Society of Actuaries
Research Project

30-Year Treasury Rates & Defined Benefit Pension Plans

The Society of Actuaries (SOA), its Pension Section and its Committee on Retirement Systems Research sponsored this research with the objective of identifying one or more indices, for calculating Current Liability, designed to approximate the interest assumption underlying annuity rates that might be found in a group "close out" quotation for a terminating plan. Part of the motivation was related to a concern over the use of a rate tied to 30-year US Treasury securities for calculating current liability, PBGC variable premiums, and other statutory purposes. Between the time that the research was completed and the time it was published, the US Treasury announced that it no longer would be issuing 30-year Treasury securities. This announcement will likely stimulate further interest in this area. While the end of the 30-year Treasury security was not known to the researchers when they did their work, this announcement makes their studies all the more significant. We hope that these papers demonstrate considerations that can be used in the evaluation of potential alternative rates.

Given the complexity of the issue and difference in approaches, the SOA hired two different researchers in response to a formal Request for Proposal. Both were highly qualified and brought their own distinct perspectives to their research. One researcher is Victor Modugno, an actuary with a long career in pricing pension products for insurance companies. The other researcher is the firm Ryan Labs, Inc. Ryan Labs does investment research including the creation of investment indexes.

Both researchers were free to present their own recommendations. Not surprisingly, each came up with different recommendations. The SOA's role includes the sponsoring of research but not the recommendation of policy therefore, it should be noted that the recommendations contained in these two studies are solely those of the authors and not the position of the SOA. The SOA does not assume any responsibility for any statements made or opinions expressed in these reports.

Beyond the actual recommendations, the studies offer a significant amount of background information and discussion of what should be considered when adopting an interest basis. We would like to thank both Victor Modugno and Ryan Labs, Inc. for their work.

Attached to this memo are Victor Modugno's report and Ryan Labs' report, in that order.

30-YEAR TREASURY RATES AND DEFINED BENEFIT PENSION PLANS

by Victor Modugno
August 22, 2001

DISCLAIMER

This report was prepared on commission for the Society of Actuaries. The opinions expressed and conclusions reached by the author are his own and do not represent any official position or opinion of the Society of Actuaries or its members.

ABSTRACT

This paper concludes that there are two index rates that could best replace the 30-year Treasury in the calculation of the Current Liability[1] of a pension plan – either the 30-year swap rate, as published in Federal Reserve Board Statistical Release H.15 or the benchmark 30-year FNMA[2] bond, as published in their website. These rates are very close to each other. They follow annuity rates used for closeouts by life insurers, while attaining the goals of simplicity, stability, and transparency. This paper then examines the use of these index rates for other related calculations, and suggests some modifications. This paper assumes that the mortality basis will be updated to the RP2000 with projection for future improvement.

BACKGROUND

The Society of Actuaries commissioned a study of indices that could replace the 30-year Treasury in the calculation of the Current Liability and other pension related calculations. The objective was an index that would approximate the net interest rates used for group annuity closeout pricing by life insurers and that would be simple to use, transparent, stable, and expected to be around for a long time. While the Society of Actuaries commissioned this report, any conclusions or policy statements are those of the author and are not necessarily endorsed by the Society.

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[1] As described in 26USC412 and 29USC1082. Current Liability, which is part of the minimum funding rules, is discussed in detail later in this paper.

[2] Federal National Mortgage Association (Fannie Mae).

The impetus for the study was the belief that the decline in Treasury issuance resulting from the budget surplus has caused volatile and widening spreads between the 30-year Treasury and corporate debt securities. This is having a negative impact on defined benefit pension plans in the U.S., by unnecessarily increasing funding costs.[3]

While credit spreads normally widen at the onset of a recession, the decline in issuance is also having an impact. The 10-year Treasury has replaced the 30-year as a benchmark for the bond market, which is consistent with global practices. Based upon CBO projections of budget surpluses, all redeemable Treasury debt held by the public will be paid off by 2006, and the U.S. Treasury will either have to buy back non-callable bonds or invest excess funds.[4] The Treasury market, as we know it, will disappear. Thus it will become necessary to find replacement indices where Treasuries are currently used.

METHODOLOGY

A survey of pricing practices of life insurers active in the group annuity closeout market was completed. Based upon composite answers, model office pricing was constructed. PBGC[5] Interest Rates were also used, since they are based upon a survey of annuity rates used by insurers. Available fixed income indices were considered in relation to insurer rates and other objectives. The effect of using the best indices on the Current Liability and other calculations was then measured along with possible modifications. In calculating duration and early retirement, RP2000 data was downloaded using the Society of Actuaries Table Manager. The effects of generational projection AA were derived from Table 8-1A of the RP2000 Mortality Tables[6]. While the results were reviewed for reasonableness, the data was assumed to be accurate.

SURVEY RESULTS

Survey of Life Insurer's Pricing for Group Annuity Closeouts

Pricing actuaries at eleven life insurances companies[7] that are currently active in the group annuity closeout business were contacted. All but Travelers agreed to participate with the assurance that their responses would be confidential. The following is a summary of these responses.

Interest Assumptions – The most common response was that liability duration (or projected cash flow) was given to the investment area to obtain a gross rate. Capital (and profit) charges are deducted usually based upon Corporate ROE requirements using NAIC factors with

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[3] Turpin *et. al*. "The Impact of Inordinately Low 30-Year Treasury Rates on Defined Benefit Plans"

[4] Congressional Budget Office, "The Budget Outlook" Chapter One. January 2001

[5] Pension Benefit Guaranty Corporation "Interest Rates"

[6] Retirement Plans Experience Committee, Society of Actuaries, "RP2000 Tables" p.79

[7] Aegon, AIG, Hancock, Hartford, Massachusetts Mutual, Metropolitan, Mutual of Omaha, New York Life, Pacific Life, Principal, and Travelers

an assumed asset mix (in one case the asset RBC was given with the gross rate)[8]. Overhead expense was also deducted, as was an asset default charge in some cases. One rate was used for the entire case for most companies. One company had a yield curve from investments from which they picked a rate based upon liability duration. One company in the small case market used an assumed duration for all cases. This company used 10-year A-rated bond yields, unless they were funding a specific asset. One company appeared to use a percent of premium for the profit/capital charge.

Only two companies used anything resembling transfer pricing, with benchmark assets to obtain rates and capital charges. These were the only companies that used spot rates to discount liability cash flows. A few companies looked at cost of funds relative to LIBOR [London Interbank Offered Rate]. While the investment areas of some of the companies might be using benchmark assets and cost of funds measures, it is more likely that they are funding specific assets. These liabilities are generally not subject to early withdrawal and thus ideal for private loans, commercial mortgages and other highly illiquid long-term investments of life insurers. There is significant liquidity premium that would not show up in bond indices with similar credit ratings.

Expense Assumptions – Overhead was usually deducted as part of the interest spread. Two companies deducted overhead as a percent of premium. Most companies had a set-up charge and a per life charge. The per life charge is based upon a present value of future benefit expenses, and was typically $200 to $300. One company converted these charges into an interest spread. A few companies projected future benefit expenses and discounted them with the benefit cash flow. Despite different computational methods, administrative expenses are remarkably similar for all companies.

Mortality Assumptions – There was a great deal of variance in the base tables used. However, all companies adjusted their mortality by projection to the current date (one company in the small case market used an age adjustment). Most companies projected future improvement (generational projection). The most common projection scale was AA[9]. One company used an interest spread to cover future mortality improvement. A few companies used different tables for hourly versus salaried employees, or made other adjustments to customize mortality assumptions to the group covered. All companies used sex distinct rates.

The following is a summary of the tables used[10]:

Mortality Table	Number of Companies
83 GAM	3 (1 basic)
94 GAR	5 (3 basic)
RP2000	2

Early Retirement Assumptions – Most companies used retirement scales with annual decrements. One company used a scale with three ages for early retirement decrements while one company used an assumed early retirement age for the group. The choice of early retirement

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[8] ROE is Return on Equity; NAIC is National Association of Insurance Commissioners; RBC is Risk Based Capital, which is additional funds that insurers must hold to support liabilities

[9] Retirement Plans Experience Committee, *Op. Cit.* p. 75

[10] Basic indicates that margins for insurance company valuation of 7% to 10% have been stripped out.

scales was highly dependent on judgment. Historical data and company prospects could be taken into account. This particular assumption may account for much difference between insurers' quotes for a given case.

Statutory and Tax Reserve Strain – Most companies include statutory reserve strain as a capital cost, and have additional charge to cover shortfall between what surplus earns and ROE requirements. While tax strain is not currently an issue, most companies indicated that it would be reflected in pricing if it became an issue in the future[11].

