



SOCIETY OF ACTUARIES

Article from:

Risks and Rewards Newsletter

February 2002 – Issue No. 38



RISKS and REWARDS

The Newsletter of the Investment Section of the Society of Actuaries

NUMBER 38

FEBRUARY 2002

Swap It! Variable M&E Revenue for Fixed M&E Revenue

by Marshall Greenbaum & Adam Zivotofsky

Insurers who issue variable life and annuity products are currently rethinking their risk management practices. As equity markets decline and become more volatile, the likelihood of significant guaranteed benefit claims increases, while the anticipated revenue from mortality and expense (M&E) fees declines. Current market conditions are leading to undesirable earnings volatility on both Statutory and GAAP accounting statements for companies with large in-force blocks of variable policies. This paper illustrates how to use a derivative contract, a properly structured *total return swap*, to turn a company's uncertain M&E revenue patterns into predictable revenue.

M&E Fee Basics

Insurers assess M&E fees against their policyholders' current account balances as the primary source of revenue to cover their servicing and benefit costs, and to provide a source of profit. They are collected as a fixed percentage rate (basis point charge) of the current account balances over the life of the contract. Typically, policyholders allocate most of their premiums to the equity-based subaccounts. Any percentage decline in account balances driven by equity markets leads to a corresponding percentage decline in the level of M&E fees

(continued on page 22)

30-Year Treasury Rates and Defined Benefit Pension Plans

by Victor Modugno

Editor's Note: This report is one of two reports prepared on commission for the Society of Actuaries with the objective of identifying one or more indices designed to approximate the interest assumption underlying group "close out" annuity quotes for terminating pension plans. 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. This report can also be found on the SOA Web site at: <http://www.soa.org/sections/dbpp.pdf>.

Abstract

This paper concludes that there are two index rates that could best replace the 30-year Treasury in the calculation of the Current Liability¹ 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 FNMA²



(continued on page 13)

In This Issue

page		page	page
	Swap It! Variable M&E Revenue for Fixed M&E Revenue	Exploring C1 Risk	So Long to 30-Year Treasuries
	by Marshall Greenbaum & Adam. Zivotofsky1	by Thomas Merfeld6	Barclays Investors28
	30-Year Treasury Rates and Defined Benefit Pension Plans	Redington Prize Awarded12	Reader Poll: How Many Scenarios?31
	by Victor Modugno1	What Do You Mean You Are An FRM From GARP?	Understanding Equity Risk Premium
	Chairperson's Corner: General Topics	by David N. Ingram21	by Richard Q. Wendtsee insert
	by Peter D. Tilley2	30-Year Treasury—Trick or Treat	Photos from the Annual Meeting in New Orleans32
	Editor's Note: Will The Fed Someday Run Out Of Easing Room?	Ryan Labs, Inc.24	
	by Nino J. Boezio4	Gambling, or a Competitive Advantage? The Investment Actuary Symposium Looks At Stochastic Modeling	
		by Max J. Rudolph26	

30-Year Treasury Rates and Defined Benefit Pension Plans *continued from page 1*

bond, as published in their Web site. 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.

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 on 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.

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.

“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 30-year Treasury and corporate debt securities.”

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. PBGC⁵ 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, 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 insurance companies⁷ that are currently active in the group annuity closeout

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 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

(continued on page 14)

30-Year Treasury Rates and Defined Benefit Pension Plans continued from page 13

[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 used¹⁰:

<u>Mortality Table</u>	<u>Number of Companies</u>
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 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 charges 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 GATT¹² 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 since the original paper on terminal funding pricing 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 defaults¹⁷ 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.

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 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 insurers net purchase rates for closeouts. I could find no explanation for the anomaly of rates below treasuries prior to 1998 in the attached chart. The strengthening of insurer's mortality assumptions relative to the 1983 GAM would have had the opposite effect. It may be a result of the Safest Annuity Rule¹⁸, 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 is looking at specifically at the interest rates used for the Current Liability, or if they are, it is a secret.

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 seven is much shorter than typical pension plan, with duration of 10 to 20. Also it has limited shelf life, assuming budget surpluses materialize as expected.

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 Mac¹⁹ 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 Web site 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 five years. The Fannie Mae yield closely follows the 30-year swap rate, which on average is about five basis points higher. The correlation between changes in swap rates and agencies is extremely high—0.985 during 1998–99 period which covers the extreme spread widening from the Russian debt and Long Term Capital Management crisis.²¹

The chart also shows that Fannie Mae bond has been close to PBGC rates in recent years. On average during the past five 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 Web site. 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 one year. For example, if three month LIBOR is exchanged for a fixed rate, the LIBOR rate would be reset every three months based upon the rate then in effect for three 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 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 five basis points higher than 30-year FNMA bonds over the past five years.

