Evaluating Pension Insurance Pricing

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Introduction

Significant progress has been made since I first reviewed the PIMS model some 17 years ago, and I applaud the painstaking efforts to create a model sufficiently rich in detail to encompass many and perhaps most of the complexities that face PBGC in carrying out its mission. In particular, the PIMS model has taken on the Herculean task of modeling in detail and under many scenarios the cash outflows associated with the pension obligations they have assumed. I commend them for this work.

My comments are focused almost entirely upon PBGC's termination liabilities. They will touch upon several areas that are germane to carrying out PBGC's valuation and insurance pricing mission, are complementary to the cash flow modeling they have already done, and which by comparison are relatively easy to implement. All of them will help the PIMS model to be more firmly ensconced in principles consistent with fundamental financial economics, which is a precursor to adequate insurance pricing. I will address four issues I deem most pressing: (1) the need to discount the liability stream by current riskless interest rates instead of using corporate bond rates that reflect credit risk, call risk, and other risks, or using some *ad hoc* prescribed average of past rates; (2) the need to use the entire term structure of interest rates; (3) the need to employ more useful investment management benchmarks; and (4) the way to implement a relevant and rigorous liability benchmark.

Insights from Financial Economics on Proper Discount Rates[1]

One of the most significant advances in private pension valuation that has occurred over the past few years was the adoption by the accounting and actuarial professions of a set of discount rate protocols that result in valuations closer to their fundamental economic value (i.e., their present value) than what was reported years ago.[2] These revised standards were having a beneficial, albeit short-lived spillover impact on the discount rates used by PBGC, as plan sponsors had to begin shoring up their insufficient assets.[3] When coupled with the commendable

[1] An early discussion on the valuation of corporate pension liabilities, from a corporate viewpoint, is provided by Bulow (1982, pp. 436-7) in which conditions are specified under which well-funded corporate pensions should be valued at riskless rates of interest. In the case of "a severely underfunded plan, the firm's pension liability is less than the present value of workers' benefits. The difference is made up by PBGC through its 'insurance' program, and is often referred to as the 'pension put'" (Bulow, Mørck, and Summers, 1987, p. 84).

[2] Not everyone is on board with the new discount rate protocols, as evidenced by the recent debate raging in the *Wall Street Journal* between finance professionals and actuaries. The actuaries charged with valuing public pensions continue to discount them by the returns they expect on the supporting asset portfolios based on historical rates of return rather than by current rates that reflect the characteristics of promised payouts to pensioners and current cots of meeting them. See Andy Kessler's "The Pension Rate-of-Return Fantasy" (op-ed, April 10, 2013 and the three rebuttal Letters to the Editor appearing on April 19, 2013.

[3] The beneficial effect was reversed, however, with the recent mandated changes in discounting protocols, which will be discussed later.

initiative the current administration has recently proposed to let PBGC determine its own insurance rates, we are on the threshold of substantial advancement, but setting premium rates adequately will require proper valuation of pension liabilities that the assets and premiums are designed and required to fund.

In the past, private pension liabilities were discounted by expected returns on the asset portfolios supporting them, according to various accounting and actuarial standards. This resulted in a strong temptation for some plan sponsors, fiduciary duties notwithstanding, to rush to the bottom of the investment quality spectrum, as using the higher discount rates generally associated with lower quality assets could result in lower reported values of pension liabilities, higher reported plan surpluses (or lower reported plan deficits), and better-looking financials for the firm. The absurdity of this earlier approach is that by making pension asset portfolios riskier through loading the asset portfolio with low-grade bonds and equities, the linked discount rates on liabilities could make much of the reported liabilities vanish.[4] Unfortunately, but predictably, many plan sponsors succumbed to this temptation, which led, in part, to heavy claims upon PBGC. This would have been less likely to happen had pension liabilities been properly valued in the first place.

Below I will discuss three lines of thinking in financial economics that support the use of riskless interest rates for valuing PBGC termination liabilities.

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[4] Above, I underscored "reported" for a good reason, and invoke Abraham Lincoln's observation to justify it. Said he, "If you call a tail a leg, how many legs has a horse? Five? No, four. Calling a tail a leg doesn't make it a leg." Similarly, reporting a liability at a reduced value does not reduce its actual value at all.

The cost of funds is determined by the use of funds, not their source. If investor X provides me with $100,000 to invest, and I provide her returns that are identical in riskiness to the S&P 500 returns over time, she will expect of me returns commensurate with the S&P 500. If, on the other hand, I provide her returns that are identical in risk with Treasury bills, she will require of me returns commensurate with T-bills. In both cases, the source of funds is the same investor, but the cost of capital differs, depending on the use of funds. This is a fundamental economic insight from corporate finance as well as securities markets. If the investor doesn't like the return pattern she is receiving, she can recoup her entire investment by selling her income stream rights to someone who is perfectly happy with that return pattern and then turn around and invest her funds with a manager who accedes to her risk/return preferences. Indeed, the same investor may require several different rates of return for separate components of her overall portfolio, each exhibiting distinct patterns of returns. Thus, the cost of funds is not determined by their source, but by their use.

In the case of private pensions, the plan sponsor makes funded promises and backs those promises with supplemental funding, if necessary. In the event of problems, PBGC guarantees the payments, both in terms of timing and amounts, up to the statutory maximum annual payment for each pensioner. Thus, from the plan beneficiaries' standpoint, the payments are riskless; hence, it is appropriate to utilize riskless rates of interest to present-value those payments that are fixed, and within the statutory limit. As for PBGC, it is responsible only for those payments within the statutory limit, so it should also value them by using the appropriate riskless rates of interest.

Disparate expected returns have same certainty-equivalent riskless return. Expected and required rates of returns depend upon the relevant risks assumed. As far as I am aware, none of

the prevailing valuation models used in modern finance would justify discounting PBGC termination liabilities with bond yields that incorporate risks not germane to PBGC or its beneficiaries (e.g., credit risk, illiquidity, call risk, etc.).[5] Moreover, there has never been an accepted finance theory or valuation model that would calculate the *present* cost of funding an existing guaranteed pension liability using an average of *past* rates of interest – whether riskless or risky. As I understand it, by the time a pension liability has been transferred to PBGC, the pension is closed to further contributions, and liabilities are fixed going forward, contingent only upon uncertain longevity. Accordingly, the expected future cash flows can be recast into their present value by taking into account only the time value of money using appropriate riskless interest rates. Longevity risk is either not priced directly (as it is diversified among a large population), or the population longevity drift over time cannot be hedged well using available traded instruments. In either case, such risk must be handled through the maintenance of an adequate plan surplus, actuarially determined. But the present value of expected future cash flows is computed using appropriate risk-free interest rates.

