 1970s various authors have studied the topic of how plan sponsors should fund their pension plans in the presence of pension insurance. Early works in this area conclude that (1) the value provided by pension insurance is significant (2) financial distressed firms may try to capture this value by shifting underfunding to PBGC.[63] The value of pension insurance to a firm is known as "PBGC put."

However, the evidence of financially distressed firms unloading pension liabilities to PBGC is mixed. For example, it has been observed that financially distressed firms have lower funded ratios and make less pension contributions. However, this may not indicate an attempt to shift liabilities to PBGC, but is simply a result of less resources being available to a financially distressed firm.

A firm may shift unfunded liabilities to PBGC by underfunding pensions and/or investing in risky assets. In a study by Rauh published in 2009,[64] he identified two competing incentives for a financially distressed firm regarding the pension plans it sponsors: a firm can risk-manage its pension plans if doing so can reduce the probability of bankruptcy and increase shareholder value, or a firm can risk-shift its pension plans to PBGC to realize the value of pension insurance. By studying the pension fund asset allocations for defined-benefit pension sponsors between 1997 and 2004 with respect to the firm's credit ratings and bankruptcy status, he concludes that financially distressed firms risk-manage their pension plans by allocating a larger portion of pension assets to bonds. Falkenheim also showed that there is limited evidence that less creditworthy companies would reduce pension contributions to increase the value of their PBGC insurance.[65]

Since there is no conclusive evidence that companies reduce pension contributions or invest aggressively to realize the value of their PBGC insurance, we do not recommend modeling such behavior with PIMS. In recent years we believe plan sponsors' behavior is driven mostly by a desire to de-risk their pension plans rather than a desire to risk-shift their pension plans to PBGC.

On the other hand, large pension plan underfunding may increase the probability of bankruptcy. We will address this issue in our Subtask 4.3 report.

Modeling of Future Trends for Single-Employer Plans

The trend of plan sponsors to de-risk their pension plan has been observed for many years. PBGC's 2015 risk transfer study provides good insights into these activities from 2009 to 2013.[66] Commentary from

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[63] On the value of PBGC insurance, see Sharpe, W. "Corporate Pension Funding Policy", 1976, Marcus, A, "Corporate Pension Policy and the Value of PBGC Insurance", 1987, and Pennacchi G, et al, "The Value of Pension Benefit Guaranty Corporation Insurance", 1994.

[64] Rauh, "Risk Shifting versus Risk Management: Investment Policy in Corporate Pension Plans", 2009.

[65] Falkenheim, M., "Optimal Pension Funding Strategy and Pension Insurance Reform", 2015.

[66] Ranade, N., et al, "Risk Transfer Study Plan Years 2009 – 2013", 2015.

consulting firms indicates that the pace of pension risk transfer in 2016 is expected to continue.[67] By de-risking activities we include the following strategies: a shift in asset allocation toward bonds and long duration bonds, dynamic asset allocation based on funded status (also known as a glide path or journey plan), and pension risk transfer via lump sum offering, buy-in or buy-out.[68] The goal of de-risking strategies is to reduce the volatility in pension funded status. To assess whether PIMS should model plan sponsors' de-risking activities, we make the following observations:

- With respect to pension underfunding, de-risking strategies should not materially change the level of pension underfunding. In pension risk transfer, the assets needed to transfer the liability to a third party usually exceed the funding target or the accounting Projected Benefit Obligation (PBO) of the liability. Therefore the funded status measured on the funding or accounting basis may decline initially. However, companies usually increase their cash contributions to maintain funded ratio targets. Thus, we do not expect de-risking to materially impact the level of pension underfunding. From a corporate finance perspective, de-risking may reduce cash liquidity and increase leverage of the operating business.[69] For financially distressed companies, any action that reduces liquidity or increases leverage of the operating business is unlikely to be undertaken.

- With respect to PBGC premiums, de-risking through pension freeze or pension risk transfer will reduce the number of covered participants, and therefore the collection of flat PBGC premiums. With respect to variable-rate premium, the reduction in the volatility of pension underfunding usually means a reduction in the variable-rate premium.

- As Moody's has observed,[70] for healthy companies, de-risking is usually credit rating neutral or positive. Therefore, de-risking should not materially change the bankruptcy probability for healthy companies. For financially distressed companies, they are unlikely to take pension initiatives that will adversely impact their operating business. In other words, they are more likely to risk-manage their pension plan to reduce bankruptcy probability, as Rauh has observed.

We recommend that PBGC reflects de-risking trends with PIMS, but as a separate study initially before incorporating it into the Projections Report. We suggest that PIMS models the impact of de-risking by adjusting pension plans' asset allocation and PBGC's premium collection.

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[67] For example, Mercer's commentary in July 2016 states "June was an eventful month in the pension risk transfer market as another jumbo transaction (> $1.5 billion) was announced signaling continued growth and insurer appetite for the group annuity business." On the expected pension risk transfer activity in 2016, it comments that "Based on the increased activity for elective buyouts, the market is still on track to get very close to the $14 billion of pension risk transfer sales we experienced in 2015." Available http://www.mercer.us/our-thinking/mercer-us-pension-buyout-index.html.

[68] Plan sponsors also de-risk through plan design changes, notably through a pension freeze. Since PIMS already model pension freezes, we do not discuss the modeling of de-risking through pension freeze in this section.

[69] Moody's analysis of pension de-risking shows that the reduction in liquidity and increased leverage is a key consideration in their credit rating. See Moody's Analytical Approach Presentation, 2013.

[70] See Moody's Analytical Approach Presentation, 2013.

First, PIMS can be set up to take asset allocation into account. A study by Panis using Form 5500 Schedule R data showed that underfunded plans hold a four-percentage points higher aggressive allocation than plans with funded ratio greater than 80%.[71] PBGC may conduct its own study to determine whether Form 5500 Schedule R information can be incorporated into PIMS. If PIMS is set up for asset allocations, a possible way to model the impact of de-risking is to reduce equity allocation when the funded ratio reaches a threshold, for example 100%. PBGC may conduct its own study to determine the appropriate reduction in aggressive asset allocations. Even though there are various de-risking strategies, we believe modeling the impact of de-risking through asset allocations should be sufficient to assess its impact on plan underfunding.

Secondly, to model the impact of de-risking on the PBGC premium collection for single-employer plans, we suggest that PBGC reduces the head count in flat premium projection as well as in variable-rate premium cap.

Modeling of Funding Improvement Plan/Rehabilitation Plan

What follows is a brief overview of the development of a strategy that a multiemployer pension plan that is not well-funded (under the IRS rules) will follow in order to attempt to emerge from its current financial condition. This is a complex topic, and this overview is intended to provide background but it should not be considered an exhaustive description of the elements of any process.

Under the Pension Protection Act of 2006 ("PPA"), and continued by the Multiemployer Pension Reform Act of 2014 ("MPRA"), the actuary for a multiemployer pension plan must determine the plan's "Funded Status" annually. Using the ratio of the plan's assets to its liabilities, projections of the plan's Minimum Funding Standard Account ("MFSA"), and other specified calculations, the plan actuary determines whether the fund is "Critical," "Seriously Endangered," "Endangered," or none of these (i.e., "Safe"). MPRA expanded the categories from four to seven, with a new "Critical and Declining" category being added for the most seriously troubled funds. (Note that a color scheme is often used to describe these Funding Statuses, with a "Safe" plan known as "Green," an "Endangered" plan "Yellow," a "Seriously Endangered" plan "Orange," and a "Critical" plan "Red.")

Funds that are in the "Green"/"Safe" zone are considered to be at a minimal risk of financial difficulty within the next seven years. It is important to note, however, that these calculations are performed annually and depend upon the demographics and assets of a plan on its valuation date, and that a plan that was "Green"/"Safe" in a year could be determined to be other than this level in a future year.

