

DERIVATION OF INTEREST FACTORS IN PBGC'S LIABILITY

VALUATION METHODOLOGY

September 6, 2013

The purpose of this paper is to describe the rationale for PBGC's liability valuation methodology and regulation particularly as it relates to the determination and application of interest factors.

For over a quarter century, PBGC has maintained a consistent basis both for valuing the liabilities that it is responsible for paying from terminated plans and, through its valuation regulation, for valuing benefit liabilities in terminating pension plans. This basis values a plan's benefit liabilities based on the approximate cost of purchasing equivalent annuities from an insurance company in the private sector. PBGC currently uses a quarterly survey¹ of insurance companies' annuity prices, administered for PBGC by the American Council of Life Insurers (ACLI), to determine the basis on which to value PBGC's (and plans') benefit liabilities.

Once the value of a pension plan's benefit liabilities is known, 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. ERISA gives PBGC a claim against the plan sponsor and its controlled group for the total amount of the plan's UBL as of the plan's termination date. The valuation regulation is used to determine the amount of the plan's UBL for this claim. PBGC similarly uses the methodology to determine the amount of the UBL for pension plans that are likely to, or have terminated, so that PBGC can "book" its liabilities for purposes of its financial statements.

1. Rationale Underlying the Valuation Methodology

¹ Prior to December, 2008, PBGC used an annual survey of annuity prices. From that annual survey, monthly changes in PBGC's interest factors were matched to monthly changes in corporate bond indices. Before 2002, PBGC used a Moody's corporate bond index, and from 2002 through 2008, PBGC used a Lehman' bond index. That Lehman's bond index was published by Barclay's after February 2006.

From the outset, the cornerstone of the PBGC regulatory approach has been to value a plan's benefit liabilities by approximating the fair market price of group annuities sold by private sector insurance companies.

There is a well-established and highly competitive marketplace in the United States for group annuities. The latest information² available shows that there are seven companies actively in the close-out group annuity market, these same companies have been in the market at least since 2008. In the last ten quarters PBGC has received between three and six responses to the survey each quarter; the response rate has never been less than three surveys in any quarter. PBGC does not get any additional information (such as the size of the insurer) regarding the survey respondents at the time the survey responses are received. ACLI has emphasized that providing such information would violate a key principle of the survey which is maintaining secrecy of the identity of respondents. Recently however, upon repeated inquiries from PBGC, ACLI confirmed that every quarterly survey since 2011 has included a response from at least one of the two largest annuity providers, and three of the nine quarters have included a response from both of the largest companies. Based on this level of response to the survey, we are comfortable that the survey yields a reasonable measure of prices in the annuity market.

The rationale for valuing liabilities based on their market value is twofold. First, this valuation approach 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 the PBGC than to terminate the plan in a standard termination in the private sector. Marking liabilities in PBGC-trusted plans to the annuity market matches those liabilities to the price that a plan sponsor would have to pay to terminate their plan in the open market. This avoids the moral hazard mentioned above as well as the clear impropriety of overpricing PBGC's trusteeship of a sponsor's pension plan.

² This information comes from three sources: a conversation with Dietrich Associates, the website of a terminal funding company (BCG at <http://www.bcgtermfund.com/index.php?BODY=preferredcarriers>), and the website of a benefits consulting firm (Mercer, at http://www.mercer.com/articles/US-pension-buyout-index#Methodology_for_preparation_of_the_Mercer_US_Pension_Buyout_Index). The seven companies are: Prudential Insurance, The Principal Financial Group, Metropolitan Life, Mass Mutual, Pacific Life, Mutual of Omaha, and American General Life.

Second, the regulation is premised on the rationale that valuing a liability based on the value a willing buyer and seller would exchange for that liability—i.e., a market value obtained in a competitive marketplace--- is reasonable.

Measuring terminating pension liabilities by reference to the cost of settling the liability in the market place is an accepted and preferred valuation methodology. For example, in a 2003 study by the General Accounting Office which discussed the difference between the selection of interest assumptions for measuring pension liabilities in an ongoing and in a terminated plan, the GAO noted:

The interest rate appropriate for measuring the present value of a plan’s pension liabilities may differ depending on a number of factors, including the purpose of the measurement. For example, the interest rate appropriate for measuring the present value of a plan’s pension liabilities on an ongoing basis may reflect the assumed rate of return that the plan is expected to achieve on the investment of its assets. On the other hand, the interest rate appropriate for measuring the present value of that same plan’s pension liabilities at plan termination may reflect interest rates implicit in annuity pricing.³

Similarly, the Financial Accounting Standards Board (FASB), Accounting Standards Codification (ASC) Section 960-20, *Plan Accounting – Defined Benefit Pension Plans, Accumulated Plan Benefits*, Paragraph 35-1A states that:

“[i]n selecting certain assumptions to be used in determining the actuarial present value of accumulated plan benefits...use those assumptions that are inherent in the estimated cost at the benefit information date to obtain a contract with an insurance entity to provide participants with their accumulated plan benefits.”