Prevailing asset pricing models show how expected rates of return adjust to reflect the relevant risks assumed by investing in a set of assets or pricing a set of liabilities. In some models, those priced risks include only those that are non-diversifiable. In others, they may relate to factors that the market considers priced factors, while ignoring the rest. In any case, the models arrive at similar riskless rates of interest. If retirement payments were merely a pass-

[5] An excellent, non-technical review of mainstream financial thought regarding the valuation of pensions is provided by the former editor of the *Financial Analysts Journal* in the Editors Corner column, which is highly recommended reading. See Arnott (1995).

through from the supporting asset portfolio, such as in a typical 401(k) defined contribution program, it would be appropriate to value the "pensions" using discount rates similar to those characteristic of the asset portfolio, which would render them at the current market value of assets. However, it would be totally inappropriate to value guaranteed, fixed pension liabilities based on the riskiness of the supporting asset portfolio, when the recipients of the pensions are promised and guaranteed timely and full payments of prescribed amounts. This is true whether the asset portfolio is maintained by the corporate plan sponsor or PBGC.[6]

The Merton Model can be used to show the pension valuation components. In the spirit of the Merton Model (1974), the market value of a pension liability to a corporate plan sponsor, *L,* can be decomposed into two components: its present value taking into account only the time value of money, *PV*(L), and reduced by the option devolving from limited liability to default upon the required payments and put the obligation to PBGC, *PO.* This latter expression is known by plan sponsors as "the PBGC put." Thus,

$$L = PV(L) - PO$$

The value of this put option implicitly held by the corporate plan sponsor will vary, depending on how adequately the plan is funded. This will be a function of the amount of plan surplus, the nature of the assets and surplus supporting the pension promises, and the corporation's ability to supplement these, when necessary. The *PO* will be more valuable to the corporation under two circumstances: by having inadequate surplus in the plan, and by having assets whose cash flow characteristics diverge from those of the plan's obligations, which we

[6] I am abstracting here from any "haircut" that might be imposed on certain plan liabilities above the statutory coverage limits that are transferred to PBGC from the corporate plan sponsor.

will call an asset-liability mismatch. The risks of a mismatch can be alleviated with sufficient surplus. Absent such a surplus, assets that are subject to default or to value swings different than those swings in liability values will pose a risk to the pension plan that increases the value of the put option to default. This put option value will be increased further to the extent that the corporation has inadequate resources to supplement the plan assets in the event of an adverse swing in mismatched asset and liability values. If the plan assets are default free and the asset and liability cash flows are appropriately matched, there will be no adverse effects occasioned by changing market conditions upon the economic balance sheet of the plan sponsor, because plan surplus will be immunized from such changes. The excuse for mismatching assets and liabilities in an attempt to smooth the impact of changing market conditions on the accounting balance sheet is a reflection only of accounting concerns and the actuarial practices that accommodate them, where the reporting protocols are designed in a way that is inconsistent with the underlying economics. We will not concern ourselves with these accounting issues, as they are beyond the scope of our economic analysis and in any case can be ameliorated by prudent and overdue reforms.

In any case, what relates to PBGC is simply the present value of the pension liability, adjusted for any statutory limits on benefits paid. It has no offsetting value of a put option to default to an outside agency other than to the federal government itself, which officially does not provide a guaranty on private pension obligations beyond that granted by PBGC. Thus, from PBGC's standpoint, the present value of expected pension liability payments is what matters, together with adequate surplus to support adverse deviations in covered population longevity. Additional surplus would be required to compensate for electing to continue to hold plan assets with credit risk. Still more surplus would be needed to the extent that PBGC adopts investment

programs inconsistent with maintaining an asset portfolio matched to the timing of its liabilities. Also, to the extent that PBGC needs funds above and beyond those in its "general account," it would presumably borrow from the Treasury at or near Treasury rates. In all of these cases, the present value of the liabilities is not affected; rather, the amount of surplus required to satisfy the liabilities is altered.

Exactly what useful information in conveyed by current valuation protocols? Not much. The information content of what is currently being represented in accounting statements as private pension liabilities is minimal, and sometimes misleading or unhelpful to PBGC. First of all, the present value of the liabilities, which *is* useful information, is simply not provided. Second, the pension values that *are* reported do not embed the present value of the pension liabilities together with the firm-specific "PBGC put." Thus, from what is provided, the value of the firm-specific "PBGC put" cannot be discerned because the present values of liabilities cannot merely be subtracted from reported values to derive the (negative of) "the PBGC put." The discount rates used in typical valuations reflect neither the particular plan sponsor's asset portfolio nor its plan surplus. For example, consider a plan with long duration default-free assets backing its liabilities. The plan could still be very risky if the amount of default-free long-term assets is insufficient to cover fully the liabilities, including an adequate plan surplus to handle longevity uncertainty. Alternatively, a plan with lots of surplus but with assets that behave quite differently from the liabilities they must cover may pose just as much risk to PBGC.

The discounting of expected cash flows that is done currently in rendering the reported private pension liabilities is not based on sponsor-specific or plan-specific risk factors. Instead, pension values that are reported typically use discount factors that incorporate an amalgam of various long-term investment grade corporate bond yields which may have very little to do with

a particular plan sponsor's financial situation or the portfolio supporting its liabilities. If that blending of such yields is weighted by the market values of issued bonds, the single-A-rated bonds occupy an inordinate share of that average and thus draw the overall average quality toward the lowest end of bonds in the various A-grades. Even if the categories are equally weighted, the average yield is below AA quality, as the convexity of yield levels across descending credit ratings from AAA to A assures an average yield that is between AA and A. Thus, the base rates used by plan sponsors to discount and report their liabilities are clearly much higher than those that would reflect the risks of the guaranteed liabilities.

This results in a substantial understating of liabilities by plan sponsors. How substantial? Assuming an average duration of 14 years for pension liabilities and a 200 basis point spread between the Treasury discount rates and the lower-than-AA base corporate rates used to discount the liabilities, I would estimate about a 28% understatement of liabilities, not including the additional surplus assets required to offset longevity extension risks.[7] When another (on average)

[7] Note, PBGC uses factors enlisted by private insures when assuming liabilities of terminated plans. These factors incorporate a reduction from base reference rates (often A-rated long-term corporates) to provide for profit and a surplus to cushion against average asset defaults and adverse experience. However, insurers do not price their pensions to be riskless and occasionally default on them. In such cases, there may be some coverage granted through state insolvency guaranty programs, but unlike PBGC coverage, such program coverage is based on the present value of remaining obligations ranging form $100,000 to $500,000, depending on the state, rather than covering the full monthly amounts owed (up to the annual statutory limits) over the

150 basis points are added under the MAP-21 25-year smoothing of corporate yields program, the reported values will underestimate the present-valued cost of funding the liabilities by more than 49%, not including the money surplus needed to secure the promises. This will result in a very heavy economic price to pay and an extraordinary burden will be placed on PBGC to pick up the pieces from the use of these discount factors. Think of it simply. Assets are reported at current market values, and those values are consistent with current discount rates appropriate to their risk. The present values of the assets are therefore equal to their market values. However, the calculated values of the guaranteed liabilities have nothing to do with present values, nor current discount rates, nor the present cost of funding them, and what discount rates are used have nothing to do with the guaranteed nature of the payments that must be made to satisfy the liabilities. Thus, there is simply no way using only current measures of assets and liabilities to approximate the plan deficits and exposure to PBGC. These protocols place PBGC in an unenviable position, and the US taxpayers with a potential liability that can be met only if they are extremely lucky by taking this gamble.

