This White Paper describes the methodology PBGC uses to determine the ERISA 4044 Yield Curve. It is intended to help practitioners and other interested parties better understand how the process works.

Pension Benefit
Guaranty Corporation

PBGC's Valuation Methodology
Derivation of ERISA 4044 Yield Curve

PBGC's benefits valuation regulation (subpart B to 29 CFR part 4044) requires the use of the 4044 yield curve to discount expected future benefit payments when determining benefit liabilities upon plan termination[1]. The purpose of this paper is to describe the principles and methods that are used to create the 4044 yield curve beyond what is included in the preamble to PBGC's final rule on Valuation Assumptions and Methods.

Introduction

PBGC has historically applied a consistent basis both for valuing the benefit liabilities in PBGC-trusteed plans and, through its benefits valuation regulation, for valuing benefit liabilities in non-trusteed terminating pension plans. This basis values a plan's benefit liabilities based on the approximate cost of purchasing group annuities from an insurance company in the private sector. PBGC currently uses a quarterly survey[1] of insurance companies' annuity prices, administered for PBGC by the American Council of Life Insurers (ACLI), to determine the discount rates used to value PBGC's and terminating pension plans' benefit liabilities.

Once the value of a pension plan's benefit liabilities is determined, PBGC can determine the amount of a terminating plan's unfunded benefit liabilities ("UBL"). This is done by subtracting the value of the plan's assets from the value of its benefit liabilities. Under ERISA, PBGC has a claim against the plan sponsor and any members of its controlled group for the plan's UBL as of the plan's termination date. The benefits valuation regulation is used to determine the amount of the plan's UBL for this claim. PBGC uses the same approach to determine the amount of the UBL for pension plans that are likely to, or have terminated, so that PBGC can accrue these liabilities on its financial statements.

PBGC's approach is intended to be consistent with actuarial practices of group annuity providers (insurers) for determining benefit liabilities in settlement situations.

Group Annuity Price Principle

The fundamental principle underlying the way benefit liabilities are determined per PBGC's benefits valuation regulation (subpart B to 29 CFR part 4044) is that such benefit liabilities should approximate the fair market price of group annuities sold by private sector insurance companies. This means that the discount rate should reflect the value of expected future benefit cash flows as well as the risk that actual future payments differ from the expected amounts. The market cost of settling a benefit liability for these payments is adjusted upwards by insurers to account for the risk borne by the insurer, expenses, and a profit for taking on this risk. This profit is compensation demanded in the settlement of any risky, irrevocable financial obligation and is therefore a reasonable part of the cost of settling pension obligations.

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[1] On or after July 31, 2024

PBGC's benefit liability valuation approach also minimizes the "moral hazard" inherent in the Title IV termination insurance program by ensuring that it is not less costly for an employer to terminate a pension plan in a distress termination with PBGC than to terminate the plan in a standard termination in the private sector. Marking benefit liabilities in PBGC-trusteed plans to the annuity market matches those benefit liabilities to the price that a plan sponsor would have to pay to settle their pension plan obligations in the annuity market. This avoids the moral hazard mentioned above as well as overpricing benefit liabilities when PBGC becomes trustee of a plan sponsor's terminated pension plan.

Structure of Rates

Insurance companies develop interest rates for pricing group annuities starting with the expected yield in each future year on the investments they expect to make with the premium proceeds for a contract. The expected investment yields are adjusted for potential defaults and are then adjusted downwards, which increases the price to reflect risk, expenses, and profit. The structure of the 4044 yield curve and the process used to develop it are intended to estimate these net yields that are used to price group annuity contracts.

The 4044 yield curve is made up of a "blended market yield curve" plus spreads developed to adjust the market-based curve to represent yields used by insurance companies to price group annuity contracts. The spreads are developed using quarterly surveys of group annuity insurers. The market-based curve as of any measurement date is adjusted by the average spreads determined from earlier annuity price surveys.

The blended market yield curve reflects interest rates as of the date of liability measurement, which is important because assets invested to fund the liability are impacted by the same interest rates. The yield spreads in the 4044 yield curve reflect the average or typical difference between market interest rates and group annuity pricing yields during the prior year. Determining the 4044 spreads as of the measurement date is impractical, but also less important than using the market interest rates on the measurement date. The spreads do not affect asset values and do not vary over time as much as interest rates do.

