

**RECORD OF SOCIETY OF ACTUARIES
1986 VOL. 12 NO. 1**

**MATCHING OF INSURANCE COMPANY
PENSION ASSETS AND LIABILITIES**

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- o The pitfalls of underwriting group pension funding contracts with significant interest guarantees will be discussed. Insurance companies are faced with concerns in meeting solvency requirements, reducing surplus strain, and managing risk. Methods and procedures that companies are using in evaluating and monitoring risk and in matching assets with emerging liabilities will be highlighted.

MR. DONALD R. SONDERGELD: Our first speaker is Judy Weiss. She's Vice-President and Actuary at the Metropolitan Life Insurance Company, in charge of pension financial areas. She's responsible for the financial management and planning of guaranteed product research and development, asset liability analysis and strategies, pricing policy, and actuarial consulting. She previously was responsible for all pension pricing and underwriting, including Guaranteed Investment Contracts (GICs), closeouts, Immediate Participation Guarantees (IPGs), terminal funding, and other products.

MS. JUDY WEISS: What are some of the key liability risks involved with major pension products offered by insurance companies? My comments focus on this aspect of underwriting GICs and non-participating closeout annuity contracts.

* Mr. Meyers, not a member of the Society, is Assistant Vice President of Aetna Life and Casualty.

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GICs are a major product and source of funds for the insurance industry. An estimate of the amount currently up for bids during 1986 is \$30 billion. Many insurance companies have entered this market in the last few years, seeing it perhaps as a means to fuel rapid asset growth.

The bulk of the funds comes from defined contribution plans -- 401 (k) plans and savings and profit-sharing plans. The typical plan provides for employee contributions with a portion matched by the employer. There are usually two or more potential investment options -- the GIC, employer stock, a diversified stock fund, a bond fund, a balanced fund, and occasionally a money market fund. The typical GIC accepts all contributions and transfers to the GIC option for a one year period, commencing anywhere from a few weeks to a half year in the future, and holds those funds at the guaranteed rate for an additional two to four years, although other periods and terms are available and negotiated between the insurance carrier and the plan sponsor.

In this typical situation, one of the first significant risks is the variability of potential cash inflow during the one year "open window" period. How attractive will the rate quoted, perhaps in the early fall, appear to employees when they make their decisions to contribute or transfer funds to this option at any point or points during the following calendar year? Generally, a single rate is credited to all funds in the GIC option, which represents a blend of rates on different contracts with one or more insurance companies. Occasionally, the plan maintains interest rate cells which credit separate rates to employee funds based on the year in which contributions were made. For the plan being bid, will the employees participate directly in the quoted rate, or will it be blended with previous GICs into a single rate that may be higher or lower than currently available interest rates? How will the rate the employees are offered compare with expected performance in the other options under the plan?

Perhaps past experience can be of value in predicting GIC cash flow. If there is sufficient historical experience and it shows a consistent pattern, an expectation of the coming year's cash inflow can be established.

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However, changes in economic conditions, particularly for the industry and company involved, can dramatically change plan cash flows. Are employees likely to be laid off, or plan benefits cut back? If so, a drop in contributions could be expected. Is the company a takeover candidate, or has some other factor driven up the value of company stock? Perhaps the employees will decide this is a good time to lock in appreciation and transfer from employer stock to the GIC. The exposure in this instance could be tremendous, given the relative maturity of plans today, which may have accumulated amounts of hundreds of millions of dollars or more in each of the GIC and stock options, while annual net cash flow to a new contract may recently have been running at only \$10 million or \$20 million per year. One might be very surprised to find cash inflow resulting from transfers two, three, or more times the original expected amount. Now imagine this happening in the 1985-1986 interest rate environment.

If the plan is small, cash flow is generally likely to be more variable and subject to swings as employees who all work together discuss and share similar economic situations and expectations. New plans, of course, have no historical experience, and the first year cash flow depends on the effectiveness of employer communication of the plan and its options, the success of enrollment, the economics of the employee group, and other factors. Some pre-commitment sampling of employee reactions or other techniques may help narrow down the "guess" at what the cash inflows will be for this new plan.

Just as there are risks in predicting the level of cash inflows, so too there are risks in predicting the level of employee withdrawals and transfers to other funds. The plan provisions, the nature of the employee group, and the design and timing of employer communications all play significant roles here. Also, concerns with the financial health of the company, and the possible impact of massive layoffs or early retirements, are other risk factors.

Is it a small plan where the employees are more likely to act nearly in unison in deciding to transfer out of their GIC funds? Is a major portion of the plan's funds controlled by a small group of senior level plan participants? Are there other investment options which invite antiselection, such as money market funds? In a cell year plan, is there a way for the employee to

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effectively transfer from a lower yielding GIC cell to a higher yielding one? Does the design of the loan provision encourage antiselection? Low plan loan rates may encourage borrowing when rates are high and the funds can be temporarily invested outside the plan at an attractive net after-all-taxes rate. Conversely, if the plan design has the employee pay the interest back to his own account, high rates which are tax deductible may be very attractive.

How can the insurance company reduce or control the level of risks? One way is through careful plan underwriting and contract design. A common example is the refusal of many insurers to underwrite plans with direct transfers between a money market fund and the GIC option. While this is a helpful limitation, it does not alleviate the risk on allocations of contributions during the open window period. Clearly, if short term rates rise above the level of the GIC rate, current or blended, the new contributions will be directed to the money market fund, leaving the insurer with asset commitments for liabilities that never materialize and which now have a market value less than the book value. Conversely, if rates fall, all the contributions expected to be directed to the money market fund will now come to the GIC, without sufficient asset coverage. Also, a prohibition on direct transfers may still not prevent "wash through" transfers. In this situation, say an employee who is 50% in the GIC options and 50% in stock wants to move his GIC funds to the money market fund, but instead transfers his stock funds to the money market fund and the GIC funds to the stock fund, accomplishing the same result. Even if the plan or contract prohibits this type of transaction, can the plan administrator effectively enforce the prohibition, and can the insurer verify the enforcement? As a result of these concerns, some insurers refuse to underwrite plans with money market funds under any circumstances.

Similarly, insurers may restrict the allowable maturity mix of a bond fund, or the percentage component of bonds in a balanced fund. Care in the writing of plans with individual interest cells is called for, for the reasons I described earlier. Careful review of loan provisions is also of importance.

A review of the industry and company can be of great value as an indication of potential developments which may dramatically affect cash flow. A company in

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the newspaper as a takeover target or a strike target, or expecting layoffs or cutbacks, or in an industry facing these trends may be riskier than usual.

In order to reduce the risks through plan underwriting, the insurer should of course obtain all the pertinent information. As is obvious from the examples described, this includes a complete description of the plan, including contribution amounts; investment options; transfer, withdrawal, and loan provisions; makeup contribution provisions; method of crediting interest to employees; current rate or rates to employees; GIC maturity structures; percentage of participation in the plan; recent plan cash flow experience; projected changes in the plan or employee population; financial health of the company and industry; recent performance of the other investment options; and the plan sponsor's forecast of likely results.