Essentially, what has happened is worse – much worse – than the government issuing $100 billion in Treasury bonds and investing those proceeds in common stock, junk bonds, and corporate bonds of varying qualities. If this were a sound bet, why wouldn't the government simply issue a couple of trillion dollars and invest the proceeds in the stock market and bond market, to bail out the deficit? But it is worse, because what the actual bet being conducted is tantamount to issuing government debt in an amount that is far less than the true value of the

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pensioners' remaining lifetimes. In many cases, the guaranty programs will result in considerably less coverage for pensioners.

liabilities it is assuming, and taking the inadequate proceeds from the debt issuance and investing them in risky securities of far lower value than the liabilities being assumed. In such a case, the risky invested assets must not only do well, but must do extraordinarily well to first close the deficit before a surplus can begin to be built. Many financial institutions and investors and have entered into insolvency pursuing such a risky course.

Using the Term Structure of Interest to Discount Liabilities

I understand that by statute, PBGC is directed to derive and use a set of two interest factors based upon a set of private insurers' group annuity prices to calculate a value of its pension liabilities.[8] Until this is changed to be more in line with accepted principles of financial economics, such factors must continue to be used. However, by my way of thinking, just because PBGC is directed to use a set of discount factors derived from private insurers' group annuity prices (together with an assumed mortality table) to calculate a value does not mean that it cannot also conduct further analysis to determine the actual present values of *its* liabilities. In fact, if it wishes to set premiums pursuant to the plan risks it assumes, such calculations would be required as a first step in understanding the risks imposed upon it.

I see no compelling reason today for PBGC, or anyone else for that matter, to estimate the value of pension liabilities using a single interest rate factor, or even two interest rate factors, each applying to a different band of timing for cash flows. Seventeen years ago this had some merit from a practical viewpoint, as there were many different term structure of spot interest rate

[8] The procedure is explained in http://www.pbgc.gov/news/other/res/pbgc-procedure-interest-factors.html.

(pure discount) models but none readily available in the public domain. Today there is an excellent term structure of spot interest rates model in the public domain, updated daily by the Federal Reserve. It has passed the test of time and certainly provides adequate estimates of the spot interest rates that apply to each term to maturity.[9]

An alternative and equally good way to derive appropriate interest rate factors is to simply use the yields of zero-coupon Treasury STRIPS of various maturities. These are available daily on any Bloomberg terminal. The interest rate factors from such instruments will closely approximate those from the Federal Reserve model.[10]

A third way to estimate the value of pension liabilities is by using stochastic interest rate models. It has been shown elsewhere that where cash flows are contingent on emerging future interest rates, it is necessary to utilize stochastic interest rate valuation models to properly model the cash flows and capture their present values. However, where the cash flows are fixed by contract, and related only to factors (e.g., uncertain longevity) that are not contingent upon interest rates, you will get the same exact present value whether you use the present term structure of interest rates to value the cash flows or a suitable stochastic interest rate valuation model.[11] Indeed, the way that stochastic interest rate valuation models are calibrated is to ensure

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[9] See Gurkaynak, Sack, and Wright (2007) with data posted at: http://www.federalreserve.gov/pubs/feds/2006/

[10] Suffice it to say that because of the greater fungibility of coupon strips relative to principal strips, a yield curve based on coupon strips is generally preferred for valuation purposes. See Sack (2000).

[11] The various classes of stochastic interest rate models are detailed in Babbel and Merrill (2000).

that they render the same present values as term structure models do when applied to fixed future cash flows. Clearly, then, there is no need to go through the hassle of using stochastic interest rate valuation models to determine the present values of such cash flows, which would be characteristic of fixed pensions in payout mode. However, in the case of pensions that are still in the accumulation phase, there may be future payouts that are contingent on the evolution of wage or price inflation, which are at least loosely related to nominal interest rates over time. In such cases, the employment of stochastic interest rate valuation models could be indicated. An alternative is to utilize the real term structure of interest published daily by the Federal Reserve,[12] when cash flows are related to emerging inflation rates.

One reason to avoid use of interest rate factors derived from a survey of insurers' annuity prices is that their annuity prices conflate various elements that should have no bearing on what it costs PBGC to cover such plans. More will be said about this below.

Another reason is that the annuity prices quoted by many insurers are typically based on yields-to-maturity of long-term AA-rated or A-rated bonds. From those yields are subtracted a number of basis points to adjust for adverse selection, longevity risk, capital contribution, and in some cases expected asset defaults. (For example, in the 1980s and early 1990's, investment banks and insurers would often use the long-term A-rated bond yields, subtract 75 basis points from them, and then discount projected benefits in determining the liability for assuming a pension.) Moreover, insurers have the protections of limited liability, as they do have the option to default on their obligations.

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[12] See: http://www.treasury.gov/resource-center/data-chart-center/interest rates/Pages/TextView.aspx?data= realyield

A third reason to avoid the use of interest rate factors derived from a survey of insurers' group annuity prices is that the resulting (essentially equivalent) yields-to-maturity themselves are not useful except in valuing something whose value is already known.[13] They cannot be used to value something with cash flows that are any different than those of the particular instrument from which they were derived. Spot rates of interest, on the other hand, can be used properly to value anything whose cash flows are either fixed beforehand or are otherwise independent of the evolution of interest rates over time.

A fourth reason stems from the fact that a bond's yield-to-maturity can be approximated by the dollar-duration weighted average of the underlying spot rates of interest.[14] Because a long-term bond typically has a cash payment of principal at maturity that is perhaps twenty to sixty times higher than the size of the intervening cash flows from interest, and because its payment date is twenty to thirty years away, the dollar duration of principal repayment is huge relative to any other payment. This places an inordinate weight upon the single underlying spot rate of interest associated with that particular cash flow in deriving its contribution to the calculated yield-to-maturity. While this may work with ordinary bonds, I know of no pension payout pattern that could justify placing such a weight on one particular cash flow far distant into the future. The distortion by using a discount factor ultimately based on such a yield to value pensions is particularly pronounced if there is slope (either positive or negative) in the term structure of spot rates of interest. Therefore, I can see no justification for using an interest rate factor that is ultimately based on underlying bond yields-to-maturity.

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[13] See Santomero and Babbel (2001: 77, 99-101).