Funds that are "Yellow"/"Endangered" or "Seriously Endangered"/"Orange" must develop a "Funding Improvement Plan (FIP)," intended to improve the fund's financial condition and attempt to move it to the "Green"/"Safe" zone in the near future (note that the actual requirements and timing are complex, and can be found at IRC 436 and related Regulations). A fund that is "Red"/"Critical" must have a "Rehabilitation Plan (RP)" developed to help the plan emerge from Critical status in the projected future, and - eventually - be in the "Green"/"Safe" zone.

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[71] Panis, C., et al, Asset Allocation of Defined Benefit Pension Plans, 2015.

For both the FIP and RP, the trustees of the fund are directed to work together to come up with a plan that meets PPA's requirements and timing. PPA has "fail safe" mechanisms in place in the case where the trustees of a "Critical" fund cannot agree to an approach to meet PPA's requirements.

Because the trustees of a pension fund are not necessarily the same people who participate in collective bargaining, there can be a disconnect between the intent of the plan's trustees and those of the bargaining parties under a collective bargaining agreement. PPA does not address this situation.

FIP

Plans that are "Endangered" or "Seriously Endangered" may implement the following actions in their FIP: an increase in the hourly contribution rate, a reduction in future accruals, or other modification of future benefits. These changes have the intent of improving the plan's current status to the "Green"/"Safe" status, at which time benefit changes that were made are not typically reversed. Fund trustees are typically motivated to take these actions in order to prevent a plan from becoming "Critical" and the more drastic actions that come with Critical status. While a plan is "Endangered" or "Seriously Endangered," there are restrictions on the trustees' granting benefit improvements.

The plan's progress toward meeting the goal of the FIP is reviewed annually by the actuary, who opines on whether the FIP remains "on track." If not, the trustees consider additional changes to the plan and contribution level.

RP

A fund that is "Critical" must develop the RP as a way to move out of "Critical" status. The Rehabilitation Plan must include one or more schedules that reflect a combination of decreased benefits and increased contributions. One schedule is designated the "default schedule" and generally reflects the maximum permitted decrease in future benefit accruals, elimination of "adjustable benefits" (as defined by the Code, and which include such items as early retirement subsidies and certain disability benefits) permitted by law, and an increase in contributions. A "Critical" pension fund imposes the default schedule on bargaining parties who fail to adopt another schedule under the Rehabilitation Plan within the legally required period. A contributing employer to a multiemployer fund in "Critical" status must pay a surcharge to the pension fund until the bargaining parties adopt a schedule in the Rehabilitation Plan.

This automatic surcharge is in addition to the contribution otherwise required under the collective bargaining agreement. Generally, the surcharge is equal to 5% of otherwise-required contributions for the initial year a fund is in "Critical" status, and 10% for each succeeding plan year in which the plan remains in that status. The surcharge ends on the effective date of a collective bargaining agreement (or other agreement) that includes contribution and benefit terms consistent with the Rehabilitation Plan.

Modeling

ME-PIMS models FIP and RP via a series of steps the trustees are assumed to take. These steps are similar to those described above, and reflect updates based on studies PBGC conducted after Buck's review of ME-PIMS[72] and are summarized in Appendix B.

In the discussion that follows, our focus is on the behavior of the trustees of a multiemployer pension plan as it relates to FIP ad RP. With that as our focus, we are not directly addressing the mechanics or logic of the ME-PIMS system, which has been adequately addressed in PBGC's recent studies on FIP and RP. Instead, we offer observations and perspectives related to the way the trustees of a fund may think, which should provide context for any future changes to the modeling of FIP and RP in ME-PIMS. In many cases, we believe that the modeling of these behaviors may be difficult, but we have highlighted and commented on these areas because we believe they are integral to any review of multiemployer plans.

PIMS makes certain assumptions about how trustees will react when the plan is in "Endangered," "Seriously Endangered," and "Critical" statuses, but real world implications might dampen the trustees' ability to create a RP (or FIP) that meets the goals of PPA and MPRA.

For example, it might be determined that for a "Critical" status plan, contributions would need to increase by $1.00 per hour and benefit accruals would have to be reduced by 20% (in addition to the removal of "adjustable benefits," as noted earlier). However, the economic conditions of the area in which the fund provides benefits could be such that an increase in contribution rate to the needed level would prevent employers from being competitive, and could force some or all employers to withdraw from the plan, causing a "mass withdrawal," about which more details are noted later in this report. Additionally, a change in benefit accruals could cause otherwise-eligible plan participants to elect to work for employers who do not contribute to the plan (for the purpose of this discussion, we are not addressing any "labor relations" or "union" issues), thus reducing the overall contributions to the plan. This, of course, puts the plan and the trustees of the plan in a financial predicament -- making no changes can cause a potential insolvency, but making the required changes may also produce the same ultimate result.

Although ME-PIMS models the likely actions to be taken by plan trustees, the actual development of a FIP or RP may not follow a linear path of steps modeled under ME-PIMS. However, we acknowledge that attempting to model such real-world non-digital decision-making process is probably beyond the scope of the PIMS model, as it may not be feasible for most computer-based models. We do, however, suggest that PBGC considers modeling the uncertainty in plan trustees' actions and the possible impact of these complex decisions on the future financial health of the plan, perhaps with an array of probabilities.

Withdrawal Liability / Mass Withdrawal

A multiemployer plan typically has many employers that contribute to it. Each employer usually makes its own independent decision regarding its participation in or withdrawal from the fund. And, when an employer elects to withdraw from the fund, the employer may be subject to payment of a "withdrawal liability" amount to the fund. This payment is not the same as the otherwise-required contribution that

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[72] See the memo "Verification and Quantification of Ruck's Recommended Changes" by Jensen Chan and Marcus Cleary.

the employer has been making to the fund. Its purpose is to have an employer who has been a "contributing employer" to a fund whose liabilities exceed its assets to pay its "share" of any underfunding at the time the employer withdraws from the fund. The calculation of an employer's withdrawal liability is complex, and requires a significant amount of data for an accurate computation.

However, in practice, the withdrawal decision of participating employers may not be independent. A contributing employer may realize that the departure of one or more other contributing employers from the fund (and requirement that those employers pay a share of the fund's underfunding) may cause an employer to reevaluate its participation in the fund. This thought process results from an employer's not wishing to remain in a fund when fewer and fewer other employers continue to make regular contributions, since the growing liabilities of the fund are spread among a smaller and smaller pool of employers. As with other discussion points in this document, the decision-making process of a particular employer is not an easy one to quantify and turn into computer code.

ME-PIMS does not model an individual employer's decision to withdraw from a fund, but models "mass withdrawals." Unlike the "withdrawal liability" discussed in this section, a "mass withdrawal" is deemed to occur when a significant number of contributing employers have left the fund within a relatively short period of time. The determination of whether a "mass withdrawal" has occurred for a multiemployer fund does not follow a "bright line" test, but is based on facts and circumstances. However, when this determination has been made, all contributing employers (including those that have not withdrawn) are subject to a withdrawal liability payment. It can be seen, therefore, that the existence of a potential "mass withdrawal" payment could motivate an employer to leave a fund that it would otherwise have had no intent of leaving. Since a fund that is undergoing a mass withdrawal replaces "regular contributions from employers" with "mass withdrawal payments from employers," this could have a significant negative effect on cash flow (especially in the case with the mass withdrawal payments, by nature of their relating to unfunded amounts and an employer's contribution history).

ME-PIMS models mass withdrawals by considering various factors that measure the viability of the plan to the remaining employers (see Appendix B for details). In recent years, the probability of mass withdrawals has been low, and PBGC has indicated that it is currently studying the modeling of mass withdrawals. We recommend that PIMS continue to model mass withdrawals, but with a simplified formula for the mass withdrawal probability.

Insolvency

One of the elements the multiemployer actuary investigates when determining the funding "zone" is whether the fund in question will run out of assets within the next seven (or five) years. A fund that is projected to run out of assets within that period is clearly in financial difficulty. A fund that does not have sufficient assets to pay benefits is deemed "insolvent."