Likewise, the Actuarial Standards Board adopts this approach:

“The purpose of the measurement is the primary factor. For example, an actuary measuring a plan’s termination liability may use an investment return rate reflecting interest rates implicit in current or anticipated future annuity purchase rates.”⁴

³ US General Accounting Office, “Private Pensions: Process Needed to Monitor the Mandated Interest Rate for Pension Calculations.” (GAO-03-313, February 2003) at 6-7. The purpose of the measurement is of critical importance. Where the expected rate of return on plan assets might be appropriate for an ongoing plan as noted by GAO, that is correct only when the sponsor has the ability to make additional payments in the future should the actual rate of return and retiree mortality turn out to be different than expected. The annuity pricing model, also cited by the GAO and used by the PBGC for both ongoing and terminated plans, correctly prices both the currently expected benefit payments and the uncertainties relating to actual rate of return and mortality.

PBGC’s survey reaches out to the broad annuity market, and achieves acceptable response rates given the standard in FASB ASC 960-20. In addition, PBGC has a continuing commitment to assure that the survey response rate provides a reliable measure of annuity market prices. We have met with industry representatives to encourage responses to the survey at industry gatherings at ACLI, and are currently scheduled to do so again in early fall 2013.

Over the last ten quarters, PBGC has received between three and six responses each quarter. Although we have not formally determined a minimum number of responses that would define a “sufficient response rate”, we believe a response of 4 or more surveys is more than adequate and even a response of 3 surveys should be sufficient if at least one of the two major insurers has responded. Starting in 2013 we ask ACLI, starting at 3 weeks after the survey date (earlier than previous practice), to send out requests for additional responses when we have received fewer than four responses by that time. Such second requests usually produce additional responses before the deadline for publication of the PBGC interest rate factor. The table below shows the number of surveys received for each quarter’s survey date for the past ten quarters:

Survey date	Number of Survey Responses
6/30/2013	5
3/31/2013	3 / 5 *
12/31/2012	3 / 4 *
9/30/2012	4
6/30/2012	5
3/31/2012	4 **
12/31/2011	3 / 5 *, ***
9/30/2011	4 / 6 *, **
6/30/2011	4
3/31/2011	6 **
<p>* In quarters where two numbers are shown, the smaller number of surveys was received in time for use as most recent survey – additional surveys were received only in time for use as the prior survey during the next quarterly derivation of interest factors.</p> <p>** <i>Includes</i> one company that indicated “temporarily withdrawn from the deferred annuity market”. We used the immediate annuity prices from the surveys in these quarters.</p> <p>*** <i>Does not include</i> one company that indicated “temporarily withdrawn from the immediate and deferred annuity markets.” That is, we received 6 responses, but one did not contain prices and so was not used in the derivation of the interest factors.</p>	

⁴ Actuarial Standards of Practice no. 27, Selection of Economic Assumptions for Measuring Pension Obligations, section 3.6.3(a).

PBGC's use of market prices, where we get prices for annuities at over a dozen different specific ages, recognizes the difficulty in ascertaining the assumptions that underlie insurance companies' pricing. At least three entities⁵ now publish their own results of surveys of insurance companies' interest assumptions, and only one of those surveys has been in use for more than a brief time⁶. These published surveys have arisen only in recent years. The interest rate assumption is clearly a major factor in calculating the value or price of an annuity, and there are many factors⁷ that underlie any interest rate assumption that is presented as representative of annuity pricing. PBGC uses surveyed prices for annuities at many ages to derive its interest factors – when combined with PBGC's mortality assumptions those interest factors generate values that very closely match annuity market prices at every age.

PBGC and PRAD staff continue to monitor trends in the annuity market through contacts with industry participants, participation in various academic and industry meetings, associations and literature review. The number of insurers in the marketplace has changed over the period that we have used the annuity pricing survey, as have broad demographic and economic patterns, including the mortality and reserving requirements insurers face. PRAD monitors these changes and reviews its procedures and the regulations for needed changes to reflect the evolving insurance industry in general, and the annuity market in particular.

Finally, it is vitally important that the methodology recognize the difference between the present value of a given stream of fixed payments and that of a similar stream with administrative costs and, more importantly, subject to longevity and other risks (e.g. changing retirement patterns) associated with defined benefit plan liabilities.

⁵ Currently, those entities are BCG Termination, Dietrich Associates, and Mercer. BCG has published rates starting in August 2012; Dietrich has gathered rate information for over a decade, but their methodology has changed during that period. Mercer started publishing a risk transfer index in early 2013 [**awaiting confirmation**], their index compares a broad measure of annuity pricing assumptions against a broad measure of funding assumptions.

⁶ Dietrich associates created their "update" 12 years ago, and the BCG and Mercer surveys both started less than two years ago.