In addition to careful plan underwriting, the contract design may have protections built in. The total receivable contributions may be limited, or the open window may be shortened. The contract may be partially participating, with the rate tied to some index or actual experience based on receipt of contributions. Withdrawals at book value might be restricted, or limited to some maximum amount. Interest might be paid out during the contract life to handle expected liquidity needs. The contract may guard against unfavorable changes in the plan provisions or its administration. Even with careful plan underwriting and contract design, the predictability of inflows and outflows is usually subject to significant variability.

Looking now at the non-participating closeout annuity contract there are many different risks. These contracts are used for plan terminations and reversions. The insurer assumes the liability for a complex plan, or multiple plans. A tape of participant data is sent, which for administrative reasons is of necessity out-of-date, and may contain errors. The insurer then has 3 or 4 weeks to price the case, at least for the first of a number of potential rounds of bidding, which may involve hundreds of millions of dollars.

What are the special risks in this product? The mortality risk, including breakthroughs as well as general improvements, is perhaps one of the least appreciated risks of the consumers of this product. Is it inconceivable that

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20 or more years from now mechanical devices will be keeping annuitants alive for extended periods? Will cancer be cured or prevented? Will technology be developed and become generally available to keep otherwise terminally ill individuals alive indefinitely, awaiting future cures?

Interest rate risk often arises from the need to cover deferred lives with average ages as young as 35 - 40. In pricing the product, how much reinvestment risk should be taken? If this product is managed in conjunction with shorter duration products, how much convexity risk should be taken?

In the closeout product, the options are given to the employees in the form of benefit and the commencement date of annuity. The early retirement risk is a major risk. Subsidized early retirement reduction factors can add 10-50% to the cost of deferred lives.

How can early retirement experience be predicted? Each plan is different, and the experience of other plans is not a reliable predictor. Experience will be influenced by the richness of the basic benefit, the degree of subsidization in the early retirement reduction factors, the nature of the employees, current economic conditions, and other factors.

Will the last 3-5 years' experience under a plan be a reliable predictor? What about the financial health of a company and industry? Is the customer a likely takeover target? Can layoffs or early retirement incentives be expected? If this risk is assumed by an insurer, is the answer to this last question likely to be different than it would have been if the cost would have been borne by the plan?

Does the plan allow for lump sums? If so, what's the likely experience from this option, especially when compounded by subsidized early retirement? It would not be surprising to find that 90% or more of active lives choose a lump sum if given a special option at the time of plan termination. In this situation, what factors are used to determine the lump sum equivalents? Is this a risk of the insurer, or will the amounts be paid outside of the contract?

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When the employer takes 6 months or a year after the sale to bring the data up to date, how closely do the data resemble what you originally quoted? Is the final price 5%, 10%, 20% more, or less, than the original bid? How have interest rates changed in the meantime?

What changes might there be in the law in the future that might impact these contracts? Consider unisex requirements and their impact on optional factors for items such as joint and survivor benefits and term certain benefits. How about requirements that lump sums cannot be calculated on bases less favorable than Pension Benefit Guaranty Corporation (PBGC) rates? How is the PBGC going to change its rate bases in the future? Perhaps portability legislation will force the availability of lump sums. Could there be a law in the future which requires benefits to be indexed to inflation? Does your contract wording protect you completely against these and other possibilities?

How strong is your administrative capability? Can you handle these complex plans and their options, including employee interaction and reporting requirements, for the next 20-30 years? When you are long gone and a deferred annuitant currently 35 years old becomes 61 and asks what his various options are, will your company be able to accurately reflect the plan and contract provisions? If there is a third party payor, can you insure that the payments are made in accordance with your contract? Are deaths reported promptly? If you use electronic fund transfers to make payments, at the death of an annuitant will the spouse realize that he or she is no longer entitled to the payments automatically being deposited into a joint account each month with no signature required?

These are some of the key risks involved with GICs and closeout annuity products offered by insurance companies. Some are hedgeable or partially hedgeable. The amount at risk can be limited or controlled by careful underwriting, well drafted contracts, limitations on exposure, well planned and executed administrative procedures and a willingness to recognize and refuse to underwrite situations involving potential unsound design or pricing in the market.

MR. SONDERGELD: Kent Meyers joined the Aetna Life and Casualty fourteen years ago. Kent is Assistant Vice President in the Pension and Financial

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Services Division. The first ten years at the Aetna he was in its Financial Division with his duties spread among corporate finance, real estate investment, and investment planning and strategy. The last four years he's had responsibilities for GIC and other guaranteed product management, including investment strategy and risk management. He's also responsible for pension and financial services planning and earnings reporting.

MR. KENT L. MEYERS: My actuary friends tell me that the difference between an insurer and a speculator is that an insurer pools risks and a speculator takes risks. If that's true, I don't believe there are many, if any, pure insurance companies. In almost any insurance market there is some degree of speculation. Even in basic life insurance, we pool mortality risks but take a gamble on catastrophic events and general mortality trends. Thus, I view the insurance business as a continuum between pure insurance on the one hand and pure speculation on the other hand, and where we fall along that continuum determines the volatility of our earnings and our financial stability in the amount of surplus that notionally should be required to support the business we have written.

These concepts are quite familiar on the insurance side, but only recently has the actuarial community begun to focus in a disciplined way on the same assessment of speculative risks on the asset side of the balance sheet. Judy has discussed liability risks in the GIC and closeout markets. My task is to talk about asset risks. My intent is not to provide a detailed analysis of call option pricing theory or historical default ratios on junk bonds, but to provide an overview of the types of risks involved in guaranteed portfolios and what is required to assess and manage those risks.

Asset yields are notionally made up of a number of subcomponents. The basic yield, or as it is sometimes called in the literature, the default-free or risk-free yield, is generally assumed to be the yield on U.S. Treasuries at the desired maturity. When we purchase other instruments besides Treasuries we should obtain some additional yield for the quality or the potential default risk of the issuer, for any call options that may be granted on the security, for the marketability of the instrument, and lastly, for the structure.

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It is in these last two areas of marketability and structure that insurance companies have gained a franchise and have added value to the marketplace through real estate mortgage and private bond placements. Both of these markets require additional expense beyond the public markets because they require a highly trained staff of investment professionals to understand, underwrite, price, and negotiate deals which meet the specific needs of the borrower. Our experience as an industry has been that the extra yield obtained has sufficiently exceeded the expense required to make it worth the effort.

The other two yield add-ons represent at any given time the market's assessment of the risk associated with a particular security. I'd like to focus my remarks in this area. When we are matching assets against liabilities, it is crucial to understand the possible effect of asset risks on the projected cash flows relative to the liabilities. The various asset risks which may be incurred can be categorized into two broad areas.

First, there are changes in the timing of the cash flow, which I will refer to as duration risk. In this situation the asset cash flows occur at a time other than that in which they were needed to meet the contract liability. No explicit loss is incurred on the asset, but the duration changes and creates an interest rate risk which may not have been anticipated. In this example we are exposed to interest rates being low at the time the asset cash flows occur, causing a shortfall in interest earnings as the proceeds are reinvested at the lower rates.

The second area is changes in the amount of cash flows, which I will refer to as yield risks. Such changes reduce the total yield achieved on the investment and consequently reduce the profits.