However, even without the passage of PPA and MPRA, insolvency is an important concept for any fund. A fund that is projected to run out of money during a time period of more than seven years but within the foreseeable and projectable future may not be determined to be "Critical" or "Endangered" status, but it is still in great financial difficulty.

A multiemployer fund that has undergone a "mass withdrawal" must file an annual actuarial valuation with the PBGC, indicating the date it is projected to become insolvent. ME-PIMS recognizes insolvency

date as one of the key outputs in its determination of the financial condition of a multiemployer plan. Notably, funds that are "Critical" should be the focus of any projection, since it is more likely that they will become insolvent and need the PBGC's assistance than a fund that is not in "Critical" status.

MPRA Modeling

The Multiemployer Pension Reform Act of 2014 ("MPRA") was signed at the end of the 2014 calendar year, and included many provisions intended to strengthen the financial condition of multiemployer plans. While some of the provisions were more technical in nature (such as removing the "sunset" provision that the Pension Protection Act of 2006 anticipated, thus extending PPA's rules permanently), some addressed the weakening financial condition of certain multiemployer funds.

MPRA added a category of "Critical and Declining" to the four PPA funding statuses, noted earlier in this report. (Note that MPRA also added a few other modifications to the PPA list of statuses, bringing the total to eight.) Plans that are determined to be "Critical and Declining" must develop a plan to move the fund from this status to a more financially stable one; this plan could include a possible reduction of benefits that had been accrued. This was the first time since the passage of ERISA that legislation would allow plans to remove benefits that were otherwise already accrued. This potential reduction would be allowed to be applied to active participants, whose accrued benefit would be allowed decrease, and to certain retirees in pay status. Because of the controversial nature of reducing benefits to current recipients and those who will have anticipated receiving a certain level of benefits, MPRA requires a detailed process before such a reduction is allowed to occur.

Rather than detail each of the elements that are required to be in any such filing, or details about each step of the process, we will note that the filing is ultimately submitted to the Treasury Department, who then would rule on whether the plan complies with the statutory requirements, at which point benefit reductions would be allowed.

To date, no such approvals have been made by Treasury. Several funds, most notably the Central States Pension Fund, have applied for Treasury approval. The Central States Pension Fund was notified in May 2016 that their filing was denied for a variety of reasons, including the interest rate used in the projections, equity of the reductions among classes of participants, and certain problems with the communication to affected members.

At the time of this report, 10 multiemployer funds have submitted proposals for the fund to reduce accrued benefits under MPRA. Central States Teamsters' and Road Carrier Local 707's submission has been denied, Teamsters Local 469 Pension Plan has withdrawn its application, and the other seven (including a fund that submitted a request, withdrew it, and resubmitted it) are "in review." Additional information can be found at https://www.treasury.gov/services/Pages/Plan-Applications.aspx.

Because MPRA is a recent law, and there is little experience thus far, it is not surprising that the PIMS system can only account for MPRA with probabilities as to what will ultimately happen to MPRA-eligible plans. We expect PIMS would be modified to reflect additional information as it becomes available.

We recommend that the PIMS modifications continue to be made based on Treasury's considerations for approving MPRA applications, for example, using a lower investment return assumption when performing MPRA-related projections.

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Spreadsheet Files

"ASD Probs and RPs.xls"

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http://www.unionstats.com.

Appendix A: Useful Sources of Industry Information

Source	Website	Description of Data Available
UnionStats	http://www.unionstats.com/	Provides private and public sector labor union membership, coverage, and density estimates organized by state, industry, occupation and metropolitan area.
S&P Capital IQ	https://www.capitaliq.com/	A financial information platform that provides analytics, proprietary research, and extensive market and financial data, gathered from sources on companies, industries and markets.
Economic Census Data	http://www.census.gov/econ/census/data/	Provides business dynamics statistics, workforce statistics, import and export information, employer statistics, commodity data, and manufacturing and consumption data based on the results of the Economic Census Survey sent to businesses across the country.
Bureau of Labor Statistics	http://www.bls.gov/data/	Offers a wide range of labor related data including inflation and prices, employment, unemployment, pay and benefits, spending time and use, productivity, and workplace injuries broken down by industry.
Survey of Current Business	https://www.bea.gov/scb/	Provides industry data such as GDP by industry and region, consumption expenditures, income and employment statistics, input-output statistics, and transaction and position data based on information collected from various surveys.
ITC Dataweb	https://dataweb.usitc.gov/	Aggregates international trade and US tariff data including US import, export statistics and tariff statistics broken down by geographic region, industry and product.
US ITC Important Injury Investigations Case Statistics	https://www.usitc.gov/trade_remedy/documents/historical_case_stats.pdf	A report published by the US International Trade Commission that presents data on Title VII Investigations, Global Safeguard Investigations and imports by year, product and industry.
US Census Foreign Trade Data	https://www.census.gov/foreign-trade/index.html	Provides detailed statistics on US imports and exports of goods and services based on commodity classification, quantities, values, shipping weights, method of transportation, state of origin, customs district, customs port, country of destination, and whether contents are domestic goods or re-exports.
Council of Economic Advisors Reports	https://www.whitehouse.gov/administration/eop/cea/factsheets-reports	Reports that contain economic data including government revenues and expenditures by year, US Treasury obligation data, Federal receipts, outlays, surplus and debt data, employment data by industry, historical CPI data, and historical GDP data for various regions, industries, demographics and sectors.
The Future of Employment: How Susceptible Are Jobs to Computerisation	http://www.oxfordmartin.ox.ac.uk/downloads/academic/The_Future_of_Employment.pdf	A study that estimates the probability of computerisation for 702 detailed occupations and examines the expected impacts of future computerisation on US labor market outcomes.
Industry Analyst Reports		Provides industry data and analysis from an investment perspective including general company history, financial statements and analysis, financial projections, and specific market background and analysis.
Form 10-K's for Industry Leaders		Annual reports filed each year by publicly traded companies that contain a wide range of company information such as audited financial statements, general market information, company history, organizational structure, management's discussion of a company's financial condition, risk factors, accounting policies and methods, and executive compensation.
Trade Association Publications		Reports that analyze trends and provide statistical studies on the markets of a specific industry including key regulatory and technological trends.

Appendix B: Summary of Actuarial Methods and Assumptions Reviewed

	Summary of Methods	Model Simplification
Data – Census and Source	[2014 Projections Report page 42] ME data source 2012 Form 5500 [2014 Projections Report page 45] ME Actives: ME-PIMS uses aggregate information as reported on Form 5500. It imputes individual participant census information from the active age/service scatter attachment. ME Inactives: ME-PIMS imputes inactive census based on actual inactive data received from several plans, which provides a template for assumed distributions by age, service, gender, and form of payment. Individual plan accrual rates are applied to this initial inactive census, which is then further calibrated to Form 5500 in-pay benefits and starting current liability of the plan. [2014 Projections Report page 50] [PIMS System Description 1.5] SE data source Sources are 2012 Form 5500, publicly accessible data on plan sponsors for bankruptcy modeling, and Compustat [2014 Projections Report page 52] [PIMS System Description 2.3.3.3 and 3.4.1] SE Actives: Distribution of actives is based on population data from Form 5500. The active covered participation level is a fixed percentage of the total stochastic firm employment. SE Inactives: PIMS imputes the inactive distribution by performing a 100-year projection of the current active population furnished by the schedule SB and normalizes to the actual inactive counts SE plan sponsor bankruptcy: PIMS uses a new internal data source to better identify who was the plan's sponsor	