[14] A proof is provided by Santomero and Babbel (2001: 150-151).

An argument against using the term structure of spot interest rates for valuing pension liabilities is that the pension obligations and payouts may extend far beyond the 30-year maximum range of the term structure. Of course, this limitation applies equally to the use of yields-to-maturity, which also typically max out at around 30 years. One approach is to simply apply the longest spot interest rate available to cash flows exceeding the range of the term structure. This approach, however, will surely result in an undervaluation of distant cash flows. The primary reason for this is that positive "gain from convexity" grows as a function of the square of duration.[15] This is apparent in Figure 1, Panels A-C, examined closely. In the latter two panels, a secant is drawn between the high and low values of 30-year and 60-year zeros,

[15] The term "gain from convexity" is defined as the asymmetrically positive gain in value that is associated with a decrease in interest rates relative to the lower loss in value that would occur with an equal rise in interest rates. The asymmetry arises simply from the mathematics of geometric discounting factors, where the discount factors are raised to exponents reflecting the terms to maturity. For example, a 50 b.p. drop in yields from 8% to 7.5% on a 15-year zero-coupon bond will produce a $22.73 rise in the value of a bond, from $315.24 to $337.97, whereas a 50 b.p. rise in yields to 8.5% will result in a price drop of only $21.06 in that same bond. (In these calculations, I have used straightforward spot rates of interest to discount the cash flows, and not the contrived bond-equivalent yields used in practice, although the point remains the same.) As maturity lengthens, a zero-coupon bond will reflect an increasingly greater disparity in price rises versus price declines, as the mathematics of geometric compounding become more pronounced. A description of gain from convexity, its calculation and importance is given by Santomero and Babbel *op cit*, pp. 153-158.

respectively, to demonstrate the increasing convexity with term-to-maturity. The amount of convexity in these two instruments is shown by the areas between the secants and their respective value curves whose end points are connected by the secants. Clearly, there is a much larger area of convexity in the 60-year zero value plot and in the 30-year zero value plot. Accordingly, as traders take into account the available gains from convexity in their pricing, long-term yields begin to decline as convexity becomes the dominating factor. Any student of the term structure of interest can observe this common phenomenon, as the impact of convexity tends to cause spot rates to begin falling beyond 15-28 years. For example, in Figure 2, I have plotted some randomly selected zero-coupon yield curves across various dates. On each yield curve, I have placed a mark at the peak yield. Note that the peaks do not occur at the longest term. I have plotted monthly yield curves from 1941 to 2013 and the findings shown in Figure 2 are typical of what I've found. Exceptions are rare.

Figures 1 and 2 here

This reduction cannot be said to be related to expectations for reduced interest rates in the distant future, but is simply an artifact of the mathematics of convexity.[16] Therefore, a more reasonable approach would be to use longer-term rates that begin at the 30-year spot rate and gradually diminish as term increases over the next 30 years by as much as 1-2%, depending on current volatility. (Higher interest rate volatility creates the opportunity for investors to benefit more from exposure to positive convexity, and hence gives rise to lower long-term yields.) This

[16] Our expectations for future interest rates beyond a few years out have little basis and beyond 30 years are nothing more than a guess without support. See Dybvig and Marshall (1996). This article considers credit risk, volatility, expectations, duration and convexity.

approximation would still be a conservative way to estimate the pension liabilities. A way to approximate more closely the unobserved very long-term spot rates is to model them stochastically by maintaining constant the expected value of future short rates and their volatility and then deriving mathematically the long rates by capturing the increasingly dominating effect of convexity as time extends. In either case, it will be noted that the use of increasing spot rates as time extends beyond 30 years is simply inappropriate and will underestimate the cost of funding pension liabilities.

Investment Management

The 2012 *Pension Benefit Guaranty Corporation Annual Report* provides some detail on pages 35-44 about its asset management program. Although not my primary focus in this commentary, I offer some observations next.

Overall, it appears to me that a very careful set of protocols and safeguards has been designed and that conflicts of interest are minimized. Annual assurance statements, an internal control committee, and external audits form a portion of their management oversight.

PBGC summarizes its approach to investment management on p. 35 of its *Annual Report* as follows:

> "PBGC uses institutional investment management firms to invest its assets, subject to PBGC's oversight and consistent with the Corporation's investment policy statement approved by its Board. PBGC does not determine the specific investments to be made but instead relies entirely on its investment managers' discretion in executing investments appropriate for their assigned investment mandates. PBGC does ensure that each investment manager adheres to PBGC

> prescribed investment guidelines associated with each investment mandate and measures each investment manager‘s performance in comparison with agreed upon benchmarks.” (PBGC 2012: 35.)

It then goes on to explain the segmentation of its investment portfolio, the asset allocations to each segment, and targeted return benchmarks that are prescribed for managers of each of its segments. The equity investments fall into two categories: Global Public Stock and Private Markets. The Global Public Stock sector is further divided into a segment called U.S. Public Stock, which is comprised of U.S. Equity Securities and Real Estate Investment Trusts, and into another segment called International Public Stock. Private Markets include private equity, private debt, and private real estate funds. For example, the “investment policy establishes a 30 percent target asset allocation for equities and other non-fixed income assets, and a 70 percent asset allocation for fixed income.” Within these broad categories, finer distinctions are made. For example, the equity investments fall into two categories: Global Public Stock and Private Markets. The Global Public Stock sector is further divided into a segment called U.S. Public Stock, which is comprised of U.S. Equity Securities and Real Estate Investment Trusts, and into another segment called International Public Stock. Private Markets include private equity, private debt, and private real estate funds. Within the fixed income portfolio, there are categories for Treasuries, TIPS, Long Duration, Core, Developed Markets, High Yield, and Emerging Markets. Money Market is a separate category.

Each of these investment categories is assigned carefully selected performance benchmarks or target returns. These benchmark indices are among the best known in the investment community, developed by Barclays, J. P. Morgan, and others. However, it is not clear to me that any of these benchmarks have anything to do with assets outperforming the pension

liabilities that they are destined to fund. Simply calculating the total rate of return on the assets and comparing it with any of the widely available generic stock and bond indexes is not sufficient. It is virtually impossible that such an index or combination of indices would mirror the insurer's actual liabilities. The stock and bond market indices couldn't be expected to match the duration of PBGC's liabilities, not to mention their convexity characteristics or other measures of interest rate sensitivity (e.g., to yield curve twists, duration drift, or changing volatility).

Establishing a Pension Liability Benchmark

A primary consideration for a pension insurer in assessing the quality of investment management, particularly if outsourced such as is the case with PBGC, *is whether the pension assets have outperformed the pension liabilities*.