⁷ Those factors include, but certainly are not limited to: whether an expense load is implicit in the interest rate, which mortality table was used, whether the demographic distribution of the population is "typical" or "average", etc.

The former stream is the equivalent of a simple bond portfolio with similar timing and certainty of payment and could correctly be discounted using the rates associated with such a portfolio.

The latter, involving liabilities that the PBGC's methodologies must discount, has to additionally price in the potential for the stream having to lengthen, perhaps substantially. Benefit payments, even once fixed, also have administrative costs that straight bond coupons do not. While it may be possible to synthetically create a price, and thus an adjusted discount rate or interest factor, that would cover the additional costs and uncertainties of defined benefit payment streams, that is not necessary when one adopts the market price of an annuity contract for the valuation basis. Such contracts inherently capture not only the expected payment stream, but also the longevity risks and other costs associated with paying that stream over an uncertain period of time. It is for these reasons that the PBGC's methodologies are based on annuity prices and not merely corporate bond or other fixed income rates.

In summary, use of a fair market value approach when focused on a similar payment promise, such as an annuity contract, is an accepted and reasonable method for valuing a terminating pension plan's benefit liabilities and minimizes the moral hazard to the Title IV insurance program.

2. PBGC's Rate-Setting Methodology

In order to obtain the cost of single premium group annuity contracts that would pay benefits under a terminated plan, PBGC utilizes a "double-blind" survey of current prices charged by insurance companies for single premium annuities. Insurance companies consider such pricing information to be trade secret and highly confidential business information, and will not publicly disclose it. Therefore, PBGC relies on a trade association, the American Council of Life Insurers ("ACLI"), to obtain this pricing information. On a quarterly basis, ACLI sends survey forms to the insurance companies, who complete the form, and send it back to ACLI. ACLI then forwards the unopened coded responses to

PBGC.⁸ Each company's response is identified only by a code letter and PBGC does not know the identity of the companies who respond to the survey. We describe the survey as "double blind", to reflect this level of confidentiality.

A detailed discussion of how PBGC uses the ACLI survey data to arrive at an annuity price is contained in a document on PBGC's website entitled "PBGC Procedure for Setting Interest Factors Used to Value Liabilities for PBGC Financial Statements"⁹ attached as Exhibit 1). Generally, an insurance company will price an annuity by analyzing participant demographics and making assumptions about a number of variables the most important of which are interest, mortality rates and expected retirement age. Since PBGC does not have access to the assumptions the insurance company uses, the agency must work backwards from the pricing information obtained from the ACLI survey to determine exactly what combination of interest factors and mortality assumptions will most closely match the annuity prices.

To do this, the PBGC valuation regulation prescribes certain assumptions about interest, and mortality that, when used in combination, and *only* in combination, will approximate the market price of insurance company annuity contracts obtained from the ACLI survey. ("PBGC's interest assumptions have been designed so that, when coupled with the mortality assumptions found in the regulation, the benefit values are in line with industry annuity prices.")¹⁰ Because the ACLI survey is a double blind survey (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, the agency does employ certain tests to identify and eliminate "outliers" which would skew the interest factor.¹¹

It is important to emphasize that the interest factor in the valuation regulation has no independent significance apart from the mortality assumptions with which it is linked. Under

⁸ In litigation challenging the "discount rate" used in the PBGC's valuation regulation, Gary Hughes, the Senior Vice President and general counsel of the ACLI, stated in an affidavit filed with the court that maintaining the confidentiality of the pricing information was critical. Mr. Hughes stated in part, "If this confidentiality is not respected I believe that it is very likely---and indeed, almost certain---that companies will not continue to participate in the survey, making it impossible for ACLI to continue conducting this survey for the PBGC and the IRS." Affidavit of Gary Hughes, *In re US Airways Group, Inc., et al.*, Case No. 02-83984, (Bankr. E.D. Va., October 3, 2002) at p.2, para. 5.

⁹ <http://www.pbgc.gov/news/other/res/pbgc-procedure-interest-factors.html>

¹⁰ 41 Fed.Reg.at 48,485.

¹¹ <http://www.pbgc.gov/news/other/res/pbgc-procedure-interest-factors.html>

the regulation, the current market price of an annuity will be approximated only when the interest factor is coupled with specific mortality assumptions. If the mortality assumptions are changed, but the interest factor remains the same, the resulting price will not replicate a private sector annuity price. In essence, the PBGC interest factor is a proxy for annuity prices, and has significance only in relation to the specific mortality assumptions that are used.