The use of a single rate, the 30-year swap, instead of pricing off the swap

(continued on page 16)

30-Year Treasury Rates and Defined Benefit Pension Plans continued from page 15

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 show 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 five 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 convexity²⁶ characteristics that are ill

fitted to pension liabilities. Examples include Lehman Aggregate, Merrill Lynch U.S. Domestic Master, and Solomon Smith Barney Broad Investment Grade (BIG).

The BIG index has duration of five and a yield to maturity on 7/31/01 of 5.7%. Solomon Smith Barney also has an index called Large Pension Fund Index that has duration of seven, 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 unweighted average yield of 100 bonds, with average maturity of 30 years, would have a duration equivalent to the long bond, 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 four 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 four years, swap rates have been about .8% higher than treasuries at 30 years. Assuming an average duration of pension liabilities of 15, 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.

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%

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% at 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 rate 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 Principals. 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.

Bibliography

(Note: URLs listed below are as of 8/15/01)

Bloomberg, L.P. www.bloomberg.com

California Insurance Code www.leginfo.ca.gov/calaw.html

Committee on Retirement Systems Research of the Society of Actuaries, “Safest Annuity Rule” *Transactions, Society of Actuaries*, 1997-98 Reports www.soa.org/library/tsareports/1990-9/TSR974.pdf

Congressional Budget Office, U. S. Congress “The Budget and Economic Outlook: Fiscal Years 2002-2011” Jan. 2001 www.cbo.gov/showdoc.cfm?index=2727&sequence=2&from=5

Contingency Analysis, “Glossary” http://www.contingencyanalysis.com/_frame/indexglossary2.htm

Daskais, R. and LeSueur, “An Introduction to Duration for Pension Actuaries” *The Pension Forum* Vol. 8, No.1 (1993). <http://www.soa.org/library/sectionnews/pension/PFN9306.pdf>

Fabozzi, F.A., ed., *Professional Perspectives on Indexing Information Management Network*, New Hope PA (1997)
Federal National Mortgage Association, “Fannie Mae Debt Securities” http://www.fanniemae.com/markets/debt/Cmi/constant_maturity.html

30-Year Treasury Rates and Defined Benefit Pension Plans continued from page 17

Federal Reserve Board of Governors Statistical Release H.15,
“Selected Interest Rates”

<http://www.federalreserve.gov/releases/h15/Current/>
Flemming, M. J. “The Benchmark U.S. Treasury Market: Recent
Performance and Possible Alternatives” Federal Reserve Board
New York Economic Policy Review April 2001
http://www.ny.frb.org/rmaghome/econ_pol/100flem.pdf

Investorwords, “Glossary” [http://www.investorwords.com/
directory.htm](http://www.investorwords.com/directory.htm)

Mercer, W.M. “New Rules for Underfunded Pension Plans”
William M. Mercer, Inc. New York (1994)

Modugno, V. J. “Terminal Funding” *Transactions, Society of
Actuaries*, Vol. 38 (1986)
<http://www.soa.org/library/tsa/1980-89/TSA86V389.pdf>

Moody’s Investor Services, “Default and Recovery Rates of
Corporate Bond Issuers: 2000” February 2001
<http://riskcalc.moodysrms.com/us/research/defrate/63770.pdf>.

National Association of Insurance Commissioners, “Risk Based
Capital” <http://www.naic.org/1rbc/rbcinformation.htm>

Pension Benefit Guarantee Corporation (PBGC) www.pbgc.gov

Retirement Plans Experience Committee, Society of Actuaries,
“RP2000 Tables”
http://www.soa.org/research/rp00_mortalitytables.pdf

Society of Actuaries, “Statistics for Employee Benefit
Actuaries” <http://www.soa.org/library/stats/seb.htm>

Turpin, J.E. and Gebhardtshauer, R. “The Impact of Inordinately
Low 30 Year Treasury Rates on Defined Benefit Plans”
American Academy of Actuaries, July 11, 2001
www.actuary.org/pdf/pension/treasurybonds_071101.pdf

U.S. Code Titles 26 (Internal Revenue) and 29 (Labor)
<http://www.access.gpo.gov/nara/cfr/cfr-table-search.html>

U.S. Department of Labor, “Interpretive Bulletin 95-1”
29CFR2509.95-1 (1995)