Each of the risks that we're going to talk about fits into one or a combination of both of these risk categories. I stress this very simplistic approach to asset risks because in managing a portfolio of guaranteed products, every risk, every decision, every portfolio move will affect either the timing or the amount of cash flows, or both. Analyzing potential cash flow changes is the simplest and most straightforward approach to assessing such risks.

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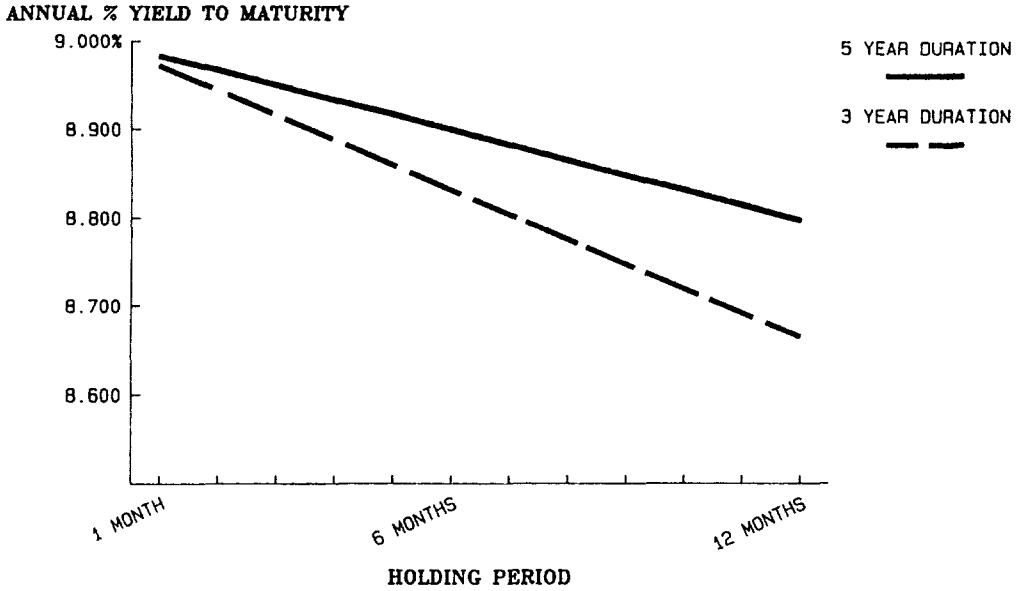
The first area that I would like to address is the risk of holding surrogates. When I speak of surrogates, I speak of the approach that many of the asset liability managers use to try to lock in a given interest rate level when there aren't enough of the permanent investments that they would like to purchase at the time that cash flow is received. For example, they may purchase Treasuries of the desired maturity and hold them until more permanent investments can be obtained. Assuming that nothing else changes, when the Treasury is sold, the capital gain or loss on the Treasury in combination with the yield on the new investment purchase should provide a total yield that's comparable to the initial objective.

This strategy exposes the portfolio to two risks. The first is that the volume of permanent investments does not develop as we expect, and we end up holding the surrogates for a longer than anticipated period of time. When we have protected ourselves from duration risks we are subject to some yield risks. Chart 1 shows how the yield to maturity over the entire duration of the investment will change based upon the holding period of the surrogates. The bottom line shows the impact on a three year duration investment and the top line, the effect on a five year duration investment. For both of these, the surrogate is assumed to yield a hundred basis points less than the target investment. As you can see, even a three month holding period on a three year duration investment would cut profit margins by ten basis points. In the GIC market, where profit margins are slim, such a cost cut can be substantial.

But the greater yield risk from surrogates is in changing yield spreads. The target investments we want to ultimately hold in the portfolio will change in yield on a day to day basis relative to Treasury securities. Chart 2 shows two indicators of changing yield spreads over the past year. These spreads are smoothed somewhat from actual experience because they reflect only average spreads for a given month and do not indicate the volatility within the month, but they serve the purpose. The top line shows the difference between GNMA yields and the yield on ten year Treasuries. The bottom line is the difference between an intermediate industrial index and the 7-year Treasury. In each case, you can see that the purchase of surrogates exposes the portfolio to losses or gains of 10 or 20 basis points or more over a relatively short period of time.

CHART 1

EFFECT OF HOLDING SURROGATES*



* 100 BP YIELD GIVE-UP

YIELD SPREADS



CHART 2

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The same risks are there whether you buy Treasuries or whether you invest in short terms or buy futures. Even greater volatility could be experienced between different instruments other than Treasuries. For example, if we had purchased GNMA's as a surrogate for industrial bonds we could have experienced spread changes of 40 to 50 basis points in the course of a month. Such changes could wipe out not only profit, but some expense margins as well. Pricing must consequently make adequate provision for any surrogates used.

In summary, the larger the surrogate position, the greater the risk that you will have to hold the surrogates longer than you expected, and the greater the risk that the yield spreads will change adversely.

The second and more commonly understood risk is that of asset default. I'm not going to dwell long on this topic, but would like to make a few important points. When a bond or mortgage defaults, four generalized results can occur:

1. The problems are solved, the loan is reinstated with full interest, and everything's fine.
2. A prepayment at par is negotiated, including interest due.
3. The loan is repaid at less than par and/or with the loss of accrued interest.
4. The loan is renegotiated, usually with a lower yield and a longer maturity.

The impacts of these various resolutions are shown on the right of Chart 3 and range from no impact other than a temporary cash flow change to changes in both duration and yield.

Two thoughts are in order. First, I believe we have focused in the past solely on the yield risk of defaults. Sometimes the duration risk can in fact be greater, but it has been buried in the normal portfolio rollover. History shows that the greatest default risk and the greatest experience on defaults do not occur when interest rates are high and you can reinvest those funds at high

DEFAULTS

RESOLUTION	→	IMPACT
1. REINSTATED WITH FULL INTEREST	→	1. NONE (temporary cash shortfall)
2. REPAID IN FULL AT PAR	→	2. SHORTENS DURATION (similar to call)
3. REPAID AT LESS THAN PAR	→	3. SHORTENS DURATION, REDUCES YIELD
4. RESTRUCTURED	→	4. LOWERS YIELD, MAY CHANGE DURATION

CHART 3

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rates, but instead they tend to happen after interest rates have already fallen. Weaker companies, forced to borrow at high rates to fund their capital needs, find themselves unable to carry the high debt burden over the business cycle, and the result is that payoffs and workouts tend to occur when reinvestment rates are low.

The second point is that most companies' investment and accounting systems never highlight restructures or renegotiations. They may show up as a prepayment of the old loan and a new investment at a low yield, but more likely they just show up as an unexplained reduction in investment income. They don't show up in default statistics, non-admitted income reports, or new money rates. Our pricing, based on historical data, will never reflect them. They consequently creep in as a gradual erosion of profit for which no one is accountable.