Blended Market Yield Curve

The 4044 yield curve is an adjusted version of the blended market yield curve. The blended market yield curve is a combination of two-thirds of the corporate bond spot yield curve and one-third of the Treasury spot yield curve. It has rates determined out to 30 years and fixed rates after 30 years. Unlike the curves from which it is determined, 4044 rates are assumed to be constant after 30 years because this was determined to be more consistent with group annuity pricing yields. With a normal upward sloping yield curve, this means that these rates are lower and represent higher risk for payments made more than 30 years in the future.[2]

Both the corporate bond and Treasury yield curves are created by the Treasury Department as of the last day of each month and are generally available at Treasury.gov within one to two weeks after the end of the month. The HQM curve is based on the same bond data used to develop the monthly

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[2] The underlying yield curves have slightly different shapes up to 30 years if yields are held constant after 30 years rather than increasing.

corporate bond yield curve provided under § 1.430(h)(2)-1(d) for funding and other purposes, but is based on the spot rates as of the end of month whereas the monthly § 1.430(h)(2)-1(d) curve represents the average of each day in the month. The TNC curve as of the end of month is used for the Treasury rates.[3]

The Treasury portion of the blended market yield curve is not meant to represent insurer investment practices. The specific 1/3 Treasury – 2/3 corporate bond rate mix creates a curve that has the highest correlation with changes in group annuity pricing yields, based on data from 2011- 2020. The yield curve of spreads is not typically flat, indicating that the shape of the typical insurance pricing curve is different than the shape of the blended market yield curve.

The blended market yield curve more heavily weights the yields on investment grade corporate bonds because corporate bond yields are the most important driver of group annuity prices[4]. However, based on discussions with insurers and PBGC's own analysis, PBGC understands that insurers likely adjust the level of the corporate spread they expect to earn based on economic conditions. In times of economic distress, when the difference between corporate bond yields and Treasury bond yields (the corporate bond spread) widens considerably, group annuity prices do not typically reflect the full extent of this spread widening. This is because insurance companies may avoid investing in the highest yielding (riskiest) bonds in any credit rating category and they may increase their assumption about how yields will be offset by future downgrades and defaults. In these environments, the inclusion of Treasury bond yields in the blended market yield curve will dampen the impact of this difference and allow PBGC to estimate private-sector group annuity pricing more accurately.

Group Annuity Market Survey

To obtain the cost of single premium group annuity contracts that would pay benefits for a terminated plan, PBGC conducts a "double-blind" survey of current premium rates (prices) charged by insurance companies for single premium group annuities. Insurance companies consider such pricing information to be confidential and will not publicly disclose it. Therefore, PBGC relies on a trade association, the ACLI, to obtain this price information for PBGC. On a quarterly basis, ACLI sends group annuity surveys to various insurance companies participating in the group annuity market. These insurers complete the surveys with information as of the end of each calendar quarter and return them to ACLI. ACLI then forwards the unopened/anonymized company-coded responses to PBGC. Each company's response is identified only by a company-code letter, which changes quarterly, so PBGC does not know the identity of the companies who respond to the survey.

Insurers price group annuities by analyzing participant demographics and making assumptions about variables such as yield on investments, mortality rates and retirement age. PBGC requests that the premium rate (price) information on the surveys exclude the insurers' administrative expenses because

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[3] PBGC generally uses a similar process described in this paper for determining interest rates used to value PBGC's financial statement liability. However, yield curves available daily from ICE Data Services LLC are used for the blended market yield curve in the financial statement process in order to produce financial statements on time. The HQM and TNC curves are used for 4044 purposes because they are publicly accessible at no cost. The use of different yield curve information does not result in meaningful differences in liability measurement because both blended market yield curves are adjusted to represent group annuity prices.

[4] See NAIC Special Markets Report as of the end of 2021 for breakdown of life insurance company investment allocation.

PBGC has its own expense assumption. The premium rates provided on the surveys are the prices that the insurers would charge, as of the quarterly survey date, for a $10/month annuity, payable in straight-life form, beginning at the requested ages. More detail on the survey contents is discussed in the "Composite Premium" section below.

Because the ACLI survey is double-blind (PBGC does not know the identity of the survey respondents, and ACLI does not see the prices contained in the responses), PBGC cannot independently verify the accuracy of the information it obtains. However certain tests are used to eliminate "outliers" which may skew the results as described below. PBGC also checks the outcome of its process against both publicly available and fee-based surveys that collect group annuity pricing yields, as described below in Review of Yield Curve Rates.

Determination of Spreads

The 4044 yield curve is derived from the group annuity survey information. Because PBGC does not have access to the component assumptions the insurance companies use in pricing, PBGC uses an iterative process to determine the yield curve that best fits the survey information based on a mortality assumption assumed to be used by the insurance companies in the sample prices.[5] Once this yield curve is determined, the spreads between this group annuity pricing yield curve and the blended market yield curve on the survey date are calculated for each year on the curve. Spreads are updated each quarter and averaged over four quarterly surveys to smooth out random variation and any impact of seasonality in pricing. The average spreads are used to adjust the blended market yield curves as of future valuation dates in the applicable quarter.