Data - Sampling	[2014 Projections Report pages 43-44]	
	ME Sampling	
	PIMS includes almost all the largest plans and decreasing proportions of smaller plans (including large and medium plans that an external model determined as "critical and declining") in the sample	
	For currently insolvent and probable plans (i.e., booked plans), a sample of 27 insolvent plans, 29 terminated probable plans, and 44 ongoing probable plans are used to generate the current net position on the financial statement for booked plans.	
	Funded status data on 184 non-booked plans are weighted to represent the universe of PBGC-covered plans that are not current or probable claims for PBGC	
	The ongoing non-booked PIMS sample is divided into tiers, by plan size (based on vested current liabilities). The weight for an individual plan in each tier is the total vested liabilities for all plans in that tier divided by the total vested liabilities for the sample plans in that tier.	
	For purposes of determining which plans are to be booked, the PIMS sample is divided into three categories: small (< 2,500 participants), medium (2,500 – 35,000 participants) and large (> 35,000 participants). Each of these groups is divided into "MPRA" and "other," for a total of six categories.	
	Plans in each MPRA group are sampled from a list, which has plans that are potentially in "critical and declining" status as determined by an external model.	
	For the MPRA groups, weights are 1.00, 1.03 and 7.75 for large, medium and small, with a total of 28 sample plans. In the "others" groups, there are 11 tiers of plans: two tiers for the large plans, five for the medium plans, and four for the small plans. The weights range from one for the largest plans to 15.54 for the smallest plans.	
	For ongoing small plans, ME-PIMS does not duplicate the bulk reserve methodology. Rather, small plans assumed to be booked in the first valuation year (year 0) as determined by an initial ME-PIMS run are scaled to the bulk reserve with a weight of 1.584. The plans that are not booked in year 0 are weighted according to the process used for the medium and large tiers.	
	[2014 Projections Report pages 50-51]	
	SE Sampling	
	PIMS uses more than 400 actual plans from 300 firms with the largest share of total plan liabilities in the single-employer defined benefit	

	system, weighted to reflect the value of total liabilities and underfunding, and the distribution of funding levels among plans in the insured universe that were available publicly as of the preceding spring. PIMS creates scaled copies ("partners") of plan sponsors, each 0.2 of its source sponsors. Partners are allocated to sponsors to create a weighted sample that approximates the distribution of plan liabilities by funding status in the insured universe. For example, the weighted sample's total plan liabilities among plans between 50 to 60 percent funded is comparable to the same total for the insured universe.	

Plan Sponsor Behavior - ME	[2014 Projections Report page 47]
	
	For critical status plans and critical status plans that have "exhausted all reasonable measures" (ERM plans), PIMS assumes:
	
	  1. The per-capita contribution in critical status plans increases at a multiple of the prior observed rate, but the annual rate of increase in per-capita contribution is limited to 12% (7% for ERM plans)
	  2. The plan aggregate contribution amount (indexed for wage inflation) is capped by a multiple of the 2008 contribution: for non-ERM plans, not more than double in the first six years, not more than triple in the next six years or exceed 3.5 times the base year amount thereafter; for ERM plans, 1.5 times the pre-PPA06 base year contribution. A floor is set such that the aggregate dollar limit never falls below the prior year's contribution.
	  3. These contribution increases are supplemental and do not affect the benefit accrual rate in "percentage-of-employer contribution" benefit formulas
	  4. Non-ERM critical status plans are assumed to eliminate early retirement subsidies and temporary supplements for active participants
	
	[2014 Projections Report page 44]
	
	For critical and declining status plans (as characterized in MPRA)
	
	  1. PIMS determines when the plan becomes critical and declining
	  2. PIMS determines whether cutting back to 110 percent of PBGC guarantee is sufficient to maintain plan solvency over the long term, i.e., if suspension will maintain plan solvency.
	  3. If a plan selects suspension (as given by a random draw) it solves for the smallest level of cutback using an approximation to the regulatory solvency test, where the plan is projected to remain solvent throughout the next 50 years and have at least a 20% funded ratio at the end of 50 years using the actuary's return	

assumption

4. The test and random draw for suspension is determined for 2015 and thereafter for any plan not deemed to be "critical and declining" in any previous year.

5. If suspension is not sufficient, partition (on top of maximum suspension) is tested

    a. Inactives are partitioned to a new spin-off plan, and ME-PIMS tests for (1) whether supporting the partition would reduce the long term cost to the multiemployer insurance program by at least 10 percent of the present value of projected assistance, and (2) whether suspension/partition would ensure the plan's solvency

    b. 20% of eligible plans (i.e., plans that pass both tests) will partition in the first possible year

[2014 Projections Report pages 47-48]

MPRA Utilization Assumption:

1. Suspension only: For plans that can suspend benefits and remain solvent without requiring partition, ME-PIMS assumes that one large plan will suspend, and that other suspension-only eligible plans will do so 60% of the time (60% utilization).

2. Partition: For those plans that require partition in addition to suspension in order to maintain solvency, ME-PIMS tests that partition will reduce PBGC'S long run loss by at least 10 percent. For plans that pass that test, 20% are assumed to be partitioned.

[2014 Projections Report page 47]

ME-PIMS assumes critical status plans and most endangered status plans will not adopt future benefit improvements.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 13 page 23]

Negotiation cycle:

Cycle is assumed to be three years, with initial cycle started in the Schedule B/MB year. Generally the per-capital contribution value is assumed to increase at twice the rate in a cross-cycle year than in a mid-cycle year. Negotiation cycle reflected in "aging" (including imputed aging carried out in PPA forecast) but not in Cash Flow Model (CFM) forecasting nor in annual valuations.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 14 pages 24-25]

Sponsor Contribution Rate:

1. ME-PIMS calculates the per-capita historical increase ratio over the nine years preceding the data year; a value called "H" is computed as 1/12 of this increase, thus representing ¾ of the average annual historical increase. H is not permitted to exceed 200% nor fall short of 80% of the average wage-inflation rate

expected during a ten-year projection period.

2. The pre-PPA per-capita contribution rate is assumed to increase by 200% of H in each cross-cycle year and by 100% of H in each mid-cycle year

3. Contribution amount is computed as per-capita rate multiplied by active counts.

ME-PIMS applies a floor to potentially "boost" the contribution amount. The floor can be as high as Gross ERC less 10% of (FSA – CB), but not more than 15% above the initial per-capita value. For the initial projection year, the booster cap is limited to 30% instead of 15%. The booster models an effort to maintain a CB without interest. Booster is reflected in per-capita rates, hence compounded in the future.

ME-PIMS limits contribution to IRC 404 maximum deductible, and to an amount that will not bring the actuarial funded ratio above 125%.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 15 page 26]

Current and historical value of active head-count (proxy for contribution base), total contributions, and per-capita contribution rate (ratio of total contributions to active head count) are kept and made available by PIMS. These are used for OBC (Overburden Credit) and WLP (Withdrawal Liability Payment) calculations:

1. 3 years of active head count history are used in both
2. 10 years of per-capita history are used in computing starting WLP value when a plan goes into MW
3. A trend rate used to back-trend plan contributions up to 35 years for accruals in POC formulas is computed from the 10 years of Per Capita values. The 9-year average rate increase is subject to a trend ceiling of 1.2 (20% annual growth) and a trend floor of 1.0. This 9-year average rate is computed in the same manner as "H," except the total 9-year increase factor is raised to the 1/9 rather than 1/12 power.