Optional Forms of Annuity – For the most part, these are not subsidized. Occasionally plans may have subsidized joint and survivor factors or lump sum factors. However, since GATT[12] lowered the cost of offering lump sum settlements to all non-retired participants in lieu of annuity benefits at plan termination, these optional forms have become less of a factor in pricing. However, if included, they would be priced similar to early retirement assumptions, based upon conservative rates of election.

Select and Ultimate Rates – This refers to the practice of using a lower rate after 20 or 30 years to reflect reinvestment risk. While a few insurers still do this, it is an anachronism from the 1980s, when interest rates were high, and most debt securities were callable or matured in 10 years or less. In the current, low interest rate environment, 30-year non-callable bonds are commonly issued, and there are 50 and 100-year bonds available. Derivative products also exist today to immunize long cash flows, although they have regulatory and accounting issues. Thus insurers are able to fully immunize terminal funding cash flows with high yielding corporate debt and so there is no need to make assumptions regarding reinvestment rates after 20 or 30 years.

There has been little change in terminal funding pricing since the original paper on the topic was published in 1986, other than to update interest and mortality assumptions.[13]

Model Office Pricing

Based upon the foregoing survey, we have constructed a model of insurer pricing. First a 30-year NAIC 1 bond, represented by 30-year A3 industrial bonds from Bloomberg, is chosen as the asset[14]. Then redundancies are applied to NAIC capital charges giving a total required surplus of 3%.[15] The target after tax return on this surplus is 12%[16], and we have assumed surplus earns 7% pre-tax, and the tax rate is 35%. The required spread rounds to 0.35%. We have added 0.20% for overhead and investment management expenses, 0.05% for asset defaults[17] and 0.10% for administrative expenses, giving a total spread of 0.70% off the A3 bond rate. We have ignored surplus and tax strain, which are not an issue at this time.

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[11] Statutory strain occurs when statutory reserves are higher than gross premiums and the insurer must allocate surplus; tax strain occurs when tax reserves are lower than premiums, and the insurers must front income taxes.

[12] General Agreement on Tariffs and Trade, Uruguay Round PL 103-465

[13] Modugno, "Terminal Funding"

[14] NAIC 1 is equivalent to A rating from S&P or Moodys; Bloomberg A3 industrial bonds is based upon bid prices for a3 bullet maturity bonds from industrial companies

[15] National Association of Insurance Commissioners, "Risk Based Capital"; assumes AA redundancy of 225%

[16] This assumes 9 to 10% for cost of capital with the balance as shareholder value-added

[17] Moody's Investor Services, "Default and Recovery Rates of Corporate Bond Issuers: 2000"

In practice, insurers frequently invest in less liquid assets and obtain higher rates with the same RBC (*e.g*., private placements) or assets with higher RBC (*e.g*., commercial mortgages) where the asset spread more than offsets the additional capital charge. While the Current Liability provides for early retirement costs, the insurer's pricing actuary will likely be more conservative than the plan actuary, since he cannot revise pricing assumptions in the future if experience deteriorates. The insurer's administrative expenses will also vary by case size. We have assumed an average consideration of $25,000 per life and ignored any per case charge.

PBGC Rates

The PBGC collects sample annuity rates from participating insurers quarterly. Such rates were not available for this study. However, the PBGC uses an average of the June 30 and September 30 rates to produce its valuation rates. The interest rate is extracted from the average annuity rates from the survey by assuming 1983 GAM mortality. The interest rates are then updated to November assuming rates change in proportion to an average of Moody's AA and A rates. The rates are fitted to a select and an ultimate rate where the rate decreases slightly after 20 or 25 years. This becomes the January initial rate for the following year, which is then updated monthly using changes in the Moody's yields.

While the methodology used by the PBGC is somewhat arbitrary, it gives an indication of the relative level of insurers net purchase rates for closeouts. I could find no explanation for the anomaly of PBGC rates below Treasuries prior to 1998 in the attached chart. In addition, the strengthening of insurers' mortality assumptions relative to the 1983 GAM should have further decreased PBGC rates relative to Treasuries over time. It may be a result of the Safest Annuity Rule[18], which forced out smaller companies with higher expense loads, thereby changing the companies in the survey.

Survey of Other Organizations Considering Similar Issues

Attempts were made to contact individuals at the PBGC, DOL [Department of Labor], and Treasury to determine if anyone in government was working on replacement indices for pension related calculations. While there are high-level studies underway on the effect of reduced Treasury issuance on the economy, no one appears to be looking specifically at the interest rates used for the Current Liability.

FIXED INCOME INDICES

The 10-Year Treasury

The 10-year Treasury has replaced the 30-year as the benchmark security for the U.S. bond market. However, it is inappropriate for the Current Liability for two reasons. Its duration of 7 is much shorter than typical pension plans, with durations of 10 to 20. Also it has limited shelf life, assuming budget surpluses materialize as expected.

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[18] 29CFR2509.95-1 U.S. Department of Labor Interpretive Bulletin 95-1

Agencies

Three U.S. agencies have benchmark securities programs designed to replace U.S. Treasuries as standards for the bond market. Two of these, Fannie Mae and Freddie Mac[19] have non-callable 30-year notes that could be used for the Current Liability. Both Agencies have scheduled auctions and buy back and reissue programs designed to provide liquidity similar to Treasuries. The programs are substantially identical and the securities have the same yields within a basis point. Fannie Mae's benchmark securities program has $3.5 billion in 30-year bonds outstanding while Freddie Mac's reference note program has $4 billion. (U.S. Treasury has $15.9 billion of 30-year bonds outstanding.)[20]

Either of these agencies, or an average of both, could be used. We chose Fannie Mae because its website has benchmark yield curve and historical yield information for these securities that is easily downloadable. To get yields for Freddie Mac requires Bloomberg, a subscription service. The chart at the end of this paper shows monthly yields for the Fannie Mae 30-year bond compared to other rates for the past 5 years. The Fannie Mae yield closely follows the 30-year swap rate, which on average is about 5 basis points higher. The correlation between changes in swap rates and agencies is extremely high – 0.985 during 1998-99 which covers the extreme spread widening from the Russian debt and Long Term Capital Management crisis.[21]

The chart also shows that Fannie Mae yields have been close to PBGC rates in recent years. On average during the past 5 years, Fannie Mae yields have been 0.74% below that of A3 Industrials, which is in line with our model office pricing spreads. Agency issuance is projected to continue to grow, and exceed U.S. Treasury outstanding public debt in 2005.[22]

The Fannie Mae, FNMA 30-year benchmark bond has the characteristics of a good index for the Current Liability. It follows insurer pricing and is simple to use, transparent, with long expected shelf life.

Swap Rates

The use of fixed – floating interest rate swaps has grown exponentially in recent years, with daily trading volume of $22 billion in 1998.[23] Swap rates have already replaced Treasuries as the risk free discount rate for future cash flows in many private transactions. Swap rates are now published in the Federal Reserve Statistical Release H.15, and are accessible on their website. Under a fixed - floating swap, one party pays a fixed rate in exchange for a floating rate based upon LIBOR on a notional amount. LIBOR is a short-term rate paid on Eurodollar deposits. The rate is set daily in London based upon the average paid by AA banks for various terms up to 1 year. For example, if 3 month LIBOR is exchanged for a fixed rate, the LIBOR rate would be reset every 3 months based upon the rate then in effect for 3 month deposits.

Swaps have the advantage of not depending upon physical securities. They have a high level of liquidity. However, most activity is under 10 years and there is currently a 4-basis point bid ask spread on 30-year swaps[24], although there is growing use of long dated swaps. When a

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[19] Federal Home Loan Mortgage Corporation, FHLMC

[20] Bloomberg

[21] Flemming, "The Benchmark U.S. Treasury Market: Recent Performance and Possible Alternatives" p. 11

[22] *Ibid.,* p.13

[23] Flemming, *Op. Cit.*, p.20

[24] Bloomberg

bank is downgraded, it is dropped from LIBOR calculation, and so LIBOR is a constant AA rate. This would be lower than an AA bond at long durations, where the bond has downgrade risk. Thus it is not surprising that swap rates are close to agencies. On average swap rates were 5 basis points higher than 30-year FNMA bonds over the past 5 years.

The use of a single rate, the 30-year swap, instead of pricing off the swap curve (*e.g.*, pricing cash flow at year one using the one-year rate), is more than a simplification for ease of use. Only 20% of the insurers in our survey use spot rates. Most use a single, long-term rate. This reflects the nature of insurers' assets and liabilities. Most insurers have short liabilities, such as GICs and SPDAs that are managed with long-term liabilities. Any excess asset cash flow at the early durations can be used for these short-term liabilities.

Like the 30-year FNMA bonds, the chart shows 30-year swap rates close to PBGC rates in recent years. On average, 30-year swap rates were 69 basis points below A3 Industrials during the past 5 years[25]. Thus it matches our model office pricing for closeout annuities. The 30-year swap rate has the characteristics of a good index for the Current Liability. It follows insurer pricing and is simple to use, transparent, with long expected shelf life.