Adequate pricing for defaults requires thorough review of historical results by type of assets and by quality. To be complete, this review must include the results of renegotiated rates. In addition, we have to continually ask the question whether historical results will hold in the future. A case in point is junk bonds. Some carriers have purchased significant volumes of what are euphemistically called high yield securities to back their guaranteed portfolios. This has been done based on very valid historical studies which show that yields on these securities have more than compensated for default experience. We might, however, ask ourselves these questions:

1. Does an order-of-magnitude increase in the total volume of junk bonds in the market today change the potential risk from historical experience?
2. Has market demand bid down the yield differential relative to historical spreads for the same quality?
3. In our pricing, who is being compensated for the added risk: the GIC purchaser or the issuer?
4. If the purchaser is being compensated, does he know the added risk to the carrier and consequently to the value of his security? In other words, is the purchaser buying a BBB GIC, thinking its AAA?

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5. Have we adequately provided surplus to accommodate the added risk?

A further feature of junk bonds is very poor call protection and possibly no call protection at all, and this leads us to the next asset risk.

Salomon Brothers has dubbed 1986 "the year of the call," with up to \$28 billion of utility bonds alone likely to be prepaid this year. Asset calls are the flip side of surrenders on a single premium deferred annuity. With the asset, the option is instead to prepay prior to maturity with a fixed premium (akin to a surrender charge). As some SPDA issuers found out a few years back, the action occurs when it hurts you the most.

Some bonds have some added protection against calls in what is termed a refunding provision. For example, a 10-year loan may be callable after five years, but not refundable for eight years. This means the loan may only be repaid from internally generated funds after five years, but cannot be refinanced from external funds until eight years. Someone felt that this added protection was worth a great deal. Unfortunately, such refunding provisions are difficult to enforce, particularly when a 700 or 800 basis point advantage adds incentive to creativity.

When an asset calls, we experience a sudden shortening of duration, almost always when interest rates are low. Consequently the effect of call provisions is to limit the price appreciation on a bond when interest rates fall. As market interest rates move lower than the coupon rate on the bond, no one is willing to pay more than par plus the call premium, in this example 100 plus a 6% premium, or 106. The result is that selling a callable asset after interest rates have fallen provides little, if any, improvement over an actual call. I was asked a few weeks ago by a reporter what companies could do to manage the emerging call risk. My response was a little facetious, but reflects the reality of what holders face: companies simply turn the clock back a year or so and buy non-callable bonds.

Those who were attracted to the extra yield of a callable asset in a 12% market now in a 9% market realize they were receiving a risk premium. If they gave away that premium to the GIC purchaser, they have nothing to show for the risk

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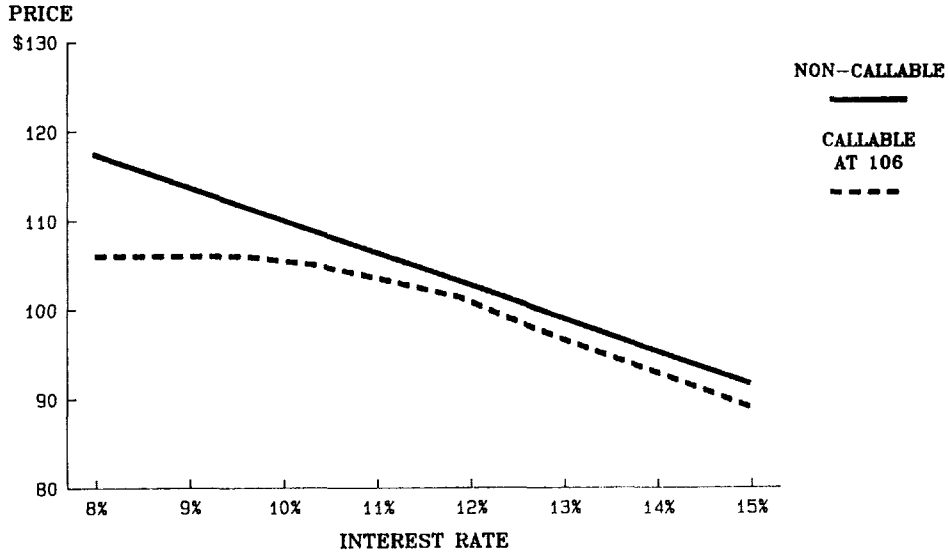
but an assured loss. They now need \$112 to buy a non-callable bond at 12% and have only \$106 to do it.

GNMAs and other mortgage pass-throughs are a special case of callable securities. The call premium is large, as evidenced by 100 or even 200 basis point spreads between Treasuries and GNMAs. The risk is also large, as some pass-throughs with 13% coupons are now experiencing prepayments of as much as 50%, with no premiums.

The impact of calls on a GIC portfolio is graphically illustrated in Chart 4. The solid line represents the present value of assets less liabilities on a portfolio where the duration of the assets is slightly longer than the duration of the liabilities. With such a portfolio, we would expect higher profits as interest rates fall. If, however, the portfolio has securities open to call, profits will flatten, as indicated by the dotted line, and then fall as interest rates continue to drop. Unfortunately, the losses are relatively permanent. They could only be recouped by taking another bet: holding all the call proceeds in short term and hoping interest rates rise quickly. This is known in gambling circles as "doubling your bet."

GICs and close-outs are sold on various tight margins. There is little room for error. To make money you have to know precisely what risks you're taking on both the assets and the liabilities, what you are being paid for those risks and how experience is developing. This requires more than a quick and dirty PC program you whipped up over the weekend. The key is a solid data base together with sophisticated enough applications to monitor experience, to forecast cash flows and perform "what-ifs" under varying scenarios. The data base must be impeccably accurate for both assets and liabilities -- accurate in terms of balances, maturities, yield, payment schedules and call provisions. Such accuracy requires proper input controls, edits and ongoing controls against accounting systems. It does not come cheaply or quickly. Without such capabilities the analysis and the managements of risks that they measure, the GIC issuer is like the vacationing blackjack player in Las Vegas. He wins some and loses some, maybe even winning big once or twice as he dances with "Lady Luck." Eventually, though, the house will win. The only way to beat the house and consistently make money at the GIC table is to be a "card counter." You know

EFFECT OF CALL ON PRICE CHANGE
12% COUPON BOND -- 5 YEARS TO MATURITY



PANEL DISCUSSION
CHART 4

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the odds, you watch carefully and you stick to the program that sends you home with more than you came with. That is the real difference between the business of insurance and the game of speculation.

MR. SONDERGELD: Klaus Shigley is a Second Vice President at the John Hancock. He's held many different positions in the Group Pension Department. He's now manager of the non-participating Group Pension product line. Products include GICs, single premium annuity close-outs, and allocation services for defined contribution plans. Functions include pricing, underwriting and the processing of benefit payments.

MR. KLAUS O. SHIGLEY: First, I want to pick up a little bit where Kent left off and expose you to the results of an option pricing model for the purpose of clarifying some of the options that we put into our contracts. Slide 1 gives you an indication of some of the things that Kent and Judy were talking about and the things they mentioned, callable bonds, default or mortgage loan commitments that fall through, transfer of funds into GICs, transfers out of GICs, loans, and increase or reduction of contributions.

SLIDE 1

Financial Options in GIC Contracts

<i>Contract Feature</i>	<i>Option</i>
A. Assets	
1. Callable Bond	Written Call Option
2. Mortgage Loan Commitment	Written Call Option
B. Liabilities	
1. Transfers into GIC	Written Call Option
2. Book Value Transfers from GIC	Written Put Option
3. 401(k) Loan Provision	Written Put Option
4. Reduction of Contribution	Written Put or Call Option

I've taken each of these contract features and transferred it into an option type terminology. Written means somebody else has the right to exercise the option. A call is the right to buy, and a put is the right to sell. Second,

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I'm going to examine a matrix of risk management strategies, including various asset liability matching strategies, and talk about the associated implications for surplus and capital requirements, which I hope may explain some of the various GIC rates that we've all seen.