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[5] Currently the Pri-2012 Total Dataset with separate employee and nondisabled-annuitant rates together with the latest mortality improvement scale as issued by the Society of Actuaries. PBGC understands this to be representative of the mortality assumption used in the premium information provided by insurers in response to the quarterly survey.

The chart below shows which surveys are averaged to develop the spreads and which spreads are used to determine which 4044 yield curves. See the appendix for a full example of how the 4044 yield curve is determined.

Valuation Date	Blended Market Yield Curve	Applicable Spreads	Surveys Averaged to Develop Spreads			
01/31/2023	01/31/2023	Q1 2023	09/30/2022	06/30/2022	03/31/2022	12/31/2021
02/28/2023	02/28/2023	---------------------------- same as above -------------------------------				
03/31/2023	03/31/2023	---------------------------- same as above -------------------------------				
04/30/2023	04/30/2023	Q2 2023	12/31/2022	09/30/2022	06/30/2022	03/31/2022
05/31/2023	05/31/2023	---------------------------- same as above -------------------------------				
06/30/2023	06/30/2023	---------------------------- same as above -------------------------------				
07/31/2023	07/31/2023	Q3 2023	03/31/2023	12/31/2022	09/30/2022	06/30/2022
08/31/2023	08/31/2023	---------------------------- same as above -------------------------------				
09/30/2023	09/30/2023	---------------------------- same as above -------------------------------				
10/31/2023	10/31/2023	Q4 2023	06/30/2023	03/31/2023	12/31/2022	09/30/2022
11/30/2023	11/30/2023	---------------------------- same as above -------------------------------				
12/31/2023	12/31/2023	---------------------------- same as above -------------------------------				

Changes in spreads from quarter to quarter are likely impacted most by supply and demand factors. It isn't practical to receive and process surveys quickly enough to use the pricing discount rates from a survey for liability measurement on the date of the survey. That means that unusual conditions in the group annuity market on any particular measurement date won't be represented in benefit liability measurements as of that date. PBGC averages spreads over four quarters to minimize the impact of unusual conditions in the group annuity market on one date on the liability measurement as of another date.   In addition, because there may be some seasonality to the supply and demand factors, using spreads from four quarterly surveys ensures that all parts of the year are represented in the average spread every quarter.

Processing and Analyzing Survey Information

PBGC's principle of aligning benefit liability measurements with group annuity premiums requires matching prices in actual transactions that take place in the market to the greatest extent possible. Using actual transactions to calibrate PBGC's assumptions would present significant practical challenges. Finding the transactions to observe would be difficult given industry practices. Also, even if transactions could be found to observe, it would be extremely difficult to translate the transaction data into useable information -- for example, because the mortality assumption may be customized for each transaction.

Competitive Bidding

There are two effects from competition that are desirable to capture. First, typically, insurers enter the bidding for a case with an initial bid (single sum dollar amount) using so called "sheet rates" or "off-the-shelf" pricing. Later, in the final bid, insurers may reduce their bid by anywhere from a few percentage points to high single digit percentage points. The other effect is that the lowest bid usually wins a case.

The group annuity survey respondents typically provide "off-the-shelf" premium rates. To represent the competition that determines actual transaction prices, PBGC uses an average of the lower end of prices from each set of surveys (as explained below). Other organizations that do similar surveys that ask directly for interest rate information also use some portion of the lowest prices (or highest interest rates) received for this reason. For example, at the time of writing, the Canadian Institute of Actuaries uses the highest three premium interest rates out of seven responses received to their quarterly survey. Consulting firms in the U.S. distinguish between average survey rates and competitive survey rates. One firm uses the average of the interest rates from the highest third out of a typical set of nine responses received.[6]

PBGC uses the lowest cost half of prices provided in the survey responses, based on the composite premiums and size units described below. However, representing the competitive process with fewer surveys is balanced against using enough surveys to represent a meaningful portion of the market. In addition, an approach that does not use only the lowest survey response recognizes that not every insurer bids on every case, that some cases will be settled with higher prices due to the complexity of the plan provisions and that the lowest bidder does not always win the business.

Composite Premiums

Survey respondents are asked to provide 28 sample premium rates through the survey, 14 male and 14 female.[7] The sample premium rates provided by each insurer are weighted based on the demographic profile of a typical pension plan population. For example, the deferred-to-age 65 premium rate for a 30-year-old has a smaller weighting than an immediate premium rate for a 65-year-old since the deferred-to-age 65 premium rate would be associated with a smaller liability in a typical pension population.[8] A composite premium is determined for each survey respondent by adding up the weighted premium rates received through the survey. The primary purpose for the weightings and the resulting composite premiums is to better represent the bidding process and enable the other procedures described below.