This interdependence between the interest and mortality assumptions explains why the interest factor in the valuation regulation is not a true “discount rate.” The PBGC interest factor is derived from group annuity market information. As PBGC explained in the Preamble to its recent amendment to the valuation regulation updating the mortality assumptions: “Because of the relationship among annuity prices, a mortality table and the derived interest factors, it is never meaningful to compare PBGC’s interest factors to market interest rates. The PBGC’s interest factors are meaningful only in combination with the PBGC’s mortality assumptions.”¹²

3. The Valuation Regulation

Title IV of ERISA is the exclusive means of terminating a defined benefit pension plan. When a plan terminates, the employer is responsible for paying plan participants and their beneficiaries all benefits promised under the plan. If a plan has sufficient assets to cover all of its benefit liabilities, the employer can voluntarily terminate the plan in a “standard” termination.¹³ To do this, the employer must determine if the plan in fact, has sufficient assets to cover all of its benefit liabilities.¹⁴ If it does, the employer can complete the standard termination by distributing plan assets in the form of annuities purchased from a private insurer.¹⁵ An employer may voluntarily terminate an underfunded plan only if the employer and each member of the controlled group meet one of ERISA’s tests for financial

¹² 70 Fed.Reg.72205 (December 2, 2005). The use of the mortality table required by the amended regulation results in about a 100 basis points increase in the PBGC interest factor.

¹³ 29 U.S.C. § 1341(b)(2000 & Supp. III, 2003)

¹⁴ 29 U.S.C. § 1341(b)(3); 29 C.F.R. § 4044.1 and 4044.41.

¹⁵ 29 U.S.C. § 1341(b)(3)(A)(i). 29 C.F.R. § 4041.28(c)(2).

“distress.”¹⁶ PBGC may also involuntarily terminate an underfunded plan in certain circumstances.¹⁷

ERISA mandates that the value of a terminated pension plan’s benefit liabilities be determined “on the basis of assumptions prescribed by PBGC.”¹⁸ Before Congress added this provision to ERISA in 1987, PBGC had already promulgated assumptions for valuing a plan’s benefit liabilities in the interim valuation regulation published in 1976 and finalized in 1981.¹⁹ Consequently, when Congress directed in 1987 that a pension plan’s benefit liabilities should be determined “on the basis of assumptions prescribed by PBGC,” it ratified the existing PBGC valuation regulation which prescribes such assumptions. As the court in the US Airways bankruptcy case found in upholding the PBGC valuation regulation, “That regulation was already in effect when the statute was amended to its present form, and the court must therefore presume that Congress knew and approved of the PBGC’s general methodology.”²⁰

4. Litigation Considerations

Over the years, a number of legal challenges to the so-called “discount rate” in the PBGC valuation regulation have been made by debtors in bankruptcy cases where PBGC filed claims for the unfunded benefit liabilities of a terminated pension plan.²¹ The debtors in these cases successfully argued that a so-called “prudent investor” rate should be substituted for the interest factor in the regulation. The “prudent investor” rate generally looked to the expected long-term rate of return that could be earned by a prudent investor on a plan asset pool typically consisting of 60% stocks and 40% bonds. Use of a “prudent

¹⁶ 29 U.S.C. § 1341 (c).(2)(B) (i)-(iii).

¹⁷ 29 U.S.C. § 1342(a).

¹⁸ 29 U.S.C. § 1301(a)(18)(A).

¹⁹ In 1975, PBGC proposed a regulation that prescribed assumptions for valuing a plan’s benefit liabilities. This regulation was adopted on an interim basis in 1976 and finalized in 1981. The regulation was issued in full compliance with the notice and comment requirements of the Administrative Procedure Act, 5 U.S.C. § 553 (“APA”). The valuation regulation was amended in 1993 and in 2005, again in compliance with the APA, to modernize and clarify certain of the assumptions with out any change in the overall approach. *Valuation of Plan Benefits*, 40 Fed. Reg. 57,982 (proposed rule); 41 Fed. Reg. 48,484 (1976)(interim rule); 46 Fed. Reg. 9492 (1981)(final rule); 58 Fed. Reg. 5128 (1993)(proposed rule); 58 Fed. Reg. 50,812 (1993)(final rule); 70 Fed. Reg. 72205 (2005)(final rule); 29 C.F.R. § 4044.41-75(current codification).

²⁰ *In re US Airways Group, Inc., et al.*, 303 B.R. 784, 797 (Bankr. E.D. Va., 2003).

²¹ See e.g., *In re CF&I Fabricators of Utah, Inc.*, 150 F. 3rd 1293 (10th Cir. 1998), *cert. denied* 526 U.S. 1145 (1999); *In re CSC Indus. Inc.*, 232 F. 3rd 505 (6th Cir. 2000), *cert. denied* 534 U.S. 819, 122 S.Ct. 50, 151 L.Ed

investor” rate dramatically reduced PBGC’s UBL claim, often by more than half. For example, using the “prudent investor” rate advocated by the debtors in CF&I, the PBGC’s UBL claim was reduced from \$223 million to \$124 million. In the *Copperweld* case, the UBL claim was slashed from \$49.7 million to \$1.8 million. If the debtors had been successful in upholding a prudent investor rate in the US Airways case, PBGC’s \$2.2 billion claim would have been cut to \$894 million. And of course, if a prudent investor rate is substituted for the interest factor in the PBGC regulation, the resulting liability amount will be dramatically lower than the cost of an annuity which would be required to fully defease the promised benefit payments, thus magnifying the moral hazard inherent in the pension insurance program.