Corporate Bond and Other Indices

There has been a proliferation of bond market indices in recent years, numbering in the hundreds, counting sub-indices. Most of these are total return indices and are designed for measuring performance of fixed income managers. Measures of yield, such as yield to maturity, yield to worst, and option adjusted yield can be extracted for these indexes. There are a number of indices that focus on yield.

While there are many indices, they can be divided into categories that are similar. The first category is the broker indices. Major, and some minor, bond brokers have total return indices. We would first eliminate all global and foreign bond indices as not applicable to U.S. pension liabilities. One problem with the domestic broker indices is that they are proprietary, and subject to change. The broker determines the pricing and analytics. Another is that the broad market indices have duration and convexity[26] characteristics that are ill fitted to pension liabilities. Examples include Lehman Aggregate, Merrill Lynch U.S. Domestic Master, and Salomon Smith Barney Broad Investment Grade (BIG).

The BIG index has duration of 5 and a yield to maturity on 7/31/01 of 5.7%. Salomon Smith Barney also has an index called Large Pension Fund Index that has duration of 7, which is still too short for pension closeout liability. There are, however, sub-indices that can approach pension liability duration. For example, Merrill Lynch U.S. Corporate A rated 15+ years index had duration of 11 and yield of 7.3% on 7/31/01.[27] While this may be an appropriate proxy for insurance company assets, the lack of transparency and the dependence on the broker makes these undesirable for the Current Liability.

Another category is publisher indices. These include some yield indices. Examples include Moody's, S&P, Bloomberg, and Barron's. They are available to subscribers and have similar transparency issues as the broker indices. The Moody's Corporate A Index, which is an

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[25] Bloomberg

[26] Convexity is the rate of change of duration with yield. Modified duration is the first derivative of price with respect to yield and convexity is the second derivative. More detailed information and sample calculations can be obtained on: http://www.finpipe.com/duration.htm

[27] Bloomberg.

unweighted average yield of 100 bonds with average maturity of 30 years, would have a duration equivalent to the long bond and would be an appropriate proxy for insurers' closeout assets. The yield on 7/31/01 was 7.5%.[28] This has disadvantages as an index for the Current Liability similar to broker indices (*i.e.*, proprietary, and subject to change). We used Bloomberg fair market yield curve for 30-year A3 rated Industrial bonds in this paper because these are option adjusted (*i.e.*, bullet bond) yields.

CURRENT LIABILITY

The Current Liability of a pension plan is a measure of the cost of benefits accrued to date. It was introduced in OBRA 1987 and refined in RPA 1994.[29] It is designed to measure plan termination liability. It mandates mortality (1983 GAM for non-disabled) and interest between 90% and 105% of weighted average of 30-year Treasuries for the past 4 years, using a 4/3/2/1 weighting going back in time. Early retirement and turnover assumptions must be included if material. To determine if additional funding (and disclosure) is needed, the Current Liability is calculated at the 105% of smoothed Treasury rate and compared to the actuarial value of the assets.

Looking at the past 4 years, swap rates have been about 0.8% higher than Treasuries at 30 years.   Assuming an average duration of pension liabilities of 15, a change to similarly smoothed swap rates would reduce the Current Liability by 12%. However, if the RP2000 table were adopted at the same time, almost half of this decrease might be offset[30]. If the swap rate (or FNMA rate) were used flat (i.e., 100% instead of 105%) along with the mortality change, the reduction in Current Liability would be minimal for many plans.

A more radical change that would rationalize and simplify these calculations and make them more closely reflect the cost of purchasing an annuity would be to compare the market value of the assets and the Current Liability using the swap rate in effect on the same date. All calculations would be keyed off the ratio of these assets to liabilities. If the ratio exceeds 100% and duration of the assets and liabilities are reasonably close, no additional PBGC premiums or funding would be required.   For non-immunized cases, some additional over collateralization might be required.

OTHER CALCULATIONS

PBGC Premiums

PBGC variable premiums are 0.9% of the under funding based on the Current Liability calculated using 85% of 30-year Treasuries compared to market value of assets. Based upon 7/31/01 rates and duration of 15, a change to 85% of swap rates would reduce liabilities by about 11%, *cet. par.* However, if the mortality were changed to the RP2000, the decrease would be reduced to 6%, assuming 50% male/ 50% female.

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[28] Ibid.

[29] Omnibus Budget Reconciliation Act of 1987 and Retirement Protection Act of 1994 (GATT)

[30] This assumes 50% male/50% female. RP2000 AA Generational Combined Healthy has lower mortality for males, but higher mortality for females at some ages compared to 1983 GAM. Thus a group that was predominately female would see a greater reduction in Current Liability. Average age distribution assumed.

Maximum Permissible Lump Sum Benefits From Qualified Plans

If this is changed from 30-year Treasuries to swap rates, the effect should be less than the previous examples, since those receiving maximum lump sums are likely to be older than the average plan participant. At age 65, the reduction from using swap rates would be about 5.5%. The increase from using RP2000 would be 2.5%, so the net change is a 3% reduction[31].

Minimum Lump Sum Benefits Equivalent to Stated Income Benefits

The value of lump sum distributions should be close to the price of an annuity for the accrued benefit. If the value of the lump sum is too high (i.e., if the interest rate is too low) and the plan provides for lump sum distributions, then the employers are being overcharged. There is also additional incentive for employees to choose a lump sum distribution, which could be squandered. This defeats the purpose of pension plans.

If the lump sum is too small compared to the value of the annuity then it would not be fair to employees and if they choose a lump sum they would not be able to replace the benefit. This may also encourage employers to amend plans to offer lump sums to obtain the lower cost, with the potential for the lump sums to be squandered.[32]

It may be appropriate to include early retirement subsidies and an estimate of insurer expense charges in order to better approximate annuity prices if realistic interest rates are used. However, this would require a change in the law and it would increase employer costs for ongoing plans that provide a lump sum option.

The chart below compares the effect of changes. We have illustrated the cost of early retirement for a plan with an early retirement benefit of 70% payable at age 55. We have illustrated expense of 5% ($250/$5,000), 50% male/50% female, using RP2000 Combined Healthy with an interest rate of 6.23%.[33]

Effect of adding the following changes to lump sum calculation

Age	Swap Rate	RP2000 Projected	Early Retire at 55	Total including 5%
30	-29%	+15%	+68%	+59%
50	-16%	+8%	+68%	+65%
70	-5%	+2%	0%	+2%

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[31] Assumes 50% male/50% female using RP2000 AA Generational Combined Healthy at 6%.

[32] For a discussion of employee use and preference for lump sums see: Watson Wyatt, "Choosey Employees Choose Lump Sums!" and Working Group On Retirement Plan Leakage, "Are We Cashing Out Our Future?". For information on the increased use of lump sums options see Committee on Retirement Systems Research of the Society of Actuaries, "Safest Annuity Rule" p. 47

[33] The swap rate in effect on 7/31/01

Annuity Rates for Converting Accumulated Mandatory Employee Contributions

Switching to swap rates from 30-year Treasuries would result in a higher accumulation depending on the number of years to normal retirement age. For example, for 10 years, the increase would be 7%, while it would be 24% for 30 years at current rates.

Other Related Calculations

Tax and statutory reserves of life insurers for annuities purchased by terminating pension plan can significantly affect pricing and availability of these annuities. Tax reserves have been based upon applicable federal rates since the Tax Act of 1987 (but not less than the statutory rate). This was originally done for revenue enhancement, but is not producing any at this point. To avoid problems in the future, tax reserves should be changed back to equal to statutory reserves. Statutory reserves for the current year are based upon a weighted average of Moody's corporate bond average for the period from July of the prior year through June of the current year and 3%[34]. The result is spurious reserve strain during periods of rising interest rates. Statutory reserves should equal the greater of reserves calculated using the 30-year swap rate for the month of purchase or GAAP reserves. This would involve changing laws in several states and Statutory Accounting Principles. Since new closeouts are an insignificant portion of reserves of very highly rated companies and since this change would apply prospectively, it should not be overly controversial.

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[34] See for example, California Insurance Code Section 10489.4.