Why do I want to talk about options? I think that a lot of actuaries still think of options as financial instruments, when in fact options should be well understood by every actuary in product development or pricing. The other reason I think options need special emphasis is that so many of the risks that are in our contracts can be quantified in terms of options in an option model.

I don't think I need to convince you that the price of asset calls is significant. It's less clear, however, on the liability side that options are real and that they have financial value. Slide 2 lists cash flows from a large New England bank showing five different investment options in a series of years. In 1981, when short term rates were extremely high and yield curves were inverted, there wasn't money being transferred from the Money Market into the GIC; that pattern was reversed in 1983, when money came out of the Money Markets and went into the GIC. To put this into perspective, the amount of transfer was roughly equal to the gross contribution going into this plan, so this gives you some feeling for the amount of variation that you can expect.

SLIDE 2

Breakdown of Flows

Transfers

	<i>1981</i>	<i>1982</i>	<i>1983</i>	<i>1984</i>
GIC	(1,674,028)	(187,122)	5,454,985	3,271,486
Stocks and Bonds	(313,569)	(1,576,928)	322,235	(2,593,420)
RE	(20,239)	139,913	113,577	(61,638)
Money Market	2,023,565	1,664,305	5,248,710	626,258
C.S.	(15,729)	(40,168)	(642,087)	(1,210,674)
Commercial Paper %	18.50%	13.25%	8.63%	10.00%

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The other noteworthy thing about this pattern is that selection isn't completely efficient, although that's not obvious because you don't know what other plan provisions are, such as frequency of switches and any limitations on the direction of switches. Another interesting thing about this plan is that the data come in a form that allows for a decent cash flow underwriting. For this particular plan, the data were received in terms of gross contributions, gross withdrawals, transfers, total funds and composite rates. It illustrates the kind of data that you need to do some intelligent plan underwriting.

Slide 3 quantifies what the cost is for some of the options. We assume in this case that interest rate is a random variable or that the change in rates is a random variable with a log normal distribution, and this allows us to calculate the value of a call option. The bond is a ten-year bond with a non-call yield to maturity of 10%; it is callable after five years at 105, and the call premium declines to zero after 10 years. When volatility is zero, the value of the call option is zero. This explains the design for many of the products that we have in the insurance industry; for so many years we lived through somewhat stable interest rates, and as a result, I think we packed our products with a lot of free-options. Life insurance has many examples, the 30-day free look and the cash value pay-outs. As volatility increases, the price of the option goes up. Recently we experienced volatility greater than the 19% which is at the bottom of this slide. The value of the call option on this bond is \$1.69 per \$100, and converted into basis points, is 27 basis points.

SLIDE 3

Quantifying the Effect of Call on a Standard 10-Year Bond

Coupon - 10% Noncallable YTM = 10%
Call Provision: After 5 Years at 105, Declining to 100 at 10 Years

<i>Volatility</i>	<i>Call Option Value (\$)</i>	<i>Effect on YTM (Basis Points)</i>
0	0	0
12	.45	7
16	1.10	18
19	1.69	27

PANEL DISCUSSION

The other application that is useful for an option pricing model is that to the extent that the option has a value, the change in rates or a change in interest rates will affect that value, so that the option on an asset has an important effect on the duration of that asset. This is what makes an option pricing model an indispensable asset liability management tool.

On the liability side, we also have options. As with the bonds, the value of the option on the liability side also varies with the volatility. But it also varies with the degree of efficiency with which the options are exercised in the plan. Slide 4 quantifies the value of the right to make book value withdrawals under a four-year GIC. Assume that no decisions are made for changes in interest rates less than 1%, so there is a 1% corridor where employees don't make any moves.

SLIDE 4

Quantifying the Value of Book Value Withdrawal Options on a 4-Year Compound GIC 1% "Corridor"

Option Cost in Basis Points

<i>Exercise Efficiency</i>	<i>Volatility</i>	
	<i>12%</i>	<i>17%</i>
5%	8	19
10%	15	36
25%	33	72
50%	55	111

Even with low rates of efficiency for exercising options over long periods of time, these options can be expensive; furthermore, if the window of opportunity is long enough, the percentage of employees who act efficiently tends to increase. It is pretty difficult to quantify the efficiency factor. However, it is clear that it is a function of plan design features, such as loans, frequency of switches, limitation on the direction of switches, the number of options, the types of options, the potential for layoff and the length of the

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window. To wrap up the discussion on options, let me give you a couple of references. There is a paper by Bob Clancy in the *Transactions* which is called "Options on Bonds and Applications to Product Pricing." A paper by Jim Tilley, "Risk Control Techniques for Life Insurance Companies," has some applications for SPDAs.

The other theme I want to develop relates to the choice of strategies for asset liability matching. We have all scratched our heads and said to ourselves, "How can I possibly compete with these crazy rates, or what is it I am missing? The margins can't possibly be that thin, or why are AAA companies raising money at AA rates?" There really isn't much of a secret to why there can be 100 or more points on a spread between different carriers.

We can explain 20 or 30 points on the basis of economies of scale. Anything wider involves different philosophies respecting what we have called the C1 Risk, C2 Risk, C3 Risk and C4 Risk. The C3 Risk is the interest rate risk, C1 Risk is the credit risk, C2 is the insurance risk. In GIC pricing, I think the C2 risk might relate to the degree of efficiency with which prime participants exercise their options. C4 risk is a political risk, and I think many of us have taken some C4 risks in the past when we have made certain tax assumptions. These tax assumptions are basically under attack now and have been eroded somewhat over the last five years. The C1 risk is real. Texaco, for example, is a household name. We could probably get Texaco for 500 or 600 basis points over Treasuries. We had Seabrook Nuclear Power Facility, which was at one time going about 800 points over Treasuries. There are some real choices to be made with regard to the C1 risk. Collectively, we all fit into some combination of C1-C3 risk that we take. I want to concentrate a little on the C3 Risk, which is easier to model and really the subject of this panel.

We all know what cash matching is, and we all have an idea of what mismatching is. I can assume that we know what duration is. The limited bet option on the C3 spectrum means betting on whether rates will move up or down and positioning the portfolio to cash in for such a move. It is not, strictly speaking, correct to distinguish between duration matching and limited bets, because duration matching involves a second order bet on the volatility, not the direction of interest rates. If you want to make yourself indifferent to large

PANEL DISCUSSION

or volatile rate moves, you need to match convexity, and that is the duration/convexity strategy within the spectrum.