After years of litigation, in 2003, this string of losses on the “discount rate” issue was reversed. In the *US Airways* bankruptcy case, after a trial in which both PBGC and US Airways presented the testimony of economic and actuarial experts, the court upheld the validity of the PBGC valuation regulation. In *US Airways*, the debtors and the creditors committee challenged the valuation regulation under the APA arguing it was arbitrary and capricious. In a decision that departed from prior precedent, but which has since been followed by the judge in the *United Airlines* bankruptcy case, the court found that:

Because the PBGC’s valuation regulation---which seeks to replicate the cost of a private-sector annuity paying the promised benefits---gives proper weight to Congress’s goal of protecting the health of the nation’s private pension system, it is to be preferred over the use of a discount rate premised on uncertain projections of future stock market returns.²²

The court agreed with the trial testimony of PBGC’s economic experts that “the fair value of a liability is the amount a willing purchaser would charge in order to assume it, not the amount of money that would have to be invested to pay the liability when it became due.”²³

The court also examined the ACLI survey and observed that it can “hardly be questioned” that the survey has serious limitations including the fact that, “the PBGC has no way of knowing whether it is receiving responses from market leaders or small players, nor

2d 20 (2001); *In re Chateaugay Corp.*, 126 B.R. 165 (Bankr. S.D.N.Y. 1991), *vacated op. withdrawn sub nom. The LTV Corp. v. PBGC*, 1993 WL 388809 (S.D.N.Y. 1993).

²² *In re US Airways Group, Inc., et al.*, 303 B.R. 784, 798 (Bankr. E.D. Va. 2003).

²³ *Id.* at 795.

does it have any way of independently verifying that the values reported on the survey forms accurately reflect what the responding company is actually charging for the policies it sells.”²⁴ The judge noted, however, that no evidence had been presented that the PBGC methodology produces an incorrect result or that the values obtained under the regulation “differ in any substantial way from the price of commercial annuities.” Despite the limitations in the ACLI survey, the court upheld the regulation stating:

But the issue is not whether the survey could be improved. The question is whether, notwithstanding its limitations, the survey is nevertheless a rational way for the PBGC to implement the stated goal of determining a value that approximates the cost of a commercial annuity. Here, considerable deference must be given to PBGC, as the agency responsible for carrying out a legislatively-delegated function for determining how to best implement the statutory mandate.²⁵

The *US Airways* decision has since been followed by the judge in the *United Airlines* bankruptcy case to overrule objections to PBGC’s estimated \$10 billion UBL claim. The *United* judge stated:

In reviewing the precedent on this question, the reasoning I’ve outlined is consistent with the decision in *In re US Airways Group*, [citation omitted]. The contrary decisions in *In re CF&I Fabricators of Utah, Inc.* and *In re CSC Industries, Inc.* [citations omitted], are based on holdings that bankruptcy courts do have an equitable power to determine the amount of claims in a manner different than what applicable nonbankruptcy law would require. Those holdings do not accurately reflect the provisions of the code I outlined earlier and so cannot be followed.²⁶

In 2006, the bankruptcy court for the District of Massachusetts, relying on the *US Airways* and *UAL* decisions, found that ERISA and the valuation regulation control the calculation of PBGC’s claim in bankruptcy.²⁷ That was followed by a similar ruling from the bankruptcy court in the Northern District of Georgia in 2008.²⁸ Finally, in 2010 the district court for the District of Massachusetts upheld a bankruptcy court ruling to the same effect in

²⁴ *Id.* at 797. The court noted that based on the evidence presented at trial, the survey responses are “remarkably consistent.” “To take just one example, the reported prices for the September 2002 survey for an annuity paying \$10 per month for life beginning immediately at age 60 were as follows: \$1,450.91;\$1,436.59; \$1,485.58; \$1, 465.62; \$1,492.61; \$1.434.60; \$1,582.00 and \$1,482.00.” *Id.* at 788.

²⁵ *Id.* at 797.

²⁶ *In re UAL Corp.*, No. 02B48181 (Bankr. N.D. Ill. December 30, 2005) at p. 33.

²⁷ Order issued in *In re High Voltage Engineering Corporation, et al.*, Case No. 05-10787-INF, (Bankr. District of Massachusetts, July 21, 2006).