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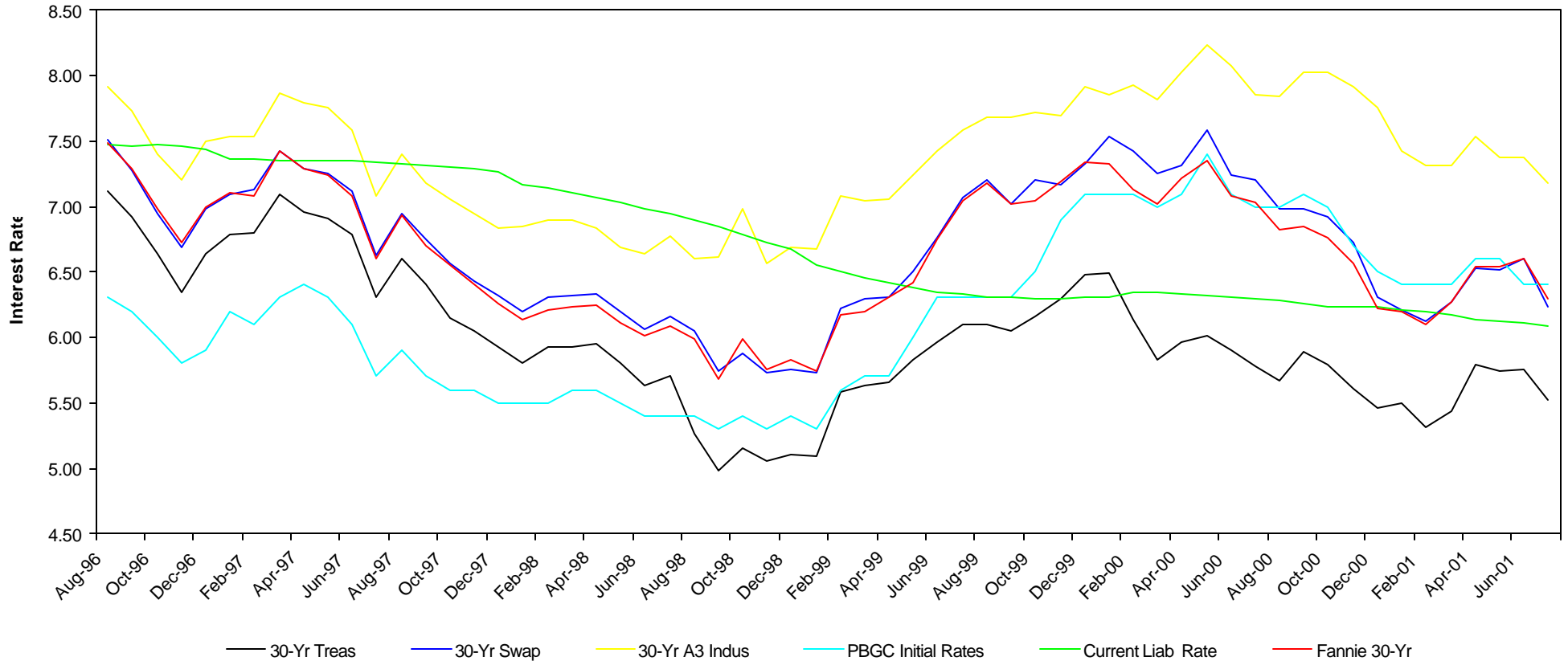
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Pension Financial Management
And
Valuation Discount Rates

By

Ryan Labs, Inc.

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20 October 2001

Pension Financial Management
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Pension Financial Management
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I. Summary of Recommendations

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1. Current Liability Valuation and Lump Sum Settlement Discount Rates:

Use a complete term structure of spot rates derived from Aa corporate bonds minus a 100 basis points (bps) static spread, reflecting industry average cost, risk and profit margin spreads. For liabilities longer than 30 years, a straight-line (level) projection from the 30-year spot rate should be used. This spot rate curve should be sponsored by an informed organization, and published monthly via the Internet and major electronic financial services.

2. PBGC Premium Rates (the rate used for the 0.9% variable/risk premium):

Same as above minus an additional 50 bps static spread.

3. For Small Plans:

A Society of Actuaries Table of single rates, derived from the above Liability Discount Rates applied to standardized projected benefit payment time profiles for retired lives, deferred vested lives, and one (or more) average age active lives profiles.

All rates are to be 'current' (not averaged). In order to measure liabilities reflecting current market valuations, use rates no older than one month. For certain pre-specified administrative activities, rates no older than 90 days should apply.

II. Introduction

The immediate impetus for this review of the selection and application of interest rates used in the (present) valuation of pension liabilities has been the emergence of capital markets anomalies caused by the 'scarcity' price premium for the U.S. Treasury 30-year (long) bond. (For a review of the consequences of this premium pricing see Turpin, James E. and Gebhardtsbauer, Ron; The Impact of Inordinately Low 30-Year Treasury Rates on Defined Benefit Pension Plans; A Public Statement by The Pension Practice Council of the American Academy of Actuaries). This current concern provides an opportunity to review best financial management practices and the current procedures connected with the use of a single 30-year U.S. Treasury coupon bond.

The problem with the 30-year US Treasury (30-year UST) bond and its application involves more than its potential scarcity premium value:

1. The timing of cash flows of a 30-year coupon bond is *not* reflective of the term structure of benefit payments.

2. The 30-year US Treasury market is *not* reflective of the markets from which insurance company buyout bids are constructed.

3. The 30-year UST bond price (hence yield) reflects a *price premium* for the liquidity of payment claims possessed in much lesser degree by pension benefits.

4. The 30-year UST bond's value as a liability pricing benchmark rate is *distorted* by multi-year averaging.

In all, these distortions give rise to potential arbitrary wealth transfers between parties relative to then existing market opportunities. The objectives developed and recommendations provided in this report address these financial imperfections.

Modern financial risk (asset/liability) management at major financial institutions employs measurement and hedging instruments, including derivatives, which manage risk tightly and continuously. It is not possible to control risks tightly without continuous monitoring and adjustment, which, in turn, requires continuous measurement. The costs associated with mismatches arising from large market moves are financially disruptive. For these reasons, *worldwide accounting standards are migrating toward current market or fair value standards*. Pension financial management practices have only fitfully followed this trend. The move to reexamine discounting rates and their application in defined benefit pension finance provides an ideal opportunity to advance the economic content and utility of best financial management practice in this field.

The actuarial and financial disciplines have, and will continue to converge. Such elements as the valuation of assets and liabilities, reference to capital market rates, the role of pension finances in merger and acquisition pricing, and the increasing financial content of actuarial education all attest to this. As a long run consequence, the design of pension benefits, liability valuation and

funding will reflect capital market arrangements and instruments. As a result, pension plans will be more efficiently measured, valued, hedged and managed at lower cost to shareholders, taxpayers, employees and the PBGC.

III. Objectives

The objective of the following recommendations is to build upon the practices surveyed, to support a discount rate design less reliant on the 'endangered' 30-year UST bond, and to reconcile financial policy objectives among pension plan buy-outs, lump sum settlements and current liability (the measure of the minimum amount required to collateralize accrued benefits with little or no risk).

These policy objectives all require the measure of economic value of liabilities including their sensitivity to economic factors such that their risk may be effectively managed (hedged), and settled with liability holders or bought out by third parties at continuously knowable prices.

These considerations give rise to three criteria for the assessment of our (or other possible) recommendations:

1. *Arbitrage-Free.* Near continuous valuations that do not give rise to (or at least minimize) arbitrary wealth transfers between affected parties: sponsors (obligors), employees (beneficiaries), or arm's length third parties assuming liabilities such as insurance companies and the PBGC. (Note: Averaged, outdated valuations give rise to an increased probability of such arbitrary transfers.) This efficiency principle recognizes that in principle, all liabilities are somebody's assets and, therefore, suggests symmetry in their pricing.

2. *Hedge-ability*. The ability to measure liabilities in economic terms linked to available, continuously priced capital markets instruments for the purpose of benchmarking or hedging for determining best asset allocation and hedging policies.

3. *Collateral Measurement*. Funding surpluses and deficits require the determination of the economic (market) value of liabilities against which to compare the adequacy of market valued pension assets. Current liability measurement must reflect the dollar value of assets reasonably required to buy out the liabilities in an arm's length, third party transaction. The advent of ERISA promoted minimum funding standards subsequently systematically strengthened to protect the PBGC. The intent of these standards is satisfied only by an economic measure of liabilities against which to measure the extent of coverage provided by pension assets – at market value. A current liability definition is central to the determination of the financial exposure of the PBGC.

These three criteria are the foundation of the following recommendations.

IV. Recommendations

1. *A Spot Rate Curve, Not A Single Rate Should Be Used*

Promises to pay future cash flows are discounted by the capital markets at any point in time by rates that differ by payment dates – *a term structure of interest rates.* This market reality is addressed expressly by both the Financial Accounting Standards Board, and by the Securities and Exchange Commission in their implicit and explicit reference to a spot rate (zero coupon) pricing of Pension Liabilities. (See attached Exhibit A citing FAS #87, FAS #106 and SEC Letter.)