Plan Sponsor Behavior - SE	[2014 Projections Report pages 51 and 53] [PIMS System Description 2.3.3.5] Sponsor contributions: PIMS assumes that plan sponsors contribute the minimum each year, and that any credit balance will be used to the maximum extent permitted until the balance is depleted. This is because firms in bankruptcy with underfunded plans seldom have positive credit balances. [2014 Projections Report page 53] Variable Rate Premiums: For variable rate premiums projections only, the SE-PIMS model reflects an adjustment to plan assets phased in over five years to offset the assumption that plans generally contribute at the minimum. Variable rate premiums are further scaled to match recent experience. The Model reflects an additional one-year delay in both the asset increase and the variable rate premium scaling to better match PBGC's actual experience in collecting variable-rate premiums.	
Assumptions –SE and ME	[2014 Projections Report page 46] ME [2014 Projections Report page 52] SE For purposes of modeling interest rates, Treasury yield for a given period is expected to be equal to the yield for the prior period, plus or minus some random amount Stock and bond returns and correlation are based on an estimate derived from the period 1973 – 2007. [PIMS System Description 2.3.3.4, supplemented by review of input data] PIMS valuation interest rate uses simulated corporate bond yields (a spread of approximately 1.1% over the Treasury yield per economic assumption parameters) [PIMS System Description 3.4.2] PIMS valuation interest rate also reflects the 8.85% interest rate relief granted to frozen plans of commercial airlines. [2014 Projections Report page 46] ME [2014 Projections Report page 52] SE [Key Differences Between SE-PIMS and ME-PIMS Chapter 11 page 21] For plan asset returns, PIMS starts with best-fit historical asset returns among large plans using stocks and Treasury bond returns and yields (weighted as 48% stock, 23% long-term Treasury bond returns, and 30%	[PIMS System Description 3.2.1] [PIMS System Description 3.4.1] For PPA annuity factors, PIMS uses single effective interest rate instead of segment rates. Additionally, SE-PIMS assumes annual payments of SLA to male participants. PIMS is designed to use end-of-year disclosures, thus no decrement in year 0 All non-mortality tables are assumed to be probabilities, while mortality is assumed to be rates of decrement

long-term Treasury yields, with a -2.5 basis-points additive return adjustment). All plans are assumed to have identical asset allocations.

[PIMS System Description 2.3.3.6]

Projections of Plan Asset Returns:

PIMS uses a variation of the Capital Asset Pricing Model (CAPM) to model asset returns

[2014 Projections Report page 46] ME
[2014 Projections Report page 52] SE
[PIMS System Description 3.4.2]

For demographic assumptions, PIMS uses the plan's own retirement, disability and termination tables.

ME-PIMS assumes historical hiring distributions continue to bring the active population to a stochastically-determined level. ME-PIMS models changes in employment levels to reflect economic variables, resulting in a mean net decrease in active population of 1.3% per year across all scenarios. No industry-specific employment trends are assumed.

SE-PIMS assumes a stationary mean active participation level unless the plan is frozen.

[2014 Projections Report page 48]
[2014 Projections Report page 52]

ME

ME-PIMS assumes the following plan demographics to facilitate cash flow modeling:

1. % male for actives: 70%
2. % male for retirees (in ongoing plans): 80%
3. % male for TVs (in ongoing plans): 94%
4. Age difference: females 3 years younger than male spouses
5. % elect J&S for actives: 60%
6. % have J&S for retirees: 30%
7. % elect J&S for terminated vesteds: 35%
8. JS form: 50% J&S
9. % married for pre-retirement death benefit: 80%
10. 50% J&S conversion factor based on PBGC rates: .8730 for male participants; .9135 for female participants

The above assumptions used in cash flow modeling were chosen because they are representative of the data available to PBGC from multiemployer plans

[PIMS System Description 3.4.1]

SE

In SE-PIMS, all participants are assumed to be male and are assumed to elect straight life annuities, based on prescribed healthy male table

[2014 Projections Report page 46]

ME

ME benefit-level and employer-contribution increases vary annually with some correlation to modeled economic conditions in each future year

Probability of mass withdrawal is generated taking into account plan size, ratio of active to inactive population, ratio of assets to benefit payments and expenses, ratio of the accumulated credit balance in the funding standard account to employer contributions, ratio of market value of assets to vested actuarial liabilities, and ratio of current year to previous year contribution amount

[2014 Projections Report page 46]
[2014 Projections Report page 52]

ME Mortality: For experience (plan aging), ME-PIMS uses the RP2000 combined healthy table projected with scale AA to projection year; for determining PV of PBGC assistance, PIMS uses RP2014 combined healthy male and female tables projected 13 years beyond the applicable valuation year using the MP2014 scale.

SE Mortality: For experience (plan aging), SE-PIMS uses the RP2000 combined healthy male table projected with scale AA to projection year; for determining underfunding at termination, PIMS uses RP2014 combined healthy male mortality projected 13 years beyond the applicable valuation year using the MP2014 scale.

[2014 Projections Report page 47]
[2014 Projections Report page 53]

Contribution Level/Credit Balances – ME:

Credit balance is rolled forward each year with interest and decreased by the amount the modeled contribution is below the minimum required. ME-PIMS models that most employers make contributions at a level above the minimum required.

Contribution Level/Credit Balances – SE:

Credit balance is rolled forward with plan's rate of return and decreased by the amount assumed to be used to satisfy minimum funding requirement.

[2014 Projections Report page 47]
[2014 Projections Report page 53]

[PIMS System Description 2.3.3.2]

Benefit Improvements – ME:

For flat-dollar plans not in critical or endangered status, benefit multipliers are assumed to increase annually by the rate of increase in average wages

[Key Differences Between SE-PIMS and ME-PIMS Chapter 10, page 20]

For both ME and SE, in case of a plan freeze, PIMS assumes no new entrants, no further benefit accruals, and no multiplier growth

For both ME and SE, PIMS assumes no post-retirement benefit increases (COLAs)

Benefit Improvements – SE:

For flat-dollar plans, multipliers in SE-PIMS are assumed to increase annually by the rate of inflation and productivity growth. For salary-related plans, the benefit formula is assumed to remain constant, but annual salary is assumed to increase based on inflation, productivity growth, and a factor measuring merit and/or seniority. Benefit improvement restrictions are not applicable in PIMS.

[Review of data manual, input data and of code]

Salary merit increase scale is imputed from current age/service/salary distribution

PIMS assumes base wage rates increase by 3% per year

[2014 Projections Report page 53]

Cash Balance Plans – SE:

PIMS assumes the full account balance will be paid as a lump sum to retiring and terminating active participants in any plan that is at least 80% funded.

[2014 Projections Report page 53]

Plan Accrual Benefit Restrictions – SE:

PIMS assumes a plan is permanently frozen once the funded percentage is below 60%

[2014 Projections Report page 53]

Declassifying Credit Balance to Avoid Benefit Restrictions – SE:

PIMS reduces assets by credit balances to determine funded percentages for triggering benefit restrictions. PIMS assumes plan sponsors will declassify credit balances to avoid benefit freeze restriction (60%

	threshold), but not to attain the 80% threshold, except for cash balance plans where it is assumed that the plan sponsor will declassify to 80% to pay lump sums. [2014 Projections Report page 47] [2014 Projections Report page 53-54] Discounting Future Claims: PIMS uses a single interest factor which models the "select" and "ultimate" factors described in the 2014 financial statements with an assumed reversion to the relationship of market interest rate and annuity pricing factors observed prior to the 2008 financial crisis (33 basis points, based on a review of input data). These factors are based on a survey of private-sector annuity market prices. [2014 Projections Report page 47] [2014 Projections Report page 54] For discounting future present values to the current report date, PIMS uses the simulated 30-year Treasury rate generated for the particular year and economic scenario	
Liability and Normal Costs	[2014 Projections Report page 47] [Key Differences Between SE-PIMS and ME-PIMS Chapter Eight page 18] Benefit formula - ME: ME-PIMS models both flat dollar and percent-of-contributions formulas; all other formulas are translated to and modeled as a flat-dollar plan. [2014 Projections Report page 51] [PIMS System Description 3.4.3] Benefit formula –SE: SE-PIMS models flat dollar, final salary, hybrid (max of flat and final salary) and cash balance formulas. [Based on review of code] PIMS models these items: retirement eligibility, early retirement reduction, supplemental benefits, Social Security integration, breakpoints for benefit accrual by age or service [PIMS System Description 3.3.2, supplemented by code review] PIMS values these liabilities: actuarial, current/PPA, premium (vested, using PBGC Interest rate), termination (vested, assuming retirement at earliest eligible age, using only the mortality decrement), termination capped by PBGC guarantee [PIMS System Description 3.7.4] Liability calibration in PIMS is based on current liability.	[PIMS System Description 3.4.3] [Key Differences Between SE-PIMS and ME-PIMS Chapter Four page13] Supplemented by review of code Pre-retirement and subsidized post-retirement death benefits are not valued. Disability formulas are not coded; employees disabled after five years of service are assumed to get normal retirement benefits. Calibration is used to compensate these simplifications. [Key Differences Between SE-PIMS and ME-PIMS Chapter Four page13]