To determine whether investment assets have indeed outperformed PBGC's liabilities, it must first determine how its pension liabilities have performed. Because pension liabilities are not traded on an organized public exchange, it is not possible to monitor their behavior directly and on a continual basis. Therefore, *a liability benchmark must be devised, based on traded securities that will mirror changes in values of the pension liabilities*.[17]

[17] Not every variable influencing the value of liabilities can be mirrored by action in the capital markets. In pensions the mortality risk cannot be so mirrored. We will work only with the impacts of changes in the Treasury yield curve because the known effects of those changes overwhelm any of the more esoteric factors we could hypothesize.

Two characteristics of a pension liability benchmark are of utmost importance. First, the benchmark must be based on traded securities for which an active market exists. This will allow PBGC to get reliable quotes on a timely basis. Second, and more importantly, the benchmark must behave in a manner that closely parallels the present value of the liabilities over time and under disparate economic circumstances. For example, it should exhibit duration, convexity, and sensitivity to other broad market forces in which one can take an investment position similar to that of the liabilities. The difficulty of evaluating certain complex pension liabilities should not be underestimated. Nonetheless, it must be the starting point for developing an appropriate investment strategy from an asset/liability management perspective.

The valuation methods are based on replicating the cash flows of the pension liabilities with capital market instruments and pricing the resulting replicated portfolios with market prices. This technology gives PBGC the ability to translate its non-traded liabilities into equivalent capital market portfolios for which there are active markets and therefore reliable price quotes. Consequently, it is possible to track the market value of PBGC's pension liabilities over time, even though they are not actively traded. This process differs from the usual approach of calculating only a yield and a duration of the liabilities as benchmarks for the asset portfolio characteristics. The mimicking portfolio has the desirable properties that (1) returns reflect the shape of the yield curve and the cost of any embedded options, and (2) the effects of important sources of interest rate risk other than just duration — such as convexity and changing volatility — are directly incorporated. As noted, many insurers may depend upon duration as the only characterization of the changes in the value of liabilities. However, our suggested approach allows a richer representation of the risk and return properties of liabilities, and also one that easily can be replicated for historical analysis, if desired.

Using a liquid, traded securities portfolio that mimics the liabilities allows for a straightforward computation of a liability total-rate-of-return index against which the performance of the assets can be measured. Outperforming this liability index ensures that the asset managers are, in fact, acting in a manner consistent with increasing the value of PBGC's economic surplus (or reducing the size of its deficit). The current practice of measuring asset managers against a set of arbitrary market indices not only does not ensure this result but gives management of PBGC, Congress and the taxpayers incorrect information about the status of PBGC. Indeed, it would be quite possible for outside investment managers to exceed each of their target indices yet not contribute positively to PBGC's financial wellbeing.[18] This is because there is no close relationship between the way that the value of the pension liabilities behaves over time and the target indices that have been chosen by PBGC.

While a well-constructed portfolio that mimics a mature book of business should not vary dramatically over time, its composition may change as pensions age and new pension liabilities are assumed. Consequently, it will be necessary to reevaluate the liabilities periodically and rebalance the liability benchmark if appropriate.

Example of a Simple, Appropriate Liability Benchmark

[18] This would have happened during the recent deep recession, for example, when spreads widened considerably between A-rated long bonds and long Treasury rates. Also and more obviously, beating a stock market benchmark that fell by 40% would not have helped much against a (correctly valued) liability that *rose* in value over the same period.

Consider a closed pension plan in payout phase, assumed by PBGC. After plotting out the scheduled and expected payment pattern, one could fund it with a portfolio of Treasury zero-coupon bonds, each maturing on a date and in an amount to satisfy the pension outflows. The price of such a bond portfolio could easily be monitored over time and serve as a basis for measuring the present value of the remaining pension liability. If the liability extends beyond the maturity range of Treasury zeros, other measures could be taken, as described earlier, to handle the very long-term obligations. This liability benchmark would change over time as payment obligations are satisfied, year-by-year, and when the prices of zeros change occasioned by changes in market interest rates. This kind of benchmark based on a portfolio of zeros, or another based on what is known as a "dedicated bond portfolio" wherein bonds are purchased in varying amounts and maturities in such a way that their aggregate payments at any time are identical to those of a portfolio of zeros, is appropriate. There may be slightly less expensive ways to effectively fund the same liabilities with the same level of funding risk – for example, if the investment managers carefully measure and match the duration, convexity, and drift of the pension liabilities.[19] But for practical purposes, using the portfolio of zeros benchmark is sufficient.

For more complex patterns of liability payments, additional Treasury-based securities and their derivatives may be needed to adequately mirror the liability duration, convexity and drift.

Levels of Performance Measurement

[19] These approaches are described and tested in Babbel (1983).

Armed with the concept of liability benchmarks, we are now prepared to measure whether our assets are outperforming our liabilities. Performance attribution requires first a measure of performance so that there is something to attribute! A useful starting point is to compare the spread between the actual total rate of return on the combined investment portfolios and the total rate of change on the overall liability benchmark. We recommend that PBGC investment managers continue to measure their asset performance on a total-rate-of-return basis, but compare their performance to the total rate of change on a liability benchmark carefully constructed to reflect the costs of their liabilities. This liability benchmark (i.e., "liability proxy") could be decomposed into various sector benchmarks, where each would be assigned to separate investment managers, but would be weighted so that in aggregate they would match the overall liability benchmark. A comprehensive performance measurement system will provide for evaluation of performance at several levels,[20] as illustrated in Figure 3.

Figure 3 here

PBGC could calculate its asset values and liability proxy on a monthly basis. An assumption would be required for handling intra-month cash flows. Typically, these are assumed to occur in the middle of the month.

Chaining together monthly total costs and returns allows PBGC to calculate a time-weighted rate of return over any long-term horizon. It eliminates the impact of the actual timing

[20] A detailed presentation of how to implement such a comprehensive performance measurement system was derived by Goldman Sachs and is described in Babbel, Stricker and Vanderhoof, (1990, 1994) and Babbel (1992).

of cash flows over which PBGC and its investment managers have no control. This allows for unbiased comparisons of performance.

Using a liability benchmark is appropriate for measuring the performance of asset portfolios funding PBGC's liabilities.

Epilogue: Not in My Backyard, or Kicking the Can Down the Road?

In designing a portfolio of securities to serve as liability and sub-liability benchmarks, we recommend the selection of U.S. Treasury securities, their derivatives, and other securities of minimal default risk. There are several reasons why we favor the inclusion and predominance of these securities:

- They are liquid and widely traded, and price quotes are easily obtained.
- They are typically the benchmark used for valuing other asset classes and are starting to be used as a benchmark for valuing insurance liabilities as well.
- Their diversity of characteristics allows them to be combined into portfolios that can emulate the market value behavior of almost any default-free cash flow stream.