When observing market rates, many non-fixed-income market professionals confuse market quotes with market pricing. Professionals break down any collection of promises to pay future cash flows (coupon bonds and other liabilities) by future dates and *price* each future cash flow separately. A single rate is then derived which produces the same price (present value), and the collection is then *quoted* at that single rate – even though none of its individual cash flows may have been priced at that rate. (See Society of Actuaries Monograph- M-FI96-1 Valuation of Interest-Sensitive Financial Instruments by Babbel and Merrill). Market professionals are wary of relying on any single summary measure of multiple cash flows such as "average duration" in the comparative pricing of commitments. The use of a single (yield, maturity, duration, etc.) number facilitates communication but not the actual detail underlying a price (yield) quote. Indeed, FAS 87 Paragraph 199 is clear that individual discount rates are a more faithful representation, though the Statement permits use of a weighted average for aggregate computations (Exhibit A).

Significant respondents to the Society of Actuaries sponsored survey of annuity writers indicated that projected future cash flows and not just duration or other summary measures were addressed by their valuation/bidding processes. Any single rate does not adequately reflect significant differences in the duration and convexity of projected pension liability schedules as between plans for differing age groups, terms and gender mixes to be reflected in competitive buy-out bids.

For smaller plans the use of a spot curve may be relatively costly. For these, a table of single rates (separately for active and retired lives) can be developed, sponsored and published by or on behalf of an informed organization such as the Society of Actuaries based on average ages and reflecting standard "time profiles" of projected benefit payments for these groups. (See Exhibit B for time profiles of a sample of active and retired groups.)

2. *Adopt Standard Static (Fixed) Spreads Reflecting Average Mortality Risk, Administration Costs, etc., as well as Annuity Provider Credit Standing*

Next, we consider the development and use of credit and cost spreads in the determination of rates in three contexts: plan sponsor financial reporting, lump sum settlements, and PBGC measures of financial exposures.

Current Liability Measurement

Competitive bids to buy-out pension liabilities by the insurance industry look to rates that can be earned currently on investment grade fixed income assets (generally in the Aa /A credit range). In part, this amount of yield spread over U.S. Treasuries reflects the investment risk-return preferences of major insurance companies as well as the comparative absence of liquidity of pension benefits. Discounts reflecting administrative costs, commissions, risk premium for mortality and early retirement built into the required rate of return on insurance company assets (profitability) are then applied. Consistent with competitive buy-out market pricing and term structure and liquidity considerations, *a corporate Aa spot rate curve should be developed and regularly published (monthly) minus a fixed 100 bps spread.* This fixed spread is intended to capture an industry measure of all of the above-mentioned cost, risk and profit margin elements, and reflects a reasonable mid-point of the spreads employed by the surveyed insurance companies active in this market.

This recommended discounting approach is generally consistent with those used by the insurance companies surveyed who are active in this industry (summarized in Appendix A- Pension Liability Pricing Practices).

Such a curve can be electronically published by an informed organization such as the Society of Actuaries, and continuously monitored and maintained under fixed, prescribed and published rules under contract with a bond index provider, which is independent of the insurance, banking and brokerage business. (See Exhibit C - Preliminary Summary Pension Spot Rate Curve Specifications.) Equivalent single rate proxies, separated for active and retired lives, for small plans along the lines discussed above can also be developed by or on behalf of the Society.

These rates will best estimate the market (balance sheet exit value) of pension liabilities by way of a standard measure of their buy-out value for meaningful financial disclosures.
The majority of major U.S. corporations now use the Moody's Aa Corporate Rate (or rates which move with that rate) for discounting pension liabilities for financial disclosures. (See McConnell, Patricia, Retirement Benefits Impact Operating Income, Accounting Issues, Bear Stearns, Equity Research/Accounting & Taxation, September 17, 1999.)

Some have argued, and the adoption of U.S. Treasury security rates as a benchmark supports the argument, that a 'riskless' rate is economically supportable when discounting projected pension benefit payments. This argument focuses on credit risk issues such as those between plan sponsors and the U.S. Treasury, and ignores those such as the risk-return investment preferences of willing buyers of group pension liabilities, liquidity differences, and the precision of the quantity and timing of future cash flows.

When comparing present values discounted by an Aa Spot Rate Curve and a single rate on the 30-year UST Bond, results will differ according to four factors:

1. The slope of the yield curve
2. Credit spreads
3. The time shape of projected benefit payments
4. The "scarcity premium," if any, of the UST Bond market.

Lump Sum Settlements

The use of a single or standard spot rate term structure for both buyouts and lump sum settlements avoids adverse selection and arbitrary wealth transfers between sponsors, employees and life annuity providers. If the same valuation discounting is used, liability valuation is indifferent to whether or not plan provisions provide for lump sums. Public policy issues concerning the subsidization or discouragement of lump sum settlements are two-sided, and no final position has been realized or legislated. Should plan sponsors and employees jointly wish to subsidize wealth transfers to either party's benefit, that determination is rightfully the subject of private sector contracting negotiations. However, the PBGC is impacted to the extent that lump sum elections can significantly impact funding ratios. A lump sum settlement at discount rates lower than for current liability results in a larger reduction in plan assets than in plan liabilities, and does so instantaneously upon settlement. Lump sum settlements at current liability discount rates are pension surplus (deficit) neutral.

(For this discussion we have ignored mortality adverse selection and consider only "interest rate" adverse selection.)

PBGC Annuity Rates

Protection of the PBGC has been strengthened by the addition of minimum current funding standards and the imposition of variable/risk premiums. This arrangement looks to accelerate the formation of collateral (plan assets). An appropriate measure of adequate collateral is current liability valued at current, private sector, buy-out rates. In this context, the appropriate 0.9% variable risk premium determination should be based on the current liability measurement rate above minus an additional 50 bps.

The PBGC's current policy is to seek a level playing field between itself and the private sector, and recognizes that it acquires liabilities only in distress terminations. In this role it is not particularly concerned with adverse selection on the basis of its annuity discount rates. However, as a buyout quasi-agency of last resort, the PBGC should require liabilities that it assumes to be a higher, or at least no lower, value than a private sector value on buyout pricing. No private-sector, life annuity provider can have a credit rating equal to or higher than the PBGC. Hence, an additional yield discount of 50 bps or more is appropriate.

Hence, where an employer shifts residual mortality risk and administrative costs to the PBGC, liabilities should be valued consistently with the above recommendations at lower rates

approximating that of a U.S. government agency (notwithstanding its quasi-public charter). A lower spread before deduction for non-interest rate risk and administration costs helps insure against arbitrary wealth transfers from the PBGC to plan sponsors.

Appendix B - Critique of Alternative Indexes, summarizes and addresses alternative interest rate benchmarks in light of the objectives and recommendations of this report. In particular, the use of standard bond market indices and the use of the swaps markets are discussed.

3. *No Averaging of Rates*

The averaging of rates has been adopted on the basis of historical, actuarially approved capital budgeting (funding methods) coupled with two beliefs not shared by the capital markets and financial economists. First, some would hold that without averaging, valuations are 'too volatile'. Unfortunately, what constitutes 'acceptable volatility' is purely a matter of taste, and all averaging mechanisms to achieve it are arbitrary. Worse, it is not possible (or at least quite costly) to risk manage or hedge against an average value, or to settle or transfer liabilities at an average value. *One can only act (transact) at current market prices.* Moreover, transfers and settlements based on average rates give rise to arbitrary wealth transfers between parties relative to currently available market opportunities.

Second, it is sometimes argued that the prices of relevant capital market instruments are 'noisy', and some average is a more accurate measure of 'true value'. Unfortunately, it is only possible to transact or do anything at current prices. Moreover, current prices incorporate all known information as of that date. Next day prices reflect new information not available the previous day, and thereby today's prices are a more accurate measure of value today than yesterday's prices of values today. In well-hedged positions, short-term spikes or volatility affect both sides equally such that net (surplus) is stable. *Ultimately, hedging is the true economic source of stability and predictability.*

The use of book or cost values for assets has largely been abandoned, and should likewise be abandoned for liabilities. Furthermore, it is meaningless to compare by subtraction or by ratios values differentially averaged or otherwise not fully effective as of the same date. Hedging, risk management and asset allocation decisions and implementation can only be effected with respect to current, not average prices and values.

No concrete economic rationale has been put forward to support averaging as superior to the economic content or true valuation content of current prices. Second, it is not possible to hedge, settle or competitively buy-out liabilities at other than current prices. Third, to buy-out or settle liabilities at other than current prices results in arbitrary wealth transfers between participating parties relative to then existing capital market opportunities.

With respect to the capital budgeting techniques implicit in actuarial funding methods, the intent is to achieve adequate funding (collateral) in the long run. Hence, prior to ERISA and the creation of the PBGC, pension funding was conducted with emphasis on predictable contributions as a percent of payroll. Since the major alteration in financial arrangements and

exposures introduced by ERISA and subsequent Financial Accounting Standards, the need for a financially functional measure of *current* liability has emerged.