Size Units

To ensure that the responses included in the average group annuity prices represent a material portion of the market, the size of the group annuity business for each insurer is determined. The amount of group annuity business won in the prior four quarters, the total amount of group annuity business on the books and the capacity for taking on new business in the upcoming quarter are used to assign respondents a numerical size rating (size units) from 1 – 15. The lowest half of survey premium rates is determined using these size units. The size units for all insurers (excluding outliers) are summed and the lowest half of composite premium rate information described above is determined based on these units. In the example below, the lowest three composite premiums and 3/15 of the fourth lowest composite

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[6] These survey practices for other organizations were in use in mid-2021.

[7] PBGC requests prices for immediate annuities for males and for females beginning at ages 50, 55, 60, 65, 70, 75, and 80, and deferred annuities beginning at age 65 for individuals currently at ages 30, 35, 40, 45, 50, 55, and 60.

[8] PBGC uses data from Form 5500 filings for plans used in the Projections Report modeling to determine these weightings.

premium will be included in the lowest half cost average. This approach ensures that the information included in the lowest half average represents a significant portion of the market.

Insurer	Composite Premium	Size Units	Size Units Included in Lowest Half Average
#1	$1,560	9	9
#2	$1,580	15	15
#3	$1,620	3	3
#4	$1,660	15	3
#5	$1,820	9	0
#6	$1,860	9	0
Total		60	30

The average net premium based on the above table is $1,586 [((9 x $1,560) + (15 x $1,580) + (3 x $1,620) + (3 x 1,660))/30].

Minimum Representation

PBGC believes that the validity of the survey process is compromised if the portion of the group annuity market represented is too small. Therefore, a minimum of 15 size units will be used to determine the average premium rates even if that represents more than half of the size units in the survey.

Outlier Responses

PBGC excludes premium rate information that is not representative of the market for settling pension liabilities through group annuities. For example, this could happen due to an insurer inadvertently providing information as of the wrong date or misunderstanding PBGC's survey instructions. Outlier responses could also be due to the wide range of practice regarding "off-the-shelf" prices and expense loads or the niche markets that individual insurers may target. PBGC believes that these types of responses are most likely to be received from insurers that are responding for the first time to the survey. A question on the survey allows PBGC to identify respondents that have participated in the survey in the last year.

PBGC identifies outlier premium rate information based on the composite premium described above. In the event one or more responses from new participating insurers are significantly different from other responses, the new responses will be compared to a benchmark that is not impacted by those new responses. Composite premiums that are more than 15% higher or lower than the average composite premium for respondents that have participated in the past year are considered outliers and excluded.

Immediate only responses

Because benefit liabilities measured based on Section 4044 represent the settlement of liabilities for a full plan population, interest rates used to price plan terminations, rather than retiree only buyouts, are most relevant. PBGC does receive survey responses that only provide premium rates for immediate contracts, with no information for deferred contracts. To minimize the impact of retiree buyout pricing, survey responses that do not include information for deferred contracts are only used if there are not enough full survey responses (immediate and deferred contracts).

Review of Yield Curve Rates

PBGC uses several sources to benchmark the 4044 interest rates that result from the process described above to ensure that it is a good representation of the group annuity market. These sources include informal surveys by group annuity brokers, indexes prepared by consulting firms showing annuity pricing relative to pension accounting liability measurement, and a commercial group annuity survey pricing service.

Appendix

The following example illustrates how the 4044 yield curve would have been developed for a valuation date on December 31, 2023, had the rule been in effect at that time and assuming the fourth quarter spreads for 2023 were as shown in column D below:

Maturity	(A) Dec. 31, 2023, Nominal TNC Treasury Yield Curve	(B) Dec. 31, 2023, HQM Bond Yield Curve	(C) Blended Market Yield Curve $\frac{1}{3}$ (A) + $\frac{2}{3}$ (B)	(D) Fourth Quarter 2023 Spreads	(E) Applicable 4044 Yield Curve* (C)+(D)
0.5	5.17%	5.29%	5.25%	0.36%	5.61%
1.0	4.78%	5.12%	5.01%	0.36%	5.37%
1.5	4.46%	4.97%	4.80%	0.36%	5.16%
2.0	4.21%	4.84%	4.63%	0.36%	4.99%
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
28.5	4.04%	5.10%	4.75%	0.36%	5.11%
29.0	4.04%	5.10%	4.75%	0.36%	5.11%
29.5	4.04%	5.10%	4.75%	0.37%	5.12%
30.0	4.04%	5.10%	4.75%	0.37%	5.12%**

* Because of the lookback rule, valuation dates from January 1, 2024, through January 30, 2024, would also use the December 31, 2023, blended market yield curve which means they would also use the fourth quarter spreads. Thus, the 4044 yield curve in column (E) would also be used for those valuation dates.

** The 5.12% rate would be used for benefits expected to be paid 30 or more years after the valuation date.