Summary: Not in my backyard, or kicking the can down the road? When a private pension plan is transferred from the sponsoring company to a private insurance company, as I understand it, PBGC's obligations with respect to that plan are relieved at that point. If the insurer later becomes insolvent, PBGC will not be obligated to assume the pension liabilities. There may be limited coverage through the National Association of Life and Health Guaranty Association (NOLHGA) or its state counterparts, but there is no federal responsibility other than some oversight to ensure that the Plan liabilities have been transferred to what USDOL has termed

"the best available annuity provider," which is an aspiration with heavy connotations, albeit subject to various interpretations. This eventuality is what we refer to as "not in my backyard."

However, when a private pension plan's obligations and assets are transferred to PBGC, to the extent that PBGC is using discount rates to value its obligations derived from a survey of private insurers' group annuity purchase prices (wherein each insurer has the protection of limited liability and the option to default), we refer to this action as simply "kicking the can down the road." To satisfy its liabilities, PBGC can do one of two things. Either it can invest in an appropriate set of riskless, matched assets, and maintain an adequate surplus to handle longevity uncertainties and other contingencies in order to provide the promised benefits, or it may invest pension assets in whatever kind of portfolio it deems best, *providing, however, that it maintains sufficient excess economic surplus in the plan to cover asset defaults, longevity drift, and additional contingencies arising from holding such unmatched assets.* Otherwise, PBGC is, in essence, simply transferring the liabilities from one risky pension provider to another (i.e., itself). Sooner or later, this will come back to bite them, or the taxpayers who probably will ultimately have to pay even though they currently provide no explicit guarantee against risky behavior followed by PBGC. We learned this from the Fannie Mae and Freddy Mac financial debacles of 2008.

I should note here that current pension valuations by PBGC simply reflect the statutory guidelines imposed upon it. We have found, in another context, that sound actuarial operating principles are sometimes sacrificed on the altar of short-term political expediencies, such as what happened in the two-year reduction in Social Security rates that occurred in 2011-12. More direct evidence that this can occur, to the detriment of PBGC's own solvency prospects, is the recent looting of private pensions in an effort to fund a highway program through a change prescribed

for discount factors used in valuing pension liabilities (the Moving Ahead for Progress in the 21st Century [MAP-21]). Using a moving average of past discount rates is unjustified from a finance-theoretic viewpoint. Even the Federal Government is unable to sell any of its bonds at or near face value if they offer interest based on averaged historical rates. The prices garnered will always reflect current market interest rates. This sort of accounting subterfuge and gimmickry may be sufficiently complex to keep it off the radar screen of most news outlets and voters, but knowledgeable people recognize it for what it is.

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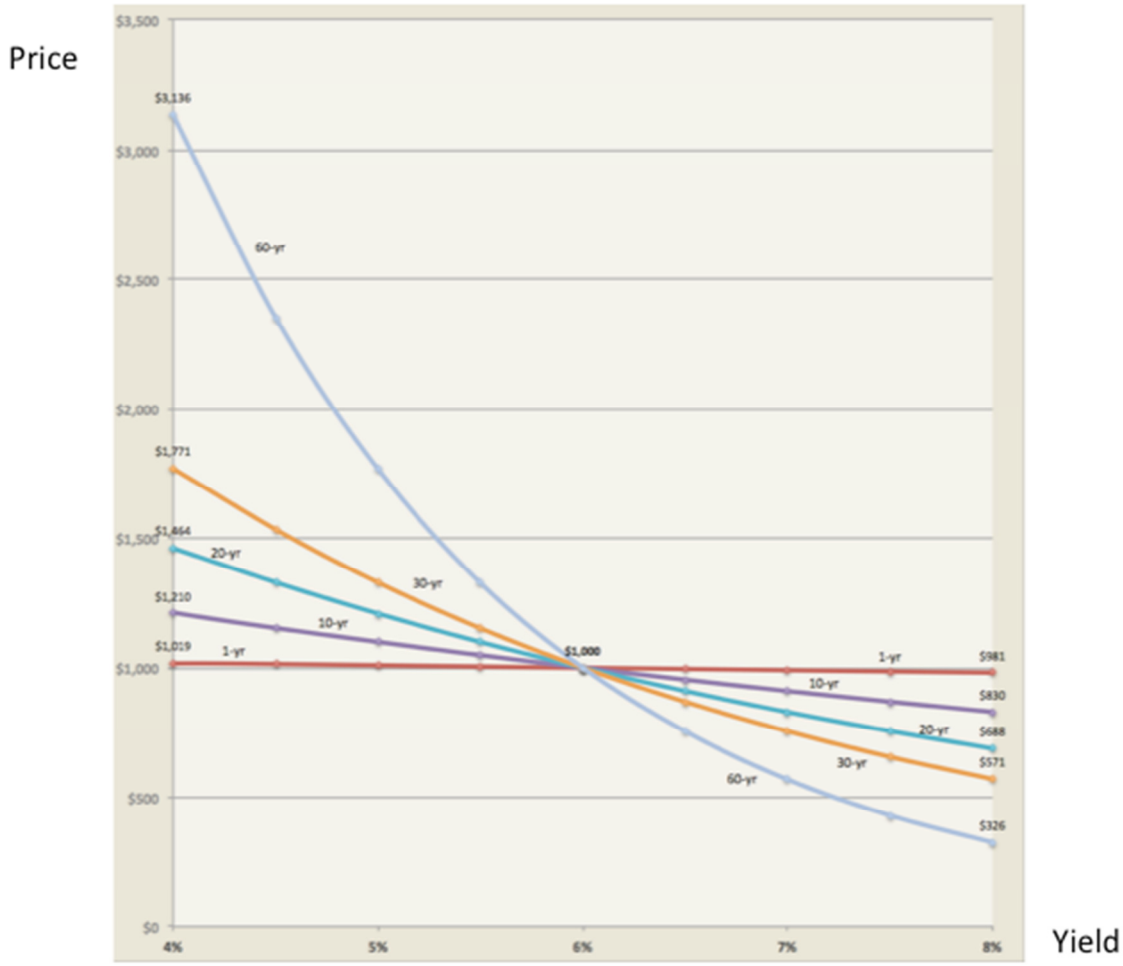
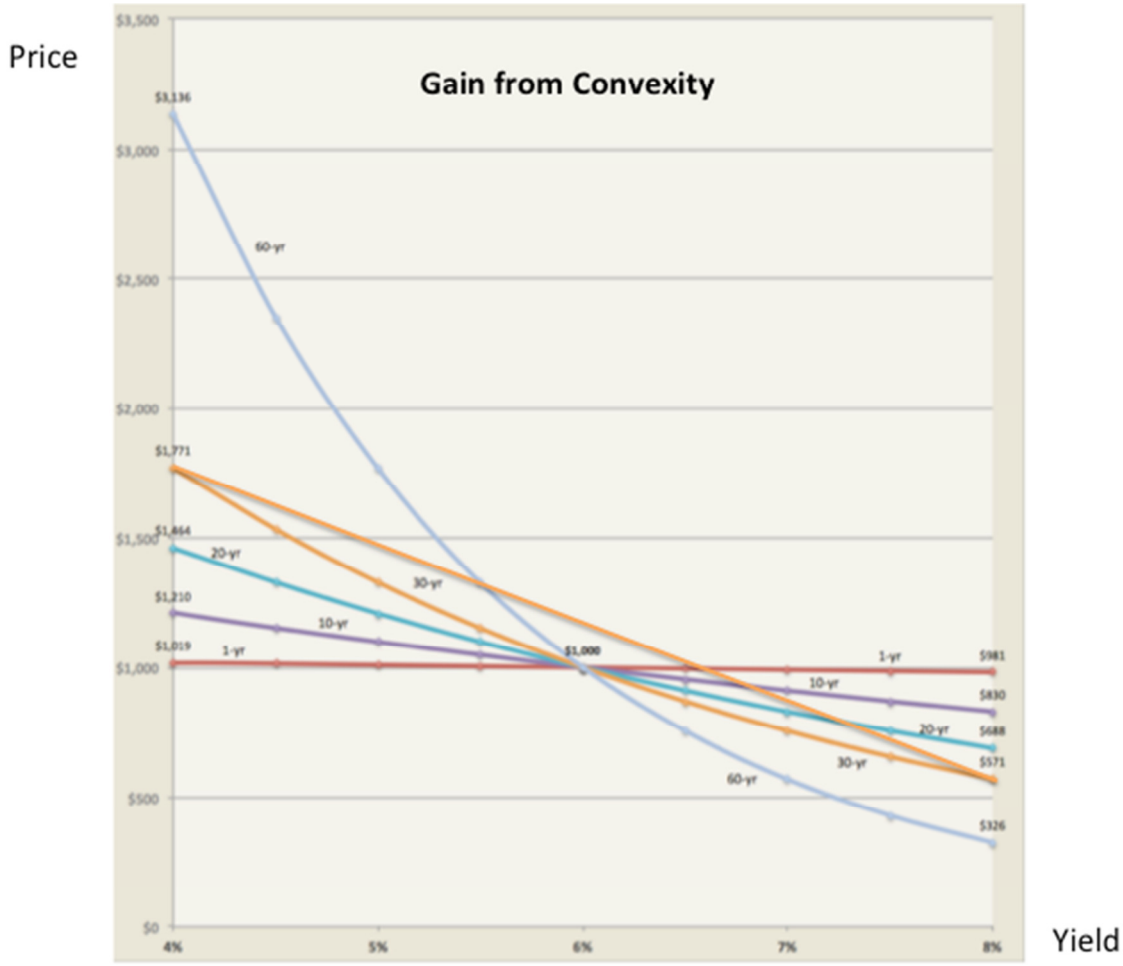
Figure 1.