For many years now, pension liability measures have clung to their actuarial *funding* (capital budgeting) purpose – how much to contribute and when. In that context, the smoothed, pro forma measures of assets and liabilities used as capital budgeting (funding method) devices support the predictability of contributions and as such are "instrumental" variables. Instrumental variables are measures, which are role-players within a calculation system having little stand-alone economic content taken out of that system. (See for example, the actuarial use of the concept of 'unfunded liability'.) Best financial practice which serves legislated public policy and financial management requires a liability measure which addresses *investment* issues – how best to allocate pension assets- and *collateral measurement* – how sufficiently do assets currently collateralize liabilities, both at market value. Neither of these purposes is well served by actuarial or averaged measures of liability.

In sum, no insurance company, bank or trading desk could afford to manage its business on the basis of such intermittent valuation of liabilities or short positions. The argument that pension plans are special, long-term arrangements applies to *funding* (cash flow budgeting). The PBGC's stake in current levels of collateralizations is now explicitly represented in funding standards.

True volatility reduction is supported by market- based measures and by hedging– not by redefining liabilities in the attempt to excise 'volatile' economic content. The smoothing or amortizing of contribution as a percent of pay should be undertaken with respect to actuarial funding measures (outputs) derived from current economic data (inputs), not the other way around. It is always preferable in complex systems to achieve stability by dealing with system outputs than to destroy information within the system by arbitrarily smoothing inputs.

4. *Timely Valuation*

Economic and capital market events in an increasingly global 24/7 world do not occur at convenient calendar intervals, and the cost of mismatched asset/liability exposures can be high and made worse by delayed recognition and response. Modern financial technology and communications make frequent liability valuation possible. Purely financial management administration (asset reporting and management, etc.) is now common on a daily basis. However, for many administrative purposes, lags in reporting, communication and decision-making require some temporal stability in values for a viable system. ***It is difficult to make a case for making any fixed valuation good for longer than one month.*** On the outside, plans should employ rates no older than 90 days throughout their plan year.

For large plan lump sum settlements, rates as of determination date should be no older than 30 days and no more than 90 days old on payment date. These time lags are more than sufficient to give interested parties time to evaluate decisions and for administrative systems to generate the required data. Continuous development of computer systems and electronic data communications will make even these lags excessive. For small plans, determination date rates should be no older than one year, and on payment date no older than 90 days before the plan year begins.

For the purposes of PBGC monitoring and premium setting, annual funding status (collateral determination) can be made workable – particularly if data regarding liability term structure and asset allocation parameters were reported to permit intra-year estimates to be made by the PBGC internally.

Exhibit A

FAS-87, FAS-106 and SEC Citations[*]

A.   FAS-87

Paragraph 199:
"Interest rates vary depending on the duration of the investments; for example, US Treasury bill, 7-year bonds, and 30-year bonds have different interest rates…The disclosures required by this Statement regarding components of pension benefit obligation will be more representationally faithful if individual discount rates to various benefit deferral periods are selected. A properly weighted average rate can be used for aggregate computations such as…"

Paragraph 44: *"In making those estimates, employers may also look to rates of return on high-quality, fixed-income investments currently available and expected to be available during the period to maturity of the pension benefits."*

B.   FAS-106   Discount rates defined 12/15/90

Paragraph 186:
"The objective of selecting assumed discount rates is to measure the single amount that, if invested at the measurement date in a portfolio of high-quality debt instruments, would provide the necessary future cash flows to pay the accumulated benefits when due. Notionally, that single amount, the accumulated post-retirement benefit obligation, would equal the current market value of a portfolio of high-quality, zero-coupon bonds whose maturity dates and amounts would be the same as the timing and amount of the expected future benefit payments."

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[*] Underlining is not in the original. It is included here for emphasis.

C. **SEC Guidelines** FAS 106/Addendum to FAS 87(June '93 letter to all corporations)

"The SEC staff believes that the guidance that is provided in paragraph 186 of FASB 106, for selecting discount rates to measure the post-retirement benefit obligation also is appropriate guidance for measuring the pension benefit obligation."

"Rates that cannot be justified or are just too high will be passed on to the SEC's enforcement division for further action. The enforcement division could require restatement of the company's financial statements, as well as seek to impose civil or criminal penalties."

Exhibit B

Example: "Time Shape" of Future Value of Pension Benefit Payments

Multiplying the total value of all undiscounted, future payments (FV) by the weights determined by the time shape of liabilities {w(T)}, allocates the total, which when cross-multiplied by the time shape of zero coupon prices {b(T)} (derived from the term structure of spot rates) {r(T)} produces a total present value (PV). From that present value, an iterative procedure (such as Goal Seek in MS Excel) can be used to determine an equivalent constant rate (Y), which produces the same present value.

$V(T) = w(T) \; FV$

$b(T) = \exp(-r(T)*T)$

$PV = SUM[b(T)*V(T)] = SUM[B(T)*V(T)]$, where $B(T) = \exp(-RT)$

$Y = \exp(R) - 1.$

Y is the annually compounded equivalent to the continuously compounded constant rate R

Exhibit B (Continued)

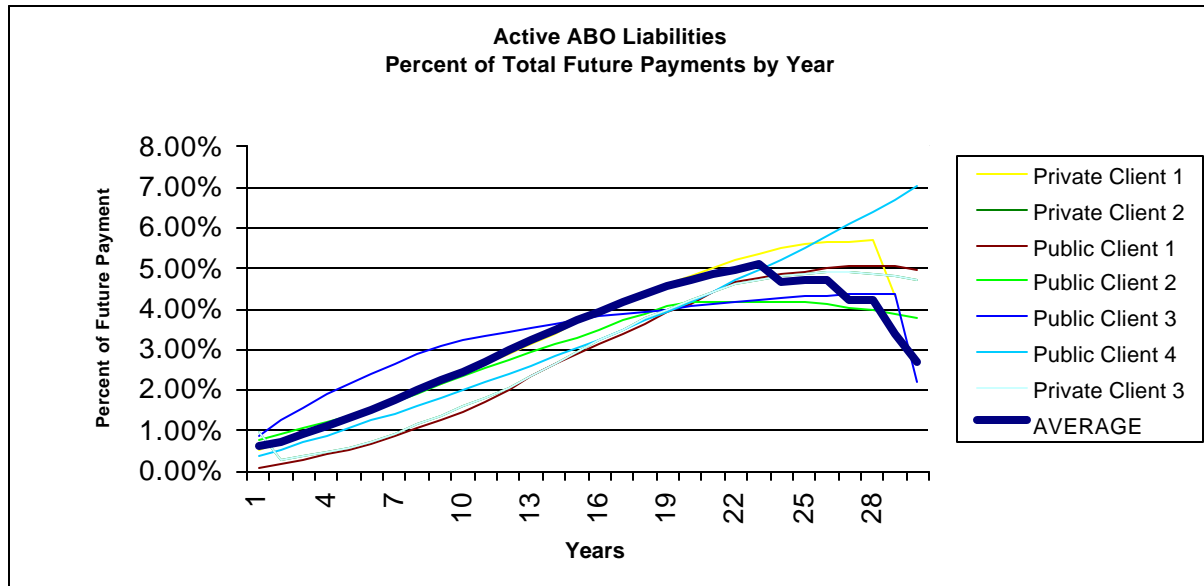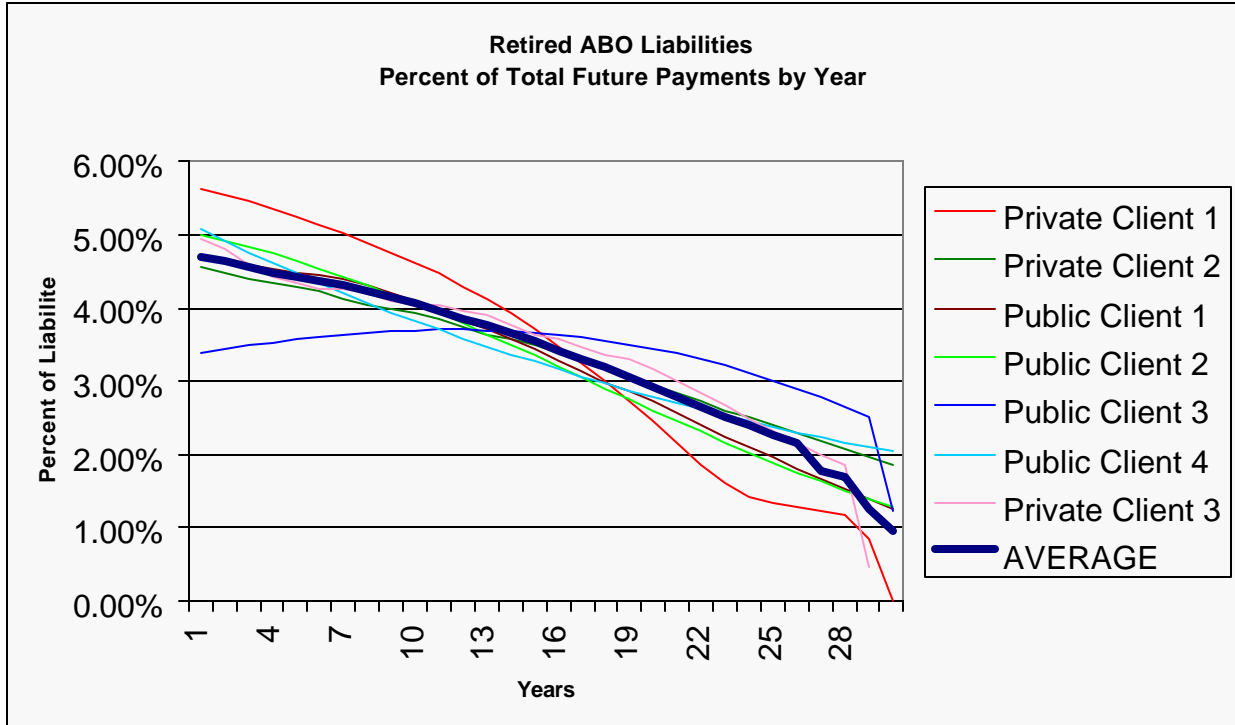## Example: "Time Shape" of Future Value of Pension Benefit Payments