	[Key Differences Between SE-PIMS and ME-PIMS Chapter Four page 13] Cost method: PIMS models the EAN and PUC methods; for other funding methods, PIMS imputes an immediate change to EAN, done during the DataPrep process by creating a charge or credit base. [Key Differences Between SE-PIMS and ME-PIMS Chapter Nine, page 19] Actuarial interest rate: PIMS assumes this to remain constant at level reported on Schedule B	PIMS does not model the Shortfall Method nor Alternative FSA.
IRS Funding Rules - SE	[2014 Projections Report page 51] [PIMS System Description 3.2.2] SE: PIMS models current law minimum funding as required by PPA06 and subsequent legislation (more specifically, reflecting WRERA, HATFA, as commented in PIMS's program codes) PIMS reflects modified calculations of liabilities for at-risk plans [PIMS System Description 3.4.4] [Key Differences Between SE-PIMS and ME-PIMS Chapter Seven, page 17] [as supplemented by code review – (SE) Plan.cpp] After PPA, actuarial value of assets is modeled as a 2-year "moving-average," with 10% corridor; PIMS uses 106% of average corporate bond rate as a proxy for the 3rd segment rate [PIMS System Description 3.7.1] PIMS reflects credit balances [PIMS System Description 3.7.2] The maximum deductible contribution is modeled in PIMS [PIMS System Description 3.7.3] The 415(b) benefit limit and 401(a)(17) pay limit are reflected in PIMS on a simplified basis. For PV of future pay, PIMS projects capped input pay. For benefits, projected final average pay is capped at the pay limit for the valuation year. PIMS limits lifetime benefits to the 415 cap for the valuation year, reduced before age 62. [PIMS System Description 3.7.4] Amortization post-PPA: PIMS sets up 7-year amortization of bases; bases are reset to zero if the plan is fully funded	[PIMS System Description 3.2.2] For at-risk liabilities, PIMS does not reflect the most valuable form of payment, but assumes a 15% load in addition to the $700/4% load. The $700/4% is always applied. [PIMS System Description 3.2.5] Extended amortization schedules allowed by PRA 2010 are not reflected in PIMS. [PIMS System Description 3.7.1] PIMS assumes no funding waivers and the amount of any waiver amortization installments are zero [PIMS System Description 3.7.3] For benefit limits, PIMS ignore late retirement increases, proration for fewer than ten years of participation, and the impact of supplements and/or survivor benefits.

| IRS Funding Rules - ME | [Key Differences Between SE-PIMS and ME-PIMS Chapter Three page 11]

Pre-PPA funding:

1. Amortization period: ME-PIMS uses 15 years for experience gains/loss; 30 years for assumption changes; 30 years for plan amendments
2. DRC/AFC and liquidity minimum are not applicable for ME
3. The ME-PIMS model reflected Reorganization status
4. ME-PIMS reflects asset smoothing; smoothing period can be up to five years

[Key Differences Between SE-PIMS and ME-PIMS Chapter Five pages 14-15]
[Key Differences Between SE-PIMS and ME-PIMS Chapter Six page 16]

ME-PIMS models funding standard account (FSA), full funding limit (FFL), balance equation, reconciliation amount, and reorganization (no longer applicable)

[Key Differences Between SE-PIMS and ME-PIMS Chapter 7 page 17]

Assets: If MVA is equal to AVA, then the asset method is assumed to be MVA, otherwise AVA. IF MVA, PIMS changes it to AVA in 2008 due to poor asset returns. Asset smoothing period is five years with 20% corridor. Reflects PRA 2010 and notice 2010-83, with asset losses during 2008 amortized over 10 years and with an asset corridor of 30% in 2009 and 2010.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 12 page 22]

Expense loading: ME-PIMS explicitly models expenses for the purpose of CFM forecasting, PPA forecasting, aging and valuations, generally equal to 5% of benefit payments. For CFM forecasting and actual "aging," expenses are assumed to be either a constant dollar or constant percent of benefit. Level-dollar is used as long as retired total liability account for less than half of the plan's total liability. PPA forecasts assume 5% of benefit payment for expense loading. "Aging" deducts 5% of benefit payments from plan assets.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 17 page 28]
[Key Differences Between SE-PIMS and ME-PIMS Chapter 18 page 29]

Amortization periods post-PPA: The model uses 15 years for assumption and benefit changes; extension of up to five years if projected to enter one of the formal troubled "zones"

[Key Differences Between SE-PIMS and ME-PIMS Chapter 19 pages 30-33] | [Key Differences Between SE-PIMS and ME-PIMS Chapter 24 page 40]

Parts of PRA 2010 are not valued in ME-PIMS: benefit-increase restrictions when a plan elects the relief; a plan's ability to elect relief in one year and discontinue it in a later year; a solvency test for a plan to be eligible for the relief provisions |

	PPA forecasts in ME-PIMS:	
	1. The PPA forecast follows the funding valuation assumptions in a closed-group projection 2. The benefit multiplier increases with the most recently experienced (stochastic) wage inflation for two years and remains level thereafter (more aggressive than the valuation assumption of zero benefit increase) 3. Models administrative expenses of 5% of benefit payments, for the expense load on ERC and aging of plan assets 4. The Per Capita contribution rates are assumed to remain level unless the plan adopted increases under FIP or RP, in which case contributions are increased based on the Step 2 or Step 4 multiplier (28/15 or 36/15 of H). Neither contribution boosting nor the funding policy maximum is applied. 5. WLPs are modeled to progress at a set schedule 6. ME-PIMS models net flow as equal to contributions + WLP – benefit payments – expenses 7. Forecast asset return is modeled as the assumed actuarial rate applied to beginning of year MVA and ½ of net flow 8. MVA is aged by adding net flow and asset return, and PBGC financial assistance to ensure MVA >= 0 9. Asset capital gain (CG) can be modeled but equal to 0 10. AVA is aged 11. Amortization schedule is aged, with and without amortization period extension under step 0 of FIP/RP; An experience G/L base is created due to AVA <> MVA 12. Each forecast year, per-capita NC is assumed to be level for plans using EAN and to grows at assumed interest rate for plans using PUC 13. Each year, ERISA-Required Contribution (ERC) is computed as NC + amortization + expenses; two versions of ERC are computed for the two different versions (standard and alternative) of amortization; net ERC is gross ERC less FSA balance; FFL and 404 are not reflected 14. Each year, the FSA (both standard and alternative versions) is advanced by crediting interest + contributions + WLPs –gross ERC 15. Each year, the AL is advanced with interest + NC – BP 16. The PVB is advanced, tracking actives and inactives separately 17. UAL is calculated as AL – AVA 18. PRA 2010 is reflected in PPA forecasts.	
	[Key Differences Between SE-PIMS and ME-PIMS Chapter 20 pages 34-36] [Verification and Quantification of Buck's Recommended Changes memorandum]	
	In PPA forecasts, the following tests are performed:	
	(a) Current funded ratio (FR) below 80% (b) Forecast to have funding deficiency (FD) within seven years (taking into account amortization extensions) (c) Current FR below 65% and insolvency forecast within seven years (d) Current FR below 65% and FD within five years, ignoring amortization extensions	

(e) FD forecast within four years (regardless of FR), ignoring extensions

(f) Insolvency forecast within five years (regardless of FR)

(g) Inactive PVB > active PVB, NC + interest on UL > expected contributions, and FD forecast within five years, ignoring extensions

ME-PIMS forecasts AVA & uses UC cost method as well, per PPA regulation

PIMS simulates the status forecasts each year: Failing any of (c) through (g) puts a plan in the "Red Zone"; failing (a) and (b) puts a plan in the "Orange Zone"; failing (a) or (b) puts a plan in the "Yellow Zone." Passing all seven tests keeps a plan in the "Green Zone."

ME-PIMS models these FIP/RP sequential steps and tests for adequacy for any plan moving from Green Zone into a non-Green Zone.