Panel A. Zeros have varying degrees of convexity.



Panel B. Secant showing gain from convexity of 30-year zero.



Panel C. Secant showing larger gain from convexity of 60-year zero.

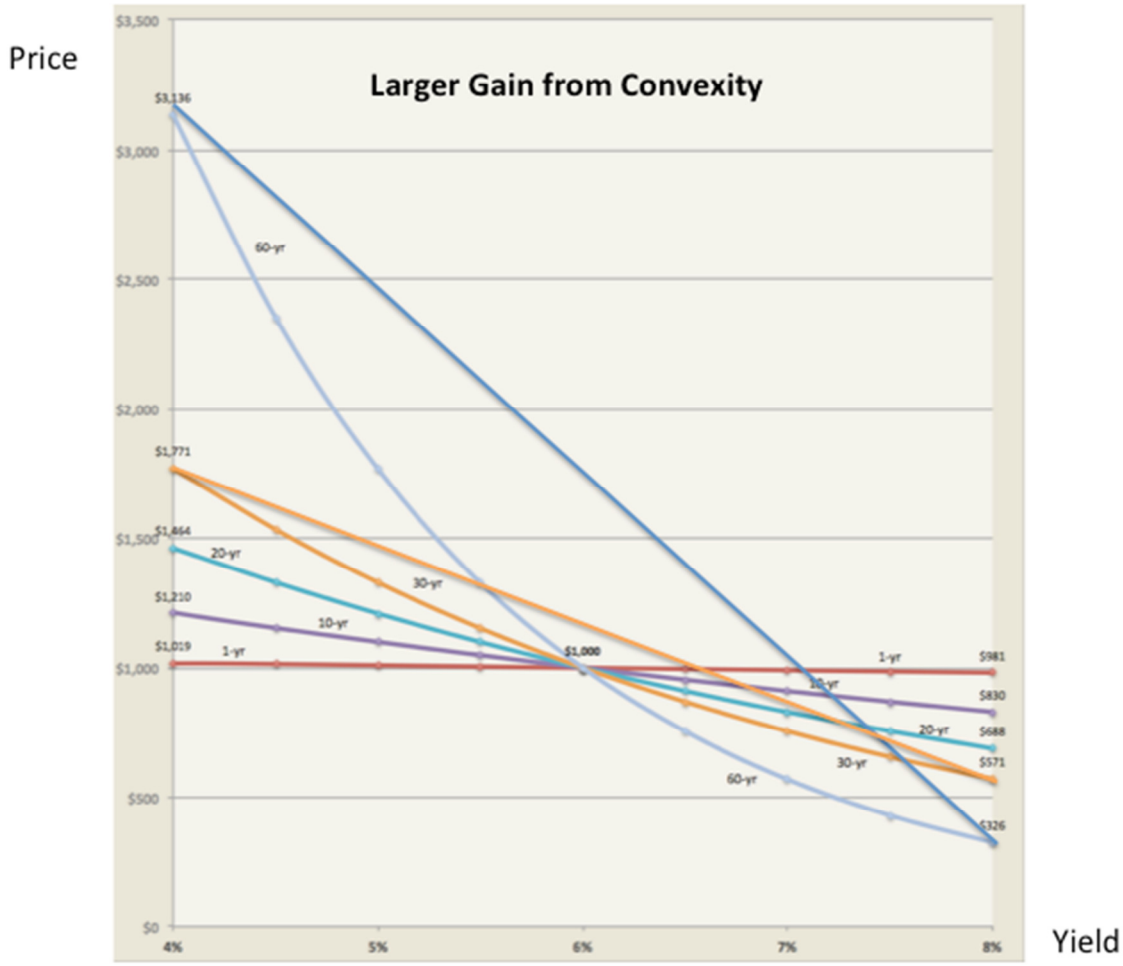


Figure 1. *Notes:* Panel A: Zeros have varying degrees of convexity; Panel B: Secant showing gain from convexity of 30-year zero; Panel C: Secant showing larger gain from convexity of 60-year zero. *Source:* Author's calculations.