Retired ABO Liabilities
Percent of Total Future Payments by Year

Active ABO Liabilities
Percent of Total Future Payments by Year

Exhibit C

Preliminary Specifications for Aa Corporate Spot Rate Curve

Corporate Bond Sectors:
    All sectors

Weighting:
    Equal within sectors and each maturity on spot curve

Credit Ratings:
     Only Aa by Moody's or AA by S&P if Moody's rating not available

Maturity:
     One year and longer

Minimum Issue Size:
    $200 million

Embedded Options Adjusted:
    Puttable, callable features price adjusted, convertible bonds excluded

Spot Rate Interpolation:
    Mathematical procedure established
    Boot-strap and curve fitting technologies reviewed and approved by sponsor

Exhibit D

The Swap Curve
(Pros and Cons)

Recent credit and liquidity conditions in the bond markets and U.S. Treasury funding decisions have resulted in reduced aggregate correlation between the Treasury and other bond markets. Because of the large and growing size of the Swaps market, and the ability of Swaps to hedge yield spread products in the banking and insurance markets as well as bond trading desk risks, many traders have sought to quote bond yields relative to the Swap Curve. By extension, some have begun to advocate the use of the Swaps curve to price pension (and other) liabilities.

In what follows, we first describe how Swaps work and the derivation of the 'Swaps curve'. We then describe our concerns regarding its use in the valuation of future cash liability payments such as pension benefits.

1. What are (Interest Rate) "Swaps"?

An Interest Rate Swap is a contract between parties in which an exchange of cash flows (interest) takes place on a nominal par amount enabling one party to assume fixed rate cost risk and another party to assume floating rate cost risk. The floating rate is most often based upon **LIBOR** (London Interbank Offered Rate) set upon either quarterly or semi-annual intervals. LIBOR is the most well known international short-term interest rate. The fixed rate is based upon a particular spot on the Treasury Yield Curve plus a margin or spread. As recently as ten years ago, Interest Rate Swaps were very much a closed end market. Swaps were fixed contracts and often could not be broken without complicated discussions and severe penalties. This mindset has changed over the last few years and has resulted in Swaps becoming a very liquid and secondarily traded market.

Swaps were originally created as a tool for bond issuers to use the liquidity of the bond market to borrow funds in the most efficient product type or style. For example, a bank issuing ten-year bonds would ideally choose to issue floating rate debt as an alternative to their ongoing issuance of six month certificates of deposit. The bond market, however, is not conducive to an active market in long term, floating rate bonds. Through the Swap market, however, they could accomplish the basis for this transaction. By acquiescing to the bond market's appetite for fixed rate debt, the bank would issue ten-year fixed rate bonds and enter into a Swaps contract with the underwriter or another counterparty. The Swaps transaction would enable the bank to receive fixed rate cash flows in exchange for paying floating rate cash flows to the counterparty. In this vein, the fixed payments of the debt issuance are offset by the receipt of fixed cash flows (plus some agreed upon spread). The bank has now essentially created a floating rate bond, as far as they may be concerned, based upon LIBOR. This is often referred to as LIBOR based funding.

2. What is the "Swaps Curve"?

The Swaps Curve is produced from arbitrary theoretical loans where counterparties exchange interest payments based on the LIBOR rate. Unlike the Treasury Yield Curve, which trades every minute of every day, the **Swaps Curve is the interpolated LIBOR curve**. LIBOR is set once daily at 8:00 a.m. London time and is usually set by a consensus of leading financial institutions. The market is very tight, most often with differences of only 1/16 of a percent. In recent years, the Swaps curve has been expanded to be more of a bond type curve with maturities extending to ten years.

The Swaps curve does not reset itself for intra-day trading. In addition, the longer the underlying maturity of Swaps, the more suspect the quote for that portion of the yield curve becomes.

3. The Advent Of Swaps In Today's Bond Market

The increased liquidity of Swaps has caused a watershed event for securities dealers and traders. Swaps are now being used as the basis for pricing bonds. The change in shape and supply of the Treasury Yield Curve has caused the trading community to veer from Treasuries due to their delicate nature as a hedge. Not coincidentally, the use of Option Adjusted Spreads (OAS) has visibly declined because the Treasury Yield Curve has flattened over the past few years and inverted during the Year 2000.   (Note: The regressions inherent in the calculation of OAS factor in only a positively shaped yield curve. The probability of an inverted yield curve cannot be determined. Therefore, in times of an inverted yield curve the output of OAS is less reliable than in times of normally shaped yield curves.) **(See Ryan Labs Research: OAS, Caveat Emptor!)** Much of this has been caused by the Treasury's decision to limit the issuance of long-term sovereign debt and recall high coupon long-term bonds. The supply of Treasuries has been constrained by the pattern of auctions, not necessarily the size of the same. The disappearance of certain maturities (three, four and seven-year) and fewer auctions of others (fives, tens and thirties) have greatly contributed to the value of United States Treasury Bonds. Only the two-year Note and shorter dated bills have continued to maintain the same tendencies over long periods of time.

Dealers were used to pricing bonds via the Treasury Yield Curve plus a spread for varying degrees of risk (credit, prepayment and duration). A market maker is forced to "hedge" their position of spread product at the end of each day. The most common hedge was to "short" Treasury securities (either by direct purchase or through futures contracts) for every "long" spread category on a duration-weighted basis. In most markets, the so-called "basis" (Treasuries) is tied to both sides of the equation. The price risk for the long side of the inventory accumulation was offset by an equal price risk in Treasuries (plus or minus the difference in financing costs). Therefore, the dealer could profit from the difference between the bid and offer of his inventory as well as the positive carry (income) of the hedge if it neutralizes principal risk.

As Treasuries became less of an effective hedge, the dealers' scheme capsized. Beginning with the flights to quality in late 1998, Treasury prices rose while spread product prices declined. Dealers who shorted Treasuries as a hedge were now being annihilated. Their hedge now became a liability and alternative sources of risk prevention needed to be found. Agency

benchmark securities were created and began to serve as a proxy but not nearly as quickly nor with the degree of liquidity needed.

Swaps thus became an appropriate hedge replacement. By using Swaps, the investment community was persuaded to steer away from Treasury valuations and use a market maintained and stabilized by the dealer community. **Dealers are the primary drivers of the Swap community** and now have direct control over the risk of their positions. Since Swaps track spreads more than the base rate of the curve (remember LIBOR sets nightly, Treasuries second to second), the hedge is more effective.

Bond market participants, primarily the investment community, are currently being forced to use Swaps as the basis for bond pricing by dealers. This establishes extra work on the part of portfolio managers and analysts. Where bonds are now quoted on a "Swaps +" basis, the ultimate spread to the Treasury Yield Curve must still be known. As a result, a nominal spread must be derived by converting the Swaps spread to a yield and then subtracting the appropriate Treasury benchmark. Since the total return bond manager has no use for Swaps themselves, this creates additional work for no greater benefit.

The comparison between Swaps and OAS is important to note. Just as OAS has been de-emphasized during an inverted yield curve so, too will the use of Swaps be de-emphasized when times of high volatility in Treasury yield curves subside.