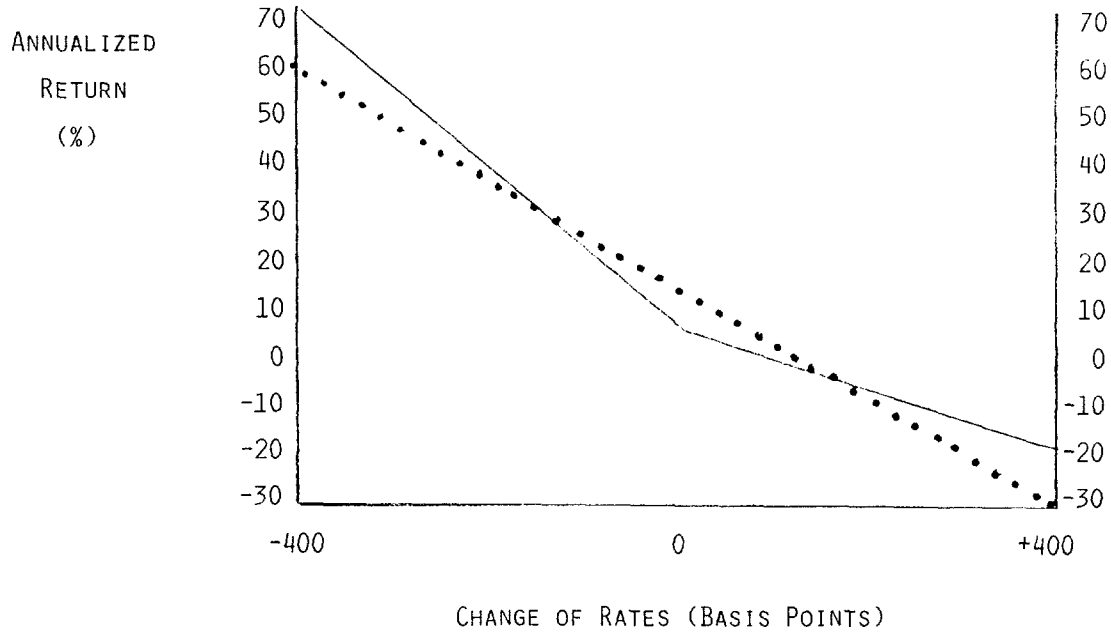
Slide 5 is from a paper by Richard Clotts of Salomon Brothers entitled "Convexity of Fixed Income Securities". It illustrates the point about making a bet on volatility. The solid line represents a barbell portfolio, and the dotted line represents a bullet bond. The assumption is that yield curves are positive. Where there is no move in rates -- that is, where volatility is small -- you are better off with the less convex bond. If rates move, you are better off with the more convex bond. The convexity is like price functions, and the price function for a more convex instrument is steeper than the price function for a less convex instrument. The giveup for low volatility is that there's less rate in the barbell than there is in the bullet.

One other problem with not matching the convexity is something called duration drift, and I think Kent touched on that. The duration of the bonds tends to change with time at different rates.

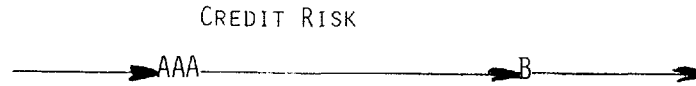
An important point is that it is all right, and not inherently evil, to pick any strategy. We have a matrix of risk management strategy. Slide 6 shows a spectrum of C3 risk and a spectrum of C1 risk. If you create a matrix with C3 on one side and C1 on the other side, what you have instead of a one dimensional view of each spectrum, is a matrix of risk management spectra. You could have a high cash match and a low C1 risk, and that would fit into one corner of the risk spectrum, or you could opt for a very large risk on both the cash matching and on the credit spectra. In the financial services industry, we have the investment bankers, who take very little risk in terms of cash matching and credit risk, and at the other end of the risk spectrum we have finance companies. Finance companies will tend to take some matching fund risks, and they also tend to take some credit risks.

The important point to keep in mind here is that in a fair game, each bet has a winner and a loser, and at a minimum you want your expected value to be zero. Therefore, unless you have inside information, your product ought to be priced to include the cost to get matched or be close to it, and that means that in your pricing you have to provide the cost to buy the options to offset any

DURATION CONVEXITY
BAR-BELL VS BULLET OVER 6-MONTH HORIZON



COMBINATION OF RISK MANAGEMENT STRATEGIES
 THE FINANCIAL MARKET PERSPECTIVE



C-3 RISK
 CASH MATCH
 DURATION/CONVEXITY
 DURATION
 LIMITED BETS
 MISMATCH

INVESTMENT BANKERS (LOW RISK)	COMMERCIAL BANKERS (HIGH RISK)
SAVINGS BANKS (HIGH RISK)	FINANCE COMPANIES (VERY HIGH RISK)

PANEL DISCUSSION
 SLIDE 6

MATCHING INSURANCE COMPANY PENSION ASSETS AND LIABILITIES

convexity risks that you assume. It is my guess that with respect to the C3 risk, there has been an element of "heads you win, tails I lose" within this industry.

The other constraint to choosing a strategy is the potential effect on solvency, or the ability to pay claims to policyholders. To dramatize the implication of adopting a risky strategy, I have chosen to model an extreme version of a limited bet.

Slide 7 is an extreme example of a limited bet. This is an example of doing a two-year mismatch; the assumed volatility here in interest rates was 12%, and the graph shows the returns with a 95% confidence limit. Slide 7 is sensitive to certain assumptions. Volatility here is at 12%. At 17%, the compound negative return at the 95% confidence level of minus 207 drops down to a negative 3.3, so as I change my volatility assumption, the compound negative return at the end of the fifth year goes to over minus 3%. This modeling is also sensitive to the mismatch that we assume. Slide 7 shows the results of a two-year mismatch under a one-year mismatch. At the end of the fifth year, we get minus .75% compound negative return. Over a five year period, a strategy of consistent two-year mismatch, which is extreme, at a 50 point boost in yield would require roughly 10% equity to avoid insolvency, not to mention stockholder uprising. Looked at another way, if we allocated \$5.00 of equity per \$100 of liability, our two-year mismatch strategy would develop a large number of negative return on equity curves within the 95% confidence limit, as indicated in the lower half of Slide 7.

It should be noted that this, again, is a pretty extreme mismatch, and I think most Boards of Directors wouldn't accept this kind of strategy. A riskier strategy requires the allocation of more capital to avoid an insolvency and maintain borrowing capacity, and indirectly this is the position that the New York State Insurance Department takes when it requires a reserve certification as a condition for using the weaker of two reserve standards.