(0) Extend amortization charge bases by five years if a plan starts out in green status, but cap amortization period at 30 years

(1) Eliminate early retirement subsidies and, prospectively, temporary supplements

(2) Increase Per-Capita contribution at each cycle by (28/15) of H, capped at 8%

(3) Reduce future accruals, down to a floor of 1% of Per-Capita value

(4) Increase the Per-Capita value at each new cycle by a factor of 36/15 of H, capped at 12%

Step 1 is used only for a RP, not a FIP.

There are different steps for ERM plans.

Aging of plans from that point forward in the projection will reflect any FIP/RP steps taken. Annual valuations also will reflect amortization and cutback steps; CFM forecasts will reflect benefit cutbacks, but not contribution increases.

All steps adopted will be reflected in PPA forecasts after adoption, but for status forecasts, Steps 2 and 4 are applied for only three years. For "adequacy forecasts," Step 2 and Step 4 are applied indefinitely.

Adequacy-Test for FIP or RP: This tests whether the plan is forecast to emerge from Red or Yellow Zone back into Green within 10 years, from Orange Zone within 15 years.

For FIP, the Adequacy-Test reflects two additional "exit" tests:
1. The plan must be FD-free for 10 or 15 years as applicable, as extended by law or as shortened due to lapse of time
2. The plan must achieve a benchmark reduction in unfunded percentage over that period (33% = 1/3 for a Yellow-Zone plan, 20% = 1/5 for an Orange-Zone plan)

For RP, the Adequacy-Test is that the plan be FD free for 10 years after emerging from the Red Zone

Adequacy testing is performed in PIMS by extending forecast out an additional 17 years

FIP/RP update: ME-PIMS models the annual forecasting of PPA status and adequacy testing. If the FIP or RP is no longer adequate, additional steps are implemented. Existing steps are not dropped for plans which improve more quickly than scheduled.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 22 page 38]

A 5-year benefit rollback is modeled by backing out five years' worth of inflation from the benefit unit, under these circumstances:
1. A plan goes into mass withdrawal (MW)
2. A plan runs out of assets and receives financial assistance. PBGC's maximum guaranteed benefit is computed based on the rolled back benefit unit.

For actives, 100% of wage-growth rate in the flat-dollar multiplier is backed out. A separate rollback is performed for retirees by assuming years-retired for each cell (zero years-retired at current age 50, five or more at age 70, interpolated at intermediate ages). Since no COLA is assumed for retirees, the amount of rollback for retirees is (5 minus years-retired)*wage inflation.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 23 page 39]

WRERA 2008: ME-PIMS assumes plans extend the FIP and RP period to up to three years if the plan first went non-Green in 2008. In practice, the horizon becomes 12 years for Yellow or Red, and 17 years for Orange, as of 2009. ME-PIMS allows a plan first going non-Green in 2009 to elect to retain its 2008 zone.

[Key Differences Between SE-PIMS and ME-PIMS Chapter 24 pages 40-41]

PRA 2010: ME-PIMS models only 2008 eligible asset losses (EALs) because the assumed 2009 asset return is in excess of actuary's assumed interest rate. PIMS models (1) 10-year smoothing of EAL into AVA and 130% corridor bound (2) EAL amortization carve out of 50% (2009) 0% (2010), and 6.25% for eight years (2011 – 2018).

PIMS assumes all are plans eligible for relief, except it models that that a plan will elect not to use the amortization relief if doing so would cause it to move from critical to endangered or severely endangered status.

PIMS also carves out a 30-year base for the change in asset-smoothing period where needed (when plans moved from MVA to AVA in 2009).

These relief provisions are reflected in PPA forecasts as well as in plan

	aging.	
	As noted above, PIMS does not model benefit increase restrictions for plans electing relief, a plan discontinuing relief after so electing, nor a solvency test for relief.	

| Bankruptcy Modeling - SE | [2014 Projections Report page 51]

SE-PIMS reflects the relationship that occurred from 1980 to 1998 between the probability of bankruptcy and the firm's contemporaneous financial health variables (equity-to-debt ratio, cash flow, firm equity, and employment). The model simulates changes to those variables correlated with changes in the economy to determine probability of bankruptcy.

[2014 Projections Report page 52]

PIMS's bankruptcy probability formulas generally do not vary by industry, except for the financial and utilities industries, and for a few large companies, especially in the retail industry

PIMS compares market indices of bankruptcy risk to those generated by PIMS and recalibrates the outliers in PIMS to equal the mean of the market estimate of bankruptcy risk for that class of bonds | |
| PBGC Assets | [2014 Projections Report page 47]
[Key Differences Between SE-PIMS and ME-PIMS Chapter 25 page 44]

ME

All ME program assets are in revolving funds invested in U.S. Treasury securities. Asset returns in ME-PIMS are bound by the modeling of Treasury returns in future years.

[2014 Projections Report page 53]

SE

Projected returns on SE program assets are based on analysis of historical returns, return volatilities, and correlations between the different asset class returns

[PIMS System Description 4.2.2, supplemented by review of code and of output]

PIMS tracks the Trust Fund (trusteed plan assets) and Revolving Fund assets separately. PIMS uses different investment asset allocations for the Trust Fund and the Revolving Fund assets.

[PIMS System Description 4.2.8]

Before transfer to the PBGC, plan assets are reduced by one year of minimum required contributions, the "Due and Unpaid Employer Contribution" (DUEC).

[PIMS System Description 4.3] | |

	In PIMS, the PBGC Trust Fund pays a percentage of benefits and expenses equal to the lesser of 100% or the ratio of its assets to the PV of future benefits. The Revolving Fund pays the remainder. In PIMS, PBGC expenses are all paid from the Trust Fund. Premiums flow into the Revolving Fund. Newly trusteed assets flow into the Trust Fund. [PIMS System Description 4.4] [Supplemented by the post-PIMS processing spreadsheet] PBGC first purchases 30-year zero-coupon Treasury securities to immunize liabilities. If PBGC is to invest in equities in a simulation, any remaining assets are invested in equities, provided that the equity investment cannot exceed 30% of total PBGC assets. Any remainder is invested in one-year T-bills, using the Revolving Fund first and then the Trust Fund. PBGC assets are adjusted externally via post-PIMS processing to reflect the one-year delay in the employers' payment of variable-rate premiums.	
PBGC Premiums	[2014 Projections Report page 47] ME In ME-PIMS, premiums are based on the rate under current law, reflecting doubling in 2015 under MPRA, with projected rates increasing under the indexing provisions in the current law. There is no allowance in premium projections for write-offs of uncollectable premiums and for the fact that a portion of the premium collected is not credited with interest under MPRA. [2014 Projections Report page 53] SE SE-PIMS models current law PBGC premiums with projected rates increasing under the fixed increases and indexing provisions in current law. There is no allowance in premium projections for write-offs of uncollectable premiums. [PIMS System Description 3.4.7] To reflect the tendency of plan sponsors to fund above the minimum to reduce variable rate premiums, assets for the variable rate premium purpose are calculated assuming a higher level of contributions [PIMS System Description 4.2.5] [supplemented by review of input data] PIMS assumes that sponsors with less than 3% of bankruptcy probability will contribute above the minimum required, modeled through an increase in plan asset values that are projected under the minimum	