4. *Swaps Curve and Pension Liability Valuation*

The Swaps market is then a Trader's Tool for managing (hedging) yield *spread risk*. In itself, it is not a tool for managing total *price or return risk*. Because it does not involve the purchase or sale of principal, there is no means by which a Swap contract in association with any position in derivatives can pre-fund or passively hedge a future specified cash obligation such as a pension benefit; and consequently market price that payment. In short, **if you can't use (buy) an instrument to pre-fund or defease a liability at low risk, it can't be used to assess the market value of the liability.**

The Swaps yield curve lies above the Treasury curve because the higher yields are compensation for adverse elements not present with Treasury bonds (and STRIPS):

- **Interest Rate Risk**. One side of a Swap contract must pay a floating rate whose value might rise dramatically in the future and with increasing probability. When held to maturity, to pre-fund a specified cash liability (benefit payment) a zero coupon bond (STRIPS) has no corresponding volatility.

- **Credit Risk**. The probability that the counterparty to a Swap might default also increases the longer the contract maturity. FASB and SEC pronouncements refer to "high quality" instruments in the pricing of pension liabilities.

- **Illiquidity**. While the liquidity in the Swaps market is high and growing, it still does not approach that of the Treasury market. Moreover, Swaps tend not to exceed a ten-year maturity.

- **Not An Asset.** Swaps are truly not a tradable asset in the sense they have no principal. As a result, to buy a Swap to defease liabilities or to use as an investment asset would be impossible.

Hence, we would argue that **Swaps and the Swap Curve**, important as they are as a yield spread risk management tool for traders, **are inappropriate to apply to the market valuation of future liability payments.**

Our recommended approach employs U.S. Treasury STRIPS prices for the valuation of projected pension benefit payments (and other cash flow obligations). The logic of this approach reflects the economic principle that the cost to risklessly pre-fund, defease, or to fully hedge a liability payment is to price it at the market. This use reflects both the appropriate financial methodology and is the only set of securities fully consistent with FASB and SEC pronouncements on the subject of pricing pension benefit and medical obligations. **(See Ryan Labs Research Report: Liabilities – The True Objective.)**

Exhibit E

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Appendix A

Pension Liability Pricing Practices
Summary of Insurance Company Responses

Ryan Labs surveyed the U.S. life insurance companies that comprise the major participants in the pension annuity and plan buyout business regarding their approach to valuing (pricing) pension liabilities.

The predominant approach applied differing mortality tables and early retirement assumptions, and other adjustments to arrive at schedules of future cash flows against which a schedule of discount rates (term structure) is applied. Some respondents indicated that they used a single, duration appropriate "flat" rate rather than a yield curve. Basically, all respondents use the Treasury yield curve as the "base rate" with a spread for risk and profit. This spread varies significantly and has no obvious trend.

1. *Projected Cash Flows*

Elements affecting projected benefit payments include mortality, retirement age and lump sum elections (if any). The respondents indicated the following variety in mortality tables applied:

Number of Respondents	Table	Comments
2	RP2000	
3	GAM83	1 projected to '97 1 projected 5 years 1 moving to GAR94
3	GAM94	1 GAR94 also

2. *Projection Scales*

Projection Scales were based on either those implied by the mortality tables used (3), or AA with adjustments (4).

3. *Discount Rates*

The rate(s) used were based on current U.S. Treasury coupon bond rates for 10 and 30 years, with credit and profit spread added. Some interpolated a complete spot (zero coupon) curve consistent with modern bond market pricing methods. Two respondents noted that they used a constant 4% discount rate for cash flows beyond 40 years. One respondent replied that no benchmark was used, and another simply applied bonds with appropriate duration.

The discount rate(s) used were <u>not</u> adjusted for:
1. Actives vs. retirees
2. Assumed early retirements
3. Plan size
4. Demographics

These elements were incorporated in cash flow projections. However, two respondents noted that they made rate adjustments for lump sum distributions or short certain periods.

On top of the discount rate(s) applied, the following various elements were then added:
1. Contract charge
2. Charge per annuitant
3. Commission + Premium Tax (if applicable)
4. Risk Charge
5. Profit Charge (required ROR spread)

In total, these spread adjustments varied widely from 40 to 250 bps depending upon what items are included.

Appendix B

Critique
of
Alternative Indexes

Wall Street firms (i.e. brokerage, research) are the leading creators and publishers of generic bond indexes. Starting with the birth of the first bond index in the summer of 1973 (by Kuhn Loeb), generic fixed income indexes are now quite numerous and varied.

The mainstream indexes are meant to provide measurements of total returns and volatility. The yield measures of these indexes are statistical summaries (averages), which often are erroneous or misleading measurements since they tend to be linear calculations whereas bond math is not linear. To say it differently, you could not use these statistical summaries to match the risk/reward behavior of the index portfolio.

1. *Composition*

Generic bond indexes were built to measure the volatility, return and yield behavior of a certain part of the fixed income market (i.e. a sector) or a very broad composite (i.e. Aggregate). Their composition includes all issues that qualify under the rules. As a result, generic indexes tend to be large portfolios in terms of number of issues (thousands of bonds in a portfolio mix).

2. *Pricing*

The trader pricing of such large portfolios is usually cumbersome and most difficult. As a result, some form of matrix pricing is inevitable which results in constant or smooth yield spread levels. Since there is no bond exchange or universally acceptable price per bond (i.e. closing price), the pricing matrix of index providers tends to be proprietary. This leads to tracking deviations among similar indexes and even erroneous calculations. Naturally, the pricing disparities are the smallest between Treasuries and the widest among lower rated corporates and complex mortgages.

3. *Term Structure*

Most generic bond indexes do not sub-divide their calculations into a precise yield curve but rather use ambiguous and broad categories like intermediate (all maturities between 1.0 and 10.0 years) and long (longer than 10.0 years). With the exception of the Ryan Labs indexes (Liability and AA Corporate), we cannot find a generic index with a well-defined yield curve term structure such that a schedule of pension benefit payments could be priced easily (in conformity to FAS 87). A yield curve with numerous spot rates is required.

4. *Zero-Coupon*

With the exception of the Ryan Indexes we could not find any generic zero-coupon bond indexes. In accordance with FAS 87 and 106, to price liabilities properly a zero-coupon pricing or index would be a requirement.

Two exceptions to the problems with generic indexes as noted above are:
Ryan Labs Liability Index(s)
Ryan Labs AA Corporate Bond Index

5. *Ryan Labs Liability Index*

Invented in 1991, after two years of development, this index is intended for pricing pension liabilities in conformity to FAS 87. This index is calculated as both a generic and custom index. The generic index is the Treasury STRIP curve equally weighted. As a result, it has a constant 15.5-year average maturity/duration. A yield and a total return are calculated for each annual duration (1 through 30 years) as well as a composite index. Each duration is priced and comprised of the Treasury STRIP that best represents that annual maturity. This index is daily and delivered via the Internet.   A Custom Liability Index is available whereby the Plan Sponsor's liabilities are weighted by the present values of all the benefit payments using a zero-coupon pricing curve for each liability. Each liability is priced daily and has a custom index built for it. As a result, Plan Sponsors and their consultants know the growth rate, present value and term structure of the liabilities on a continuous basis.

6. *Ryan Labs AA Corporate Index*

Ryan Labs invented this index to assist a major corporation in pricing their PBO liabilities. The composition is strictly AA Corporate bonds built as a yield curve of 2, 5, 10 and 30-year maturity cells. From this is interpolated a fitted yield curve for each year between these four average maturities. Currently, this is a coupon bond portfolio construction with a zero-coupon derivative index under construction. Once completed, this zero-coupon derived index would be a suitable base rate structure.

Next, we would like to comment specifically on some of the other popular indexes:

7. *Moody's AA Corporate Rate*

This is a generic index available via subscription. Its construction is long corporate bonds (20.0 years plus) rated AA1-AA3 by Moody's. Issues are selected at month end and must be close to par to avoid feature distortion (calls, puts, etc.). As a result, the portfolio changes with rates. Only one bond per issuer is allowed with $100 million minimum outstanding. Index is equal-weighted with daily frequency but posted with usually a one or two-day lag.

8. *S&P Credit Indexes*

New index with maturities three years and longer rated BBB to AAA by S&P. Its objective is to create a portfolio with a constant average duration of approximately 10 years and provide option adjusted yield spreads by rating groups and industry groups. There is no term structure breakout or total return index series.

9. **Morgan Stanley**

Provides Custom Liability Indexes based on each plan's demographics and cash flow assumptions. They use the 30-year Treasury as the key discount rate base with a yield spread for AA corporates such that each liability has the same discount rate up to 30 years. They use a 4% discount rate for liabilities past 30 years.

10. *Ibbotson Government Series*

Has two index series: Intermediate and Long. The Intermediate is a one-bond index holding the Treasury closest to a five-year maturity for a calendar year. The long series is a one-bond index holding the Treasury closest to a 20-year maturity for a calendar year. Issues selected are to be noncallable.

Conclusion

In conformity with FAS 87 and 106, a zero-coupon yield curve is needed. This is difficult without using Treasuries since Agencies have no clear single issuer with enough liquidity and Corporates do not issue zero-coupon bonds. An implied zero-coupon yield curve for Corporates needs to be created.