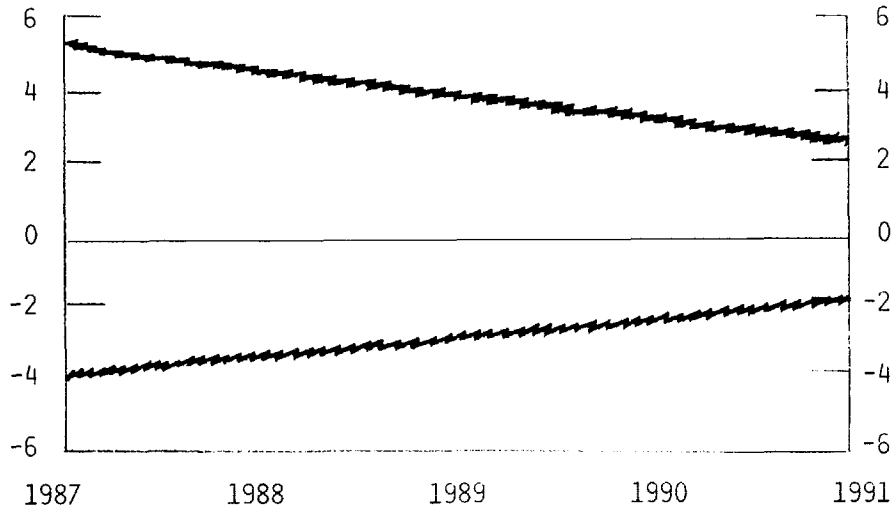
Slide 8 shows how the financial services industry has evolved to deal with the risk versus return choices inherent in the selection of risk management strategies, and this will also begin to answer how you can have a spread of 100 or

RISK-RETURN EXPECTATIONS

CUMULATIVE ANNUALIZED RETURNS
(ASSETS LESS LIABILITIES) FOR 2-YEAR MISMATCH

ASSUMED: 12% VOLATILITY IN TOTAL RETURNS
95% CONFIDENCE LEVEL

ANNUALIZED
RETURN
(%)



SLIDE 7

PANEL DISCUSSION

MATCHING INSURANCE COMPANY PENSION ASSETS AND LIABILITIES

more points for the same product within the industry. What Slide 8 says is that there exist Triple A Investment Banks with 2% to 3% equity to asset ratios, but the reason they can get away with these ratios is that they tend to take a low risk strategy. There exist Triple A Finance Companies with 10% to 15% equity to asset ratios, and they may take a high risk strategy, mostly credit risk. A lot of Savings and Loans are capitalized at 4%, and we've all concluded that that's an inadequate level of capital for the mismatch risk that they took. Commercial Banks are required to hold about 6% equity to asset, and they are losing market share to investment bankers and foreign banks which have less equity in their capital structure. I think that this equity ratio explains what's happening with GIC rates. Companies with strong asset-liability matching constraints and strong quality constraints are competing with higher risk strategies that are insufficiently capitalized, which means that their profit margins are too thin.

Let's see on Slide 8 how the equity requirements begin to explain differences like 100 basis points. Assume Company A takes a lot of credit risk and that it notionally allocates 10% equity to its product line, and assume that it has a 15% return on equity bogey. That would mean that this company needs to take 200 basis points out for profit margin, because as you change the 10% return on equity to 15%, each of those numbers doubles, so Company A would need 200 basis

SLIDE 8

Equity to Asset Relationship Based on Typical Risk Strategies

<i>ROE (BPS)</i>			
<i>1%</i>	<i>10%</i>	<i>15%</i>	<i>Financial Institutions</i>
2%	20	40	Investment Bankers
4%	40	80	S & Ls
6%	60	120	Commercial Banks
10%	100	200	Finance Companies
15%	150	300	Leasing Companies

PANEL DISCUSSION

points to compensate itself for that kind of risk at a 15% return on equity bogey. Company B, which takes the same credit risk and has the same equity, but with a 10% bogey, would only need to take out 100 points; the difference between those two would be 100 points. Company C, same credit risk, inadequate equity at 5%, would only need to take out 50 basis points, and you have a difference of 150 basis points between Company A and Company C. To the extent that the capital markets let you get 15% return on equity bogeys at lower risk, if a hypothetical insurance company prices to a 10% bogey with inadequate equity, then it will beat all other insurance companies with strong cash match and quality constraints by wide margins.

To summarize, these are the factors that are important in managing the business: (1) do an effective job of underwriting, and this means getting good plan data; (2) quantify the options; (3) pick a strategy that's consistent with the amount of equity that's notionally allocated; (4) develop a good asset liability data base; (5) develop meaningful profitability data, and (6) ask for competitor feedback.

MR. OSCAR ZIMMERMAN: It's clearly a very complex business, and it would seem that an interaction between the asset side and the liability side, in terms of writing this business, is very important. I was wondering whether any of the panelists would provide us some of their thoughts in terms of how they are currently operating between the liability side and the asset side of the house in the following activities: (1) The accountability between those two sides. (2) The decision-making process in terms of pricing and new product development. (3) How performance is measured in terms of whether there's internal asset segmentation, whether the actual investment results are flowed through to an internal profit center or product manager, or whether there's negotiated investment income. (4) How the valuation actuary figures out what's going on for solvency reasons. Mr. Shigley might have some comments if he's a product manager in terms of how he's measured.

MR. SHIGLEY: The one that I picked up on right away is, how do you allocate the investment performance? In our case we have a separate account where we manage all GIC and annuity close-out liabilities.

MATCHING INSURANCE COMPANY PENSION ASSETS AND LIABILITIES

MR. ZIMMERMAN: So you have segmented assets for some of your liabilities?

MR. SHIGLEY: No, it's a separate account.

MR. ZIMMERMAN: So it's a real asset. You can hold, touch and feel them. Look at the cashflows.

MR. SHIGLEY: That account is dedicated entirely to GIC type liability.

MR. MEYERS: I don't think you can manage this business without segmenting the assets from the rest of your business. Trying to mix them in with experience rated assets leaves nothing but headaches and problems, and you never know what you've got.

MR. ZIMMERMAN: I guess the key point that I have is that this business has very slim margins. If we took a vote of how many people would invest their life savings in this business, I doubt we'd have a lot of hands going up. You end up with both the asset side and liability side and sit around the table figuring out how the other guy is doing this for the risk.

There's not enough money on the table for the risks, and I'm very interested in terms of how companies are trying to handle that inter-relationship in a very tough business in terms of measuring performance. If you've got all these asset calls, all of a sudden you don't have enough yield, and the valuation actuary says, "Well, you don't have the reinvestment rate; I'm going to pop your reserves." What goes on in companies? You've got committee structures; you've got profit centers. Is there one guy who is accountable for the bottom line? Is there a committee accountable for the bottom line? I'm just searching; it's an issue that we're struggling with.

MR. MEYERS: I guess I can respond for Aetna. Basically, the bottom line comes to me. I'm the product manager for the GIC and other guarantee products. I have a working relationship with the marketing people and with the underwriting pricing people and with the investment people; I'm in daily contact and sometimes hourly contact with the investment people. We have a dedicated portfolio manager on the investment side dedicated to this particular asset liability

PANEL DISCUSSION

segment. She has a sole say on what specific investments are purchased for this segment. The risk strategies and the investment strategies are worked out between the two of us, and the final say basically rests with me as to what kinds of strategies we take, what risks we take. There is a separate valuation actuary who looks over my shoulder. He runs through the modeling and testing against different scenarios and determines the reserve levels that are required to be able to manage the business at the risk levels that we're taking.

MR. ZIMMERMAN: Does that mean that you have final call on the quality of the assets, whether you go for A or BAA? You have a call on liquidity in the assets in terms of private placements, for instance, and the policy that you pick is a function of the liabilities you've got? Does the Board get involved in approving that, or is it just sort of internal management?