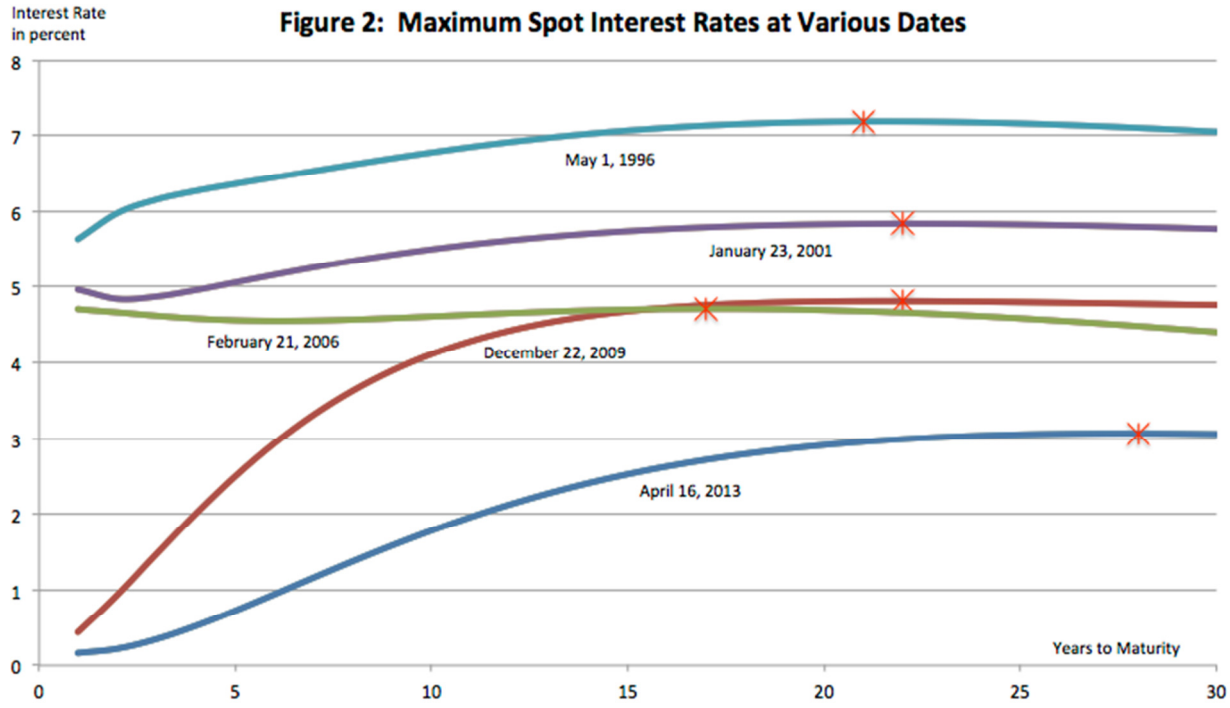


Figure 2. Maximum spot interest rates at various dates. *Source:* Author's calculations.

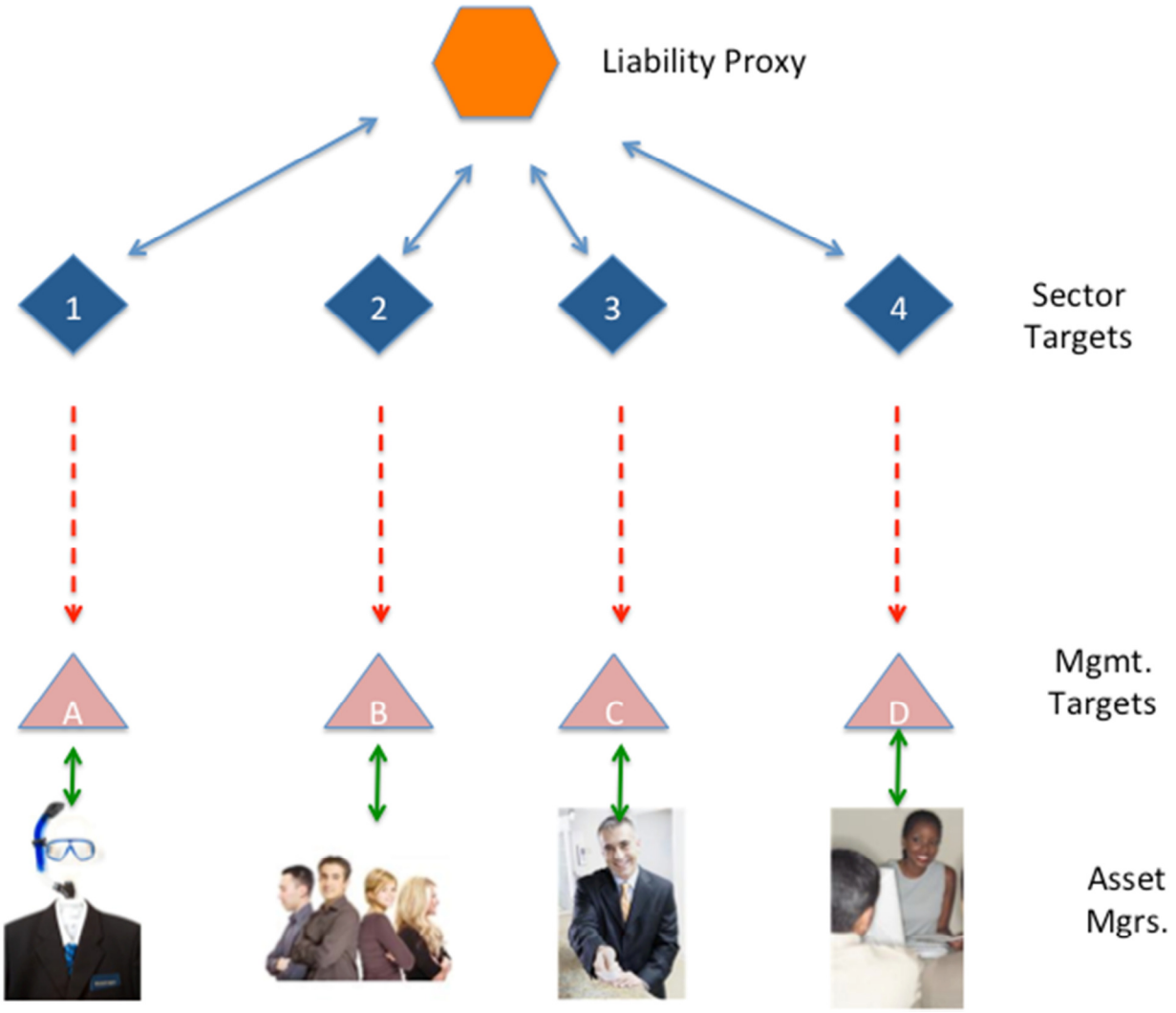


Figure 3. Establishing a liability benchmark for asset management and performance evaluation.

Source: Author's illustration.