²⁸ *Dugan v. PBGC*, 382 B.R. 550 (N.D. Ga 2008)..

the context of upholding a settlement of PBGC's claim, and the decision was affirmed without an opinion by the Court of Appeals for the First Circuit.²⁹

These decisions have given PBGC significant leverage in enforcing its underfunding claims at a time when the agency faces a \$ 23 billion deficit. Indeed, PBGC has not had a claims objection litigated to decision since the above cases were decided. For these reasons, any changes to the regulatory methodology should be carefully considered so that the basis for the US Airways and other favorable court decisions is not jeopardized.

²⁹ In re Wolverine Proctor & Schwartz, LLC, 436 B.R. 253 (D. Mass. 2010), aff'g 2009 WL 1271953, 47 Employee Benefits Cas. (BNA) 1569 (Bankr. D. Mass. May 5, 2009); affirmed, No. 10-1334 (1st Cir. Apr. 20, 2011).

Exhibit 1

PBGC Procedure for Setting Interest Factors Used to Value Liabilities for PBGC Financial Statements

(effective December, 2008)

I. General Description

The Pension Benefit Guaranty Corporation offers this note to explain how it selects the interest factors used to value its liabilities.

PBGC uses recent prices of group annuities to derive the interest factors that we use to calculate the present value of future benefit-payment obligations. These future benefits are obligations that we must pay to participants in the plans that we have taken over as trustee. This note provides a description of, and rationale for, the procedure that we use to derive these interest factors.

In valuing our future benefit-payment obligations, PBGC determines values that reflect current conditions in the annuity markets. To do this, we use a specific mortality tableⁱ and then derive a set of interest factors from the most recent available annuity prices. We determine the interest-factor set that, when combined with the specified mortality table, produces present values that most closely approximate the prices private insurers would charge to annuitize the same benefit-payment obligations.

PBGC's procedure for calculating interest-factor sets that are used for our financial statements is described below. We use a similar process to derive the interest-factor sets used to value immediate and deferred annuities for purposes of determining benefits under section 4044 of ERISA and determining PBGC's claim against employers for unfunded benefit liabilities. This note, however, focuses on the procedure that we use for our financial statements.

II. ACLI Annuity Price Survey

PBGC obtains information about the prices charged by private insurers from quarterly surveys conducted for PBGC by the American Council of Life Insurers (ACLI). The ACLI surveys gather annuity-pricing information as of March 31, June 30, September 30, and December 31 of each year. The surveys collect information on private-sector annuity prices for immediate and deferred annuities at a range of ages. These prices are net of administrative expenses. That is, the prices exclude costs for record-keeping, communication with annuitants, related corporate overhead, etc., but include profit and taxes. The annuity-price data that the survey collects 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 ages specified.

Preserving Survey Respondents' Confidentiality

ACLI forwards the survey responses it receivesⁱⁱ to PBGC in sealed envelopes without information that identifies the respondent. The sealed envelopes contain the respondents' price quotes, to which ACLI does not have access. ACLI does not inform us how many or which annuity providers received the survey, or which companies responded. Participation in the survey is voluntary, and the number of responses ACLI receives can vary from quarter to quarter.

The survey results show annuity prices grouped by company - that is, the prices for the immediate and deferred annuities for all ages are listed separately for each company. The companies are not explicitly identified, but are

named Company A, Company B, and so on. The letter codes are randomly generated by ACLI each quarter, so a given company will have different letter codes applied to it in different quarterly surveys.

III. Selecting the Interest Factor Set-General Procedure

PBGC uses a "select and ultimate" interest-factor structure, where the select factor applies for either the first 20 or 25 years after the valuation date (the "select period"), and the ultimate factor applies for all remaining years (the "ultimate period"), which is to age 120 in the current mortality table. The two interest factors and the select period constitute an interest-factor set. We currently use a version of the RP-2000 mortality table when selecting the interest-factor set because this table best reflects mortality experience in PBGC-trusted plans. The interest-factor set is sensitive to the mortality table used. In general, if a different mortality table were used, a different interest-factor set would be obtained.

PBGC currently uses 14 annuity-price data price points for malesⁱⁱⁱ when calculating its interest-factor sets. These prices are for: (1) *immediate* annuities beginning at ages 50, 55, 60, 65, 70, 75, and 80; and (2) *deferred* annuities that will begin at age 65 for individuals currently at ages 30, 35, 40, 45, 50, 55, and 60. , We use two consecutive ACLI surveys to derive an interest-factor set (see section IV).

Once we derive the interest-factor set, the factors for PBGC's financial statements are effective as of the last day of the quarter following the most recent ACLI survey and remain in effect until the next quarterly recalibration. Thus, for example, the interest-factor set effective from September 30 through December 30 of any given year is based on the annuity-price surveys for June 30 and March 31 of the same year.