http://www.dol.gov/dol/allcfr/Title_29/Part_2509/29CFR2509.95-1.htm

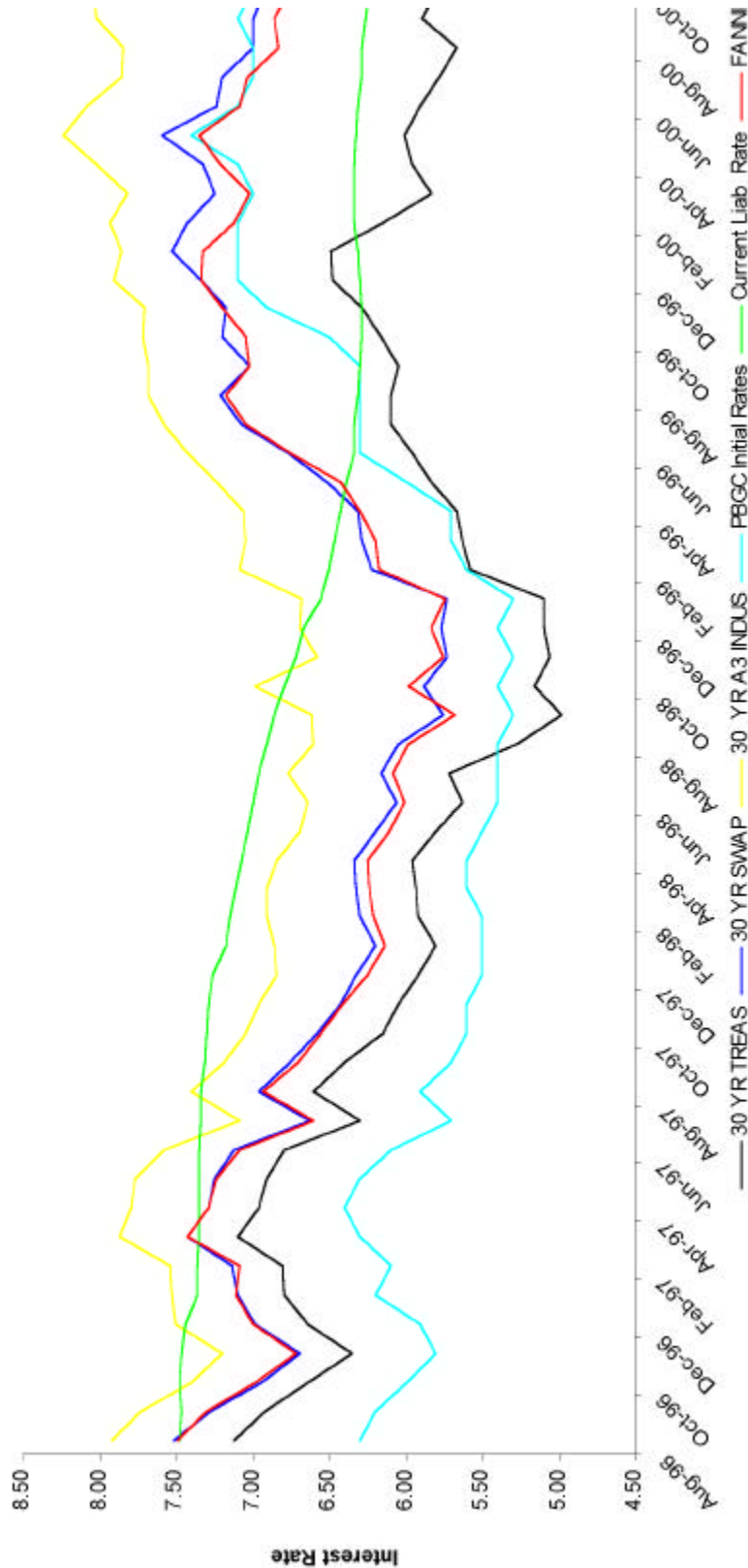
Watson Wyatt, “Choosey Employees Choose Lump Sums!”, *The
Insider* April 2001
http://www.watsonwyatt.com/homepage/us/new/Insider/new/1998/1998_04_02.asp

Working Group On Retirement Plan Leakage, U.S. Dept of
Labor, Advisory Council On Employee Welfare And Pension
Benefits, “Are We Cashing Out Our Future?”
<http://www.dol.gov/dol/pwba/public/adcount/leaknew1.htm>

Endnotes

- 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).
- 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

Comparison of Interest Rates



Sources of Data: Bloomberg except for PBGC Rates and Current Liability rates which are from Society of Actuaries, "Statistics For Employee Benefit Actuaries," and Fannie Mae 30-Year Rates for last day of the month from Fannie Mae Web site. Rates from Bloomberg are mid-market at close of trading on the last day of the month, except for A3 Industrials, which are based upon bid prices. Swap rates are based upon 6 month USD LIBOR. PBGC Rates are setback two months.

(continued on page 20)

30-Year Treasury Rates and Defined Benefit Pension Plans continued from page 19

- 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.
- 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 Moody's; 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"
- 18) 29CFR2509.95-1 U.S. Department of Labor Interpretive Bulletin 95-1
- 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
- 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.
- 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 1983GAM. Thus a group that was predominately female would see a greater reduction in current liability. Average age distribution assumed.
- 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, "Choose Employees Choose Lump Sums!" and Working Group On Retirement Plan Leakage, "Are We Cashing Out Our Future?". For a information on the increase 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
- 34) See for example, California Insurance Code Section 10489.4.