	contribution assumptions. The amount of increase is phased-in over a five-year period to a value equaling 21%* of the funding target. This asset adjustment is used only for variable rate premiums and does not carry through to actual funding of the plan. (*System Description document states this is 15% but input data shows this to be 21%.) [Post-PIMS processing spreadsheet] PBGC assets are further adjusted to reflect one-year delay of the plan sponsor behavior regarding the variable-rate premium. [Key Differences Between SE-PIMS and ME-PIMS Chapter 27 page 46] Scale factors are used to true-up flat premium receipts computed in the PIMS model to known values from PBGC financial reports.	
PBGC – ME Booking/ Un-booking	[2014 Projections Report pages 40 and 42] [Key Differences Between SE-PIMS and ME-PIMS Chapter 25 page 42-43] [Key Differences Between SE-PIMS and ME-PIMS Chapter 26 page 45] PBGC's financial liabilities reflect the present value of benefits and expenses payable pursuant to claims recognized by the PBGC. A claim for a plan is recognized when the plan is projected to be insolvent in 10 years, or within 20 years for a plan in mass withdrawal (MW). If insolvency becomes delayed beyond the 10-year threshold, the liability becomes "un-booked." In ME-PIMS, un-booking is recognized as negative claims. Financial improvements that are insufficient to cause claims to be un-booked are not reflected in the un-booked ME-PIMS claims value. PIMS records only initial claims and the reversals, but not the amount of annual post-claim "improvements." ME-PIMS uses Solvency Valuation (SV) forecasts to compute claims to be booked. A SV uses PBGC's Cash Flow Model (CFM), which is a component of its Integrated Present Value of Future benefits (IPVFB) valuation system. SV is performed if a plan fails three or more tests, or "severely fails" two or more of the following tests: (1) Asset Longevity: assets/cash flow – fail if less than 6; severely fail if less than 3 (2) Supportability: actives/inactives – fail if less than 1.3, severely fail if less than 0.25 (3) Income: fund inflow/fund outflow – fail if less than 1.3, severely fail if less than 0.5 (4) Funded Ratio: asset/total liabilities – fail if less than 0.6 severely fail if less than 0.5 (5) Retiree Funded Ratio: assets/retired liabilities – less than 1.0 for both	

	ME-PIMS uses these assumptions in SV: mortality under ERISA sections 4010/4044, which is GAM 1994 table for males set forward 1 year and projected from 1994 to the valuation year plus 10 years under scale AA; a single effective interest rate to approximate select and ultimate interest rate (also used as the CFM investment return); full retirement age (normally 65) instead of XRA. [2014 Projections Report page 43] ME-PIMS primarily models the plan's financial status rather than that of the plan's contributing employers ME books a probable liability when certain plan metrics are sufficiently problematic, a mass withdrawal is triggered, or cash-flow insolvency is projected within 10 years [Key Differences Between SE-PIMS and ME-PIMS Chapter 28 page 47] The PBGC guarantee limit on ME benefits is expressed as service times maximum accrual rate, which is 100% of first $11 of the effective, rolled-back, monthly unit plus 75% of next $33. For retirees and TV cells, a unit is estimated by dividing the cell's total benefit by its headcount, then dividing the resulting average benefit by an assumed 25 years of service. The above formula is applied to the estimated unit to obtain guaranteed benefits for the cell. [Key Differences Between SE-PIMS and ME-PIMS Chapter 29 page 48] In the year of insolvency and subsequent years, ME-PIMS: 1. determines the excess of plan outflow over its inflow 2. debits PBGC assets by this excess, and 3. imputes payment of this excess to the plan by restoring the plan's asset value from the negative amount of this excess back to zero	
PBGC – Mass Withdrawal	[Key Differences Between SE-PIMS and ME-PIMS Chapter 30 pages 49-52] ME-PIMS does not model withdrawal of individual employers from ongoing ME plans, and does not model individual sponsors paying WLPs rather than standard contribution amounts in such a situation. Factor considered in MW probability include these ratios: 1. MVA/total payments & expenses 2. MV/total vested liability 3. Active count / inactive count 4. Current year per-capita contribution / prior year per-capita contribution minus 1 5. Total participants / active participants The withdrawal probability is adjusted to yield an overall MW probability of ½% or less, with significantly higher than average probability for the	

	plans that were actually booked during that period

When a MW is modeled to occur, benefits are frozen and rolled back five years

Withdrawal Liability Payment (WLP) calculations in ME-PIMS are modeled as follows:
- Withdrawal Liability (WL) = unfunded vested liability
- Required annual payment = highest Per-Capita value, over the 10 years preceding MW times the largest 3-year average active headcount during that period
- An amortization calculation is performed to determine how many years are required for this annual payment amount to amortize the withdrawal liability; WLPs are set for plan sponsors in aggregate for that numbers of years (or indefinitely)
- A run-level collectability rate of 40% is applied to this entire schedule
- An assumed rate of decay = actively employed population of the plan's collective sponsorship over the 5-year period immediately preceding MW, recalculated annually.

The decay-adjusted schedule is used in ME-PIMS's PPA forecasting and PBGC Solvency Valuation via CFM forecasting | |
| PBGC – SE Booking of Liabilities | [2014 Projections Report page 43]

SE books a probable liability when the condition of the sponsoring employer justifies such a classification

[PIMS System Description 2.3.4]

Gross claims for the PBGC are reduced by a fixed recovery percentage (set by default at five percent)

[2014 Projections Report page 52]

A loss to PBGC is booked only if the plan is less than 80 percent funded for termination liability (and the sponsor is simulated to experience bankruptcy)

[PIMS System Description 3.5]

Calculation of plan termination liability is simplified by calculating accrued vested benefits up to the time of termination reduced by guarantee limitations included in PIMS. Benefits are assumed to commence at the earliest eligibility age. Plan assets and liabilities are transferred to PBGC's Trusteed Fund.

[PIMS System Description 4.2.7]

Before a plan is transferred to the PBGC, participant data are adjusted. Actives eligible to retire become retirees; otherwise, they become term-vesteds. Participants with supplemental benefits have supplements | |

	reduced so that the total of supplement and lifetime benefit does not exceed the normal retirement lifetime benefit. Lifetime benefits are then capped by PBGC's maximum guarantee. [PIMS System Description 4.5] PIMS has a chapter 11 variation where sponsors drawing a small enough bankruptcy probability are considered to be in reorganization rather than liquidation. They are given revised financial ratios and returned to the simulation as ongoing plans.	
PBGC – Financial Statement Valuation	[PIMS System Description 3.6] [PIMS System Description 4.2.1] See the assumption section (above) for the assumptions used in calculating PBGC's liabilities. PIMS also includes a PBGC liability for the PV of expenses. PIMS starts with initial data from PBGC's current actuarial valuation. Inactive data from seriatim valuation are scaled so that the PV of benefits and expenses match PBGC's financial statements. Census data for the non-seriatim valuations is constructed using average age and service in the actuarial reports. The participant counts and benefits are also scaled to match the results in the financial statements. PV of future expenses in PIMS is based on a 2007 study. There are two types of expenses: the reserve for cost of benefits, equal to 1.37% of the value of benefits in pay status, and the reserve for case processing, modeled using per-participant factors that varies by the number of years since plan termination. All dollar amounts in the expense and reserve formulas are indexed to reflect wage inflation [PIMS System Description 4.2] PIMS uses September 30 values to represent the PBGC's starting condition on December 31 of PIMS year zero [PIMS System Description 4.2.3] In SE-PIMS, all "probables" are assumed to terminate at the start of the simulation. Liabilities for probables are added to PV of future benefits, and assets for probables are added to the Trust Fund. [Key Differences Between SE-PIMS and ME-PIMS Chapter 25 page 44] Within ME-PIMS, PBGC's net financial position is determined as the projected value of PBGC assets net of the sum of liabilities for its projected claims. Liabilities are tallied from plan-level PIMS coding for plans projected to have become "booked"	[PIMS System Description 3.6] [PIMS System Description 4.6] PIMS does not determine additional benefits being paid to participants due to an asset allocation under PBGC priority categories (this overstates PBGC's surplus), nor does it reflect additional cutbacks due to phase-in of benefit improvements adopted or effective in five years preceding termination. Supplements remaining after the cutback to normal retirement level are not levelized and limited along with the lifetime benefit. This understates PBGC's surplus.

| | [Key Differences Between SE-PIMS and ME-PIMS Chapter 31 page 53]

Representative plans for the three types of already-booked plan (receiving financial assistance, expected to receive assistance within 10 years, or within 20 years for MW) are included in ME-PIMS data. PIMS computes results for the ME booked-plan universe by weighting each type of plan and summing. | |