Eliminating the Effect of Outlier Responses

In examining the ACLI survey responses, PBGC first tests for companies whose responses could be considered "outliers." We do not use the prices of "outlier" companies because we want to avoid skewing our interest-factor set when the survey prices quoted by one company are unreasonably high or low, relative to the survey prices of other responding companies. (In our experience, an outlier response is rare, occurring once every three to four years.) We use three outlier tests for a company's survey responses, and all three tests must be met for us to consider a company an outlier. The tests are:

1. The price quotes from a particular company must be the highest (lowest) for at least all but two of the annuity-price data points used. Thus, to be considered an outlier, the company's price quotes must be the highest (lowest) for at least 12 of the 14 male annuity-price data points.
2. For a male immediate annuity at age 65, the company's annuity price must be at least 12.5% higher (lower) than the median of all age-65 immediate-annuity prices.
3. For a male immediate annuity at age 65, the difference between the company's annuity price and the annuity price of the company with the second highest (lowest) price must be greater than the difference in annuity prices of the companies with the second and fourth highest (lowest) annuity prices.

Calculating the Interest-Factor Set

After eliminating the price quotes from any outlier companies, PBGC averages the price quotes of the remaining companies for each of the 14 male annuity-price data points.

We then select the interest-factor set using a two-step process:

1. The first step relies on the most recent ACLI price survey. PBGC selects the interest-factor set that results in calculated annuity values (the present value of future benefits) that best match the 14 averaged annuity-price quotes from the companies responding to that survey. To determine which

interest-factor set gives this best match, we calculate an annuity value for each of the 14 annuities using our specified mortality table and thousands of interest-factor sets.

2. The second step relies on the survey previous to the most recent. The same calculations are used for this second step as in the first step, but with constraints on the select period and the ultimate interest factor. These constraints are described in Section IV.

In both the first and second steps, we first use a select period of 20 years and a low ultimate interest factor, and test for the best select-interest factor by increasing a low initial select-factor value by one basis point (one one-hundredth of one percent) for each new run until the select-interest factor reaches an upper limit. (Using lower and upper limits, set by PBGC based on our experience, avoids the need for thousands more unnecessary runs that would not change the results.)

Example – Assume the first test begins with a select-interest factor of 3.0% for the first 20 years and an ultimate-interest factor of 3.0% (3.00, 20, 3.00).

- Additional iterations are performed using the same ultimate interest factor and select period ((3.01, 20, 3.00), (3.02, 20, 3.00), . . .).
- Then the ultimate interest factor is increased by one basis point, and the process is repeated for all possible select-interest factors.
- This process repeats until the PBGC-chosen upper bound on the ultimate factor is reached – say, 7%.
- Finally, the entire process repeats, using a 25-year select period. (Note that tested interest-factor sets include those where the ultimate factor is greater than the select factor.)
- From all these iterations using different select and ultimate interest factors and two select periods, the interest-factor set is determined by the process discussed next.

For each interest-factor set, we calculate the annuity value of the 14 immediate and deferred male annuities at the ages mentioned in Section II. We also calculate the error – that is, the percentage difference between the calculated value and the average of the surveyed annuity prices. To determine the best fit between the calculated values and average of the survey prices, we use the interest-factor set that gives the smallest "key mean error sum." The "key mean error sum" is the sum of the "absolute value of the mean error" ("|ME|") and the "mean absolute error" ("MAE").

For PBGC's procedure, the key mean error sum equals:

- the absolute value of one-fourteenth of the sum of the 14 individual errors, plus
- one-fourteenth of the sum of the absolute values of the 14 individual errors.

Why Use the Key Mean Error Sum?

It is not appropriate to use the interest-factor set that has only the smallest absolute value of the mean error because the mean error ignores the possibility of having large errors with different signs that "cancel each other out." If the interest-factor set results in a large error for one of the data points, then PBGC will overestimate (or underestimate if the error is negative) the present value of future benefits for plans that have many participants clustered around that age. Thus, it is important that the interest-factor set give the best fit over all 14 data points.

The absolute value of the mean error shows which interest-factor set gives the best result, on average, while the mean absolute error penalizes those interest-factor sets where there are large errors at certain ages. By selecting the interest-factor set with the smallest sum of these two error measures — that is, the smallest key

mean error sum — we ensure that we select the set that will provide the most accurate estimated annuity values regardless of the age distribution of participants in the plans that we trustee.

Example (3 iterations) - This simplified example illustrates our procedure for determining the key mean error sum.

Assume there are only five annuity-price data points (immediate annuities beginning at ages represented by 1, 2, 3, 4, and 5). PBGC's procedure calculates and compares the key mean error sums of thousands of interest-factor sets. In this example, we limit the number of iterations to three. Three separate interest-factor sets are used to generate the respective illustrated iterations. Using these interest-factor sets and the specified mortality table, we calculate annuity values for each of the five data points and compare those calculated results with the averaged annuity prices quoted by companies responding to the ACLI survey. The steps used to calculate the key mean error sum are shown below for each iteration.