MR. MEYERS: I have final call. It runs by internal management, but there are once-a-month reviews with the heads of each of the investment areas and the head of the financial division to review strategies and what's happening in all the investment portfolios, not just the GIC portfolio. I also have periodic reviews with the Employee Benefits Division management on what we're doing. We have separate managements involved, both looking over it. There are two designated individuals -- one on the product side and one on the asset side -- working together, and the one on the product side, myself, has basically the final say in all of the strategies, subject, of course, to management.

MR. ZIMMERMAN: But the investment people work within the investment division and report up through the chief investment officer, who's supposed to work directly for you?

MR. MEYERS: Yes.

MR. SONDERGELD: Let me expand on the last question. At the Hartford we operate more along functional lines. We do have a product line manager who's responsible for the profitability of the line of business, but the product line actuary does the pricing based upon certain guidelines of what profitability is. Included in the determination of the price is what the reserve basis should be, which the valuation actuary determines. The product actuary then

MATCHING INSURANCE COMPANY PENSION ASSETS AND LIABILITIES

works closely with the Investment Department to determine what kind of yield should be placed in the pricing model. The valuation actuary determines how much surplus should be allocated to the product to back up the risk associated with the product. We have 13 segments in our three life companies that we manage, and we have a dedicated segment that handles our GIC business. There's no question in my mind that segmentation of the general account or setting up separate accounts is a necessary management tool to manage this business. Once the assets are in the segment, we make sure that the assets equal the statutory reserve, and we do cash flow matching of asset and liability runs periodically to make that sure our assets and liabilities are matched.

MR. RICHARD J. BARNEY: Mr. Meyers, you mentioned the risk of holding surrogates. One risk you did not mention and perhaps it's different with your company, is the tax risk of holding surrogates. That is, when you switch out of your surrogate into your final investment, you may need the total value of that surrogate to invest in your final investment. If you have generated a capital gain, you have tax implications. If there are capital losses and you've tried to hedge, it's the other way. Would you care to address yourself to that question?

MR. MEYERS: In my presentation, I simplified. I didn't include capital gains and losses or taxes. That does have to be incorporated and addressed in surrogate pricing.

MR. SONDERGELD: You simply do it on an after-tax basis?

MR. MEYERS: Yes. You have to look at the after-tax capital gains and losses, and one of the problems is that one of the risks we're taking is a political risk. Those who purchased large volumes of discounts prior to Starke-Moore found themselves with a completely different tax consequence from holding those discounts than they thought they were getting into. We're faced again with another potential tax change which would further disadvantage discounts, so tax consequences could be substantial.

MR. BARRY L. SHEMIN: On the surrogates, it makes a big difference whether those risks that you mentioned of holding period variation and yield spread

PANEL DISCUSSION

variation are one-way risks or two-way risks. If they're one-way risks you've got to put something in the pricing for them. Could you comment on what your experience has been or what your expectations are?

MR. MEYERS: I think even in two-way risks you have to put something in the pricing. Our experience in the surrogates has been that we've done pretty well. This past year, the timing of when you roll out of your surrogates has been crucial, because the markets have been so volatile, spreads have been so volatile, that if you bought surrogates, say in December, and then tried to roll out of them in January or February, you would have lost very big this particular year. If you then held them on through today, when the spreads are back up, you would probably be in pretty good shape.

MR. SHEMIN: What I was getting at is you make an assumption as to how long you'll have to hold a Treasury. Do you think that assumption is likely to vary with what happens to interest rates during the period? For example, if interest rates go down, do you think that correlates positively with having to hold your surrogates for longer than you would have assumed?

MR. MEYERS: It does. If interest rates are falling, generally investment volumes in the private placement markets and the mortgage markets will not pick up. In the falling rate environment, borrowers in these private markets tend to hold off and won't finance until they feel like things are bottoming out. Then you'll get the investment volume. So you'll tend to hold the surrogates over a longer period of time in a falling rate environment. This gets you back again to the tax problem, because you'll generate capital gains and generate capital gains taxes on the Treasury position.

MR. ZIMMERMAN: It's also nice when the rates are falling; everybody wants to give you liabilities, so you have lots of cash, it takes longer to invest, and you make it up on volume. With surrogates, do you ever get in the position where you might say you want to take a bet that interest rates are going to fall and you want to pre-fund? In other words, you want to get some permanent assets without having the liabilities, which means essentially taking a bank loan and then getting the money.

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MR. MEYERS: That gets into the issues that Klaus is talking about. You're taking a bet there. That's generally not a bet that we take as a company. We have not placed ourselves in an interest rate bet position, at least not consciously. There are obviously some small moves that you have to make, and you're not always exactly right on the money, but we do not warehouse assets over a long period of time.

MR. ZIMMERMAN: So you're basically liability driven?

MR. MEYERS: Yes.

MR. ZIMMERMAN: So as soon as you get the liabilities in, you go buy your surrogates. When you think you've got a rate committed or something on your permanent asset, you sell out of your interims. You then have a gain or a loss, and hopefully you've got the same sector spread as when you price?

MR. MEYERS: Yes, or a wider spread. That's right. I might mention that to run an operation that way and to keep private placement and mortgage operations going -- because they can't shut on and off based on your liability sales -- you have to maintain some liquidity in your portfolio so that when a juicy bond deal, a private placement deal, comes along, you have the capacity to purchase it and sell out of some liquid asset in your portfolio, and put that in if you're not having any contract sales or liability sales at that point. So you have to maintain some liquidity level in your portfolio to manage the investment process. Liquidity will cost you something in terms of yield.

MR. MARK G. BEILKE: In one case, a third of a fund was termed interest deficiency reserve to match capital gains to spread them out so that the actual earnings are realized when they were expected, over the long term commitments. I was wondering if anyone else manages capital gains like that, or whether they allow capital gains to hit the bottom line in the year that they're actually taken?

MR. SHIGLEY: We do. We would manage this account on a GAAP basis. We look at assets and liabilities at market all the time.

PANEL DISCUSSION

MR. BEILKE: So you're always looking at market on the GAAP side?

MR. SHIGLEY: Yes.

MR. BEILKE: I'm in a stock company underneath a mutual company parent. We keep everything at book value, and things only hit the bottom line when they're actually sold and capital gains realized.

MR. MEYERS: What you can do is look at the assets and liabilities on a market value basis and set up the reserve you're talking about. It's not only going to be for capital gains and losses, but you have expected future options that you account for in your pricing, and those option premiums need to be held back against future option calls on the portfolio. So that needs to be taken into account in your reserving. There are a lot of things you have to consider in looking at what the reserve level ought to be. It's a GAAP reserve that effectively translates book value to market value and will move with variations in the market values of assets versus liabilities.

MR. BEILKE: At our company, we've always done all the investment accounting just by an allocation procedure. There wasn't any type of separate account for pensions. We just started this year actually segregating the pension. Have you ever gone through that transition and tried to allocate the GAAP accounting for all of these different things?

MR. MEYERS: I think we've all been through it. Most of the companies have segmented, and there are a lot of different ways to do it. You can pro-rata everything, or you can try to pull out whole assets. There's not a clear cut way, and it's not a trivial exercise.

MR. SONDERGELD: To expand on the last question, at The Hartford if we have gains that we don't want to report, we set up a statutory reserve and release that over the future. If you have losses; I don't think you can set up an asset, but you can net the gains and losses. We adjust our GAAP results for both gains and losses.