Iteration 1

Age	Average Survey Price	Calculated Annuity Value	Percentage Difference (Error)
1	1000	1140	14.0%
2	1150	1245	8.3%
3	1329	1315	-1.1%
4	1511	1402	-7.2%
5	1700	1449	-14.8%

Total Error E -0.8% Total Abs Error TAE 45.4%

Mean Error ME -0.16% Mean Abs Error MAE 9.08%

Abs Value of ME 'ME' 0.16%

Key Mean Error Sum 'ME' + MAE = 0.16% + 9.08% = 9.24%

Iteration 2

Age	Average Survey Price	Calculated Annuity Value	Percentage Difference (Error)
1	1000	1030	3.0%
2	1150	1163	1.1%
3	1329	1331	0.2%
4	1511	1471	-2.6%
5	1700	1636	-3.8%

Total Error E -2.1% Total Abs Error TAE 10.7%

Mean Error ME -0.42% Mean Abs Error MAE 2.14%

Abs Value of ME 'ME' 0.42%

Key Mean Error Sum 'ME' + MAE = 0.42% + 2.14% = 2.56%

Iteration 3

Age	Average Survey Price	Calculated Annuity Value	Percentage Difference (Error)
1	1000	1090	9.0%
2	1150	1205	4.8%
3	1329	1341	0.9%
4	1511	1479	-2.1%
5	1700	1597	-6.1%

Total Error E 6.5% Total Abs Error TAE 22.9%

Mean Error ME 1.3% Mean Abs Error MAE 4.58%

Abs Value of ME 'ME' 1.3%

Key Mean Error Sum 'ME' + MAE = 1.3% + 4.58% = 5.88%

Discussion of the example

1. In the first iteration, the absolute value of the mean error is small at only 0.16%, but the individual errors (average survey prices vs. calculated annuity values at each age) are large, so the key mean error sum is large.
2. The second iteration shows a slightly larger absolute mean error, at 0.42%, but none of the individual errors is large, so the key mean error sum is small.
3. The third iteration, with the largest absolute mean error of 1.3%, also has small individual errors.

IV. Selecting the Interest-Factor Set — Combining the two most-recent surveys

The procedure described above describes how the interest-factor set is determined from the most recent quarterly ACLI survey. PBGC uses the two most recent quarterly surveys, in combination, to determine each quarter's interest-factor set. In the discussion and example below, assume that we are calculating the interest-factor set that will be in effect from September 30 through December 30 of the current year.

There are three steps in determining this interest-factor set. These steps are:

1. determine the interest-factor set based on the June 30 ACLI survey (as described in the previous section);
2. determine the interest-factor set based on the March 31 ACLI survey, with the constraints that:
 1. the select period for the March-based set match the select period for the June-based set, and
 2. the ultimate interest factor for the March-based set be within 25 basis points of the ultimate interest factor determined for the June-based interest-factor set; and
3. average the two select interest factors and, separately, the two ultimate interest factors determined for June 30 and March 31

Note the constraints — that the select period for the March result matches that for the June result, and that the March ultimate factor is within 25 basis points of the June ultimate factor. These constraints model the assumption that the two ACLI surveys, only three months apart, will reflect similar views of the extremely long-term (beyond 20 or 25 years) interest environment.

It is unlikely that the March interest-factor set determined by this procedure would be the best fit of the March survey data were the constraints not imposed. This is especially true since we started testing for the interest-factor set fit using single basis-point increments. However, the key mean error sum for the constrained March 31 best fit has always been close to the key mean error sum for the un-constrained best fit.

Example - demonstrates the 3-step process:

1. Assume that the interest-factor set for the June 30 ACLI survey is:
Select int. factor: 6.08% Select period: 25 years Ultimate int. factor: 5.91%
2. The constrained March 31 interest-factor set will be the best fit of the March 31 ACLI survey data, such that the select period is 25 years and the ultimate interest factor lies between 5.66% and 6.16%. Assume that such constrained March 31 interest-factor set is:
Select-int. factor: 6.56% Select period: 25 years Ultimate-int. factor: 6.11%
3. The two select factors and two ultimate factors are now averaged.
 1. Averaged select interest factor is 6.32% ($(6.08\% + 6.56\%) / 2$) and
 2. Averaged ultimate interest factor is 6.01% ($(5.91\% + 6.11\%) / 2$).

V. Conclusions and Questions

Comments and questions can be directed to: Marc Ness in the Policy, Research and Analysis Department at 202-326-4000, ext 3227.

ⁱ PBGC uses a version of the RP-2000 mortality table, described in detail in our financial statements each year.

ⁱⁱ Typically, ACLI receives the responses six to eight weeks after the date at which prices are quoted. For example, the responses that include prices as of June 30 are typically received between August 15th and August 31.

ⁱⁱⁱ Using only male annuity prices from the surveys reflects a judgment that gender does not affect the interest assumption that an insurance company would use to discount payments that may occur at future dates. The vast majority of PBGC's liability is for male lives. The mortality assumption determines only the probability of future payments; the interest assumption determines the value of those future payments.